



**Work Plan  
Baseline Monitoring  
Red Devil Mine, Alaska**

**May 2012**

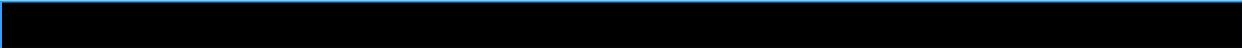
**Prepared for:**

**U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
Anchorage Field Office  
4700 BLM Road  
Anchorage, Alaska 99507**

**Prepared by:**

**ECOLOGY AND ENVIRONMENT, INC.  
720 3rd Avenue, Suite 17  
Seattle, Washington 98104-1816**

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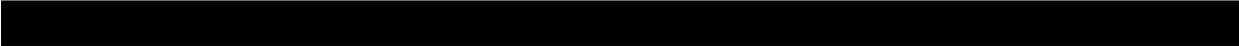


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1-1	Site Location Map
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## List of Abbreviations and Acronyms

As <sub>2</sub> S <sub>3</sub>	arsenic sulfide; orpiment;
As <sub>4</sub> S <sub>4</sub>	arsenic sulfide; realgar;
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
E & E	Ecology and Environment, Inc.
HgS	mercury sulfide
RDM	Red Devil Mine
Sb <sub>2</sub> S <sub>3</sub>	stibnite (antimony sulfide)

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# 1

## Introduction

This Baseline Monitoring Work Plan addresses monitoring of contamination at the Red Devil Mine (RDM) site. The RDM consists of an abandoned mercury mine and ore processing facility located on public lands managed by the U.S. Department of the Interior Bureau of Land Management (BLM) in the state of Alaska (see Figure 1-1). Historical mining activities at the site included underground and surface mining. Ore processing also occurred at the site, including crushing, retorting/furnacing, milling, and flotation. Ecology and Environment, Inc. (E & E), has prepared this Work Plan on behalf of the BLM under Delivery Order Number L09PD02160 and General Services Administration Contract Number GS-10F-0160J.

This Work Plan establishes procedures for ongoing monitoring of groundwater and surface water at the RDM site. Previous documents prepared by E & E characterize the site and the nature of environmental contamination in the area and provide details regarding the site's history and the regulatory framework under which work has been and is being performed. These documents are the Remedial Investigation/Feasibility Study Work Plan (E & E 2011) and the Draft Remedial Investigation Report (E & E 2012). Baseline monitoring will continue to inform remedial decisions through the provision of additional sampling data. Detailed field sampling approaches and procedures are included in the appendices of this document.

### 1.1 Purpose and Objectives

The purpose of this Work Plan is to present the baseline monitoring procedures and methods that will be used to characterize the groundwater and surface water systems at the RDM site. The objectives of baseline monitoring are:

- Characterize the seasonal variability in groundwater and surface water hydrology and chemistry.
- Characterize the long-term (multiple year) variability in groundwater and surface water hydrology and chemistry.
- Characterize trends that are present in groundwater and surface water chemistry.



## 1.2 Document Organization

The Work Plan is organized into the following chapters:

- **Chapter 1, Introduction** – Describes the purpose of the Work Plan and objectives of baseline monitoring.
- **Chapter 2, Site Background and Setting** – Summarizes the project’s location, regional setting, and operational history.
- **Chapter 3, Overview of Baseline Monitoring Design** – Summarizes the design of baseline monitoring based upon inputs from the Draft Remedial Investigation.
- **References** – Lists the guidance documents and literature resources cited in this document.
- **Figures**
- **Appendices**
  - A Field Sampling Plan
  - B Quality Assurance Project Plan
  - C Site-Specific Health and Safety Plan

# 2

## Site Background and Setting

### 2.1 Project Location and Regional Setting

The RDM site is approximately 250 air miles and 1,500 marine/river barge miles west of Anchorage, Alaska (see Figure 1-1). Located on the southwest bank of the Kuskokwim River approximately 2 miles southeast of the village of Red Devil, the site is 75 air miles northeast of Aniak, the largest village in the region, and approximately 8 miles northwest of the village of Sleetmute. Approximately 15 villages are located downstream of Red Devil on the Kuskokwim River.

The legal description for the RDM site is Township 19 North, Range 44 West, Southeast Quarter of Section 6, Sleetmute D-4 Quadrangle, Seward Meridian. The RDM site's approximate coordinates are 61° 45' 38.1" north latitude and 157° 18' 42.7" west longitude (North American Datum 27).

The RDM site is in a remote location, and access to the site is available by boat or barge on the Kuskokwim River or by means of an airstrip at the nearby village of Red Devil. An unimproved road leads from the airstrip through the village of Red Devil and to the RDM site. The central area of the RDM site that is the focus of this Work Plan, including the monitoring wells installed within that area, is shown in Figure 2-1.

### 2.2 Operational History

The RDM is an abandoned mercury mine. This section summarizes the history of the RDM; a detailed operational and mining history is available in the Remedial Investigation Report (E & E 2012). The ore minerals at the RDM consisted of cinnabar (mercury sulfide [HgS]), the primary mercury ore mineral, and stibnite (antimony sulfide [Sb<sub>2</sub>S<sub>3</sub>]). Some realgar (arsenic sulfide [As<sub>4</sub>S<sub>4</sub>]), orpiment (arsenic sulfide [As<sub>2</sub>S<sub>3</sub>]), and secondary antimony minerals were locally associated with these ore minerals.

The first claim at the RDM site was staked in 1939 by Hans Halverson. By 1941, underground and surface mining had commenced on a small scale, and the mining was being conducted by the New Idria Quicksilver Mining Company. Processing during this period was conducted first with a Johnson-Mackay retort and then with a 40-ton rotary kiln (Wright and Rutledge 1947). Between 1941 and 1946, underground mining expanded, but the market value of mercury dropped twice, forcing operational pauses and several turnovers, ultimately followed by a cessation of mining in 1946 (Webber et al. 1947). In 1952, the DeCoursey



Mountain Mining Company leased the mine and resumed operations. In 1954, a large fire rendered the existing mining surface structures unusable.

Following the fire, DeCoursey Mountain Mining Company moved ore processing from the northwest side of Red Devil Creek to the southwest side. Significant investments were made into expanding the production of the mine, with the installation of a larger processing plant with a modified Herreshoff furnace, an airfield, a company village and facilities, a power station, and, a few years later, a reservoir (Malone 1962). By 1963, there were 9,600 feet of underground mine workings. Mining slowed again in 1963, and the mine shut down again in 1965.

In 1969, the mine was dewatered and operations resumed under Alaska Mines and Minerals, Inc. A new area of surface mining along the ore zone northwest of Red Devil Creek was created during this time (Buntzen and Miller 2004). Due to complications in separating the mercury compounds from antimony compounds, a flotation mill and tailing ponds were installed around this time to help produce cinnabar and stibnite concentrates (TNH 1987). Mercury and antimony prices fell sharply in 1971, and the mine again ceased operations in June of that year. Dewatering operations continued for 11 years with the expectation that prices would rebound and the mine would reopen; however, prices remained stagnant and the mine was permanently closed in 1982 (MACTEC 2005).

# 3

## Overview of Baseline Monitoring Design

The intent of the baseline monitoring design for the RDM is to provide a framework in which repeated sampling of groundwater monitoring wells and Red Devil Creek surface water locations can occur. The number and location of the monitoring wells and surface water stations are the result of planning conducted between BLM and E & E for future data needs and were chosen based upon data gathered during the Remedial Investigation (E & E 2012). The details of the baseline monitoring study design are presented in the Field Sampling Plan in Appendix A of this document.

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# 4

## References

- Buntzen, T., and Miller, M. 2004. Alaska Resources Data File, Sleetmute Quadrangle. United States Department of the Interior, Geological Survey (USGS), Open File Report 2004-1310.
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- Webber, Bjorklund, Rutledge, Thomas, and Wright. 1947. Report of Investigations: Mercury Deposits of Southwestern Alaska. May.
- Wright, W. S. and F. A. Rutledge. 1947. Supplemental Report, Red Devil Mercury-Antimony Mine. U.S. Bureau of Mines.

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# Figures

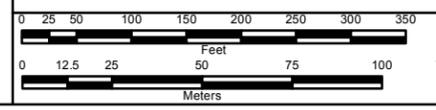
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- Groundwater Sample Location
- ~ Red Devil Creek
- Settling Pond
- Monofill
- Historical Structure

RED DEVIL MINE  
Red Devil, Alaska

Figure 2-1  
Monitoring Well Locations  
Main Processing Area

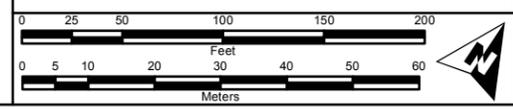




- Surface Water Sample Location
- ~ Red Devil Creek
- Settling Pond
- Monofill
- Historical Structure

RED DEVIL MINE  
Red Devil, Alaska

Figure 2-2  
Surface Water Sample Locations



# A

## Field Sampling Plan

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**Field Sampling Plan**

**Baseline Monitoring**  
**Red Devil Mine, Alaska**

**May 2012**

**Prepared for:**

**U.S. DEPARTMENT OF INTERIOR**  
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**Anchorage Field Office**  
4700 BLM Road  
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720 3rd Avenue  
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# List of Abbreviations and Acronyms

°C	degrees Celsius
ATV	all-terrain vehicle
BLM	U.S Department of the Interior Bureau of Land Management
BTEX	benzene, toluene, ethylbenzene, and xylenes
cfs	cubic feet per second
COC	chain-of-custody
COPCs	contaminants of potential concern
E & E	diesel range organics
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
MS	Matrix spike
PVC	polyvinylchloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	field quality control
RCRA	Resource Conservation and Recovery Act
RDM	Red Devil Mine
RI	Remedial Investigation
SOPs	Standard Operating Procedures
TAL	target analyte list
TDS	total dissolved solids
TSS	total suspended solids
USGS	U.S. Geological Survey

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# 1

## Introduction

This Field Sampling Plan (FSP) is to be used for baseline monitoring to be conducted at the Red Devil Mine (RDM) site. The RDM site is an abandoned mercury mine and ore-processing site on the southern bank of the Kuskokwim River in a remote area of Alaska, approximately 250 air miles west of Anchorage and 75 air miles northeast of the village of Aniak. The site is located on public lands managed by the U.S Department of the Interior Bureau of Land Management (BLM).

Baseline monitoring is being performed in support of a Remedial Investigation (RI)/Feasibility Study (FS) at the RDM site. A limited sampling event was conducted at the RDM site during the 2010 summer field season. Sampling activities and results of the 2010 limited sampling event are presented in the *2010 Limited Sampling Event* report (E & E 2010a). A broader RI field event was conducted at the RDM site during the summer of 2011 field season. The investigation activities and results are presented in the *Draft Remedial Investigation* report (E & E 2012). Baseline monitoring continues the work initiated in the RI, and targets groundwater and surface water, which may exhibit temporal variability.

The Baseline Monitoring Work Plan summarizes the site setting, site history, and baseline monitoring design. Detailed information for the site setting, site history, previous investigations, data quality objectives, and applicable and relevant or appropriate requirements for the site are available in the *Remedial Investigation / Feasibility Study Work Plan* (E & E 2011). Information in the Baseline Monitoring Work Plan is not repeated in the FSP. This FSP is intended to be used as a streamlined guide for the field investigation team.

The purpose of this FSP is to provide specific methodology for the sampling and analysis and collection of field data for baseline monitoring at the RDM site. The results of the activities performed under this FSP will be used to supplement data collected during the RI/FS to evaluate potential temporal variability of the nature and extent and fate and transport of contaminants of potential concern (COPCs) at and near the site.

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# 2

## Sample Locations, Types, and Rationale

This chapter describes the study design for each component of baseline monitoring at the RDM. The study area for baseline monitoring includes the area encompassed by the RDM monitoring wells and Red Devil Creek from the reservoir dam to its mouth at the Kuskokwim River. The RI/FS Work Plan details the contaminant sources associated with the site and the COPCs associated with these sources.

Locations for surface water sampling and the selection of monitoring wells to sample were chosen based upon data and analyses from the RI. Surface water and groundwater monitoring locations were chosen based upon their potential to express spatially variable trend information and their applicability to a network that spans the full dimensions of the baseline monitoring study area.

### 2.1 Groundwater

Groundwater samples will be collected for laboratory analyses from existing monitoring wells, as shown in Figure 2-1. In general, groundwater monitoring results will be used as follows:

- Characterization of groundwater depth, flow direction, gradient, and migration patterns of COPCs; and
- Assessment of groundwater–surface water interactions, including the potential for COPCs in groundwater to enter surface water.

Tables 2-1 and 2-2 summarize the planned groundwater samples by monitoring well and the proposed numbers of samples to be collected for selected laboratory analyses. Groundwater samples will be analyzed for total target analyte list (TAL) inorganic elements, total low-level mercury, dissolved low-level mercury, inorganic ions, nitrate/nitrite, carbonate/bicarbonate, total dissolved solids (TDS), and total suspended solids (TSS). Monitoring well MW-19 also will be analyzed for semi-volatile organic compounds, diesel-range organics, residual range organics, gasoline range organics, and benzene, toluene, ethylbenzene, and xylenes (BTEX). Monitoring well MW-19 is upgradient of two of the settling ponds and downgradient of a former petroleum aboveground storage tank area. Field measurements of pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity will be collected during

purging and immediately prior to sample collection at each monitoring well sampled.

Groundwater samples will be collected from monitoring wells using a low-flow purging/sampling technique, if feasible. If it is not possible to sample using the low-flow technique, alternative technique(s) will be employed. Specific sampling methodologies are described in Chapter 4 of this FSP.

At the beginning of the field event, a round of static water level measurement will be conducted at all existing monitoring wells at the site, including wells not selected for baseline sampling. The static water levels will be measured within the shortest time period possible.

## **2.2 Red Devil Creek Surface Water**

Surface water grab samples will be collected from seven locations along Red Devil Creek between the creek's mouth at the Kuskokwim River and the reservoir south of the Main Processing Area during baseline monitoring (Figure 2-2). All seven of the locations were sampled previously during the 2011 RI field event, and five of these locations (10RD04, 10RD05, 10RD06, 10RD08 and 10RD09) were sampled during the 2010 limited sampling event.

Surface water sample locations between the Kuskokwim River and the reservoir are intended to characterize the contribution of COPCs from overland runoff from tailings/waste rock and/or contaminated soil and from groundwater contribution. In general, sample results will be used for:

- Characterization of the nature and extent of COPCs in creek water;
- Assessment of changes in water chemical conditions along Red Devil Creek and contribution from groundwater sources; and
- Characterization of chemical attributes affecting contaminant fate and transport of COPCs in surface water.

It is anticipated that the creek will be shallow at most sample locations. To the extent feasible, surface water samples will be collected from mid-depth water in the creek. Specific sampling methodologies are summarized in Chapter 4 of this FSP.

Red Devil Creek surface water samples will be analyzed for the parameters listed in Table 2-3, including total TAL inorganic elements, dissolved TAL inorganic elements, methyl mercury, low-level total mercury, low-level dissolved mercury, arsenic speciation, inorganic ions, nitrate/nitrite, carbonate/bicarbonate, TDS, and TSS. Field measurements for pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity will be collected at each sample station.



### **2.3 Surface Water Discharge Measurement**

Surface water discharge will be measured at each of the surface water sampling locations on Red Devil Creek (Figure 2-2). These data will be used to:

- Evaluate mass transport of COPCs by surface water,
- Assess gaining versus losing conditions, and
- Evaluate possible remedial alternatives.

Surface water discharge will be measured using the Mid-Section method or a portable weir plate. Specific methodologies are summarized in Chapter 4 of this FSP.

**Table 2-1 Summary of Groundwater Samples, Initial Baseline Monitoring Sampling Event**

Sample Location ID	Sampling Method	Number of Samples										
		Total TAL Metals	Total Low Level Mercury	Dissolved Low Level Mercury	Inorganic Ions (Cl, F, SO4)	Total Dissolved Solids	Total Suspended Solids	Nitrate/Nitrite	Carbonate, Bicarbonate	SVOCs	DRO/RRO	GRO/BTEX
MW01	submersible	X	X	X	X	X	X	X	X			
MW03	peristaltic											
MW04	submersible	X	X	X	X	X	X	X	X			
MW06	peristaltic	X	X	X	X	X	X	X	X			
MW07	peristaltic											
MW08	peristaltic	X	X	X	X	X	X	X	X			
MW09	submersible											
MW10	submersible	X	X	X	X	X	X	X	X			
MW11	peristaltic											
MW12	peristaltic	X	X	X	X	X	X	X	X			
MW13	submersible	X	X	X	X	X	X	X	X			
MW14	submersible	X	X	X	X	X	X	X	X			
MW15	peristaltic	X	X	X	X	X	X	X	X			
MW16	peristaltic	X	X	X	X	X	X	X	X			
MW17	peristaltic	X	X	X	X	X	X	X	X			
MW18	submersible											
MW19	peristaltic	X	X	X	X	X	X	X	X	X	X	X
MW20	peristaltic	X	X	X	X	X	X	X	X			
MW21	peristaltic	X	X	X	X	X	X	X	X			
MW22	peristaltic											
MW23	peristaltic											
MW24	peristaltic	X	X	X	X	X	X	X	X			
MW25	submersible	X	X	X	X	X	X	X	X			
MW26	submersible											
MW27	submersible	X	X	X	X	X	X	X	X			
MW28	submersible	X	X	X	X	X	X	X	X			
MW29	submersible	X	X	X	X	X	X	X	X			
MW30	submersible	X	X	X	X	X	X	X	X			
MW31	submersible											
MW32	peristaltic	X	X	X	X	X	X	X	X			
MW33	peristaltic	X	X	X	X	X	X	X	X			
<b>Total</b>	<b>peristaltic = 12 submersible = 10</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Key:**

- BTEX = benzene, toluene, ethylbenzene, and xylenes
- DRO = diesel range organics
- GRO = gasoline range organics
- PCBs = polychlorinated biphenyls
- RRO = residual range organics
- SVOC = semivolatile organic compound
- TAL = Target Analyte List
- TIC - tentatively identified compound

**Table 2-2 Summary of Groundwater Samples, Sequent Baseline Monitoring**

Sample Location ID	Sampling Method	Number of Samples										
		Total TAL Metals	Total Low Level Mercury	Dissolved Low Level Mercury	Inorganic Ions (Cl, F, SO4)	Total Dissolved Solids	Total Suspended Solids	Nitrate/Nitrite	Carbonate, Bicarbonate	SVOCs	DRO/RRO	GRO/BTEX
MW01	submersible											
MW03	peristaltic											
MW04	submersible	X	X	X	X	X	X	X	X			
MW06	peristaltic	X	X	X	X	X	X	X	X			
MW07	peristaltic											
MW08	peristaltic											
MW09	submersible											
MW10	submersible	X	X	X	X	X	X	X	X			
MW11	peristaltic											
MW12	peristaltic											
MW13	submersible											
MW14	submersible	X	X	X	X	X	X	X	X			
MW15	peristaltic	X	X	X	X	X	X	X	X			
MW16	peristaltic	X	X	X	X	X	X	X	X			
MW17	peristaltic	X	X	X	X	X	X	X	X			
MW18	submersible											
MW19	peristaltic											
MW20	peristaltic	X	X	X	X	X	X	X	X			
MW21	peristaltic	X	X	X	X	X	X	X	X			
MW22	peristaltic											
MW23	peristaltic											
MW24	peristaltic	X	X	X	X	X	X	X	X			
MW25	submersible	X	X	X	X	X	X	X	X			
MW26	submersible											
MW27	submersible	X	X	X	X	X	X	X	X			
MW28	submersible	X	X	X	X	X	X	X	X			
MW29	submersible	X	X	X	X	X	X	X	X			
MW30	submersible											
MW31	submersible											
MW32	peristaltic	X	X	X	X	X	X	X	X			
MW33	peristaltic	X	X	X	X	X	X	X	X			
<b>Total</b>	<b>peristaltic = 9 submersible = 7</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Key:**

- BTEX = benzene, toluene, ethylbenzene, and xylenes
- DRO = diesel range organics
- GRO = gasoline range organics
- PCBs = polychlorinated biphenyls
- RRO = residual range organics
- SVOC = semivolatile organic compound
- TAL = Target Analyte List
- TIC - tentatively identified compound

**Table 2-3 Summary of Surface Water Samples**

Sample Location ID	Number of Samples											
	Total TAL Metals	Dissolved TAL Metals	Total Low Level Hg	Dissolved Low Level Hg	Methyl Mercury	Arsenic Speciation	Inorganic Ions (Cl, F, SO4)	Total Dissolved Solids	Total Suspended Solids	Nitrate/Nitrite	Carbonate, Bicarbonate	Total Organic Carbon
RD04	X	X	X	X	X	X	X	X	X	X	X	X
RD05	X	X	X	X	X	X	X	X	X	X	X	X
RD06	X	X	X	X	X	X	X	X	X	X	X	X
RD08	X	X	X	X	X	X	X	X	X	X	X	X
RD09	X	X	X	X	X	X	X	X	X	X	X	X
RD10	X	X	X	X	X	X	X	X	X	X	X	X
RD12	X	X	X	X	X	X	X	X	X	X	X	X
<b>Total</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>

Key:

Hg = mercury

TAL = Target Analyte List

## **2.4 Quality Control Samples**

Following the requirements specified in the Baseline Monitoring Quality Assurance Project Plan (QAPP), included as Appendix B in the Baseline Monitoring Work Plan, field quality control (QC) samples will be collected for all matrices and analytes. QC samples will be:

- **Field Duplicates:** A field duplicate sample is a second sample collected at the same time and location as the original sample. For surface water and groundwater sampling, field duplicate samples are collected in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Duplicate sample results are used to assess precision of the overall sample collection and analysis process. For surface water and groundwater, field duplicate samples will be collected at a minimum frequency of one field duplicate for every 10 regular samples for each matrix and sampling method and/or type of equipment used.
- **Matrix Spike:** Matrix spikes (MS) are used to assess the effect of the sample matrix on analyte recovery. An MS consists of an aliquot of a field sample to which the laboratory adds a known concentration of the analyte(s) of interest. An unspiked aliquot is also analyzed, and the percent recovery for the spiked sample is calculated. Analysis of MSs requires collection of a sufficient volume of sample to accommodate the number of aliquots to be analyzed. The sample(s) chosen for MSs should be representative of the sample matrix but should not contain excessive concentrations of analytes or interfering substances. MSs are analyzed at a frequency of one MS per 20 or fewer samples for each matrix and each sampling event.
- **Rinsate Blanks:** Rinsate blanks are used to assess the effectiveness of equipment decontamination procedures when non-dedicated sampling equipment is used. A rinsate blank is a sample of American Society for Testing and Materials Type II reagent grade water or equivalent (i.e., deionized), poured into or over the sampling device or pumped through it, collected in a sample container, and transported to the laboratory for analysis. Rinsate blanks will be collected immediately after the equipment has been decontaminated. The blank will be analyzed for all laboratory analyses requested for the environmental samples collected at the site. A minimum frequency of one rinsate blank per 20 field samples is required for each collection/decontamination method, by matrix and by sample type.
- **Equipment Blanks:** Equipment blanks are used to demonstrate that dedicated sampling equipment is adequately clean if a certificate is not available to demonstrate cleanliness. Equipment blanks will be analyzed for all laboratory analyses requested for the environmental samples collected at the site. One equipment blank sample for dedicated equipment will be



## 2 *Sample Locations, Types, and Rationale*

collected at a rate of one for each set of dedicated equipment (i.e., bailers and sample tubing) of identical manufacturer's lot number.

- **Trip Blanks:** One trip blank will be collected for every shipment of samples collected for BTEX analysis.
  
- **Field Blanks:** Field blanks are laboratory-provided, mercury-free water samples that are processed and treated as a regular sample in all respects, including sampling site conditions and analytical procedures. Field blanks are used to determine whether mercury detected in a sample is from the site or can be attributed to contamination. Field blanks will be collected at a rate of one for every 10 regular samples to be analyzed for low-level mercury.

# 3

## Sample Identification

Each sample collected during baseline monitoring will be assigned a unique alphanumeric code. Sample codes will be recorded in field logbooks, on sample containers, and on chain-of-custody (COC) forms. The field team leader will be responsible for maintaining a master database or spreadsheet of samples to be collected and samples obtained to ensure that all planned samples are collected during the field investigation, sample designation codes are not used twice for different locations, and the correct analytical parameters are identified on laboratory documentation.

Tables 3-1 and 3-2 describe the sample coding system.

**Table 3-1 Sample Identification Coding System: Groundwater Samples**

Characters	Purpose	Code	Description
1-4	Sample month and year	For example, "0512" for May 2012	Two-digit designation for month and last two digits of year
5-6	Monitoring Well	MW	Existing monitoring wells installed in 2001 (MW01, MW03, MW04, MW06, and MW07) and monitoring wells installed during the RI.
7-8	Monitoring Well Identification Number	01, 02, etc.	Consecutive numbers for existing monitoring wells installed in 2001 (MW01, MW03, MW04, MW06, and MW07) and monitoring wells installed during the Remedial Investigation.
9-10	Matrix	GW	Groundwater

Field duplicate samples for groundwater samples will be identified by selecting a unique monitoring well identification code not used for the regular sample or any subsequent samples. All groundwater samples will be cross-referenced in the field logbooks and in the sample master database to monitoring well designations.

Example sample identification codes for groundwater:

### 3 Sample Identification

- 0512MW25GW: The regular groundwater sample collected from existing monitoring well MW25 in May 2012.
- 0512MW50GW: The field duplicate groundwater sample collected from existing monitoring well MW25 in May 2012.

Surface water samples will be assigned sample identifiers as specified in Table 3-2. Pre-assigned sample location identifiers for proposed surface water samples are presented in Table 2-3 (surface water) and Figure 2-2.

**Table 3-2 Sample Identification Coding System: Surface Water and Sediment Samples**

Characters	Purpose	Code	Description
1-4	Sample month and year	For example, "0512" for May 2012	Two digit designation for month and last two digits of year
5-6	Area/location	RD	Red Devil Creek area (including creek and delta in Kuskokwim River).
7-8	Location number	01, 02, etc.	Consecutive number within area/location.
9-10	Matrix	SW	Surface water

Field duplicate samples for surface water samples will be identified by selecting a unique location number not used for the regular sample or any subsequent samples. All surface water samples will be cross-referenced in the field logbooks and in the sample master database to sample locations.

Example sample codes for surface water and sediment:

- 0512RD10SW: The regular surface water sample collected from surface water sampling station RD10 in Red Devil Creek in May 2012.
- 0512RD20SW: The field duplicate surface water sample collected from surface water sampling station RD10 in Red Devil Creek in May 2012.

# 4

## Sampling and Other Field Procedures

This chapter describes the procedures and equipment to be used in the collection of samples and collection of observations during the baseline monitoring activities. Ecology and Environment, Inc. (E & E) standard operating procedures (SOPs) are referred to in this chapter and subsequent chapters. A copy of all applicable E & E SOPs will be available on site during the implementation of the baseline monitoring field work.

All surface water and groundwater sampling conducted for baseline monitoring will be conducted using ultraclean sampling methods (EPA Method 1669). In summary, ultraclean sampling methods involve the following procedures:

- Sampling equipment and containers are obtained from the laboratory that have been cleaned using detergent, mineral acids, and reagent water, filled with weak acid solution, and individually double bagged for storage and shipment.
- On site, one member of the two-person sampling team is designated as “dirty hands”; the second member is designated as “clean hands.” All operations involving contact with the sample container and transfer of the sample from the sample collection device to the sample container are handled by the individual designated as “clean hands.”
- A new pair of nitrile gloves will be worn during each sample collection.
- All sampling equipment and sample containers used will be non-metallic and free from any material that may contain metals.
- Sampling personnel will wear clean, non-talc gloves when handling sampling equipment and sample containers.
- Surface water samples will be collected facing upstream and upwind (when possible) to minimize introduction of contamination.
- Acid preservatives will be placed in sample containers in a clean area prior to sample collection.

### 4.1 Monitoring Well Development

It was not possible to develop several wells (MW09, MW11, MW13, and MW30) during the 2011 RI field event because they contained insufficient water. These wells will be inspected during the initial baseline monitoring event and will be developed if feasible.

Well development will be accomplished by a combination of mechanical surging, bailing, and pumping with a submersible pump. The wells will be mechanically surged, depending on the geologic characteristics of the screened interval, to remove fines from inside the screen and casing and to flush the formation around the filter pack throughout the entire screened interval. Fines will be removed from the borehole periodically during the surging process using a bailer to minimize the re-entry of fines into the formation. The monitoring wells will then be pumped with a submersible pump until the measured water quality parameters are stabilized. Water will be removed throughout the entire water column by periodically lowering and raising the pump intake. Development will be considered complete when a minimum of five to ten well-bore volumes have been removed from the well, and the water is chemically stable and as free of sediment as possible. Water produced from the well will be considered chemically stable when field parameters, measured by E & E (pH, temperature, specific conductance, and turbidity) remain within 10 percent of the previous measurement for at least three successive measurements. Water produced from the well will be considered free of sediment when it is clear or turbidity has stabilized for at least three successive borehole measurements. The pump, tubing, and all other equipment used during development will be decontaminated after each use.

## **4.2 Groundwater Sampling**

During baseline monitoring, groundwater samples will be collected from selected monitoring wells. To the extent practicable, groundwater sampling will occur in a progression from the least to the most contaminated wells, based on existing groundwater sample data.

In general, each well will be sampled following the United States Environmental Protection Agency's (EPA's) Ground-Water Sampling Guidelines for Superfund and Resource-Conservation and Recovery Act (RCRA) Project Managers, EPA 542-S-02-001 (EPA 2002).

Prior to sample collection, each well will be sounded with a decontaminated electronic water level meter to determine the static water level, measured to the nearest 0.01 feet. The water level measurements will be used to determine groundwater elevation and to estimate the standing water volume contained within the well. The measurement will also be used to determine the depth of the pump intake and to monitor water drawdown during low-flow purging and sampling, as described below.

If feasible, each well will be purged and sampled using a low-flow purging and sampling technique. A battery-operated peristaltic pump outfitted with dedicated Teflon-lined tubing will be used to purge and sample monitoring wells in which the water depth is sufficiently shallow to allow the use of a peristaltic pump (approximately 25 feet below the top of casing). The tubing will be lowered into the well to the targeted sample point at the middle of the water column within the screen interval. The well will be purged at a target rate of less than 0.5 liters per

minute. During purging, the water level will be monitored with the water level indicator to measure well drawdown and to guide the adjustment of purge rate to minimize drawdown while purging. The sampling team will attempt to maintain less than 0.1 meters of drawdown during purging.

During purging, field water quality parameters, including pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity, will be measured to determine when stabilization of the groundwater is achieved. The final measurements also will be used to characterize groundwater conditions. Water quality parameters will be measured using an in-line water quality meter (e.g., Horiba U50 or similar equipment) and recorded in the field logbook. Field parameters will be measured every 3 to 5 minutes during purging. Field parameters will be considered stabilized after all parameters have stabilized for three successive readings. Criteria for stabilization are three successive readings within the following limits include:

- pH:  $\pm 0.1$  pH units;
- Temperature:  $\pm 1$  degree Celsius ( $^{\circ}\text{C}$ );
- Specific electrical conductance (conductivity):  $\pm 3\%$ ;
- Turbidity:  $\pm 10\%$  (when turbidity is greater than 10 nephelometric turbidity units);
- Dissolved oxygen:  $\pm 0.3$  milligrams per liter; and
- Oxidation-reduction potential:  $\pm 10$  millivolts.

Upon stabilization of field parameters, groundwater samples will be collected directly into the appropriate (pre-preserved, as applicable) sample containers. If stabilization of all field parameters does not occur within 1.5 hours of low-flow purging, sampling will be initiated and the unstabilized parameter noted in the sampling log. Dissolved metal aliquots will be collected following collection of the other aliquots using a dedicated in-line 0.45-micrometer filter. The filter will be inserted into the end of the sample tubing while the pump is still running in order to maintain a steady flow of water, minimizing potential disturbance of formation groundwater. Following installation of the filter, the dissolved water aliquot will be collected directly into the appropriate sample container.

The use of peristaltic pumps to collect groundwater samples is limited by the ability of peristaltic pumps to draw water from depths of greater than approximately 25 feet. If it is not possible to collect a groundwater sample from a given well using a peristaltic pump, the sampling team will attempt to use a decontaminated positive pressure pump (e.g., Proactive SS Mega-Typhoon or similar pump) to purge and sample the well using low-flow techniques.

If neither of the low-flow sampling/purging approaches is successful at a given well, the well will be purged and sampled with a clean, disposable Teflon-lined polyethylene bailer. For wells that are not sampled using low-flow techniques, each well will be purged of a minimum of three well volumes prior to sample collection. During purging, field water quality parameters will be measured using a

water quality meter (e.g., Horiba U50 or similar equipment) and recorded in the field logbook. Water quality parameters will be measured by pouring a volume of water from a bailer into a container and submerging the water quality meter probe into the container. It may not be possible to achieve the stabilization criteria outlined above using a bailer to purge the well. In this case, sample collection will occur after six well volumes have been purged from the well. Samples collected by bailer will be poured directly into the appropriate pre-cleaned sample containers. Dissolved constituent samples will be collected by pouring water from the bailer into a dedicated transfer container and pumping the water into the sample container using a peristaltic pump outfitted with dedicated tubing and in-line 0.45-micrometer filter.

For wells sampled for BTEX, if a positive pressure pump is not used to purge and sample the well, the aliquot for BTEX will be collected with a bailer following collection of all other aliquots.

### **4.3 Surface Water Sampling**

A surface water sample will be collected from each selected surface water sampling location. Surface water samples from Red Devil Creek will be collected first from near the confluence of Red Devil Creek and the Kuskokwim River. Sampling will proceed upstream to avoid disturbing sediments that could impact turbidity and contaminant concentrations in downstream locations.

Samples will be collected using a battery-operated peristaltic pump outfitted with dedicated silicone tubing. The water sample will be collected from a single location within the middle of the stream channel at the mid-depth water level. Dissolved constituent aliquots will be collected following collection of the other aliquots using a dedicated in-line 0.45-micrometer filter.

In the event that it is not possible to collect the water samples using a peristaltic pump, the samples will be collected by hand-dipping the sample container directly into the creek water. For sample containers that have been pre-preserved, a separate dedicated bottle may be used as a transfer container.

Following sample collection at each location, field parameters for pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity will be measured using a water quality meter and recorded in the field logbook.

### **4.4 Surface water and Spring Discharge Measurement**

Surface water discharge will be measured using the Mid-Section method at each surface water sampling location where the estimated discharge is greater than 2.0 cubic feet per second (cfs), and a portable weir plate will be used for stream sections with smaller discharge rates. Based on 2011 RI stream gaging results, it is anticipated that stream discharge rates at Red Devil Creek monitoring locations will be greater than 2.0 cfs and that the discharge at the seep location (RD05) may be less than 2.0 cfs. Discharge rates will be measured in accordance with

Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge (Rantz 1982) and Techniques of Water-Resources Investigations Reports (USGS 2011). At each stream gaging location, photographs will be taken of the gaging station looking upstream, downstream, and across the stream from each bank. The planned measurement methods are discussed further below.

#### **4.4.1 Measurement Methods**

The following sections detail the methods to be used. Field staff will determine which of the two proposed methods will be applied based on the flow rate during the measurement event.

##### **4.4.1.1 Mid-Section Method**

The Mid-Section method involves measuring the channel area and water velocities at discrete points along a stream cross section. This method will be used where stream flow is sufficient to allow the channel to be divided into rectangular subsections. After dividing the stream into subsections, the depth, flow velocity, and distance from bank will be measured at the center of each subsection.

In general, the preferred number of subsections across the width of the stream is 20 to 30, with a minimum of 10. If the stream width is less than 5 feet, the width of the subsections should not be less than 0.5 feet. Not more than 5 percent of stream discharge should occur within a single subsection. Subsections do not have to be the same width. For water depths greater than 2.5 feet, velocity will be measured at two depths, 20 and 80 percent of the total subsection depth, and averaged. For water depths less than 2.5 feet, velocity will be measured only at a single depth at 60 percent of the total subsection depth.

Preferred locations for stream cross sections are straight reaches where the stream bed is uniform and free of boulders and aquatic vegetation, and where the stream flow is uniform.

##### **4.4.1.2 Portable Weir Plates**

Portable weir plates will be used where the flow is too small or velocities too low to reliably use the above Mid-Section method. This is generally where stream widths are shallow and flows are less than 2.0 cfs. Weir plates are constructed with a staff gage on the upstream side, far enough away from the notch to not be impacted by the drawdown of flow through the notch. Once a steady-state discharge through the weir has been reached, the height behind the weir plate is recorded to determine the flow rate through the weir. These are intended to be short-term measurement devices and are removed after each use.

#### **4.4.2 Discharge Calculation**

The general equation for calculating discharge is:

$$\text{Discharge (Q)} = \text{Velocity (V)} \times \text{Cross sectional area of stream channel (A)}$$

For the Mid-Section method, stream discharge will be calculated for each subsection (q) and then summed together to obtain total discharge (Q).

$$q_{1,2,3,\text{etc.}} = V_{1,2,3,\text{etc.}} \times \text{Depth at Midpoint}_{1,2,3,\text{etc.}} \times \text{Width of Subsection}_{1,2,3,\text{etc.}}$$

and,

$$Q = q_1 + q_2 + q_3 + q_{\text{etc.}}$$

For the Portable Weir Plate method, the following equation will be used:

$$Q = Ch^{(5/2)}$$

where,

Q = Discharge (cfs);

h = Static head above the bottom of the notch (mean gage height), in feet; and

C = Coefficient of discharge. A standard value of 2.47 will be used for C, assuming a 90 degree notched V-weir.

### **4.4.3 Equipment**

Stream discharge measurement will require the following equipment:

**Mid-Section Method:** a Marsh McBirney or similar flow meter, top-setting wading rod, long tape measure, waders, and calculator.

**Portable Weir Plate:** portable weir plate, constructed to U.S. Geological Survey (USGS) standard specifications, shovel, carpenter's level, rebar to stabilize the weir (as needed), and canvas or similar to prevent downstream undercutting.

### **4.4.4 Stream Measurements**

#### **4.4.4.1 Mid-Section Method**

After identifying a suitable location for the stream cross section, a reference point is selected on one bank. Then, a tape measure is stretched across the stream, fixed to the reference point on one bank and another point on the opposite bank, ensuring that the tape is oriented perpendicular to the stream flow.

The appropriate number of subsections is determined using the measured channel width, based on the guidelines in Section 4.4.1.1.

The stream velocity is measured from the mid-point of each subsection at the appropriate depth or depths, as specified above. When measuring the stream velocity, the wading



rod and flow meter should be located upstream from the field personnel to ensure that stream flow is not disrupted.

Discharge is then be calculated as described in Section 4.4.2 and the velocity of each subsection is checked to ensure that it is less than 5 percent of the total stream discharge. If any subsection contains more than 5 percent of the stream discharge, that subsection will be further subdivided and the new subsections will be measured.

**4.4.4.2 Portable Weir Plate Method**

In this method, the weir plate is pushed into the stream bed perpendicular to the flow, with an effort made to channel all of the stream flow through the weir by using stream bed material to pack around the weir and/or channel the flow towards the opening of the weir plate. As needed, an estimation of flow around the weir is made and noted. A carpenter's level is then used to ensure that the weir is horizontal after insertion and that the weir is vertical. This is done to provide an accurate and consistent measurement relative to the water surface. Weir plates are be submerged on either the up- or downstream sides to also increase accurate readings.

Once the pool height has stabilized on the upstream side of the weir, gage readings are recorded every 30 seconds for three minutes. The mean value of these readings is then used to calculate discharge

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# 5

## Sample Handling, Preservation, and Shipping

Transportation and handling of samples must be accomplished in a manner that not only protects their integrity but also prevents any detrimental unnecessary exposure to sample handlers due to the possibly hazardous nature of the samples.

### 5.1 Sample Documentation

#### 5.1.1 Sample Labels

Sample labels attached to or fixed around the sample container will be used to identify all samples collected in the field. The sample labels will be placed on bottles so as not to obscure any quality assurance/quality control (QA/QC) lot numbers on the bottles, and sample information will be printed legibly. Field identification will be sufficient to enable cross-reference with the project logbook.

To minimize handling of sample containers, labels will be filled out before sample collection. Each sample label will be written in waterproof ink, attached firmly to the sample containers, and protected with Mylar tape. The sample label will contain the following information:

- Sample designation code,
- Date and time of collection,
- Analysis required, and
- pH and preservation (when applicable)

#### 5.1.2 Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Sample shipping containers (e.g., coolers) will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Upon the containers' arrival at the laboratory, the custodian will check (and certify by completing the package receipt log) that seals are intact.

#### 5.1.3 Chain-of-Custody Records

The COC records will be completed fully, at least in duplicate, by the field technician designated by the site manager as responsible for sample shipment. Information in the COC record will contain the same level of detail found in the site logbook, except that the on-site measurement data will not be recorded. The custody record will include, among other things, the following information:

- Name and company or organization of person collecting the samples;
- Date of sample collected;
- Matrix of sample collected (soil/water);
- Location of sampling station (using the sample designation code system described in Chapter 3);
- Number and type of containers shipped;
- Analysis requested; and
- Signature of the person relinquishing samples to the transporter, with the date and time of transfer noted, and signature of the designated sample custodian at the receiving facility.

If samples require rapid laboratory turnaround, the person completing the COC record will note these or similar requirements in the remarks section of the custody record.

The relinquishing individual will record pertinent shipping data (e.g., air-bill number, organization, time, and date) on the original custody record, which will be transported with the samples to the laboratory and retained in the laboratory's file. Original and duplicate custody records with the air bill or delivery note constitute a complete custody record. The field team leader will ensure that all records are consistent and that they are made part of the permanent job file.

#### **5.1.4 Field Logbooks and Data Forms**

Field logbooks (or daily logs) and data forms are necessary to document daily activities and observations. Documentation will be sufficient to enable reconstruction of events that occurred during the project accurately and objectively at a later time. All daily logs will be kept in a bound notebook containing numbered pages, and all entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason.

Minimum logbook content requirements are described in E & E's SOPs, *Preparation of Field Activities Logbooks*, a copy of which will be kept on site during the field activities. If corrections are necessary, they will be made by drawing a single line through the original entry (so that the original entry is still legible) and writing the corrected entry alongside it. The correction will be initialed and dated. Corrected errors may require a footnote explaining the correction.

#### **5.1.5 Photographs**

Photographs will be taken as directed by the team leader. Documentation of a photograph is crucial to ensure its validity as a representation of an existing situation.

The following information on photographs will be noted in field logbooks:

- Date, time, and location photograph was taken

## 5 Sample Handling, Preservation, and Shipping

- Weather conditions
- Description of photograph
- Reasons photograph was taken
- Sequential number of photograph
- Direction

After the photographs are processed, the information recorded in the field logbook will be summarized in captions in the digital photo log.

### 5.1.6 Custody Procedures

The primary objective of COC procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses. A sample is considered to be in custody if it is:

- In someone's physical possession,
- In someone's view,
- Locked up, and
- Kept in a secured area that allows authorized personnel only.

#### 5.1.6.1 Field Custody Procedures

The following guidance will be used to properly control samples during fieldwork:

- As few people as possible will handle samples.
- Coolers or boxes containing cleaned bottles will be sealed with custody tape during transport to the field or while in storage before use. Sample bottles from unsealed coolers or boxes, or bottles that appear to have been tampered with, will not be used.
- The sample collector will be responsible for the care and custody of samples until they are transferred to another person or dispatched properly under COC rules.
- The sample collector will record sample data in the field logbook.
- The site team leader will determine whether proper custody procedures were followed during the fieldwork and decide whether additional samples are required.

When custody is transferred (e.g., samples are released to a shipping agent), the following will apply:

- The coolers in which the samples are packed will be sealed and accompanied by two COC records. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the COC record. This record documents sample custody transfer.
- Samples will be dispatched to the laboratory for analysis with separate COC records accompanying each shipment. Shipping containers will be sealed with custody seals for shipment to the laboratory. The method of

## 5 Sample Handling, Preservation, and Shipping

shipment, name of courier, and other pertinent information will be entered in the COC record.

- All shipments will be accompanied by COC records identifying their contents. The original record will accompany the shipment. The other copies will be distributed appropriately to the site team leader and site manager.
- If samples are sent by common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the permanent documentation.

### 5.1.6.2 Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples from the carrier and enter preliminary information about the package into a package or sample receipt log, including the initials of the person delivering the package and the status of the custody seals on the coolers (e.g., broken versus unbroken). Additional details on laboratory custody procedures are found in the QAPP.

## 5.2 Sample Containers and Preservation

Sample aliquots submitted to the analytical laboratories will be placed in commercial certified pre-cleaned sample containers and preserved as identified in Table 5-1.

## 5.3 Sample Shipping

Due to the remote location of the RDM site, sample shipment to the analytical laboratories will require careful logistical planning to ensure that sample holding times are not exceeded and that samples arrive at the laboratories in good condition. In general, sample shipping logistics will involve the following:

- The field team leader will keep records of sample collection dates. Based on the dates of samples being held on site and the number of samples ready for shipment, the field team leader will contact E & E's Anchorage-based sample custodian to notify an aircraft charter service that a sample shipment flight is needed.
- When the sample shipment aircraft arrives at the Red Devil airstrip, the field team leader will relinquish custody of the samples to the pilot.
- When the sample shipment aircraft arrives in Anchorage, E & E's Anchorage-based sample custodian will assume custody of the samples. The custodian will re-pack all sample shipping containers with fresh ice and relinquish custody of the samples to an overnight delivery service that will ship the samples to the analytical laboratories.
- E & E's Anchorage-based sample custodian will confirm with the laboratories that all shipped samples have been received.

**Table 5-1 Sample Containers, Field Handling, and Preservation**

Matrix	Analysis	Maximum Holding Time	Preservation	Field Filtered	Sample Containers
Water	Total TAL Inorganic Elements	6 months (28 days for Hg)	HNO <sub>3</sub> , pH<2, 0–4°C	No	500-mL plastic bottle
	Dissolved TAL Inorganic Elements	6 months	HNO <sub>3</sub> , pH<2, 0–4°C	Yes	500-mL plastic bottle
	Methyl Mercury	6 months	0–4°C and dark immediately; HCl, pH<2	No	250-mL pre-tested fluoropolymer or glass bottle w/fluoropolymer-lined lids (no extra volume needed for MS/MSD)
	Dissolved Low-Level As, Sb, Pb, Hg	6 months (90 days for Low-Level Hg)	HNO <sub>3</sub> , pH<2, 0–4°C (BrCl in lab within 28 days of collection for low-level Hg)	Yes	500-mL (for MS/MSD sample) or 250-mL plastic bottle; pre-tested fluoropolymer or glass bottle w/fluoropolymer-lined lids
	Arsenic Speciation	28 days	0–4°C and dark immediately; HCl, pH<2	No	250-mL pre-tested fluoropolymer or glass bottle w/fluoropolymer-lined lids (no extra volume needed for MS/MSD)
	DRO/RRO	7 days for extraction, 40 days after extraction for analysis	None, 0–4°C	No	1-L amber bottle
	SVOCs with TICs	7 days for extraction, 40 days after extraction for analysis	None, 0–4°C	No	1-L amber bottle
	GRO and BTEX	14 days preserved, 7 days unpreserved.	HCl to pH <2, cool to 6°C	No	Four 40-mL amber glass vials, no headspace
	Total suspended solids	7 days	Cool to 6°C	No	1000 mL HDPE
	Total dissolved solids	7 days	Cool to 6°C	No	1000 mL HDPE
	Nitrate/Nitrite	28 days	2 mL H <sub>2</sub> SO <sub>4</sub> per liter. Cool to 6°C	No	500 mL or 1-L HDPE
	Alkalinity	14 days	Cool to 6°C	No	500 mL HDPE

**Table 5-1 Sample Containers, Field Handling, and Preservation**

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Key:

As	arsenic
Br	bromine
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
Cl	chlorine
DRO/RRO	diesel range organics/residual range organics
HCl	hydrochloric acid
Hg	mercury
HDPE	high density polyethylene
H <sub>2</sub> SO <sub>4</sub>	sulfuric acid
L	liter
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
Pb	lead
Sb	antimony
SE	elective sequential extraction
SVOC	semivolatile organic compound
TAL	target analyte list
TIC	tentatively identified compound

### **5.3.1 Sample Packaging**

Samples will be packaged carefully to avoid breakage or contamination and will be shipped to the laboratory at proper temperatures. The following sample package requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with the original containers.
- The sample volume level may be marked by placing the edge of the label at the appropriate sample height or by using a grease pencil. This will help the laboratory determine whether any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC lot numbers.
- All sample bottles will be placed in a plastic bag to minimize leakage in case a bottle breaks during shipment.
- The samples will be cooled by placing them on ice in sealed plastic bags. Ice is not to be used as a substitute for packing materials.
- Any remaining space in the sample shipping container should be filled with inert packing material. Under no circumstances should material such as sawdust, newspaper, or sand be used.
- The custody record must be sealed in a plastic bag and placed in the shipping container. Custody seals must be affixed to the sample cooler.

### **5.3.2 Shipping Containers**

The appropriate shipping container will be determined by U.S. Department of Transportation or International Air Transportation Association regulations for the anticipated level of suspected contaminants. For baseline monitoring of the RDM site, it is anticipated that all sample shipping containers will be commercially available coolers.

Shipping containers will be custody-sealed for shipment as appropriate. The custody seals will be affixed so that access to the container can be gained only by breaking a seal.

Field personnel will arrange transportation of samples to the laboratory. When custody is relinquished to a shipper, field personnel will inform the laboratory sample custodian by telephone of the expected arrival time of the sample shipment and advise him or her of any time constraints on sample analysis.

Suggested guidelines for marking and labeling shipping containers are presented below. In all cases, U.S. Department of Transportation or International Air Transportation Association regulations will be consulted for appropriate marking and labeling requirements, which include the following:

- Use abbreviations only where specified.
- The words “This End Up” or “This Side Up” must be printed clearly on the top of the outer package. Upward-pointing arrows should be placed on the sides of the package.



## **5 Sample Handling, Preservation, and Shipping**

- After a shipping container is sealed, two COC seals must be placed on the container, one on the front and one on the back. To protect the seals from accidental damage, clear strapping tape must be placed over them.

# 6

## Decontamination and Management of Investigation-Derived Waste

### 6.1 Equipment Decontamination Procedures

Dedicated sampling equipment will be used to collect all surface water samples and groundwater samples collected with a peristaltic pump. A submersible pump may be used for sampling groundwater from monitoring wells with a water depth greater than 25 feet below the top of casing. The submersible pump will be decontaminated between sampling locations using the following steps:

- Physical removal – Remove solid material using a dry brush or paper towels.
- Wash – Scrub with a solution of non-phosphate detergent (Alconox®) and tap water. A 5-gallon bucket lined with a clean garbage bag or a 3-foot long by 4-inch diameter polyvinylchloride (PVC) pipe will be filled with non-phosphate detergent and tap water. Materials and equipment will be scrubbed with a brush in the solution. The detergent solution will be flushed through the submersible pump.
- Deionized water rinse – A 3-foot long by 4-inch diameter PVC pipe will be filled with deionized water. Equipment will be rinsed by flushing with deionized water.
- Dry: Air dry materials and equipment prior to use.
- Decontamination solutions will be changed out between each sampling location to prevent cross contamination.

Detailed information on decontamination procedures is provided in E & E's SOP, Sampling Equipment Decontamination.

### 6.2 Vehicle Decontamination Procedures

Vehicles will be used to facilitate completion of the field activities. During baseline monitoring, vehicle use at the site will include all-terrain vehicles (ATVs) used to transport staff and equipment between the RDM site and the site and drill rigs and associated support vehicles. It is not expected that the planned use of the vehicles will result in significant contamination of the ATVs. In the event that the ATVs are subjected to significant contamination, they will be decontaminated by scrubbing with a brush and will be rinsed with potable water.

## 6 Decontamination and Management of Investigation-Derived Waste

Equipment will be decontaminated within the site Main Processing Area, away from Red Devil Creek. Gross contamination (e.g., soil or mud) will be removed by washing with potable water and phosphate-free detergent. Any equipment that has loose paint chips or is badly rusted will be scrubbed with a wire brush prior to steam cleaning. Once all visible contaminants are removed, the equipment will be rinsed with potable water.

### 6.3 Investigation-Derived Waste Management

Investigation-derived waste that is expected to be generated during baseline monitoring includes the following:

- Monitoring well development and purge water;
- Used dedicated sampling equipment (e.g., dedicated tubing, bailers); and
- Used personal protective equipment (e.g., gloves).

Non-dedicated sampling equipment decontamination fluids and used paper towels. Investigation-Derived Waste will be managed in accordance with criteria established in the document, *Management of Investigation-Derived Wastes During Site Inspections* (EPA/540/G-91/009), and guidelines outlined in EPA guidance, *Guide to Management of Investigation-Derived Wastes* (OSWER Publication 9345.3-03FS).

Used dedicated sampling equipment, personal protective equipment, and paper towels will be grossly decontaminated if there is visible evidence of contamination (soil), placed in sturdy plastic bags, and shipped off site at the conclusion of the field activities and disposed of at a sanitary landfill in Anchorage.

The decontamination fluids generated from non-dedicated sampling equipment will be allowed to run onto the ground within the boundaries of the site. Disposal of the decontamination fluid will be conducted in such a way that the water fully infiltrates into the ground without ponding and does not enter surface water. Disposal will also be conducted in such a way that it does not transport sediment to surface water.

The management of monitoring well development and purge water will be based on which monitoring well the development water and purge water originate from. Due to the potential for comparatively high concentrations of arsenic (greater than the RCRA toxicity-characteristic leaching procedure limit of 5 milligrams per liter) detected in the 2011 RI groundwater samples collected from monitoring wells MW14 and MW15, purge water generated at these two monitoring wells will be containerized by the field sampling team in drums. The drums will be shipped off site for profile characterization and disposed of in accordance with appropriate requirements. Well development and purge water generated will be disposed of onto the ground at the time of sampling. Disposal of this purge water will be conducted in the area of the well following completion of sampling by



## **6 Decontamination and Management of Investigation-Derived Waste**

pouring slowly onto the ground surface in such a way that the water fully infiltrates into the ground without ponding and does not enter surface water. Disposal will also be conducted in such a way that it does not transport sediment to surface water.

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# 7

## Deviations from the Field Sampling Plan

Deviations from the FSP are inevitable. Deviations may arise from changed field conditions, adjustment of sampling methods, inability to obtain samples from a planned location, and other circumstances. All deviations from the FSP will be carefully documented by the field team leader using the form presented in Figure 7-1. The nature and reason for FSP deviations will be documented in the baseline monitoring report.

**Red Devil Mine Baseline Monitoring  
FSP Deviation Documentation**

<b>Date:</b>	<b>Name:</b>
<b>Description of Problem:</b>	
<b>Location of Problem:</b>	
<b>Description of Deviation to Address Problem:</b>	
<b>Other Means Considered but Rejected to Address Problem:</b>	

**Figure 7-1 FSP Deviation Documentation Form**

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# 8

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# Figures

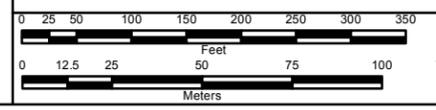
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- Groundwater Sample Location
- ~ Red Devil Creek
- Settling Pond
- Monofill
- Historical Structure

RED DEVIL MINE  
Red Devil, Alaska

Figure 2-1  
Monitoring Well Locations  
Main Processing Area

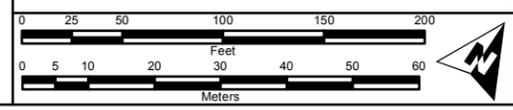




- Surface Water Sample Location
- ~ Red Devil Creek
- Settling Pond
- Monofill
- Historical Structure

RED DEVIL MINE  
Red Devil, Alaska

Figure 2-2  
Surface Water Sample Locations



**B**

**Quality Assurance Project Plan**

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# **Quality Assurance Project Plan**

## **Baseline Monitoring Red Devil Mine, Alaska**

**May 2012**

**Prepared for:**

**United States Department of the Interior  
Bureau of Land Management  
Anchorage Field Office  
4700 BLM Road  
Anchorage, Alaska 99507**

**Prepared by:**

**Ecology and Environment, Inc.  
720 3<sup>rd</sup> Avenue, Suite 1700  
Seattle, Washington 98104**

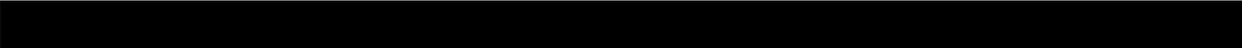
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# List of Abbreviations and Acronyms

%R	percent recovery
BLM	U.S Department of the Interior Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain-of-custody
DQO	data quality objective
E & E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
GIS	geographic information system
GPS	global positioning system
HSO	Health and Safety Officer
ID	identifier
LCSs	laboratory control samples
LCSDs	laboratory control sample duplicates
MS/MSD	matrix spike/matrix spike duplicate
NCP	National Contingency Plan
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PM	Project Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RDM	Red Devil Mine
RI	Remedial Investigation
RPD	relative percent difference
SHASP	Site-Specific health and safety plan
SOPs	standard operating procedures

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# 1

## Project Management and Objectives

The U.S. Department of the Interior Bureau of Land Management (BLM) and Ecology and Environment, Inc. (E & E), have entered into a contract for baseline monitoring that is in addition to the existing Remedial Investigation (RI)/Feasibility Study (FS) of the Red Devil Mine (RDM) site, located in a remote region of Alaska, approximately 250 air miles west of Anchorage. The purpose of the baseline monitoring is to augment the data acquired during the RI with trend and variability information for groundwater and surface water systems gathered from additional sampling events. The BLM is the lead agency, as determined by the National Contingency Plan (NCP) to implement response actions under the NCP process. The NCP defines “lead agency” as the agency that provides the On-Scene Coordinator/ Project Manager (PM) to plan and implement response actions under the NCP (BLM 2001).

Project scoping for the baseline monitoring includes the development of three plans: the project Work Plan, a Site-Specific Health and Safety Plan (SHASP), and a Field Sampling Plan (FSP). An element of the FSP, the Quality Assurance Project Plan (QAPP) provides policies, procedures, specifications, standards, and documentation sufficient to produce data of quality adequate to meet project objectives and to minimize loss of data due to out-of-control conditions or malfunctions.

This QAPP pertains to the environmental sampling and analysis program to be conducted by E & E at the RDM site. The purpose of this QAPP is to provide guidance so that all environmentally related data collection procedures and measurements are scientifically sound and of known, acceptable, and documented quality and to ensure that the sampling activities are conducted in accordance with the requirements of this project.

### 1.1 Project/Task Organization

The BLM’s PM will oversee the project and will be the primary contact for all project activities. Contact information for this and other key project roles is provided in Table 1-1. Roles and responsibilities of individual team members are described in the sections that follow.

**Table 1-1 Contact Information**

Organization	Contact	Title	Telephone	Address
BLM	Mike McCrum	PM	(907) 271-4426	Anchorage Field Office 4700 BLM Road Anchorage, Alaska 99507
E & E	Bill Richards Marcia Galloway Mark Longtine Eric Lindeman	PM QA Manager RI Lead HSO	(206) 624-9537 ext. 3601 (716) 685-8080 (206) 794-9750 (206) 624-9537 ext. 4150	720 3 <sup>rd</sup> Ave. Suite 1700 Seattle, Washington 98104
Intermountain Lab (contract laboratory)	Tom Patten	Laboratory Manager	(307) 672-8945	1673 Terra Avenue Sheridan, Wyoming 82801

Key:

BLM = Bureau of Land management

E & E = Ecology and Environment, Inc.

HSO = health and safety officer

PM = project manager

QA = quality assurance

RI = remedial investigation

### 1.1.1 BLM Project Manager

The BLM PM for the RDM RI/FS is Mr. Mike McCrum. Mr. McCrum has overall responsibility for the project, including sampling activities at the site.

As the PM, Mr. McCrum is responsible for:

- Defining project objectives.
- Establishing project policies and procedures to address the specific needs of the overall project and of each task.
- Granting final approval of project plans and reports generated by E & E.
- Ensuring that plans are implemented according to schedule.
- Committing the available resources necessary to meet project objectives and requirements.
- Evaluating project staffing requirements and E & E resources as needed to ensure performance within budget and schedule constraints.
- Informing E & E personnel of any unanticipated client requests or needs.
- Providing site access (if necessary).
- Reviewing work progress for each task to ensure that budgets and schedules are met.
- Reviewing and analyzing overall performance with respect to goals and objectives.
- Implementing corrective actions resulting from staff observations, quality assurance (QA)/quality control (QC) surveillance, and/or QA audits.
- Reviewing and approving project-specific plans.
- Directing the overall project QA program.
- Maintaining QA oversight of the project.
- Reviewing QA sections in project reports as applicable.
- Reviewing QA/QC procedures applicable to this project.

- Initiating, reviewing, and following up on response actions, as necessary.
- Arranging performance audits of measurement activities, as necessary.

**1.1.2 E & E Project Manager**

E & E's PM is Mr. Bill Richards. Mr. Richards is responsible for the overall management and coordination of E & E's implementation of the baseline monitoring project, including collection of water and any other additional samples from the RDM area. Mr. Richards will have overall responsibility for performing all appropriate procedures for sample collection. He will be assisted in this by the RI Lead, Mr. Mark Longtine. The E & E PM will be responsible for:

- Maintaining communications with BLM regarding the site work
- Assembling and supervising the project team
- Production and review of deliverables, including work plans and reports
- Tracking work progress against planned budgets and schedules
- Scheduling personnel and material resources
- Implementing all aspects of the Baseline Monitoring Work Plan and applicable guidance documents, including this QAPP and other project documents
- Notifying the BLM of the fieldwork activities
- Gathering sampling equipment and field logbook(s)
- Maintaining communication with the analytical laboratory about the sampling schedule, delivery orders, and sample analysis
- Maintaining communication with the analytical laboratory about receipt of analytical results
- Ensuring that the quantity and location of all samples meet the requirements of appropriate work plans
- Identifying problems, resolving difficulties in consultation with QA staff, implementing and documenting corrective action procedures
- Maintaining proper chain-of-custody (COC) forms during sampling events
- Overall RI/FS implementation

**1.1.3 E & E Quality Assurance Manager**

Ms. Marcia Galloway will act as the E & E QA Manager. As appropriate, she will:

- Assist the E & E PM in completing the data quality objective (DQO) selection process to ensure that project objectives are met.
- Provide oversight of the review and approval by the project chemist of the use of laboratory data.
- Direct the data validation activities and provide oversight for the preparation of data usability reports.
- Identify the need for corrective actions and solutions to laboratory QC problems or nonconformance with QAPP criteria.
- Provide appropriate direction and support to field sampling staff.

Ms. Galloway will also be responsible and accountable for selected project activities involving laboratory analyses, usability of analytical laboratory results, and data reports. As appropriate, she will:

- Review and evaluate analytical data quality.
- Perform or direct data validation activities and prepare data usability reports.
- Identify the need for corrective actions and solutions for laboratory QC problems or nonconformance.
- Inform the E & E PM of QA or QC deficiencies and work in cooperation to resolve program issues.
- Help prepare QA/QC reports as requested by the E & E PM.

#### **1.1.4 Remedial Investigation Lead**

E & E's RI Lead, Mr. Mark Longtine, will be responsible for ensuring that all samples are collected and delivered to the analytical laboratory in accordance with the approved FSP and QAPP. He will report directly to E & E's PM. As appropriate, he will:

- Schedule and direct the activities of the various subcontractors at the site.
- Assemble and supervise E & E field sampling teams.
- Schedule personnel and material resources.
- Track work progress against planned budgets and schedules.
- Ensure, as directed by the project Health and Safety Officer (HSO), that the SHASP is implemented and followed during sampling activities.
- Implement all monitoring and field screening measurements called for in the FSP, QAPP, and SHASP.
- Record all geologic observations, as directed by the FSP and QAPP.
- Document all sample collection, sample handling, and sample delivery to the laboratory, as directed by the FSP and QAPP.
- Review all boring logs, field instrumentation readings, and geologic observations in project reports.

#### **1.1.5 Field Sampling Team**

Field staff personnel are responsible for collecting samples under the direction of the RI Lead. This includes:

- Scheduling sampling activities and notifying the laboratory of sample delivery schedules.
- Gathering the necessary sampling supplies, equipment, containers, preservatives, and forms.
- Collecting samples in accordance with the FSP and applicable E & E standard operating procedures (SOPs).
- Ensuring that the quantity and location of all samples meet the requirements of appropriate work plans.
- Measuring and recording required field screening data.
- Documenting sampling activities such as completion of data collection forms, labeling of samples, and preparation of COC forms.

- Maintaining proper COC forms during sampling events and delivery of the samples to the laboratory.
- Reporting any problems encountered in the course of sampling to the RI Lead.

**1.1.6 Project Health and Safety Officer**

The project HSO will be Mr. Eric Lindeman. Mr. Lindeman will review the project SHASP, which is included in the Baseline Monitoring Work Plan, for the field crew to follow during all field activities. A site HSO will be responsible for ensuring that project personnel adhere to the site-specific SHASP during sampling activities. This officer will report to the PM. As appropriate, the project and site HSOs will:

- Evaluate safety plans and other submittals from subcontractors
- Provide project health and safety orientation and training for project staff and subcontractors
- Verify and maintain medical and safety training documentation
- Inspect work areas for hazards
- Evaluate appropriate personal protective equipment (PPE) and decontamination zone delineation
- Conduct safety monitoring, as needed
- Report and follow up on incident reports.

**1.1.7 Contract Laboratories**

Sampling activities for the RDM baseline monitoring project will be implemented by E & E under contract with the BLM.

Analytical services for the RDM baseline monitoring project will be provided by BLM-approved laboratories that have entered into a contract agreement with E & E. More than one contract laboratory may be responsible for analyzing samples for this project. Water samples will be taken during fieldwork and sent via COC protocol to professional laboratories that are licensed to perform the specific analyses requested.

The contracted laboratory will be responsible for laboratory and related QA/QC issues and maintaining continual analytical service. Additional responsibilities will include:

- Scheduling laboratory personnel and material resources.
- Maintaining proper COC protocol and performing designated analytical services.
- Preparing and delivering analytical reports to the E & E PM.
- Identifying problems, resolving difficulties in consultation with QA staff, and implementing and documenting corrective action procedures.
- Maintaining QA/QC for the laboratory.

## **1.2 Problem Definition/Background**

Detailed descriptions of the RDM history, previous investigations, existing data quality, and identified data gaps are provided in the RI/FS Work Plan.

The RI included an investigation of groundwater and surface water, as a single sampling event. It did not include multi-event trend and variability information about the groundwater and surface water systems.

## **1.3 Project Objectives and Related Sampling**

The objective of the baseline monitoring is to address the lack of trend and variability information in the groundwater and surface water systems through multiple sampling events at different phases of the hydrological cycle. The proposed activities are designed to provide sufficient data to support risk management decisions and remedy selection related to the objectives.

The RDM sampling program is defined in the FSP (Appendix A of the Baseline Monitoring Work Plan). The approach involves collection of surface water and groundwater from the suspected sources and potential receptor areas. Analysis of data collected from these sampling events will allow for evaluations of the spatial and temporal distribution of contaminants.

## **1.4 Data Measurement Objectives**

The data measurement objectives provide a means for control and review of the project so that environmentally related measurements and data collected by the field sampling teams are of known and acceptable quality.

Every reasonable attempt will be made to obtain an acceptable and high-quality set of usable field measurements and analytical data. If a measurement cannot be obtained or is unusable for any reason, the effect of the missing or invalid data will be evaluated. Precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) are indicators of data quality. PARCCS goals are established to help assess data quality. The following paragraphs define PARCCS parameters associated with this project.

### **Precision**

The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision is quantitative and most often expressed in terms of relative percent difference (RPD). Precision of the laboratory analysis will be assessed by comparing original and duplicate results. The RPD will be calculated for each pair of duplicate analyses using the following equation.

$$RPD = |S - D| \times 100 / ([S + D] / 2)$$

Where:

S = first sample value (original value)

D = second sample value (duplicate value)

Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability, depending on the type of QC sample. Various measures of precision exist, depending upon “prescribed similar condition.” Field duplicate samples will be collected to provide a measure of the contribution of field-related sources to overall variability. Acceptable RPD limits for field duplicate measurements will be less than or equal to 20% for aqueous matrices and less than or equal to 50% for other matrices. Contribution of laboratory-related sources to overall variability is measured through various laboratory QC samples. Acceptable RPD limits for laboratory measurements are specified in the source methods. Precision limits for the analyses to be run for the RI/FS are presented in Table 1-2.

### **Accuracy**

Accuracy is the degree of agreement of a measurement with an accepted reference or true value and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the percent recovery (%R) of a sample result. The %R is calculated as follows.

$$\%R = (SSR - SR / SA) \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

Ideally, it is desirable for the reported concentration to equal the actual concentration present in the sample. Analytical data will be evaluated for accuracy. Matrix spikes (MSs) and/or laboratory control samples/laboratory control sample duplicates (LCSs/LCSDs) will be used, whichever is applicable. Accuracy criteria are as follows (EPA 1990):

Inorganic MSs = 75% –125% recovery

Organic MSs = 60% –140% recovery

LCS/LCSDs = 80% –120% recovery

Accuracy limits for the analyses to be run for RI/FS are included in Table 1-2.

### **Representativeness**

Representativeness expresses the degree to which sample data accurately and precisely represent the following:

- The characteristic being measured
- Parameter variations at a sampling point
- An environmental condition.

Representativeness is a qualitative and quantitative parameter that is most concerned with the proper design of the sample plan and the absence of cross-contamination of samples. Acceptable representativeness will be achieved through:

1. Careful, informed selection of sampling locations;
2. Selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits;
3. Proper gathering and handling of samples to avoid interferences and prevent contamination and loss; and
4. Use of uncontaminated sample containers as the sample collection tool, eliminating the need for decontamination of sampling equipment and possible cross-contamination of samples.

Representativeness is a consideration that will be employed during all sample location and collection efforts. The representativeness will be assessed qualitatively by reviewing the procedures and design of the sampling event and quantitatively by reviewing the laboratory blank samples. If an analyte is detected in a field or laboratory blank, any associated positive result less than five times the detected concentration of the blank may be considered undetected.

### **Completeness**

Completeness is a measure of the amount of usable data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the PARCCs parameters, excluding completeness. Data that are reviewed and need no qualification or are qualified as estimated or undetected are considered usable. Rejected data are not considered usable. Completeness will be calculated following data evaluation. Completeness is calculated using the following equation:

$$\% \text{ Completeness} = (\text{DO}/\text{DP}) \times 100$$

Where:

DO = data obtained and usable

DP = data planned to be obtained

A completeness goal of 90% is projected for the data set collected for this investigation. This goal will be assessed for the project as a whole as well as for individual parameters and study areas within the RDM site. If the completeness goal is not met, additional sampling may be necessary to adequately achieve project objectives.

**Comparability**

Comparability is a qualitative parameter. Consistency in the acquisition, handling, and analysis of samples is necessary for comparison of results. Data developed under this investigation will be collected and analyzed using standard U.S. Environmental Protection Agency (EPA) analytical methods and QC procedures to ensure comparability of results with other analyses performed in a similar manner. Data resulting from this field investigation may subsequently be compared with other data sets.

Comparability of the data collected at the RDM site will be achieved by following, to the extent possible, the same SOPs for sample collection and analysis.

**Sensitivity**

Sensitivity is the achievement of method detection limits and depends on instrument sensitivity and sample matrix effects. Therefore, it is important to monitor the sensitivity of data-gathering instruments to ensure that data quality is met through constant instrument performance. For this project, adequate sensitivity was ensured by selection of methods with method detection limits and practical quantitation limits below the potential the applicable or relevant and appropriate requirements. These requirements are outlined in detail in Section 6 of the RI/FS Work Plan. Required detection limits are presented in Table 1-2 at the end of this chapter.

Analytical methods for chemical analysis of solid waste, water, and other wastes will follow EPA-defined testing methods and protocols (EPA 1980, 1983). The specific EPA analytical methods for chemical analyses that have been selected for this project are also given in Table 1-2.

**1.5 Special Training and Certifications**

E & E will ensure that qualified, experienced, and trained staff perform or oversee all data collection and sampling tasks conducted under E & E's direction. The field staff, including subcontractors that perform work on the site, will have completed training that meets the requirements of 29 Code of Federal Regulations (CFR) 1910.120 (Hazardous Waste Operations and Emergency Response ) including up-to-date annual refresher training. Documentation and skills certification will be completed as described in 29 CFR 1910.120 and will be available for inspection upon request. Additional information is provided in the Site-Specific Health and Safety Plan (see Appendix D of the RI/FS Work Plan).

**1.6 Documents and Records**

This section summarizes the documents and records to be generated for the RDM baseline monitoring project.

**1.6.1 Planning Documents**

The following planning documents have been prepared or are anticipated for this project:

- FSP (Appendix A of the Baseline Monitoring Work Plan) – Defines sampling and data collection methods that will be used for the project. Includes sampling objectives, sample locations and frequency, sampling equipment and procedures, and sample handling and analysis. Documents procedures that will be used to ensure that sample collection activities are conducted in accordance with technically acceptable protocols and that data collected in the field meet the DQOs established during the RI/FS scoping.
- QAPP – This QAPP has been prepared to describe the project objectives and organization, functional activities, and QA/QC protocols that will be used to achieve the desired DQOs.
- SHASP (Appendix C of the Baseline Monitoring Work Plan) – The HSP specifies employee training, protective equipment, medical surveillance requirements, SOPs, and a contingency plan in accordance with 40 CFR 300.150 of the NCP and 29 CFR 1910.120 1(1) and (1)(2).

### **1.6.2 Reports**

The reports that will be developed to document the results and identify potential future actions are described below.

Data collected during baseline monitoring will be reduced and tabulated for analysis. The data will be validated with respect to requirements outlined in the site-specific FSP and this QAPP. All usable data will be analyzed and mapped to determine whether the project objectives have been met. Any data gaps will be identified and discussed with the BLM PM. Any recommendations for additional work will be discussed during a meeting with the PM. If the baseline monitoring requirements have been met, a baseline monitoring report will be prepared.

#### **Baseline Monitoring Reports**

E & E will validate all analytical data collected during monitoring events and prepare QA data reports. The validated data will be presented in tabular format, supplemented by maps and figures illustrating sample locations and trends of the contaminants of most interest. Separate data reports will be generated for each monitoring event. Three hard copies with CDs of each report will be delivered to the BLM.

#### **Laboratory Reports**

Each laboratory will submit its standard analytical data reports to the E & E PM. The analytical laboratory deliverables will include the following:

- Case narrative (including any problems encountered, protocol modifications, and/or corrective actions taken).
- Sample analytical and QA/QC results with units.
- All protocols used during analyses.
- Any protocol deviations from the approved sampling plan.
- Surrogate recovery results.



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## **1. Project Management and Objectives**

- Matrix spike/matrix spike duplicate (MS/MSD) results.
- Laboratory duplicate/triplicate results.
- Blank results.
- Sample custody records (including original COC forms).

### **Field Records**

A record of samples, analyses, and field events will be kept in a field logbook. A complete record of all field activities will be maintained. Field documentation will include permanently bound field logbooks, field forms, digital photographs, COC documents, and sample identification labels.

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**Table 1-2 Analytes, Analytical Methods, Method Detection Limits, Screening Limits, and Risk Assessment Criteria**

Matrix	Groundwater/ Surface Water						
Analytical Group	Metals						
	Analyte	Analytical Method	Analytical Method Reporting Limits (RLs)	Achievable Laboratory Method Detection Limits (MDLs)	Human Health SL	Eco SL <sup>13</sup>	Units
<b>Total and Dissolved Metals</b>	Total Mercury (low level)	EPA 1631	1.0	0.06	100 <sup>5</sup>	50	ng/L
	Aluminum	EPA 6010B	50	40	3700 <sup>6</sup>	87	µg/L
	Antimony	EPA 6020A (mass=121)	0.05	0.02	0.2 <sup>5</sup>	NA	µg/L
		EPA 6020A (mass=123)	0.05	0.02	0.2 <sup>5</sup>	NA	µg/L
	Arsenic	EPA 6020A	0.5	0.1	0.045 <sup>6</sup>	150	µg/L
	Barium	EPA 6020A (mass=135)	0.05	0.02	200 <sup>7</sup>	NA	µg/L
		EPA 6020A (mass=137)	0.05	0.02	200 <sup>7</sup>	NA	µg/L
	Beryllium	EPA 6020A	0.02	0.006	0.4 <sup>7</sup>	NA	µg/L
	Cadmium	EPA 6020A (mass=111)	0.02	0.005	0.2 <sup>5</sup>	0.25	µg/L
		EPA 6020A (mass=114)	0.02	0.005	0.2 <sup>5</sup>	0.25	µg/L
	Calcium	EPA 6010B	50	10	NA	NA	µg/L
	Chromium	EPA 6020A (mass=52)	0.2	0.04	10 <sup>7</sup>	74	µg/L
		EPA 6020A (mass=53)	0.2	0.04	10 <sup>7</sup>	74	µg/L
	Cobalt	EPA 6020A	0.02	0.006	1.1 <sup>6</sup>	NA	µg/L
	Copper	EPA 6020A (mass=63)	0.1	0.02	18 <sup>5</sup>	9	µg/L
		EPA 6020A (mass=65)	0.1	0.02	18 <sup>5</sup>	9	µg/L
	Iron	EPA 6010B	20	3	2600 <sup>6</sup>	1000	µg/L
	Lead	EPA 6020A	0.02	0.005	1.5 <sup>7</sup>	2.5	µg/L
	Magnesium	EPA 6010B	2.0	0.4	NA	NA	µg/L
	Manganese	EPA 6020A	0.05	0.006	2 <sup>5</sup>	NA	µg/L
	Nickel	EPA 6020A (mass=60)	0.2	0.03	9 <sup>5</sup>	52	µg/L
		EPA 6020A (mass=62)	0.2	0.03	9 <sup>5</sup>	52	µg/L
	Potassium	EPA 6010B	400	50	NA	NA	µg/L
	Selenium	EPA 6020A (mass=82)	1.0	0.3	2 <sup>5</sup>	5	µg/L
		EPA 6020A (mass=78)	1.0	0.3	2 <sup>5</sup>	5	µg/L
	Silicon	EPA 6010B	0.4	0.006	NA	NA	mg/L
	Silver	EPA 6020A	0.02	0.004	2 <sup>5</sup>	3.2	µg/L
	Sodium	EPA 6010B	200	70	NA	NA	µg/L
	Thallium	EPA 6020A	0.02	0.005	0.2 <sup>7</sup>	NA	µg/L
	Vanadium	EPA 6020A	0.2	0.03	26 <sup>7</sup>	NA	µg/L
	Zinc	EPA 6020A (mass=66)	0.5	0.2	143 <sup>5</sup>	118	µg/L
		EPA 6020A (mass=67)	0.5	0.2	143 <sup>5</sup>	118	µg/L
EPA 6020A (mass=68)		0.5	0.2	143 <sup>5</sup>	118	µg/L	
<b>Methyl Mercury</b>	Methyl Mercury	EPA 1630	0.1	0.03	370 <sup>6</sup>	NA	ng/L
<b>Arsenic Speciation</b>	Arsenic Species	EPA 1632, modified As (inorganic)	0.025	0.003	0.045 <sup>6</sup>	NA	µg/L
		EPA 1632, modified As (III)	0.025	0.003	NA	NA	µg/L
		EPA 1632, modified As (V)	0.025	0.006	NA		µg/L

**Table 1-2 Analytes, Analytical Methods, Method Detection Limits, Screening Limits, and Risk Assessment Criteria**

Matrix	Groundwater/ Surface Water					
Analytical Group	Petroleum					
Analyte	Analytical Method	Analytical Method Reporting Limits (RLs)	Achievable Laboratory Method Detection Limits (MDLs)	Human Health SL	Eco SL <sup>13</sup>	Units
Gasoline Range Organics	AK 101 (15.0 mL)	0.10	0.013	2.2 <sup>7</sup>	NA	mg/L
	AK 101 (5.0 mL)	0.80	0.011	2.2 <sup>7</sup>	NA	mg/L
Diesel Range Organics	AK 102	0.50	0.014	1.5 <sup>7</sup>	NA	mg/L
Residual Range Organics	AK 103	0.5	0.1	1.1 <sup>7</sup>	NA	mg/L
Benzene	EPA 8021B (15.0 mL)	0.5	0.045	0.41 <sup>6</sup>	NA	µg/L
	EPA 8021B (5.0 mL)	0.25	0.139	0.41 <sup>6</sup>	NA	µg/L
Toluene	EPA 8021B (15.0 mL)	0.08	0.048	100 <sup>7</sup>	NA	µg/L
	EPA 8021B (5.0 mL)	0.25	0.077	100 <sup>7</sup>	NA	µg/L
Ethylbenzene	EPA 8021B (15.0 mL)	0.08	0.042	1.5 <sup>6</sup>	NA	µg/L
	EPA 8021B (5.0 mL)	0.25	0.149	1.5 <sup>6</sup>	NA	µg/L
m/p-Xylene	EPA 8021B (15.0 mL)	0.16	0.078	20 <sup>6</sup>	NA	µg/L
	EPA 8021B (5.0 mL)	0.5	0.109	20 <sup>6</sup>	NA	µg/L
o-Xylene	EPA 8021B (15.0 mL)	0.08	0.037	20 <sup>6</sup>	NA	µg/L
	EPA 8021B (5.0 mL)	0.25	0.143	20 <sup>6</sup>	NA	µg/L

Matrix	Groundwater/Surface Water			
Analytical Group	Conventionals			
Analyte	Analytical Method	Analytical Method Reporting Limits (RLs)	Achievable Laboratory Method Detection Limits (MDLs)	Units
Sulfate	EPA 300.0	0.2	0.01	mg/L
Chloride	EPA 300.0	0.2	0.03	mg/L
Fluoride	EPA 300.0	0.2	0.003	mg/L
Nitrate/Nitrite	EPA 353.2	0.05	0.004	mg/L
Carbonate, Bicarbonate	EPA 310.1	4	3	mg/L
Total Dissolved Solids (TDS)	EPA 160.1	5	5	mg/L
Total Suspended Solids (TSS)	EPA 160.2	5	5	mg/L
Total Organic Carbon	SW846 Method 9060	standard	standard	mg/L

**Table 1-2 Analytes, Analytical Methods, Method Detection Limits, Screening Limits, and Risk Assessment Criteria**

<b>Matrix</b>	Groundwater/Surface Water			
<b>Analytical Group</b>	SVOCs			
<b>Analyte</b>	<b>Analytical Method</b>	<b>Analytical Method Reporting Limits (RLs)</b>	<b>Achievable Laboratory Method Detection Limits (MDLs)</b>	<b>Units</b>
SVOCs + TICs	EPA 8270D	per method	per method	µg/L

**Key:**

- µg/L = micrograms per liter
- DRO = diesel range organics
- ERA = Ecological Risk Assessment
- GRO = gasoline-range organics
- mg/L = milligrams per liter
- ng/L = nanograms per liter
- NA = Not Available
- NOAEL = No Observed Adverse Effect Level
- RRO = residual range organics
- SL = Screening Level
- SVOC = semi-volatile organic compound
- TIC = tentatively identified compound

**Reference:** Sample, B., D. Opresko, and G. Suter. 1996.

*Toxicological Benchmarks for Wildlife: 1996 Revision*. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory. ES/ER/TM-86/R3.

**Footnotes:** <sup>1</sup> ADEC (2009) Cleanup Level- Under 40" Zone Method 2 Migration to Groundwater

<sup>2</sup> EPA (2009) RSLs for Residential Soil (levels at cancer risk 10<sup>-6</sup> and HQ=0.1)

<sup>3</sup> BLM (2004) Human Risk Management Criteria for Residents (soil)

<sup>4</sup> ADEC (2009) Cleanup Level- Under 40" Zone Direct Contact and Inhalation (One-tenth values)

<sup>5</sup> BLM (2004) Human Risk Management Criteria for Residents (water)

<sup>6</sup> EPA (2009) RSLs for Tap Water (levels at cancer risk 10<sup>-6</sup> and HQ=0.1)

<sup>7</sup> ADEC (2009) Table C Groundwater Cleanup Level (one-tenth value except GRO, DRO, and RRO)

<sup>8</sup> BLM (2004) Ecological Risk Management Criteria for Deer Mouse

<sup>9</sup> EPA (2005) Soil Screening Level for Mammals <http://www.epa.gov/ecotox/ecossl/>

<sup>10</sup> EPA (2005) Soil Screening Level for Plants <http://www.epa.gov/ecotox/ecossl/>

<sup>11</sup> EPA (2005) Soil Screening Level for Soil Invertebrates <http://www.epa.gov/ecotox/ecossl/>

<sup>12</sup> EPA (2005) Soil Screening Level for Birds <http://www.epa.gov/ecotox/ecossl/>

<sup>13</sup> EPA Water Quality Criterion or State of Alaska Water Quality Standard, whichever was lower.

<sup>14</sup> MacDonald et.al. (2000) TELs

<sup>15</sup> Alloway (1990) Soil Screening Levels for Plants

<sup>16</sup> Efronson (1997) Soil Screening Levels for Plants

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# 2

## Data Generation and Acquisition

### 2.1 Sampling Design

The sampling design for the RDM site is summarized in Section 3 of the Baseline Monitoring Work Plan and described in detail in the FSP, included as Appendix A of the Baseline Monitoring Work Plan.

### 2.2 Sampling Methods

Sampling methods are described in detail in the FSP, included as Appendix A of the Baseline Monitoring Work Plan.

### 2.3 Sample Handling and Custody

Sample handling and custody procedures are described in detail in the FSP, included as Appendix A of the Baseline Monitoring Work Plan.

### 2.4 Analytical Methods

Soil samples will be screened for field arsenic, mercury, antimony, and other metals with a portable, x-ray fluorescence. Methods for performing field screening are described in the FSP.

The laboratory analytical methods for soil, sediment, and water to be used for this project are summarized in Table 1-2 (located at the end of Chapter 1, above).

### 2.5 Quality Control

#### 2.5.1 Field Quality Control

QC samples collected in the field will include field duplicates, rinseate blanks, and MS/MSDs. Each type of QA/QC sample is briefly described below.

#### Field Duplicates

A field duplicate sample is a second sample collected at the same time and location as the original sample. Field duplicate samples are collected simultaneously (an extra volume of one sample, which is then homogenized and split into equal aliquots) or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by

laboratory personnel performing the analysis. Duplicate sample results are used to assess precision of the overall sample collection and analysis process. For soil, sediment, surface water, and groundwater, field duplicate samples will be collected at a minimum frequency of one field duplicate for every 10 regular samples for each matrix and sampling method and/or type of equipment used. A maximum RPD of 30% for waters and 50% for soil and sediment will be used for evaluation of field duplicate comparability. For vegetation samples, field duplicate samples will be collected at a rate of one field duplicate for every 20 regular samples by plant type.

### **Rinseate Blanks and Equipment Blanks**

Rinseate blanks are used to assess the effectiveness of equipment decontamination procedures when non-dedicated sampling equipment is used. A rinseate blank is a sample of American Society for Testing and Materials Type II reagent grade water or equivalent (i.e., deionized), poured into or over the sampling device or pumped through it, collected in a sample container, and transported to the laboratory for analysis. Rinseate blanks will be collected immediately after the equipment has been decontaminated. The blank will be analyzed for all laboratory analyses requested for the environmental samples collected at the site. A minimum frequency of one rinseate blank per 20 field samples is required for each collection/decontamination method, by matrix and by sample type.

Equipment blanks are used to demonstrate that dedicated sampling equipment is adequately clean if a certificate is not available to demonstrate cleanliness. Equipment blanks will be analyzed for all laboratory analyses requested for the environmental samples collected at the site. One equipment blank sample for dedicated equipment will be collected at a rate of one for each set of dedicated equipment (i.e., bailers and sample tubing) of identical manufacturer's lot number.

Analyte concentrations in rinseate and equipment blanks must be below the applicable laboratory reporting limits. For common laboratory contaminants, the blank results may be up to five times the reporting limit.

### **Field Blanks**

Field blanks are laboratory-provided, mercury-free water samples that are processed and treated as a regular sample in all respects, including contact with sampling devices, equipment, sampling site conditions, and analytical procedures. Field blanks are the best way to estimate how much mercury detected in a sample is from the site or can be attributed to contamination. Field blanks will be collected at a rate of one field blank for every 10 regular samples to be analyzed for low-level mercury.

### **Matrix Spikes/Matrix Spike Duplicates**

MSs are used to assess the effect of the sample matrix on analyte recovery. An MS consists of an aliquot of a field sample to which the laboratory adds a known concentration of the analyte(s) of interest. An unspiked aliquot is also analyzed,

and the %R for the spiked sample is calculated. Analysis of MSs requires collection of a sufficient volume of sample to accommodate the number of aliquots to be analyzed. The sample(s) chosen for MSs should be representative of the sample matrix but should not contain excessive concentrations of analytes or interfering substances. MSs are analyzed at a frequency of one MS per 20 or fewer samples for each matrix and each sampling event. Control limits for MSs are provided in the source methods and in the laboratory QA manuals.

### **2.5.2 Laboratory Quality Control**

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. Each type of laboratory-based QC sample will be analyzed at a rate of 5% or one per batch (a batch is a group of up to 20 samples analyzed together), whichever is more frequent.

#### **Method Blank**

A method blank is a sample generated in the laboratory consisting of an analyte-free matrix (e.g., reagent water) that is taken through the entire sample preparation and analysis with the field samples. It is used to monitor for contamination that may be introduced into the samples during processing within the laboratory. Evaluation criteria are provided in the source methods and in the laboratory QA manuals.

#### **Laboratory Duplicate**

A laboratory duplicate consists of an aliquot of a field sample that is taken from the same container as the initial field sample and prepared and analyzed with the field samples. The laboratory duplicate is used to monitor the precision (in terms of RPD) of the analytical process. In conjunction with field duplicates, the sampling precision can then be inferred. Criteria for laboratory duplicates are provided in the source methods and in the laboratory QA manuals.

#### **Laboratory Control Sample**

An LCS consists of a laboratory-generated sample that contains the analytes of interest at known concentrations. It may be prepared by the laboratory or purchased from an outside source. The LCS is taken through the same preparation and analytical procedures as the field samples. Analyte recoveries indicate the accuracy of the analytical system. LCSs and MSs together allow the overall accuracy of the sampling and analytical process to be determined. Criteria for LCS evaluation are provided in the source methods and in the laboratory QA manuals.

#### **Additional Quality Control Samples**

Certain analytical methods may require additional QC elements not described above. These may include surrogates, serial dilutions, and other elements. Specific requirements and evaluation criteria are provided in the source methods and laboratory QA manuals.

## **2.6 Instrument/Equipment Testing, Inspection, and Maintenance**

Field equipment will be maintained in accordance with manufacturers' instructions and the relevant field sampling SOPs.

All laboratory equipment will be maintained in accordance with the laboratory's SOPs.

## **2.7 Instrument/Equipment Calibration and Frequency**

Field instruments will be calibrated immediately prior to use in accordance with manufacturers' instructions and the relevant field sampling SOPs. Calibrations will be verified periodically throughout each work day and at the end of the day. Records of field instrument calibrations will be kept in the field log books. Additional information is provided in the FSP.

Laboratory instruments will be calibrated in accordance with the source methods, laboratory SOPs, and laboratory QA manuals. In general, laboratory instrument calibration includes the following elements:

- Initial multi-point calibration to establish the working range of the instrument and response factors or calibration curve.
- Verification of proper calibration using a standard from an independent source.
- Ongoing calibration checks at a typical frequency of 10% throughout the analytical run and at the end of the run.
- Depending on the analytical method, additional calibration elements may be required including tuning checks, interference check samples, and internal standards.

Records of initial calibration, continuing calibration and verification, repair, and replacement will be filed and maintained by the laboratory. Calibration records will also be included in data reporting packages.

## **2.8 Inspection/Acceptance of Supplies and Consumables**

Prior to acceptance, all supplies and consumables will be inspected by the E & E sampling team or other contractors to ensure that they are in satisfactory condition and free of defects. Sample containers provided by the laboratory will be pre-cleaned to EPA specifications. Preservatives will be prepared from reagent-grade or higher chemicals. Calibration standards must be traceable to National Institute of Standards and Technology or another recognized source.

## **2.9 Non-direct Measurements**

Non-direct measurements and data that will be collected for this project include the following:

- Sampling, analytical, and other data obtained from previous studies

- Global positioning system (GPS) survey of sample locations

Where possible and appropriate, these data will be obtained from peer-reviewed literature or other reputable sources such as university libraries, state and federal agencies, and the U.S. Geological Survey. The PM and/or QA Manager will review all data for consistency and accuracy. Where necessary, information will be verified by ground truthing or consultation with independent sources.

Maps and associated geographic information system (GIS) data will be continually improved as new information is obtained. Geographic coordinates will be collected for all new sample locations and included in the GIS project. All GPS data will be differentially corrected if needed. Data management discussed in Section 2.10 provides details about recording site data and incorporating these data into the project database and GIS system.

### **2.10 Data Management**

Daily field records constitute the primary documentation for field activities. Daily records are created using a combination of field logbooks and field data sheets. Field observations will be entered in field logbooks with enough detail to allow participants to accurately and objectively reconstruct events at a later time if necessary. Field logbooks will also document any deviations from the project scope, field protocols, or personal protection levels, as well as any changes in personnel. In all cases, deviations will be approved by the E & E PM and, where necessary, the BLM PM, prior to implementation in the field.

Logbooks will be bound with consecutively numbered pages; logbook pages cannot be removed, even if they are partially mutilated. Entries will be made in indelible ink using the time of day (24-hour clock) as entry headers. All logbooks will be returned to the project file at the end of the field tasks.

Each laboratory will provide the analytical results as electronic data deliverable and as paper reports. Following guidelines in the *Environmental Laboratory Data and Quality Assurance Requirements* (ADEC 2009) and following the Laboratory Data Review Checklist (ADEC 2010), all paper laboratory reports provided to E & E will be checked to verify they incorporate the following information:

- A report narrative discussing any out-of-control events, corrective actions, deviations from SOPs, and other observations pertaining to the analytical process.
- A cross-reference of field sample identifiers (IDs) to laboratory sample IDs.
- Dates of collection, receipt at laboratory, preparation, and analysis.
- Data results for each sample with associated dilution factors and reporting limits.
- Results for all laboratory QC samples (LCS, MS, MSD, duplicates), including acceptance limits.
- Surrogate recoveries and acceptance limits for each sample.



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## **2. Data Generation and Acquisition**

- A copy of the sample log-in checklist documenting sample condition, cooler temperatures, and so forth.
- A copy of the completed COC form signed by the laboratory.
- The raw data package, including initial and continuing calibration data, instrument performance checks, instrument run logs, and sample and blank data.

Each laboratory will maintain all original records relating to the analysis of the samples. These records will be maintained in such a way as to allow for complete reconstruction of the reported results by an independent party. These records will be available to E & E and/or the BLM upon request. The laboratory data reports will be maintained in the Master Records files at E & E.

# 3

## Assessment and Oversight

Assessments and oversight reports are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also address activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. They also keep management and the client current on field activities.

### 3.1 Assessments and Response Actions

#### 3.1.1 Assessments

The E & E PM is responsible for overall quality and performance on this project; responsibilities include review of project activities to ensure that objectives are met on a day-to-day basis and that this QAPP and other project planning documents have been properly implemented. The E & E QA Manager will also assist in this capacity.

The BLM is responsible for overseeing the QC aspects of each of its contractors, including E & E. BLM or its representative is responsible for the overall QC assessment of the project and may perform system audits at any time.

#### 3.1.2 Response Actions

Response actions will be implemented on a case-by-case basis to correct quality problems. All personnel involved in the project are responsible for discovering QA problems or deficiencies in their areas of responsibility. Any such deficiencies must be reported immediately to the PM. As soon as possible after discovery, the PM will also propose resolution action in cooperation with personnel in the area where the deficiency was found. The corrective action process has two components that must be addressed. The first component is the resolution of the immediate problem. The second component of the corrective action process is to prevent future occurrences of the problem. It is the responsibility of the PM to ensure that both components are addressed and to finalize the action necessary to achieve resolution.

Results of the following QA activities may also initiate corrective actions:



- Performance audits
- Systems audits
- Failure to adhere to the approved QAPP or project work plan.

### **3.2 Reports to Management**

Field teams will note any quality problems in the applicable logbook or other form of documentation. QA reports to the PM will be provided whenever quality problems are encountered.

The laboratory is responsible for providing a summary of quality issues to the PM with each data report.

Data validation reports will be provided to the PM by the data validation specialist. These reports will include a discussion of any significant quality problems that were observed and their effect on the use of the data.

Quality issues identified by the field team, laboratory, and data validation specialist will be incorporated into the data evaluation report(s) submitted to BLM. If significant problems are encountered, the PM will report these issues along with the results of the necessary response actions to BLM in a separate memorandum.

# 4

## Data Validation and Usability

### 4.1 Data Review, Verification, and Validation

Each member of the field team will be responsible for reviewing his or her work for completeness and accuracy. The RI Lead will conduct an independent review of the field data to ensure that it meets the requirements of this QAPP and the FSP.

The subcontracted laboratory will be responsible for internal review of the data prior to issuance of reports. These review procedures are documented in the laboratory QA manuals.

Laboratory data packages will be reviewed by the QA Manager for completeness, compliance with project objectives, and fulfillment of the Laboratory Data Review Checklist (ADEC 2010).

### 4.2 Verification and Validation Methods

The analytical results will be validated by an experienced E & E chemist. The data will be validated in accordance with the *National Functional Guidelines for Inorganic Data Review* (EPA 2010), *National Functional Guidelines for Organic Data Review* (EPA 2008), and *Guidelines for Data Reporting, Data Reduction, and Treatment of Non-Detect Values* (ADEC 2008) in conjunction with the QA/QC requirements specified in each specific analytical method and any project-specific QC defined in the QAPP.

Analytical data will be validated against criteria for:

- Holding times and sample integrity
- Instrument performance checks
- Initial and continuing calibrations
- Blank analyses
- Laboratory QC compounds and standards
- Field duplicates analyses
- Organic internal standard and surrogate performance
- Compound identification and compound quantification
- Reported detection limits
- System performance and overall assessment of data.



## **4. Data Validation and Usability**

Laboratory data will be assessed for usability in accordance with the DQOs presented in this QAPP. Results that are less than the reporting limit but that exceed the method detection limit will be qualified as estimates and used in calculations as a detected value. Both laboratory and field QA/QC data are also assessed for precision, accuracy, representation of true nature, comparability, and completeness.

Other data that may be reviewed for verification of total sample integrity include:

- Sample handling and storage
- Field duplicates as identified to the reviewer
- Sample preparation logs
- Instrument standards (primary and secondary records)
- Run logs for each instrument.

All corrections and/or notations will be added to the project database.

### **4.3 Reconciliation with User Requirements**

Data validation reports prepared by E & E will include an evaluation of the usability of the data. Precision, accuracy, representativeness, completeness, and comparability will be evaluated and compared with the project DQOs by the PM, in consultation with the QA Manager, as each data set is received. At the completion of the project, an overall assessment of data usability and compliance with project objectives will be conducted and documented in the Baseline Monitoring Report.

# 5

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# C

## Site-Specific Health and Safety Plan

The Site-Specific Health and Safety Plan is available upon request.

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