2010 POST-RI/FS GROUNDWATER AND SURFACE WATER FIELD SAMPLING AND ANALYSIS PLAN EAST HELENA FACILITY

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2010 POST-RI/FS GROUNDWATER AND SURFACE WATER FIELD SAMPLING AND ANALYSIS PLAN EAST HELENA FACILITY

1.0 INTRODUCTION

This Field Sampling and Analysis Plan (FSAP) summarizes the groundwater and surface water monitoring activities to be conducted as part of the 2010 Post-RI/FS groundwater and surface water monitoring program at the East Helena Facility (the Facility). The FSAP represents an update of previous annual Post-RI/FS water resources monitoring plans, and also incorporates the groundwater monitoring requirements associated with the Corrective Action Management Unit (CAMU) groundwater monitoring program (Hydrometrics, 2008), and the Acid Plant Sediment Drying area (APSD) and Speiss/Dross Slurry Wall Operation and Maintenance Plans (Asarco 2007a and 2007b). The FSAP is intended to provide guidance regarding sampling locations, sample collection methodologies, sample handling, documentation, and custody, and analytical requirements for groundwater and surface water samples collected as part of routine site-wide water resources monitoring in 2010. Monitoring activities specifically associated with the Phase II RCRA Facility Investigation (RFI) at the Facility are not discussed in this FSAP; the Phase II RFI field sampling program is outlined in the Phase II RCRA Facility Investigation Field Sampling and Analysis Plan (Hydrometrics, 2010a).

This Post-RI/FS FSAP is a streamlined document intended as a practical guide to conducting Post-RI/FS groundwater and surface water monitoring activities; therefore, it focuses on the number, type, and location of samples to be collected and the sampling and analytical methodologies to be employed for the 2010 monitoring. The Post-RI/FS FSAP is intended to be utilized in association with other Facility planning and guidance documents (prepared as part of the Phase II RFI), including the Quality Assurance Project Plan (QAPP) for Environmental Data Collection Activities (Hydrometrics, 2010b), and the Data Management

Plan (DMP) for Environmental Data Collection Activities (Hydrometrics, 2010c). Comprehensive discussions of the project and Facility history and background, the rationale for the sampling program design, and requirements for data review, reporting, and management are presented in the QAPP, the DMP, and the Phase II RFI Work Plan (Hydrometrics, 2010d), with brief summaries provided in this FSAP for context.

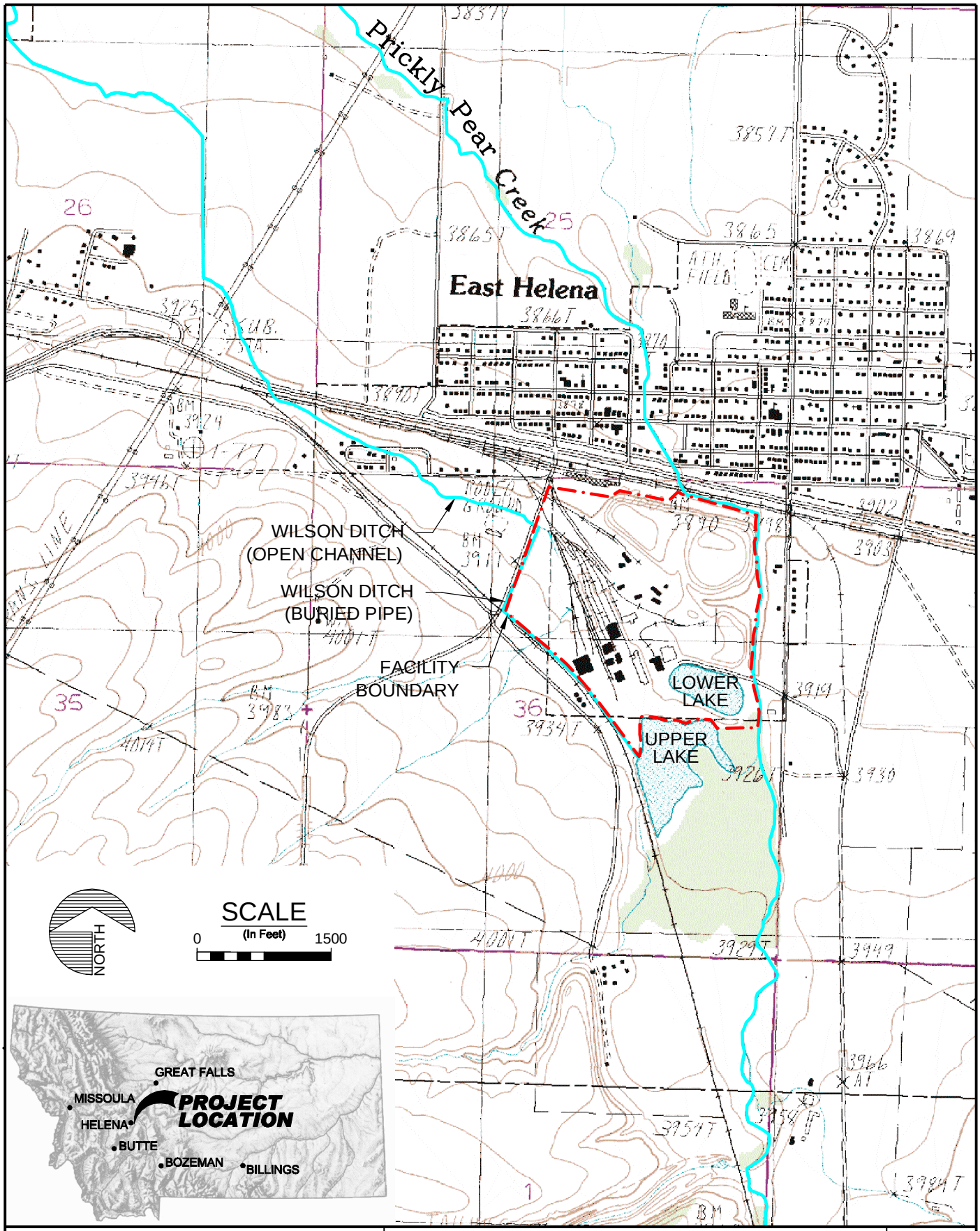
The 2010 Post-RI/FS groundwater and surface water FSAP is structured as follows:

- Section 1.0 – Introduction;
- Section 2.0 – Sampling Locations and Frequency;
- Section 3.0 – Sampling Methodology;
- Section 4.0 – Sample Handling and Documentation;
- Section 5.0 – Laboratory Analytical Procedures and Reporting; and
- Section 6.0 – References.

1.1 PROJECT BACKGROUND

The East Helena Facility is a former custom lead smelter located on approximately 142 acres. The Facility is located primarily on the Prickly Pear Creek alluvial plain, and is bounded to the south by Upper Lake and Lower Lake, to the east and northeast by Prickly Pear Creek, and to the west and southwest by uplands or foothills comprised of tertiary-age sediments. The Facility is bordered on the north by State Highway 12 and the American Chemet Facility (a manufacturer and marketer of metals-based chemicals), with the business district and major residential areas in the City of East Helena located a short distance north of the Facility (Figure 1-1).

In September 1984, pursuant to Section 105 of CERCLA, EPA added the East Helena Facility to the National Priorities List. In 1997, EPA initiated a transfer of responsibility for ongoing remedial activities at the Facility from its CERCLA program to its Corrective Action program under the Resource Conservation and Recovery Act (RCRA). In May of 1998,



2010 POST RI/FS GROUNDWATER AND SURFACE WATER SAMPLING AND ANALYSIS PLAN EAST HELENA FACILITY	**EAST HELENA FACILITY SITE LOCATION MAP**	FIGURE **1-1**

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1998, ASARCO and EPA entered into a Consent Decree (the 1998 CD) to further the objectives of RCRA and the Clean Water Act (CWA) (U.S. District Court, 1998).

On December 9, 2009, the Montana Environmental Custodial Trust was established as part of the larger Asarco bankruptcy settlement agreement approved by the Bankruptcy Court (SD, Texas) and the US Federal District Court (SD, Texas). A Consent Decree and Settlement Agreement regarding Montana Sites (the Settlement Agreement) was entered into by Asarco, US Department of Justice (DOJ), EPA, the State of Montana (the State) and the Montana Environmental Trust Group, LLC, as Trustee for the Montana Environmental Custodial Trust (the Custodial Trust). The Settlement Agreement describes the role and responsibilities of the Custodial Trust, which include owning, managing, and performing the clean-up and revitalization of Asarco's property in East Helena, Montana under oversight of EPA.

Routine (semi-annual) monitoring of groundwater and surface water within and adjacent to the Facility was initiated in 1985 as part of the Remedial Investigation/Feasibility Study (RI/FS). Post-RI/FS (long-term) groundwater and surface water monitoring has been conducted at the Facility from 1991 to the present. This monitoring program consists of monitoring groundwater and surface water conditions semi-annually (usually in May/June and October/November) within and adjacent to the East Helena Facility. The data generated through this long-term monitoring program is used to evaluate long-term trends in groundwater and surface water quality and to characterize the status and evolution of groundwater contaminant plumes beneath and downgradient of the facility, with an emphasis on arsenic and (more recently) selenium migration, as well as delineation of plume source areas.

As part of the 1998 CD with EPA and separate February 2005 and October 2007 consent decrees with the Montana Department of Environmental Quality (MDEQ), a number of site structures have been demolished with demolition waste placed in two Corrective Action Management Units (CAMUs) constructed on site. Groundwater detection monitoring

activities related to operation of the CAMUs are conducted quarterly at a suite of wells adjacent to the Phase I and Phase II CAMU cells.

1.2 SUMMARY OF GROUNDWATER AND SURFACE WATER MONITORING PROGRAMS

As noted above, routine groundwater and surface water monitoring is conducted at the East Helena Facility to achieve the following objectives:

- Evaluate long-term water quality trends;
- Characterize the status and evolution of groundwater contaminant plumes (particularly for arsenic and selenium);
- Identify groundwater plume source area(s); and
- Satisfy the detection monitoring requirements associated with the Phase I and Phase II CAMUs.

The Post RI/FS Long-Term Monitoring Program and CAMU monitoring for 2010 are summarized below. Details regarding sampling locations, methodologies, and analytical requirements are in Sections 2.0 through 5.0.

1.2.1 Post-RI/FS Long-Term Monitoring Program

The Post-RI/FS (long-term) monitoring for 2010 will include semiannual groundwater and surface water sampling, to be conducted during the spring (May/June) and fall (October/November). The sampling schedule is intended to document water resource conditions under both wet and dry season conditions, and for consistency with the previous annual monitoring schedule.

Groundwater Monitoring: semiannual groundwater monitoring will consist of the following tasks:

- Measurement of static water levels at all monitoring wells; and
- Measurement of field parameters and collection of water quality samples at selected wells for laboratory analysis of physical parameters, common ions, and dissolved metals.

Surface Water Monitoring: semiannual surface water monitoring will consist of the following tasks:

- Measurement of stream flow and/or stage at five sites on Prickly Pear Creek and at Lower Lake and Upper Lake; and
- Measurement of field parameters and collection of water quality samples at each site for laboratory analysis of physical parameters, common ions, and total recoverable metals.

1.2.2 CAMU Quarterly Groundwater Monitoring Program

The Design Analysis Report, Corrective Action Management Unit Sampling and Monitoring Plan (SMP) (Hydrometrics, 2008) addresses groundwater monitoring and reporting requirements associated with CAMU monitoring wells MW-1 through MW-11. In accordance with the SMP, monitoring of CAMU wells is specified on a quarterly basis. The 2010 CAMU monitoring program will consist of the following tasks:

- Measurement of static water levels at wells MW-1 through MW-11; and
- Measurement of field parameters and collection of water quality samples from all wells for laboratory analysis of physical parameters, common ions, and dissolved metals.

2.0 SAMPLING LOCATIONS AND FREQUENCY

This section of the FSAP describes groundwater and surface water sampling locations. Details on sampling methodologies, sample handling, and analytical requirements are presented in Sections 3.0, 4.0, and 5.0, respectively. Additional information is provided in the project QAPP (Hydrometrics, 2010b).

2.1 POST-RI/FS LONG-TERM MONITORING PROGRAM

2.1.1 Groundwater Monitoring

The 2010 Post-RI/FS groundwater monitoring will consist of static water level measurement at all 152 project monitoring wells and collection of water quality samples at a subset of wells (103 of the 152) on a semiannual basis. Table 2-1 summarizes the groundwater monitoring sites for the Post RI/FS Long-term Monitoring Program. Monitoring locations are shown on Exhibit 1. The semiannual monitoring events will be conducted at contrasting points of the seasonal hydrograph, during the spring or early summer (May/June, to coincide with wet season conditions) and in the fall season (October/November, to coincide with low water conditions).

The groundwater monitoring well network encompasses the former plant site as well as upgradient and downgradient areas (Exhibit 1). Plant site wells include all wells within and immediately adjacent to the Facility boundary (Figure 1-1) where plant activities were historically conducted. Off-site wells are located in the City of East Helena, in Lamping Field (directly west of the City of East Helena), and other properties to the north and west of the facility. Monitoring wells designated for water quality sampling in Table 2-1 consist of a subset of plant site wells and all of the off-site wells, with the exceptions of EH-66 and EH-121. The subset of monitoring wells scheduled for water quality monitoring were selected based on an evaluation of past monitoring results (Hydrometrics, 2010e), and further recommendations for wells to be omitted from the 2010 monitoring program provided by the agencies (EPA, 2010).

TABLE 2-1. EAST HELENA FACILITY POST-RI/FS AND CAMU 2010 GROUNDWATER MONITORING LOCATIONS

Site	Total Depth (ft bmp)	Wells Scheduled for Semi-annual Water Quality Sampling
Plant Site Wells		
APSD-1	11.75	
APSD-2	18.00	
APSD-3	12.5	
APSD-4	14.00	
APSD-7	16.00	
APSD-8	16.40	X
APSD-9	17.10	X
APSD-10	16.00	
APSD-11	18.20	X
APSD-12	17.30	X
APSD-15	24.50	
APSD-16	26.10	X
DH-1	51.32	X
DH-2	65.50	
DH-3	54.36	X
DH-4	24.00	X
DH-5	18.30	X
DH-6	28.30	X
DH-7	31.00	X
DH-8	49.00	
DH-9	11.50	
DH-10A	12.50	X
DH-11	31.00	X
DH-12	30.00	
DH-13	45.00	
DH-14	46.00	
DH-15	50.33	X
DH-16	28.00	
DH-17	42.80	X
DH-18	63.50	
DH-19R	25.00	
DH-20	31.75	X
DH-21	29.00	
DH-22	34.00	
DH-23	19.70	X
DH-24	35.00	
DH-27	29.00	
DH-28	36.00	
DH-29	17.00	
DH-30	24.20	X
DH-31	28.00	
DH-32	30.00	
DH-33	30.00	
DH-34	30.00	
DH-35	31.89	X
DH-36	31.00	
DH-37	30.00	
DH-38	25.00	
DH-42	39.50	X
DH-47	17.90	X
DH-48	34.00	
DH-49	37.30	X

TABLE 2-1. EAST HELENA FACILITY POST-RI/FS AND CAMU 2010 GROUNDWATER MONITORING LOCATIONS

Site	Total Depth (ft bmp)	Wells Scheduled for Semi-annual Water Quality Sampling
DH-50	36.60	X
DH-51	36.40	X
DH-52	20.10	X
DH-53	19.40	X
DH-54	29.80	X
DH-55	96.00	X
DH-56	88.00	X
DH-57	28.00	
DH-58	24.00	
DH-59	26.10	X
DH-61	30.00	
DH-62	77.70	X
DH-63	39.00	
DH-64	57.40	X
DH-65	74.00	X
DH-66	50.20	X
DH-67	49.00	X
DH-68	53.00	X
DH-69	42.50	X
DH-70	33.00	X
DH-71	36.60	X
Sparge 3	37.00	
STW-1	38.00	
STW-2	39.00	
STW-3	39.50	
STW-4	37.00	
STW-5	39.00	
STW-6	39.00	
STW-7	40.00	
STW-8	40.00	
STW-9	40.00	
SDMW-1	48.10	X
SDMW-2	42.50	
SDMW-3	41.80	X
SDMW-4	39.00	
SDMW-5	51.20	X
TW-1	49.04	
Off Site Wells		
EH-50	46.80	X
EH-51	31.50	X
EH-52	13.00	X
EH-53	38.10	X
EH-54	18.80	X
EH-57A	46.20	X
EH-58	33.80	X
EH-59	17.10	X
EH-60	29.60	X
EH-61	47.80	X
EH-62	44.50	X
EH-63	35.50	X
EH-64	38.30	X
EH-65	36.20	X
EH-66	38.50	
EH-67	40.40	X
EH-68	25.40	X
EH-69	37.60	X

TABLE 2-1. EAST HELENA FACILITY POST-RI/FS AND CAMU 2010 GROUNDWATER MONITORING LOCATIONS

Site	Total Depth (ft bmp)	Wells Scheduled for Semi-annual Water Quality Sampling
EH-100	62.70	X
EH-101	48.80	X
EH-102	36.50	X
EH-103	78.10	X
EH-104	48.20	X
EH-106	46.30	X
EH-107	79.50	X
EH-109	65.20	X
EH-110	55.90	X
EH-111	49.80	X
EH-112	41.40	X
EH-113	44.40	X
EH-114	55.25	X
EH-115	49.70	X
EH-116	51.60	X
EH-117	45.30	X
EH-118	52.70	X
EH-119	74.40	X
EH-120	68.90	X
EH-121	69.00	
EH-122	69.30	X
EH-123	63.70	X
EH-124	78.30	X
EH-125	73.10	X
EH-126	77.20	X
EH-127	76.80	X
EH-128	47.80	X
EH-129	94.40	X
EH-130	81.00	X
EH-131	88.00	X
EH-132	84.50	X
EH-133	99.60	X
EH-134	67.80	X
EH-135	68.40	X
EH-136	78.80	X
EH-137	88.00	X
EH-200	50.50	X
EH-201	121.50	X
EH-202	92.62	X
EH-203	150.00	X
EH-204	65.00	X
EH-205	36.00	X
EH-206	53.00	X
EH-208	85.00	X
EH-209	116.00	X

TABLE 2-1. EAST HELENA FACILITY POST-RI/FS AND CAMU 2010 GROUNDWATER MONITORING LOCATIONS

Site	Total Depth (ft bmp)	Wells Scheduled for Semi-annual Water Quality Sampling
CAMU Wells [2]		
MW-1	71.90	X
MW-2	69.50	X
MW-3	51.40	X
MW-4	67.70	X
MW-5	69.00	X
MW-6	43.00	X
MW-7	59.99	X
MW-8	67.80	X
MW-9	74.00	X
MW-10	65.60	X
MW-11	75.00	X

SWL Measurements	
Post RI/FS Wells (Semiannual)	152
CAMU Wells (Quarterly)	11
Total	**163**
Water Quality Samples	
Post RI/FS Wells (Semiannual)	103
CAMU Wells (Quarterly)	11
Total	**114**

[1] Static water levels will be measured at all monitoring wells, water quality samples will be collected from designated wells.

[2] CAMU wells will be sampled on a quarterly basis, with the spring and fall events coinciding with the Post RI/FS monitoring Well locations shown on Exhibit 1.

Nine new monitoring wells are proposed as part of the Phase II RFI, to be installed in 2010. Five on-site wells (DH-72 through DH-76) and four off-site wells (EH-70, EH-138, EH-139, and EH-140) will be installed to allow further delineation of the arsenic and selenium groundwater plumes, and to evaluate vertical gradients (Hydrometrics, 2010d). Proposed well locations are shown on Exhibit 1. Initial monitoring of these new wells will be conducted after the wells are installed and developed, with measurement of static water levels, field parameters and collection of water quality samples. Following the initial groundwater monitoring event the new wells will be incorporated into the Post-RI/FS monitoring program described in this FSAP.

The Post-RI/FS and CAMU groundwater monitoring locations for 2010 are summarized in the groundwater sampling matrix presented as Table 2-2. Table 2-2 also shows analytical parameter, method, and detection limit requirements, along with field quality control sampling requirements.

2.1.2 Surface Water Monitoring

Surface water monitoring will consist of semiannual collection of water quality samples, stage measurements, and discharge (stream flow) measurements at five sites on Prickly Pear Creek, and semiannual collection of water quality samples and stage measurements from two ponds located on the plant site (Lower Lake and Upper Lake). Surface water sampling will be performed during the same general time period as the Post-RI/FS groundwater monitoring, during the spring or early summer (May/June) and fall (October/November). 2010 surface water monitoring locations are described in Table 2-3 and are shown on Exhibit 1.

Surface water monitoring on Prickly Pear Creek will be conducted in a synoptic fashion. Sites will be sampled and stream flows measured from downstream to upstream in a single day, to provide information on flow gains and losses and instream parameter loading trends across various stream reaches, while minimizing the possibility of temporal variability.

TABLE 2-2. EAST HELENA FACILITY 2010 POST-RI/FS AND CAMU GROUNDWATER SAMPLE COLLECTION AND ANALYSIS MATRIX

Sample Location[1]	Purpose	Number of Sampling Events	Total Non-QC Samples	Analytical Parameters	Laboratory Methods[2]	Project Detection Limit Goal (mg/L)	Field QC Samples[3]			Total Samples
							Field Duplicates	Field D.I. Blanks	Field Rinsate Blanks	
2010 Post RI/FS Program (Semiannual) 103 Existing Monitoring Wells	Long-term trend analysis and plume delineation	2	206	*Field Parameters* pH specific conductance dissolved oxygen temperature SWL (static water level)			12	12	12	242
DH-72 (RFI) DH-73 (RFI) DH-74 (RFI) DH-75 (RFI) DH-76 (RFI) EH-70 (RFI) EH-138 (RFI) EH-139 (RFI) EH-140 (RFI)	Plume delineation and determination of vertical flow and concentration gradients	1	9	*Laboratory Parameters* Common Constituents pH specific conductance Ca Mg Na K HCO_3 SO_4 Cl Total Alkalinity as $CaCO_3$ TDS TSS	150.2/SM 4500H-B 120.1/SM 2510B 215.1/200.7 242.1/200.7 273.1/200.7 258.1/200.7 SM 2320 B 300.0 300.0/SM 4500CL-B SM 2320 B SM 2540 C SM 2540 D	 5 5 5 5 1 1 1 1 10 10	1	1	1	12
Post RI/FS CAMU Program (Quarterly) MW-1 (C) MW-2 (C) MW-3 (C) MW-4 (C) MW-5 (C) MW-6 (C) MW-7 (C) MW-8 (C) MW-9 (C) MW-10 (C) MW-11 (C)	Comply with CAMU monitoring requirements	4	44	Trace Constituents (Dissolved) Aluminum (Al) Antimony (Sb) Arsenic (As) Barium (Ba) Beryllium (Be) Cadmium (Cd) Chromium (Cr) Cobalt (Co) Copper (Cu) Gold (Au) Iron (Fe) Lead (Pb) Manganese (Mn) Mercury (Hg) Nickel (Ni) Selenium (Se) Silver (Ag) Tellurium (Te) Thallium (Tl) Vanadium (V) Zinc (Zn)	 200.7/200.8 200.7/200.8 200.8/SM 3114B 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 245.2/245.1/200.8/SM 3112B 200.7/200.8 200.7/200.8/SM 3114B 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8	 0.1 0.003 0.002 0.1 0.001 0.001 0.001 0.001 0.001 0.01 0.02 0.005 0.01 0.001 0.01 0.001 0.005 0.1 0.001 0.01 0.01	4	4	4	56
							Total Groundwater Samples			**310**

(1) (RFI) = Phase II RFI Monitoring Well; (C) = CAMU Monitoring Well. Phase II RFI Wells will be added to Post-RI/FS semiannual monitoring program following completion and development.
(2) Laboratory analytical methods are from the most recent version of *Standard Methods (SM) for the Examination of Water and Wastewater* or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).
(3) Field duplicates, rinsate blanks, and DI blanks will each be collected at a minimum frequency of 1 per 20 field samples or one per day, whichever is more frequent.

TABLE 2-3. EAST HELENA FACILITY 2010 POST-RI/FS SURFACE WATER MONITORING LOCATIONS

Site Code	Description
Lower Lake[(1)]	Former process pond in southeast portion of plant site
Upper Lake[(2)]	South end of plant site; fed by diversion from Prickly Pear Creek
PPC-3A	Prickly Pear Creek approximately 0.25 miles upstream of Facility
PPC-103	Prickly Pear Creek adjacent to Lower Lake
PPC-5	Prickly Pear Creek adjacent to slag pile
PPC-7	Prickly Pear Creek north of slag pile, upstream of Hwy 12 bridge
PPC-8	Prickly Pear Creek downstream of Facility in East Helena

(1) Water level (stage) measurement will be collected from the established measuring point at the former zinc plant pump house inlet.

(2) Water level (stage) measurement will be collected from the established measuring point at the pump station railing.

The Post-RI/FS surface water monitoring locations for 2010 are summarized in the surface water sampling matrix presented as Table 2-4. Table 2-4 also shows analytical parameter, method, and detection limit requirements, along with field quality control sampling requirements.

2.2 CAMU QUARTERLY GROUNDWATER MONITORING PROGRAM

Eleven monitoring wells have been installed southeast of the Facility for the specific purpose of monitoring groundwater flow and quality in the vicinity of the Phase I and Phase II CAMUs. CAMU groundwater monitoring locations are listed in Table 2-1 and shown on Exhibit 1. Four monitoring wells are located around the perimeter of each of the two CAMU cells: the CAMU Phase I cell is bordered by monitoring wells MW-1, MW-2, MW-3, and MW-4, while the CAMU Phase II cell is bordered by monitoring wells MW-5, MW-8, MW-9, and MW-10 (Exhibit 1). Three additional monitoring wells, MW-6, MW-7 and MW-11, are located peripheral to the CAMU cells.

TABLE 2-4. EAST HELENA FACILITY 2010 POST-RI/FS SURFACE WATER SAMPLE COLLECTION AND ANALYSIS MATRIX

Sample Location	Purpose	Number of Sampling Events	Total Non-QC Samples	Analytical Parameters	Laboratory Methods[1]	Project Detection Limit Goal (mg/L)	Field QC Samples[2]			Total Samples
							Field Duplicates	Field D.I. Blanks	Field Rinsate Blanks	
2010 Post RI/FS Program (Semiannual)	Long-term trend analysis and evaluation of potential surface water impacts	2	14	*Field Parameters*			2	2	2	20
Lower Lake				pH						
Upper Lake				specific conductance						
PPC-3A				dissolved oxygen						
PPC-5				temperature						
PPC-7				stream flow and/or stage						
PPC-8				*Laboratory Parameters*						
PPC-103				Common Constituents						
				pH	150.2/SM 4500H-B					
				specific conductance	120.1/SM 2510B					
				Ca	215.1/200.7	5				
				Mg	242.1/200.7	5				
				Na	273.1/200.7	5				
				K	258.1/200.7	5				
				HCO_3	SM 2320 B	1				
				SO_4	300.0	1				
				Cl	300.0/SM 4500CL-B	1				
				Total Alkalinity as $CaCO_3$	SM 2320 B	1				
				TDS	SM 2540 C	10				
				TSS	SM 2540 D	10				
				Trace Constituents (Total Recoverable)**						
				Aluminum (Al)**	200.7/200.8	0.05				
				Antimony (Sb)	200.7/200.8	0.003				
				Arsenic (As)	200.8/SM 3114B	0.0005				
				Barium (Ba)	200.7/200.8	0.1				
				Beryllium (Be)	200.7/200.8	0.001				
				Cadmium (Cd)	200.7/200.8	0.0001				
				Chromium (Cr)	200.7/200.8	0.001				
				Cobalt (Co)	200.7/200.8	0.0005				
				Copper (Cu)	200.7/200.8	0.001				
				Gold (Au)	200.7/200.8	0.01				
				Iron (Fe)	200.7/200.8	0.02				
				Lead (Pb)	200.7/200.8	0.0005				
				Manganese (Mn)	200.7/200.8	0.01				
				Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.00001				
				Nickel (Ni)	200.7/200.8	0.01				
				Selenium (Se)	200.7/200.8/SM 3114B	0.001				
				Silver (Ag)	200.7/200.8	0.0005				
				Tellurium (Te)	200.7/200.8	0.1				
				Thallium (Tl)	200.7/200.8	0.0002	*Total Surface Water Samples*			**20**
				Vanadium (V)	200.7/200.8	0.1				
				Zinc (Zn)	200.7/200.8	0.01				

(1) Laboratory analytical methods are from the most recent version of *Standard Methods (SM) for the Examination of Water and Wastewater* or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).
(2) Field duplicates, rinsate blanks, and DI blanks will each be collected at a minimum frequency of 1 per 20 field samples or one per day for Post-RI/FS monitoring, whichever is more frequent.
**Samples for aluminum will be field-filtered and analyzed for the dissolved fraction; all other metals will be analyzed for the total recoverable fraction.

Groundwater monitoring of CAMU wells will be conducted at monitoring wells MW-1 through MW-11 on a quarterly basis in 2010. Monitoring events will be conducted during each calendar quarter (i.e., January-March, April-June, July-September, and October-December time periods). The CAMU well monitoring events conducted during the second (April-June) and fourth (October-December) quarters of 2010 will coincide with the Post-RI/FS semiannual long-term monitoring events conducted during those periods (Section 2.1).

3.0 SAMPLING METHODOLOGY

The sampling methodologies to be utilized for groundwater and surface water monitoring conducted as part of the Post-RI/FS long-term monitoring and CAMU monitoring programs are detailed in the QAPP for Environmental Data Collection Activities at the East Helena Facility (Hydrometrics, 2010b). Standard Operating Procedures (SOPs) for performing field activities are collected in Appendix C of the QAPP. The sampling methodologies outlined below for groundwater (Section 3.1), and surface water (Section 3.2) are derived from the QAPP. Collection of field quality control samples for all sample media is discussed in Section 3.3.

3.1 GROUNDWATER MONITORING

The collection of groundwater samples from site monitoring wells will generally consist of three steps:

1. Measurement of static water level;
2. Well purging and monitoring for field parameter stabilization; and
3. Water quality sample collection.

3.1.1 Static Water Level Measurement

Prior to collection of samples or removal/introduction of any equipment into the well, the static water level will be measured at each well using an electric water level probe to determine the depth of groundwater below a specified measuring point (typically the top of the PVC well casing). Water level measurements will be combined with surveyed measuring point elevations to compute groundwater elevations at each monitoring point. Typically, a complete set of static water level measurements at all wells designated for static water level monitoring will be collected prior to initiating water quality sampling. This procedure allows static water levels to be measured over a shorter time period (one or two days) than would be possible if measurements were collected concurrently with sampling activities at each well.

3.1.2 Well Purging, Field Parameter Measurement and Water Quality Sample Collection

In general, groundwater sampling will proceed in order from "clean" sites (with lower concentrations of constituents of concern), to "dirty" sites based on previous data collected at the site to reduce the potential for cross-contamination of water samples. Field personnel will determine the appropriate sampling order before conducting sampling in cooperation with the field team leader and the project manager.

Dedicated HDPE tubing is installed in most monitoring wells, and a 12-volt submersible pump will be used to purge and sample these monitoring wells. For some deeper wells, a non-dedicated submersible pump and tubing system capable of greater pumping depths (e.g., 2-inch Grundfos pump) will be utilized. Purging will consist of removing three to five well volumes while routinely monitoring field parameters (pH, dissolved oxygen, temperature, specific conductance) at least twice during removal of each well volume. Field parameters will be measured using a flow-through device to minimize potential effects from atmospheric exposure. Field meters will be calibrated daily according to factory instructions, with calibration results recorded on calibration forms. All purge water will be containerized and routed to the Facility water treatment system.

Samples for laboratory analysis will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes have been removed and successive field parameter measurements agree to within the stability criteria given below; or
- At least five well volumes have been removed although field parameter stabilization criteria are not yet met; or
- The well has been pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed.

Criteria for field parameter stabilization are as follows:

Parameter (Units)	Stability Criteria
pH (standard units)	± 0.1 s.u.
Water temperature (°C)	± 0.2 °C
Specific conductance (µmhos/cm)	± 5% (SC ≤ 100 µmhos/cm) ± 3% (SC > 100 µmhos/cm)
Dissolved oxygen (mg/L)	± 0.3 mg/L

NOTE: Stability criteria obtained from USGS *National Field Manual for the Collection of Water Quality Data: Chapter A4, Collection of Water Samples* (September 1999).

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from a sampling port, prior to the pumped water passing through the flow-through cell. Samples for trace constituents will be filtered through a 0.45µm filter prior to preservation, to allow analysis for the dissolved fraction. Alternatively, samples for analysis of dissolved constituents may be filtered and preserved in the laboratory within 48 hours of collection.

Sample containers will be rinsed three times with sample water prior to sample collection, then preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH < 2 for metals analysis), and stored on ice in coolers at approximately 4±2°C during transport. Water quality sample container and preservation requirements are specified in the project QAPP (Hydrometrics, 2010b) and in Table 3-1.

TABLE 3-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Matrix	Parameters	Sample Containers	Preservative
Water (Groundwater and Surface Water)	Field Parameters	None	None
	Common Constituents	500 mL HDPE	Cool to 4°C
	Trace Constituents (dissolved for groundwater, total recoverable for surface water ***except aluminum***)	250 mL HDPE	Filter dissolved samples (0.45 µm) HNO_3 to pH <2 Cool to 4°C

Groundwater sampling equipment reused between monitoring locations (12-volt sampling pump and short piece of discharge line used to connect to the dedicated well tubing, or Grundfos 2-inch pump system and non-dedicated tubing) will be thoroughly decontaminated between uses. Equipment decontamination will consist of the following steps:

- Rinse with five gallons of soapy water (Alconox or other non-phosphate detergent);
- Rinse with five gallons of clean tap water; and
- Final rinse with three gallons of distilled or deionized water.

The effectiveness of the decontamination procedure will be evaluated through the periodic collection of equipment rinsate and deionized water blanks, as outlined in Section 3.3 below and in the project QAPP (Hydrometrics, 2010b).

3.2 SURFACE WATER MONITORING

Surface water monitoring will consist of the following steps:

1. Measurement of stream flow and stage (at sites instrumented with staff gages);
2. Water quality sample collection.

3.2.1 Flow Measurement

Surface water flow measurements at flowing water sites will be collected using a Marsh-McBirney current meter and wading rod (area-velocity method). If measurement conditions are unsafe due to high flows, the field sampling team will estimate the flow. Stage measurements (water surface elevations) will also be recorded at sites equipped with staff gages, or by measurement from established survey points.

Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth, or at two-tenths and eight-tenths

if the water depth exceeds 2.5 feet. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths.

3.2.2 Field Parameters and Water Quality Sample Collection

Field parameters measured at surface water quality monitoring sites will include the following:

- pH;
- specific conductance (SC);
- dissolved oxygen (DO); and
- water temperature.

Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and/or on calibration forms. Field parameter measurements will be obtained directly in the stream if possible; however, high velocity areas should be avoided to limit possible pH measurement errors due to streaming potentials. Alternatively, a clean container may be filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms. Field meters are checked periodically throughout the day for drift by measuring standard solutions (pH buffers, SC solutions), and are recalibrated as necessary.

Water quality samples will be collected from each surface water monitoring site by passing an uncapped sample container across the area of flow. When wading, samples are collected across the area of flow upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Water quality sample container and preservation requirements are specified in the project QAPP (Hydrometrics, 2010b) and in Table 3-1. Sample containers will be rinsed three times with sample water prior to sample collection.

Samples will be preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH < 2 for metals analysis), and stored on ice in coolers at approximately 4±2°C for transport. Note that all trace constituents will be analyzed for total recoverable concentrations (unfiltered samples) with the exception of aluminum, which is analyzed as dissolved. Therefore, a separate sample for aluminum will be field filtered through a 0.45 µm filter prior to preservation. Alternatively, samples for analysis of dissolved aluminum may be filtered and preserved in the laboratory within 48 hours of collection.

All samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook, and on standard field forms.

3.3 FIELD QUALITY CONTROL SAMPLES

Field quality control (QC) samples will be collected and analyzed as part of the post-RI/FS long-term groundwater and surface water monitoring program and the CAMU groundwater monitoring program as part of the project quality assurance program. Details for collection and submittal of quality assurance and quality control samples are also discussed in the Quality Assurance Project Plan for Environmental Data Collection Activities for the East Helena Facility (Hydrometrics, 2010b).

The field QC sample types and required frequencies are noted in the sample collection and analysis matrix tables for groundwater and surface water (Tables 2-2 and 2-4). The required field QC sample types for the groundwater and surface water monitoring programs will include the following QC sample types, to be collected at a frequency of 1 per 20 samples or one per day, whichever is greater:

- Equipment rinsate blanks (groundwater sampling only);
- Deionized water blanks (groundwater and surface water sampling); and
- Field duplicate samples (groundwater and surface water sampling).

Field Blanks (Rinsate Blanks and D.I. Blanks)

Rinsate blanks consist of deionized water processed through decontaminated sampling equipment (including filtration equipment as appropriate), collected into sample bottles and preserved. D. I. blanks consist of deionized water placed directly from storage containers into sample containers and preserved. Rinsate and D. I. blanks for groundwater samples, and D.I. blanks for surface water samples will be collected at a frequency of one per twenty samples (1/20) or one per day, whichever is greater.

Additional information regarding collection of rinsate blank samples is provided in the applicable SOP in Appendix C of the project QAPP (Hydrometrics, 2010b).

Field Duplicates

Field duplicate samples are replicate samples from a single sampling location submitted to a laboratory for the same set of analyses. For the purposes of this project, field duplicates will be collected by filling two samples containers consecutively from the sampling location. Duplicates will be sent to the same laboratory, but will be identified with different sample numbers. Field duplicates will be collected at a minimum frequency of one per twenty (1/20) or one per day, which ever is greater.

All field QC samples will be submitted blind to the laboratory (QC samples will be packaged and shipped in such a manner that the laboratory will not be aware of the nature of the samples).

4.0 SAMPLE HANDLING AND DOCUMENTATION

All samples transferred to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures. Samples will be stored in iced coolers or refrigerated following collection, then hand-delivered to the laboratory in iced coolers to maintain sample temperatures of approximately 4±2°C. The SOPs for sample labeling, documentation and chain-of-custody procedures are in Appendix C of the project QAPP (Hydrometrics, 2010b).

Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility sampling personnel until samples are shipped or delivered to the laboratory. Any containers used to ship samples via independent courier will be sealed with custody seals prior to shipping, and the receiving laboratory will record the condition of the seals upon arrival to ensure that the containers have not been opened during transport. Custody seals are not required for samples that are maintained under the direct custody of sampling personnel until being hand-delivered to the laboratory. Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis, and reporting. At the time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

Documents generated during sample collection will consist of:

1. Sample collection field notes and forms;
2. Chain-of-Custody forms; and
3. Shipping receipts in the event that samples are sent to a laboratory via independent courier.

Sampling activities will be recorded in a project-specific field notebook, and the appropriate water sample collection form will be completed. Each sample will be identified with a unique

sample number, along with the date and time of collection, on adhesive labels attached to sample bottles. All labels will be completed using waterproof ink.

Field notebooks used to record pertinent sampling information will include, at a minimum, the following:

- Project name;
- Date and time;
- Sample location;
- Sample number;
- Sample depth (if applicable);
- Media type;
- Field meter calibration information;
- Sampling personnel present;
- Analyses requested;
- Sample preservation;
- Field parameter measurements;
- Weather observations; and
- Other relevant project-specific site or sample information.

Entries will be made in permanent ink. Corrections to field notebooks will be made by crossing out erroneous information with a single line and initialing the correction. Field books will be signed and dated at the bottom of each page by personnel making entries on that page.

Individual samples (including QC samples) will be assigned unique sample numbers according to the following sample numbering scheme:

AAA[A]-YYMM-XXX

where AAA[A] is a three- or four-character code denoting the project, YYMM is a four-digit code denoting the year and month (e.g., 1009 for September 2010), and XXX is a three-digit code that is incremented sequentially for each successive sample.

5.0 LABORATORY ANALYTICAL PROCEDURES AND REPORTING

Laboratory analysis will be conducted by Energy Laboratories' Helena, Montana branch. Energy Laboratories is certified by EPA Region 8 and the State of Montana under the Safe Drinking Water Act. Field parameters will be analyzed by Hydrometrics' field personnel using the procedures outlined in Sections 3.1.2 and 3.2.2 above, and in the applicable SOPs collected in Appendix C of the Facility QAPP (Hydrometrics, 2010b). All laboratory analysis will be fully documented and conducted in accordance with EPA-approved and/or industry standard analytical methods.

5.1 GROUNDWATER ANALYSES

Required parameters, analytical methods, and project-required detection limits for groundwater quality samples collected as part of Post-RI/FS long-term monitoring and CAMU quarterly monitoring at the East Helena Facility are shown in Table 5-1. This information is also summarized in the groundwater sample collection matrix table (Table 2-2). Groundwater samples will be analyzed for physical parameters, common constituents, and a comprehensive suite of trace constituents. The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference (laboratory's practical quantitation limit). These limits will support project objectives for contaminant plume characterization, comparison with regulatory standards, and risk assessment. It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples due to sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

The laboratory analytical parameters listed in Table 5-1 of this SAP differ slightly from those specified in the initial CAMU SMP parameter list (Hydrometrics, 2008). The parameter list for the eleven CAMU wells was modified in 2009 with agency approval to be consistent with the parameter list used for long-term groundwater monitoring at the facility.

TABLE 5-1. ANALYTICAL METHODS AND DETECTION LIMITS FOR GROUNDWATER SAMPLES

Parameter	Analytical Method[(1)]	Project-Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Dissolved)[(2)]		
Aluminum (Al)	200.7/200.8	0.1
Antimony (Sb)	200.7/200.8	0.003
Arsenic (As)	200.8/SM 3114B	0.002
Barium (Ba)	200.7/200.8	0.1
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.7/200.8	0.001
Chromium (Cr)	200.7/200.8	0.001
Cobalt (Co)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.001
Gold	200.7/200.8	0.01
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.005
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.001
Nickel (Ni)	200.7/200.8	0.01
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Silver (Ag)	200.7/200.8	0.005
Tellurium	200.7/200.8	0.1
Thallium (Tl)	200.7/200.8	0.001
Vanadium (V)	200.7/200.8	0.01
Zinc (Zn)	200.7/200.8	0.01
Field Parameters		
Static Water Level	HF-SOP-10	0.01 ft
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L
pH	HF-SOP-20	0.01 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewa*ter (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).
(2) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

5.2 SURFACE WATER ANALYSES

Required parameters, analytical methods, and project-required detection limits for surface water quality samples collected at the East Helena Facility are shown in Table 5-2. Similar to groundwater, samples will be analyzed for physical parameters, common constituents, and a comprehensive suite of trace constituents. The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference (laboratory's practical quantitation limit). These limits will support project objectives for ongoing trend analysis, evaluation of groundwater/surface water interactions, comparison with regulatory standards, and risk assessment; therefore, PRDLs for a number of parameters are different in surface water compared with groundwater. It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples due to sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

5.3 DATA REVIEW AND REPORTING

Procedures for data review, validation, and reporting are presented and discussed in the Facility QAPP (Hydrometrics, 2010b) and in the Data Management Plan (Hydrometrics, 2010c), including control limits and criteria for specific types of field and laboratory QC samples, data validation and verification methods, potential corrective actions if criteria are not met, and database management issues.

All data deliverables containing analytical data and quality control information will be reviewed for overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in the project planning documents (including this FSAP) are present. At a minimum, deliverables will include field notes and/or forms, transmittal information, sample chain-of-custody forms, analytical results, methods and PQLs, and laboratory QC summaries. The reviewer will determine whether all required items are present and request copies of missing deliverables.

TABLE 5-2. ANALYTICAL METHODS AND DETECTION LIMITS FOR SURFACE WATER SAMPLES

Parameter	Analytical Method[(1)]	Project-Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Total Recoverable except Aluminum [Dissolved])[(2)]		
Aluminum (Al)[(2)]	200.7/200.8	0.05
Antimony (Sb)	200.7/200.8	0.003
Arsenic (As)	200.8/SM 3114B	0.0005
Barium (Ba)	200.7/200.8	0.1
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.7/200.8	0.0001
Chromium (Cr)	200.7/200.8	0.001
Cobalt (Co)	200.7/200.8	0.0005
Copper (Cu)	200.7/200.8	0.001
Gold	200.7/200.8	0.01
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.0005
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.00001
Nickel (Ni)	200.7/200.8	0.01
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Silver (Ag)	200.7/200.8	0.0005
Tellurium	200.7/200.8	0.1
Thallium (Tl)	200.7/200.8	0.0002
Vanadium (V)	200.7/200.8	0.1
Zinc (Zn)	200.7/200.8	0.01
Field Parameters		
Stream Flow	HF-SOP-37/-44/-46	NA
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L
pH	HF-SOP-20	0.01 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewa*ter (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).
(2) Samples to be analyzed for dissolved constituents (aluminum) will be field-filtered through a 0.45 µm filter.

The number and type of samples collected will be compared with project specifications to ensure conformance with the sampling process design. Review of sample collection and handling procedures will include verification of the following:

- Completeness of submittal packages;
- Completeness of field documentation, including chain-of-custody documentation;
- Field equipment calibration and maintenance and/or quality of field measurements; and
- Adherence to proper sample collection procedures.

All data will be reviewed for completeness of deliverables, and adherence to the sampling and analytical protocols prescribed in this FSAP and the Facility QAPP (Hydrometrics, 2010b). Data validation will include a detailed review of all analytical results, including:

- Reporting limits (RLs) and PQLs vs. PRDLs;
- Holding times;
- Analytical methods;
- Field QC sample results; and
- Laboratory QC sample results.

Data qualifiers will be applied to any analytical results associated with QC exceedances, as outlined in the QAPP.

All project data will be archived in hard copy format, and will also be imported to and stored in the electronic project database software, along with associated data qualifiers. The project Data Management and Validation Coordinator will be responsible for reviewing, organizing, revising, and certifying the integrity of the project database. Maintenance and use of the project database, including uploading of analytical results, and downloading of data in various formats to support site characterization, risk assessment, and other Facility-related investigations is presented in detail in the Data Management Plan (Hydrometrics, 2010c).

6.0 REFERENCES

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EXHIBIT 1

EAST HELENA FACILITY POST-RI/FS AND CAMU
2010 GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS