COKE OVEN FLATS
GROUNDWATER AND SURFACE WATER INVESTIGATION

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1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) Abandoned Mines Program contracted Hydrometrics, Inc. (Hydrometrics) to assess sources of groundwater seepage to Belt Creek from Coke Oven Flats (COF) in Belt, Montana (Figure 1-1). Coke Oven Flats is an open field where DEQ reclaimed a 27-acre pile of coal waste in the late 1980s. Acid mine drainage (AMD) from the Anaconda Mine workings is currently routed across COF through an unlined ditch (Diagonal Ditch) to Belt Creek. Seepage losses from Diagonal Ditch are a potential source component for the AMD seeps that emerge on the banks of Belt Creek at the downstream end of COF. The coal wastes buried under COF represent a second potential source component for the AMD seeps. Sources of groundwater to the buried coal waste, in addition to potential seepage from Diagonal Ditch, include infiltration of precipitation, groundwater inflow and seasonal contributions from Belt Creek during high water periods.

The purpose of this investigation is to define the contributions of AMD to Belt Creek from various sources (i.e., non-point groundwater discharge, direct point discharge from Diagonal Ditch) through a surface water loading analysis, supplemented with the results of a groundwater investigation and analysis. The following tasks were performed to address the project objectives:

1. Low Flow Surface Water Monitoring: Document flow and water quality in Belt Creek downstream and upstream of COF, Diagonal Ditch, and known seeps at the downgradient end of COF.
2. Groundwater Investigation: Establish aquifer characteristics, document groundwater quality, and evaluate the flow direction, gradient, and flux of groundwater that may discharge to Belt Creek from COF.

Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS SEEPAGE INVESTIGATION	COKE OVEN FLATS LOCATION M AP	FIGURE 1-1

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3. Mass Balance Loading Analysis: Calculate loading of AMD water to Belt Creek from point sources (Diagonal Ditch), and to estimate non-point source (groundwater) loading in the vicinity of COF. Non-point source loading was also calculated using data collected from the groundwater investigation to provide multiple lines of evidence of the amount of AMD loading from groundwater beneath COF.

2.0 SURFACE WATER MONITORING

2.1 MONITORING SUMMARY

Hydrometrics and DEQ conducted surface water monitoring at six surface water sites in the vicinity of COF on April 18, 2013. Acid mine drainage from the Anaconda Mine (ACM) workings is currently routed from under Anaconda Street in a buried pipe and across COF through an unlined ditch (Diagonal Ditch) to Belt Creek. Surface water monitoring locations included three sites along Diagonal Ditch and Flat Ditch, Belt Creek upstream and downstream of COF, and two seeps emanating from COF along the west bank of Belt Creek as shown on Figure 2-1. Monitoring consisted of collecting flow measurements and field water quality parameters at each site, with water quality samples collected at selected sites to characterize the metals and sulfate loads in Belt Creek (upstream and downstream) and from known point sources (Diagonal Ditch) in the vicinity of COF. GPS locations were recorded at the upstream and downstream sites on Belt Creek and at one site (B-11) on Diagonal Ditch. GPS locations at the other site had been previously recorded as part of the Great Falls Coal Field Water Treatment Assessment Project (Hydrometrics, 2012).

2.2 MONITORING LOCATIONS

The downstream site on Belt Creek (B-15) is located a sufficient distance from the confluence of Diagonal Ditch and any potential groundwater discharges from COF to allow for thorough mixing of AMD with Belt Creek. Mixing was verified during the April 2013 monitoring event by measuring field parameters along a transect of Belt Creek at site B-15; field parameters were stable across the entire transect indicating thorough mixing at the selected downstream site (see Table 2-1). The upstream site on Belt Creek (B-14A) is located above any potential influence from acid mine drainage associated with COF (Figure 2-1).

Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS GROUNDWATER & SURFACE WATER INVESTIGATION	SURFACE WATER MONITORING LOCATIONS	FIGURE 2-1

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TABLE 2-1. FIELD PARAMETER TRANSECT MEASUREMENTS ON BELT CREEK

	Distance From Bank	Temp ©	Specific Conductance (uhmos/cm)	pH (s.u.)	Dissolved Oxygen (mg/L)
Downstream Field Parameters Transect					
West	5	7.6	864	7.31	11.28
	15	7.4	860	7.3	11.3
	25	7.4	856	7.32	11.29
East	35	7.9	853	7.4	11.02
Upstream Field Parameters Transect					
East	14	8.4	838	8.34	12.34
	24	8.1	845	8.21	11.99
	34	8.1	826	8.15	11.81
West	44	8.2	794	8.12	11.78

The ditch crossing Coke Oven Flats has historically been identified as two separate ditches; the upper portion of the ditch is referred to as Flat Ditch and the lower section, is referred to as Diagonal Ditch (Hydrometrics, 2012). Flat Ditch receives water from the French Coulee/MDT drain pipe discharge; sampling site B-9 is located just below where the French Coulee/MDT discharge enters the ditch. The other two sites are located along Diagonal Ditch at locations where flumes were previously installed: the confluence of Flat Ditch and the Anaconda Mine Drain (B-11) and at the Diagonal Ditch outfall to Belt Creek (B-13) (Figure 2-1).

Two seeps (Seep-1 and Seep-2) emerging from bank sediments adjacent to Belt Creek near the northeast boundary of COF (Figure 2-1) were also monitored as part of the low flow surface water monitoring event.

2.3 METHODOLOGY

2.3.1 Belt Creek

Surface water monitoring on Belt Creek consisted of collecting duplicate stream flow measurements from two separate transects at each site using a Marsh-McBirney current meter and wading rod (area-velocity method). Field parameters (pH, specific conductance (SC), water temperature, and dissolved oxygen (DO)) and water quality samples were collected prior to flow measurements, or upstream of the flow measurement transects, in order to prevent possible impacts to sample water quality from flow measurement activities. Duplicate water quality samples were collected from each monitoring site on Belt Creek. Each sample was collected by filling one 500 ml sample bottle at four locations across each transect and compositing these grab samples into a 1 gallon bottle. Subsamples of the 1-gallon composited sample were transferred to appropriate sample containers and preserved as indicated in Table 2-2.

TABLE 2-2. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Parameters	Sample Containers	Preservative
Field Parameters	500 mL HDPE	None
Common Constituents	500 mL HDPE	Cool to 4°C
Trace Constituents (dissolved, except total recoverable iron)	250 mL HDPE	Filter dissolved samples (0.45 µm) HNO_3 to pH <2 Cool to 4°C

2.3.2 Diagonal Ditch

Flows along Diagonal Ditch were measured at sites B-11 and B-13 using both the existing flumes and a Marsh-McBirney current meter and wading rod (area-velocity method). The dimensions of the flumes were measured to determine the appropriate rating curve (equation to be used to convert head or water depth measurements to discharges) for each flume. The dimensions of the flume at site B-11 did not match any known flumes, therefore, the area-

velocity method was used to calculate flow at this site. The flume at site B-13 was determined to be a 1.5-foot H flume (Grant and Dawson, 1995). Flow calculated from the flume at site B-13 was determined to be more accurate than the area-velocity method at this site, as the streambed had a thick cover of iron/metals precipitate on it and flows at the inlet of the flume (where the area-velocity method was conducted) were converging toward the center resulting in non-parallel flow lines and associated higher error in the area-velocity measurements. Flow was not measured at the French Coulee/MDT discharge because all of the water infiltrated before it reached the confluence with the Anaconda Mine Drain.

Field parameters were collected from sites B-11 and B-13 prior to collection of flow measurements. Duplicate water quality samples were collected from site B-13 to quantify the concentrations of sulfate and metals discharging to Belt Creek from Diagonal Ditch. Grab samples were collected and preserved in appropriate bottles as described in Table 2-2.

2.3.3 Seeps

Field parameters and water quality samples were collected from Seep-1 and Seep-2 by digging two small holes in areas where seeps were present and purging the seep with a peristaltic pump; water quality grab samples were collected after each seep recovered and were analyzed for the same constituents as the surface water monitoring sites.

2.4 ANALYTICAL PARAMETERS

All water quality samples were submitted to Energy Labs in Helena, MT for analysis of the constituents listed in Table 2-3.

2.5 RESULTS

Field parameter, flow measurement, and analytical results from the April 2013 surface water sampling are summarized in Table 2-4. Laboratory reports for the surface water sampling are in Appendix A.

TABLE 2-3. 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
Common Ions		
Sulfate	300	1
Trace Constituents (Dissolved)		
Aluminum (Al)	200.7/200.8	0.03
Cadmium (Cd)	200.8	low level
Chromium (Cr)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.0005
Iron (Fe)	200.7/200.8	0.02
Manganese (Mn)	200.7/200.8	0.01
Nickel (Ni)	200.8	low level
Zinc (Zn)	200.8	low level
Trace Constituents (Total Recoverable)		
Iron (Fe)	200.7/200.8	0.02

Notes:

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).

TABLE 2-4. SURFACE WATER ANALYTICAL RESULTS

Site	B-14A	B-14A (dup)	B-15	B-15 (dup)	B-13	B-13 (dup)	B-11	Seep 1	Seep 2
Date	4/18/2013	4/18/2013	4/18/2013	4/18/2013	4/18/2013	4/18/2013	4/18/2013	4/18/2013	4/18/2013
Time	13:25	13:30	11:50	11:55	15:15	15:18	--	16:50	17:00
Flow (cfs)	16.54	16.99	15.86	16.65	0.38	--	0.33	0	0
Field pH (s.u.)	8.2	--	7.35	--	2.9	--	2.91	4.12	3.97
Field SC (umhos/cm)	810	--	859	--	27.14	--	2784	4476	8862
Dissolved Oxygen	12	--	11.29	--	7.36	--	1.24	2.28	4.03
Temperature ©	8.3	--	7.8	--	11.03	--	9.86	8.9	7.15
Lab pH (s.u.)	8.0	8.0	7.4	7.5	2.9	2.9		3.8	3.8
Lab SC (umhos/cm)	855	853	884	882	2690	2680	--	4570	8980
Sulfate	260	260	290	290	2200	2100	--	5200	17000
Aluminum (DIS)	< 0.03	< 0.03	0.06	0.08	121	114	--	421	2050
Cadmium (DIS)	0.00003	< 0.00003	0.00016	0.00014	0.0099	0.0104	--	0.0046	0.051
Chromium (DIS)	< 0.001	< 0.001	< 0.001	< 0.001	0.049	0.05	--	0.033	0.204
Copper (DIS)	0.0006	0.0006	0.0005	0.0008	0.0258	0.026	--	0.0534	0.398
Manganese (DIS)	< 0.01	< 0.01	0.02	0.02	0.49	0.49	--	2.54	11.1
Nickel (DIS)	< 0.002	< 0.002	0.014	0.014	0.974	1	--	0.602	2.87
Zinc (DIS)	< 0.008	< 0.008	0.033	0.031	4.18	4.28	--	2.04	11
Iron (TRC)	0.03	0.03	2.54	2.53	166	166	--	96.2	179

2.5.1 Flow Measurements

The duplicate flow measurements at sites B-14A and B-15 showed good reproducibility, with relative percent differences (RPDs) of 2.7% for the B-14A flow measurements and 4.8% for the B-15 measurements. The average flow at the upstream site on Belt Creek (B-14A) was 16.8 cubic feet per second (cfs), and the average flow at the downstream site (B-15) was 16.3 cfs. The observed difference in average flows between the upstream and downstream sites on Belt Creek (0.5 cfs) is approximately 2 to 3% of the total measured flows (16.3 and 16.8 cfs), suggesting that this difference is likely within the range of measurement error.

The flow at the Diagonal Ditch discharge to Belt Creek (site B-13) was measured at 0.38 cfs (based on the H flume measurement), while 0.33 cfs flow was measured in the ACM discharge to Diagonal Ditch (site B-11, measured using the area-velocity method). The difference in ditch flow from upstream to downstream (an increase of 0.05 cfs or about 22 gallons per minute) is assumed to be due to measurement error. Groundwater levels are greater than ten feet below ground surface in this area, suggesting it is not possible for groundwater to discharge to the ditch. There was no measurable flow from Seep-1 or Seep-2 during the April 2013 monitoring event.

2.5.2 Water Quality

Duplicate water quality samples at the Belt Creek upstream site (B-14A) and the Belt downstream site (B-15) were consistent for all constituents (Table 2-4). Water quality changes attributable to AMD discharge are apparent between the upstream and downstream sites on Belt Creek. As shown in Table 2-4, from location B-14A to B-15 stream pH decreased from 8.2 to 7.4 s.u., SC increased from 810 to 859 umhos/cm, sulfate increased from 260 to 290 mg/L, and increases were observed for most trace metals (e.g., total recoverable iron increased from 0.03 to 2.54 mg/L).

Diagonal Ditch is the only known point source that discharges to Belt Creek between the upstream (B-14A) and downstream (B-15) sites. Water quality at the discharge point to Belt Creek (site B-13) is characterized by low pH (2.9 s.u.), elevated SC (2,690 µhmos/cm), and elevated sulfate (2,200 mg/L). Trace metals concentrations are also elevated, particularly

dissolved aluminum (121 mg/L), nickel (1 mg/L), zinc (4.28 mg/L), and total recoverable iron (166 mg/L) (note that the concentrations cited are the higher of the duplicate results reported in Table 2-4).

AMD-impacted water quality was also measured at the two seeps (Seep-1 and Seep-2), although the analytical results indicated variability between the two sites (Table 2-4). Seep samples were characterized by low pH (4.0-4.1 s.u.), and elevated SC (4,476 to 8,862 µhmos/cm), sulfate (5,200 to 17,000 mg/L), and trace metals (421 to 2,050 mg/L dissolved aluminum, 2.04 to 11 mg/L dissolved zinc, 96 to 179 mg/L total recoverable iron). The differences in water quality between the seeps and the discharge from Diagonal Ditch (site B-13 in Table 2-4) suggests that seep water is likely representative of shallow groundwater quality in the vicinity of Belt Creek, rather than seepage losses from Diagonal Ditch. The high metals and sulfate concentrations present in seep water indicate the seepage is a potential source of metals to Belt Creek. In order to determine the potential impacts of this seepage on Belt Creek water quality, however, information regarding the amount of groundwater discharge from COF to Belt Creek is required. The amount of groundwater from COF discharging to Belt Creek was evaluated as part of the COF groundwater investigation.

3.0 GROUNDWATER INVESTIGATION

A groundwater investigation was conducted to provide additional information on aquifer characteristics and groundwater quality to determine if groundwater beneath COF is a significant source of metals in Belt Creek. The investigation included the following tasks:

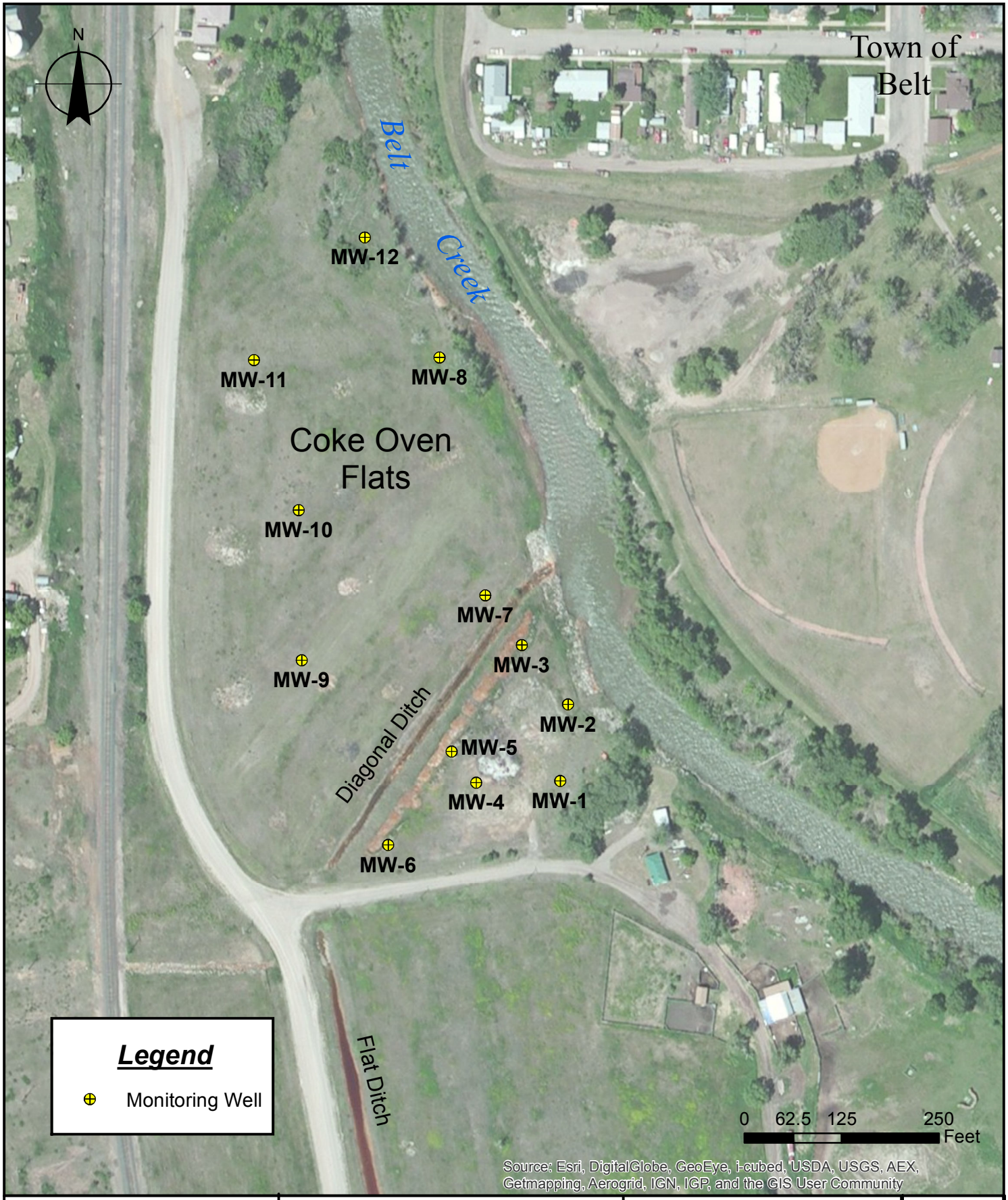
- Installation of six monitoring wells;
- Soil sampling and analysis;
- Soil leaching analysis;
- Groundwater monitoring; and
- Short-term aquifer testing.

Below is a summary of the methodology and results for the groundwater investigation.

3.1 MONITORING WELL INSTALLATION

Six monitoring wells (MW-1 through MW-6) were installed in 1995 south of Diagonal Ditch. On June 6 and 7, 2013 six additional monitoring wells were installed in the area north of Diagonal Ditch (where bank seeps have been observed) to characterize the groundwater system in this area. The locations of the new and existing wells are shown on Figure 3-1. Information from these wells was used to evaluate water quality and aquifer properties north of the ditch, and to quantify the amount of potential metals loading to Belt Creek from groundwater beneath COF.

The new monitoring wells were constructed using 2-inch inside diameter NFS-approved Schedule 40 PVC with flush-threaded joint couplings and factory slotted 0.010-inch screen, with an end cap on the bottom of the screened interval. The borehole annulus was filled with 10/20 silica sand filter pack from the bottom to three feet above the screened interval. The remainder of the borehole annulus was sealed with bentonite chips. A protective 6-inch steel casing with locking cover was installed from 2 feet below ground to above the top of the PVC well casing stick-up. The protective casing was sealed and secured with cement. Well construction and grouting details are consistent with State of Montana Monitoring Well



Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS GROUNDWATER & SURFACE WATER INVESTIGATION	MONITORING WELL LOCATIONS	FIGURE 3-1

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regulations (ARM 36.21.800). All drilling and monitoring well construction was supervised by a qualified hydrogeologist, with detailed lithologic and construction logs recorded on field forms and in a project field book. Construction details for these wells are listed in Table 3-1 and lithologic well logs for existing and new wells are in Appendix B.

TABLE 3-1. NEW MONITORING WELL CONSTRUCTION DETAILS

Station	Easting	Northing	Measuring Point Elevation	Total Depth (feet)	Screened Interval (feet)
MW-1	1614971.61	1144891.25	99.46	13.8	3.3 - 13.3
MW-2	1614981.9	1144989.75	97.94	15.8	4.5 - 14.5
MW-3	1614922.08	1145065.83	100.49	14.3	4.3 - 14.3
MW-4	1614863.71	1144889.24	103.02	23.7	13.2 - 23.2
MW-5	1614832.29	1144929.26	104.65	16.5	4.5 - 17.8
MW-6	1614750.51	1144809.29	105.94	17.5	7 - 17
MW-7	1614875.5	1145129.95	104.49	16	11 - 16
MW-8	1614816.67	1145435.32	93.24	9.5	4.5 - 9.5
MW-9	1614639.29	1145046.48	113.64	20.5	10.5 - 20.5
MW-10	1614635.17	1145239.19	117.65	32	12 - 32
MW-11	1614578.09	1145432.02	122.36	35	25 - 35
MW-12	1614720.66	1145590.05	92.76	14	9 - 14
Datum – Horizontal: Montana State Plane (Feet) NAD 83, Vertical: Site Specific					

Following well construction, the new monitoring wells were developed to remove fine sediments from the screened interval and improve the hydraulic connection with the aquifer. The procedures for well development consisted of surging the well with a bailer to bring fines into the well, followed by continued bailing to remove the fines from the well. Finally, the well was pumped with a 12-volt submersible pump to remove remaining fines and ensure a hydraulic connection to the aquifer.

A well survey was conducted at Coke Oven Flats on June 27, 2013. The horizontal location of all twelve monitoring wells was determined using a mapping-grade (Trimble GeoXH) global positioning system (GPS) instrument. Ground surface and measuring point elevations of the new monitoring wells (MW-7 through MW-12) were surveyed with a level and rod

using a vertical datum consistent with the existing monitoring wells. Well survey data for all monitoring wells is included in Table 3-1.

3.2 GEOLOGY AND HYDROGEOLOGY

The Belt 30' x 60' Geologic Quadrangle (MBMG, 2002) indicates that the surficial geology at the COF site is Quaternary alluvium consisting of gravel, sand, silt, and clay in the Belt Creek floodplain. Alluvial deposits are well- to poorly-stratified and moderately well-sorted, sub-angular to sub-rounded clasts with varying amounts of fines.

Lithology from the monitoring well drilling shows a uniform 1 to 2.5-foot layer of topsoil present across the site that was placed when DEQ reclaimed the site. Coal waste fill was encountered in the central part of the site at well MW-7 from 1.5 to 10.5 feet bgs and at MW-10 from 1 to 17 feet bgs (Appendix B). The coal waste was underlain by silt, sand and gravel alluvial deposits. Fine grained sediments (silts and clays) typically consisted of 10 to 25% of the sediment with varying amounts of sand and gravels.

The remaining monitoring wells encountered alluvial deposits from just below the topsoil to the assumed bedrock contact (coal waste fill was absent). The bedrock contact was assumed based on drill bit refusal or very hard drilling as there were no cutting returns to verify material. Depth to bedrock varied from 26 feet on the western portion of the site (MW-11), to 32 feet in the central portion of the site (MW-10) and 9.5 feet adjacent to Belt Creek (MW-8) (Appendix B).

With the exception of wells MW-9 and MW-11, the coal waste and alluvial deposits were damp to moist except immediately above the bedrock where saturated sediments were encountered. Well MW-9 encountered small lenses of saturated sediments at 4.5 feet and 8 to 10 feet with dry to moist sediments below them (Appendix B). Heavy rains occurred less than 48 hours prior to drilling, and these isolated saturated lenses may have been a result of these rains. Well MW-9 was dry when the well was completed. Well MW-11 had damp to moist sediment throughout the alluvial sediments; however, saturated conditions were not encountered until approximately 10-11 feet into the bedrock (Appendix B).

Mottled horizons that were white (potential salt or aluminum precipitation), red to red brown (iron precipitation), yellow to orange (iron precipitation), and brown (potential manganese precipitation) were observed in unsaturated sediments (Appendix B).

3.3 SUBSURFACE SOIL SAMPLING

Subsurface soil samples from each monitoring well were collected every five feet with two-foot split spoons. Split spoon samples were inspected for lithologic descriptions and then placed in 1-gallon Ziploc plastic bags, and stored in coolers or refrigerated at 4°C. In consultation with DEQ, ten samples were selected for analysis of saturated paste pH and total metals (complete analytical parameters for soil samples are listed in Table 3-2). Selected samples of coal waste and sediment were placed in the appropriate containers and submitted with chain of custody forms to Energy Labs in Helena, Montana. Three samples were selected for synthetic precipitation leaching procedure (SPLP) analysis based on total metals results and the availability of sufficient sample volume for leach testing. Table 3-3 provides a summary of samples submitted to the laboratory and analyses performed.

3.4 SUBSURFACE SOIL RESULTS

Analytical results for subsurface soils are summarized in Table 3-4. Laboratory reports for the subsurface soil analysis are in Appendix C. Total metals analysis showed aluminum concentrations ranging from 1,450 to 27,100 mg/kg and iron concentrations ranging from 3,830 to 73,300 mg/kg, along with detectable but lower concentrations of arsenic, beryllium, boron, copper, manganese, nickel, lead, thallium, and zinc. The highest concentration of iron was detected in sample MW-10 from 12-14 feet (73,300 mg/kg) and the highest concentration of aluminum was within the 5-7 foot interval at MW-11 (27,100 mg/kg) (Table 3-4). The highest concentration of arsenic (71 mg/kg) was detected in the 10-12 foot interval of MW-7. The soil sample from the 5-7 foot interval of MW-8 had the highest concentrations of manganese (163 mg/kg), nickel (18 mg/kg), lead (47 mg/kg), and zinc (76 mg/kg). With the exception of soils from wells MW-8, MW-9, and MW-12, subsurface soils were characterized by acidic saturated paste pH values (1.6 to 4.7 s.u.).

TABLE 3-2. ANALYTICAL METHODS AND DETECTION LIMITS FOR SUB-SURFACE SOIL SAMPLES

Parameter	Analytical Method	Project Required Detection Limit (mg/L)
Physical Parameters		
pH		0.1 s.u.
Total Metals-Digestion	E3050	
Aluminum (Al)	E6010	5 mg/kg
Arsenic (As)	E6010	5 mg/kg
Beryllium (Be)	E6010	5 mg/kg
Boron (B)	E6010	5 mg/kg
Cadmium (Cd)	E6010	1 mg/kg
Copper (Cu)	E6010	5 mg/kg
Iron (Fe)	E6010	5 mg/kg
Lead (Pb)	E6010	5 mg/kg
Manganese (Mn)	E6010	5 mg/kg
Nickel (Ni)	E6010	5 mg/kg
Thallium (Tl)	E6010	
Zinc (Zn)	E6010	5 mg/kg
Subsequent Analyses (telephone for instructions after analysis complete)		
SPLP	E1312	
Parameters to be chosen based upon initial analyses; may be all or a portion of the above metal analytes.		
Acid-Base Accounting	Modified Sobek Method	
SMP Single Buffer Lime Requirement	ASA Mono. #9, Part 2, Method 12-3.4.4	

TABLE 3-3. SUMMARY OF SUB-SURFACE SOIL SAMPLING AND ANALYSIS

Location	Depth (ft bgs)	Sample Date	Total Metals	pH Sat. Paste	SPLP
MW-7	5 to 7	6/7/2013	x	x	x
MW-7	10 to 12	6/7/2013	x	x	
MW-8	5 to 7	6/7/2013	x	x	
MW-9	10 to 12	6/6/2013	x	x	
MW-10	5 to 7	6/7/2013	x	x	x
MW-10	12 to 14	6/7/2013	x	x	
MW-10	15 to 17	6/7/2013	x	x	
MW-11	5 to 7	6/6/2013	x	x	
MW-11	10 to 12	6/6/2013	x	x	x
MW-12	10 to 12	6/6/2013	x	x	

SPLP analyses were conducted on three soil samples from wells MW-7, MW-10, and MW-11 (Table 3-4). The leaching test results showed low or non-detect concentrations of most metals in the leachate, with the exception of aluminum (up to 38 mg/L) and iron (up to 16 mg/L). The higher concentrations of leachable aluminum and iron (and other metals) in SPLP leachate were detected in samples characterized by lower saturated paste pH values, but were not directly correlated to the total metals concentrations. For example, the highest SPLP aluminum concentration (38 mg/L) was observed in the MW-10 sample, which showed a saturated paste pH of 2.6 s.u., and the lowest total aluminum concentration (1,860 mg/kg) of the three samples tested (Table 3-4). The SPLP sample with the highest associated saturated paste pH (MW-11, pH of 4.4 s.u.) showed the lowest concentrations of aluminum (0.04 mg/L) and iron (<0.03 mg/L) in SPLP extract (Table 2-4).

3.5 GROUNDWATER MONITORING

Groundwater monitoring was conducted by Hydrometrics personnel on June 27, 2013 at all of the COF monitoring wells (MW-1 through MW-12). Prior to collection of samples or introduction of any equipment into the well, the static water level was measured at each well using an electric water level probe to determine the depth to groundwater below the top of each designated measuring point.

TABLE 3-4. SUB-SURFACE SOIL ANALYTICAL RESULTS

Site	MW-7	MW-7	MW-8	MW-9	MW-10	MW-10	MW-10	MW-11	MW-11	MW-12
Depth (ft)	5-7	10-12	5-7	10-12	5-7	12-14	15-17	5-7	10-12	10-12
pH Sat Paste (s.u.)	2.1	1.6	6.9	6.8	2.6	2.0	2.1	4.7	4.4	6.8
Total Metals (mg/kg)										
Aluminum	2,960	4,820	9,810	1,660	1,860	1,450	2,130	27,100	15,700	15,800
Arsenic	4	71	19	2	18	15	7	24	11	8
Beryllium	3	<1	<1	<1	<1	<1	<1	1	2	1
Boron	29	17	6	<1	4	3	2	10	13	8
Cadmium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	3	8	15	5	7	11	4	10	17	18
Iron	3,830	35,300	29,400	11,700	21,300	73,300	41,500	22,500	10,800	28,900
Manganese	4	28	163	6	6	11	7	16	4	68
Nickel	2	4	18	10	3	6	4	5	13	16
Lead	12	45	47	3	3	<1	<1	22	6	10
Thallium	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	4	26	76	18	3	6	4	9	13	60
SPLP Metals (mg/L)										
Aluminum	9.3	--	--	--	38	--	--	--	0.04	--
Arsenic	<0.001	--	--	--	<0.001	--	--	--	<0.001	--
Beryllium	<0.001	--	--	--	0.004	--	--	--	<0.001	--
Boron	0.29	--	--	--	0.35	--	--	--	0.1	--
Cadmium	<0.001	--	--	--	<0.001	--	--	--	<0.001	--
Copper	0.006	--	--	--	0.057	--	--	--	<0.005	--
Iron	16	--	--	--	12	--	--	--	<0.03	--
Manganese	0.085	--	--	--	0.14	--	--	--	0.01	--
Nickel	<0.005	--	--	--	0.023	--	--	--	0.012	--
Lead	0.002	--	--	--	<0.001	--	--	--	0.005	--
Thallium	<0.0005	--	--	--	<0.0005	--	--	--	<0.0005	--
Zinc	0.03	--	--	--	0.05	--	--	--	<0.01	--

Monitoring wells were sampled utilizing either HDPE tubing and a 12-volt submersible pump, a 2-inch bailer, or a peristaltic pump to purge and sample the monitoring wells (depending on well yield). Purging consisted of removing three well volumes while monitoring field parameters (pH, dissolved oxygen, temperature, and specific conductance). Alternatively, if the well was pumped dry, it was allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples could be removed. The field meter (YSI 556 multi-meter) was calibrated daily according to factory instructions and calibration results were recorded in the field notebook.

Monitoring wells MW-1, MW-4, and MW-12 were sampled with a 12-volt submersible pump following the procedures outlined above. Monitoring wells MW-4 and MW-12 both went dry during initial purging and were sampled after recovery. Monitoring wells MW-3, MW-5, MW-6, MW-10, and MW-11 did not make sufficient water to purge with the 12-volt pump and were purged and sampled with disposable 2-inch bailers. Monitoring wells MW-2 and MW-7, also purged with bailers, went dry and were allowed to recover prior to sampling.

Monitoring wells MW-6, MW-9, and MW-8 had insufficient water to provide enough sample for complete water quality analysis. Sample volumes of 250 mL and 50 mL were collected with bailers from MW-6 and MW-9, respectively, and were delivered raw to the laboratory for filtration, preservation and analysis. Similarly, a 50 mL sample of turbid water was obtained from monitoring well MW-8 using a peristaltic pump after unsuccessful attempts with both the 12-volt pump and a bailer. This sample was also submitted to the laboratory for filtration and preservation. No field parameters were collected at well MW-8 due to the low volume of water available.

Sample containers were 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°C during transport. Samples for trace constituents were filtered through a 0.45 µm filter prior to preservation, to

allow analysis for the dissolved trace metals. All groundwater samples were submitted to Energy Laboratories in Helena, MT for the analyses listed in Table 3-5.

TABLE 3-5. 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
Common Ions		
Sulfate	300	1
Trace Constituents (Dissolved)		
Aluminum (Al)	200.7/200.8	0.03
Arsenic (As)	200.7/200.8	0.003
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.8	low level
Chromium (Cr)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.0005
Iron (Fe)	200.7/200.8	0.02
Manganese (Mn)	200.7/200.8	0.01
Nickel (Ni)	200.8	low level
Thallium (Tl)	200.8	0.001
Zinc (Zn)	200.8	low level

Notes:

(1) Analytical methods are from Standard Methods for the Examination of Water and Wastewater (SM) or EPA's Methods for Chemical Analysis of Water and Waste (1983).

Groundwater sampling equipment reused between monitoring locations (12-volt sampling pump and short piece of discharge line) was decontaminated between uses. Decontamination included rinsing with soapy water, clean rinse water, and deionized water.

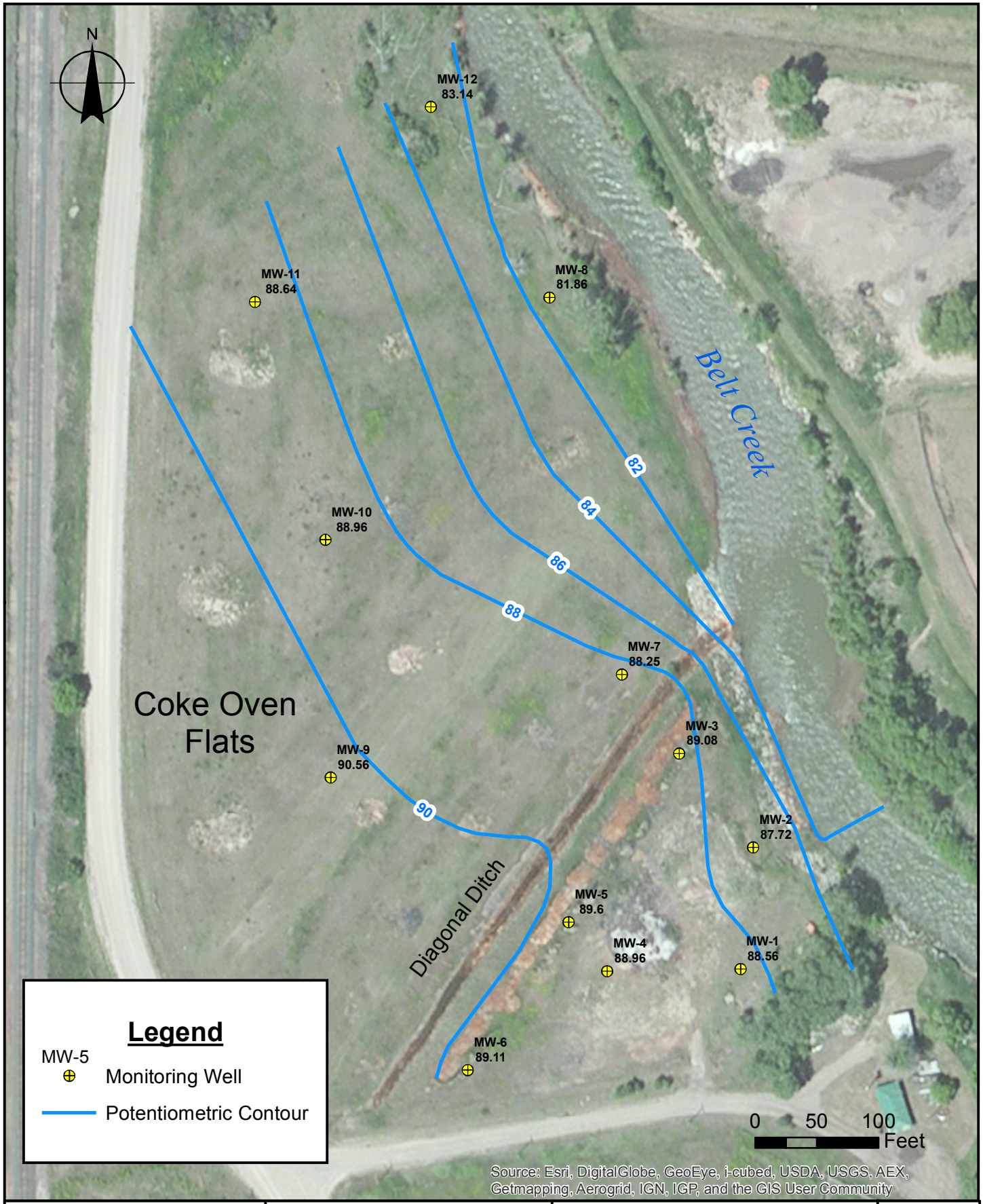
In addition to the June 27, 2013 groundwater monitoring event, water level measurements were collected from the 12 monitoring wells on June 21, 2013 using an electric water level probe. Water levels at wells MW-1 through MW-6 were also measured on March 13, 2013.

3.6 GROUNDWATER MONITORING RESULTS

Potentiometric surface maps were developed from water level measurements recorded on June 21 and June 27, 2013 (Figures 3-2 and 3-3, respectively). Groundwater beneath COF generally flows in a northeasterly direction toward Belt Creek. The groundwater gradient is lowest (0.015) on the western portion of the site and steepest (0.08) in the vicinity of where Diagonal Ditch discharges to Belt Creek. The average hydraulic gradient is approximately 0.03 across the site. The potentiometric data suggest the area south of the ditch (near wells MW-6 and MW-5) is mounded, most likely due to seepage losses from the ditch (Figures 3-2 and 3-3). The rate of ditch seepage is assumed to be relatively low based on flow measurements collected upgradient and downgradient ends of diagonal ditch, which did not show any loss of flow through the area. The potentiometric data and lack of significant seepage loss from the ditch suggest that the transmissivity of the shallow aquifer is low.

3.6.1 Groundwater Quality Results

June 2013 groundwater quality results for the twelve COF monitoring wells are summarized in Table 3-6 and laboratory analytical reports are included in Appendix D. The monitoring wells showed uniformly acidic pH values with a range in field pH of 1.87 s.u. (MW-3) to 5.10 s.u. (MW-5). These wells are further characterized by elevated and highly variable SC values (2,700 to 18,100 µmhos/cm) and sulfate concentrations (55 to 38,000 mg/L). Elevated dissolved metals concentrations were present in all wells, with dissolved aluminum concentrations up to 5,310 mg/L at well MW-10, and dissolved iron concentrations up to 4,440 mg/L at well MW-3 (Table 3-6). Wells MW-1, MW-5, MW-8, and MW-9 showed the lowest overall metals concentrations, corresponding to the more moderate pH values observed at MW-1 (4.3) and MW-5 (5.1) (note that pH values were not measured at wells MW-8 and MW-9). Dissolved metals concentrations exceeded Montana DEQ-7 groundwater Human Health standards in ten of twelve monitoring wells; results from wells MW-1 and MW-9 did not exceed any standards (Table 3-6). With the exception of thallium, all constituents with DEQ-7 human health standards analyzed during this event (arsenic, beryllium, cadmium, chromium, copper, nickel, and zinc) exceeded groundwater human health standards in one or more samples. Results for cadmium, nickel and arsenic exceeded standards by an order of magnitude in some of the wells. The beryllium standard (0.004



Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS SEEPAGE INVESTIGATION	POTENTIOMETRIC SURFACE JUNE 21, 2013	FIGURE 3-2

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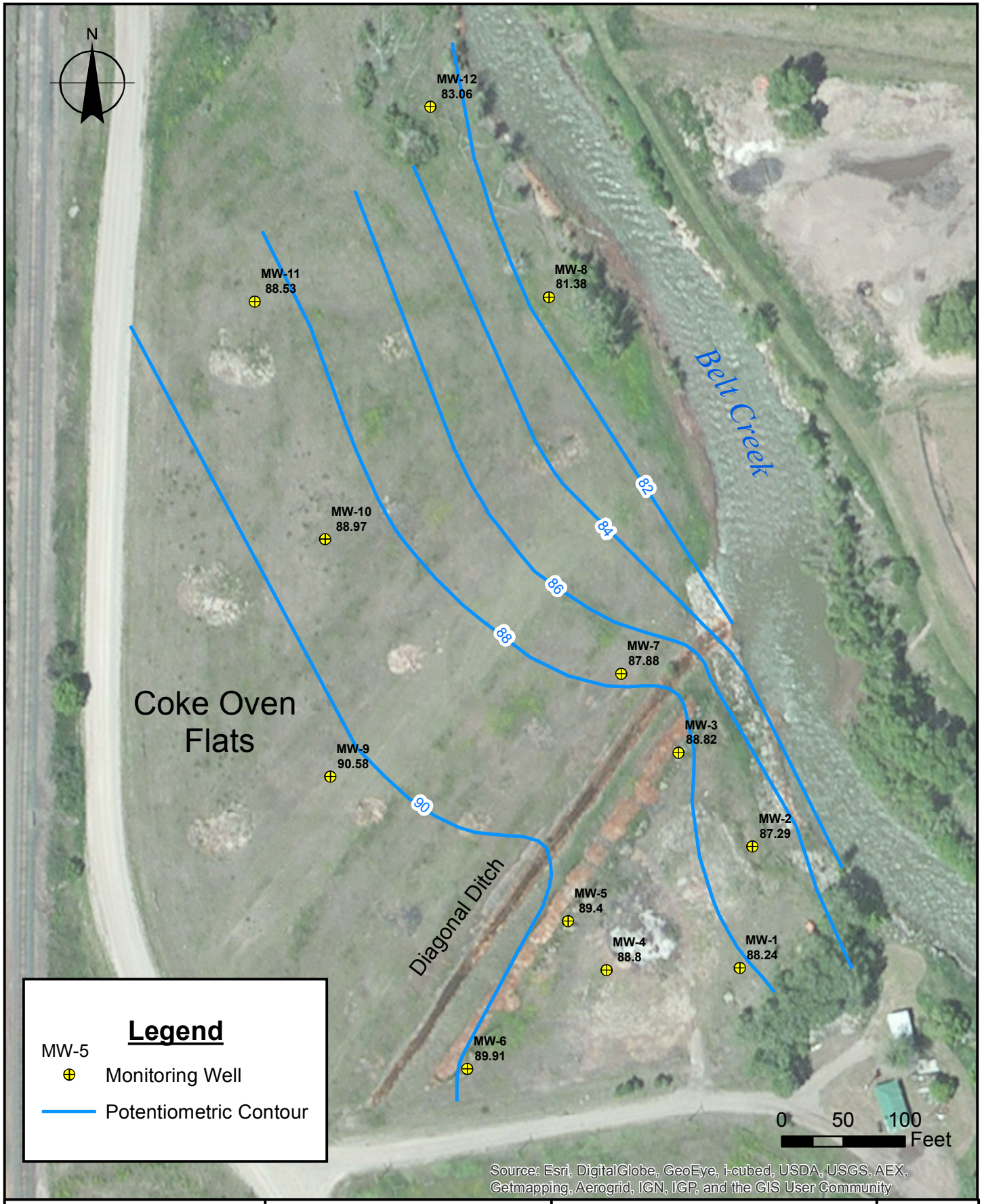

Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS SEEPAGE INVESTIGATION	POTENTIOMETRIC SURFACE JUNE 28, 2013	FIGURE 3-3

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TABLE 3-6. GROUNDWATER ANALYTICAL RESULTS

Site Code	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-10 Dup	MW-11	MW-12	*Human Health Standard*
Date	6/28/2013	6/28/2013	6/28/2013	6/28/2013	6/28/2013	6/28/2013	6/27/2013	6/28/2013	6/27/2013	6/27/2013	6/27/2013	6/27/2013	6/27/2013	
Time	12:25	14:40	13:30	11:30	14:00	14:30	16:20	15:15	16:00	15:05	15:15	14:45	14:00	
SWL (ft)	11.22	10.65	11.67	14.22	15.25	16.03	16.61	12.09	23.06	28.68	--	33.83	9.7	
Field pH (s.u.)	4.3	2.29	1.87	3.91	5.1	3.8	2.59	--	--	3.15	--	2.48	3.75	
Field SC (umhos/cm)	3,001	10,272	12,655	4,946	3,089	11,328	13,151	--	--	17,015	--	12,577	9,710	
Dissolved Oxygen	2.16	5.03	2.79	1.23	9.26	9.2	2.14	--	--	1.78	--	1.36	2.36	
Temperature ©	17.3	12.9	18.8	12.81	9.32	11	13.62	--	--	11.56	--	12.29	10.69	
Lab pH (s.u.)	5.8	2.4	2.1	4.2	5.5	3.9	2.4	--	--	3.2	3.3	2.7	4.0	
Conductivity (umhos/cm)	2,700	10,700	12,900	5,100	3,210	11,800	15,400	--	--	18,100	17,800	12,700	9,590	
Sulfate	55	19,000	31,000	6,600	2,400	26,000	31,000	--	--	38,000	38,000	21,000	19,000	
Aluminum	2.06	1,480	1,050	606	11.3	2,990	2,410	0.35	0.25	5,310	4,340	2,740	1,910	
Arsenic	< 0.003	0.06	0.457	0.007	< 0.003	0.031	0.131	< 0.003	< 0.003	0.079	0.066	0.018	0.044	*0.01*
Beryllium	< 0.001	0.221	0.061	0.025	< 0.001	0.166	0.194	< 0.001	< 0.001	0.146	0.128	0.042	0.123	*0.004*
Cadmium	< 0.001	0.038	0.0293	0.0189	0.002	0.045	0.057	0.0104	0.001	0.06	0.049	0.049	0.043	*0.005*
Chromium	< 0.001	0.252	0.256	0.006	< 0.001	0.03	0.383	< 0.001	< 0.001	0.37	0.33	0.047	0.22	*0.1*
Copper	0.0028	0.54	1.07	0.0839	0.0036	0.0342	1.32	0.016	0.02	1.16	1.04	0.0555	0.159	*1.3*
Iron	0.41	632	4,440	67.7	0.52	4.28	2420	0.05	0.3	696	681	145	527	
Manganese	0.50	3.48	3.67	16.00	2.12	10.60	10.30	16.00	9.15	10.60	9.71	8.46	8.40	
Nickel	0.0420	1.6200	1.5800	1.1400	0.2180	2.0000	1.8300	0.2250	0.0845	4.8200	5.2800	3.2700	2.6300	*0.1*
Thallium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	0.002	0.0002	< 0.001	0.002	*0.002*
Zinc	0.065	3.87	6.27	2.34	0.29	4.26	9.79	0.04	0.061	14.9	15.4	7.54	9.22	*2*

mg/L) was exceeded by up to two orders of magnitude in six wells and one order of magnitude in three additional wells.

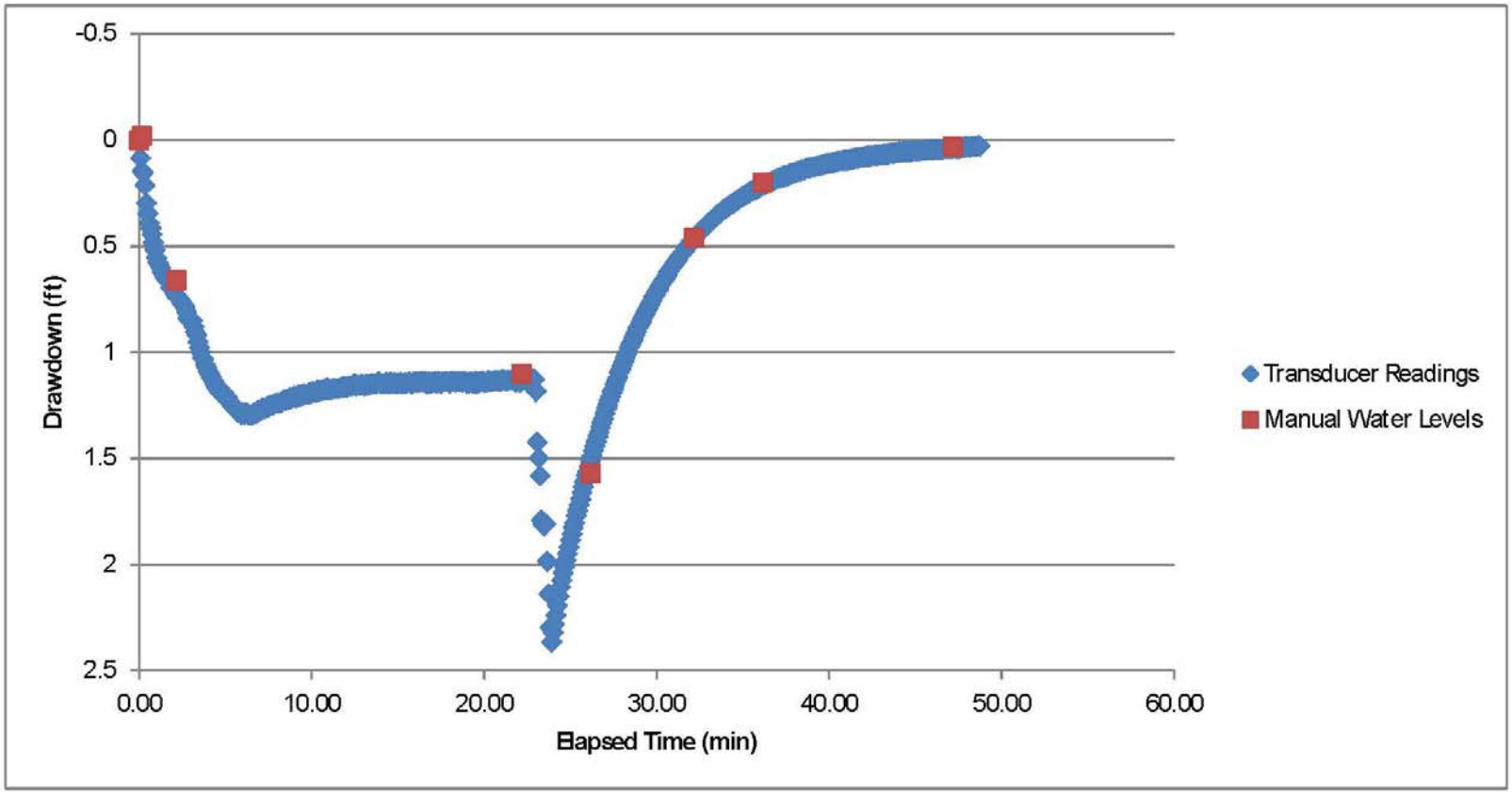
With the exception of wells MW-1, MW-5, MW-8 and MW-9, metals concentrations in groundwater (Table 3-6) are generally much higher than those observed in Diagonal Ditch (Table 2-4). These results suggest that the subsurface coal waste and sediments below COF are a large source for sulfate and metals in the groundwater system.

3.7 AQUIFER TESTING AND ANALYSIS

Hydrometrics, Inc. conducted a short-term (24 minute) aquifer test on monitoring well MW-4 prior to sampling. Water levels were collected from all of the COF monitoring wells prior to the test. A Solinst Level Logger and 12-volt pump were then placed in the monitoring well. Water level measurements were recorded using the Level Logger pressure transducer programmed to record water level and temperature in 5 second intervals. Manual measurements were taken periodically to verify transducer readings. The pumping rate was adjusted using a gate valve to approximately 0.5 gpm at the start of the test. The gate valve was adjusted throughout the test as the water level dropped and the pump could not provide as much water. The well was pumped for approximately 24 minutes until the water levels drew down below the pump intake, at which time the pump was shut off and the recovery test began. Water levels in the well recovered to within 0.03 feet approximately 24 minutes after the pump was turned off. The drawdown and recovery data is shown in Figure 3-4.

Aquifer test results were analyzed using AQTESOLV (v4.5) to calculate aquifer transmissivity. Drawdown data was excluded from the analysis as the pumping rate varied throughout the test and there are insufficient flow measurements to account for all of the fluctuations. The recovery data provided the best data set to estimate aquifer properties. The recovery data was analyzed using the Theis (1935) residual drawdown/recovery solution. The Theis solution was fit to the majority of the recovery curve resulting in an estimated transmissivity of 12 ft^2/day. The curve-matching graph for the recovery data is included in Appendix B. The average aquifer thickness below COF is approximately 8 feet, resulting in an average hydraulic conductivity of 1.5 ft/day; which is within the expected range of the silty sand material encountered during drilling (Fetter, 2001).

FIGURE 3-4. MW-4 AQUIFER TEST RESULTS



4.0 LOADING ANALYSES

As described above, April 2013 synoptic surface water sampling results showed an increase in sulfate and trace metals concentrations between the upstream and downstream sites on Belt Creek. Discharge of AMD water from Diagonal Ditch is the only identified point source of sulfate and metals loading to Belt Creek in the vicinity of COF. However, water quality from shallow monitoring wells and seeps along the bank of Belt Creek at COF have significantly higher concentrations of sulfate and trace metals than measured in Diagonal Ditch. The higher sulfate and trace metals concentrations suggest the groundwater beneath COF is a potential non-point source of sulfate and metals loading to Belt Creek. A loading analysis for Belt Creek adjacent to COF has been conducted using the surface water and groundwater data collected during this investigation, to determine the potential contribution of COF groundwater to the measured sulfate and metals loads in Belt Creek.

4.1 SURFACE WATER LOADING ANALYSIS

Surface water flow and water quality data from the April 2013 surface water sampling was used to evaluate sulfate and metals loads at the upstream (B-14A) and downstream (B-15) monitoring sites on Belt Creek and at site B-13, where Diagonal Ditch discharges AMD water to Belt Creek. For the purpose of the loading analysis the flow for the downstream site (B-15) was assumed to be equal to the sum of the flows from the upstream site (B-14A) and Diagonal Ditch (B-13). This assumption was necessary to complete the loading analysis, because the average measured flow at downstream site B-15 was lower than the average measured flow at upstream site B-14A.

The average concentrations and calculated loads of sulfate and select trace metals for upstream Belt Creek, the ditch outfall, and downstream Belt Creek are summarized in Table 4-1. The sulfate water quality data was consistent between duplicate samples, and sulfate is assumed to be geochemically conservative (i.e., concentrations affected only by dilution and mixing rather than by geochemical processes such as adsorption and precipitation); therefore, it is the best constituent to evaluate the sources of loading to Belt Creek. Thus, assuming

TABLE 4-1. LOADING ANALYSIS BASED ON APRIL 2013 SURFACE WATER RESULTS

Location	Flow	SO4	Al-D	Cd-D	Cu-D	Mn-D	Ni-D	Zn-D	Fe-TR
	gpm	Concentration (mg/L)							
Upstream Belt Creek	7,524	260	*< 0.030*	0.00003	0.0006	*< 0.010*	*< 0.002*	*< 0.008*	0.03
AMD Ditch Outfall	130	2,150	118	0.01015	0.026	0.49	0.987	4.23	166
Downstream Belt Creek[1]	7,654	290	0.10	0.00015	0.00065	0.020	0.014	0.0320	2.54
		Load (lb/day)							
Upstream Belt Creek		23,475	*< 2.71*	0.0027	0.054	*< 0.903*	*< 0.181*	*< 0.722*	2.71
Diagonal Ditch Outfall		3,354	183	0.0158	0.040	0.76	1.54	6.60	259
Upstream BC/Diagonal Ditch Subtotal	7,654	26,829	186	0.0185	0.095	1.67	1.72	7.32	262
Downstream Belt Creek		26,636	9.2	0.0138	0.060	1.84	1.3	2.9	233
Change in Load		**-193**	**-177**	**-0.0048**	**-0.035**	**0.170**	**(0.434)**	**-4.4**	**-28**
Percent Change in Load		**-1%**	**-95%**	**-26%**	**-37%**	**10%**	**-25%**	**-60%**	**-11%**

1) Belt Creek flows indicate a losing stream from upstream to downstream; therefore, downstream flow was assumed to be equivalent to the sum of upstream flow and flow from the ditch outfall for loading calculations.

Note: Sulfate concentrations are consistent and presumably more geochemically conservative than metals, and therefore is probably best for mixing estimates.

conservative behavior, the downstream Belt Creek sulfate load should be equivalent to the upstream Belt Creek sulfate load, plus the sulfate load from Diagonal Ditch and COF groundwater seepage contributions. The calculated sulfate load shows the estimated load at B-15 (downstream Belt Creek) is within 1% of the combined loads from B-14A (upstream site on Belt Creek) and B-13 (Diagonal Ditch outfall) (Table 4-1). The difference in load is within the measurement errors for flow and analytical procedures used to calculate the load. Therefore, the sulfate loading calculations indicate that surface water discharge from Diagonal Ditch is the primary source of additional sulfate and load between the upgradient and downgradient sites on Belt Creek. There is no sulfate load component in Belt Creek that can be directly attributed to groundwater seepage from COF, based on the April 2013 synoptic monitoring results.

Metals loading calculations for April 2013 in Belt Creek and Diagonal Ditch (Table 4-1) show measurable decreases in load for aluminum (-95%), cadmium (-26%), copper (-37%), zinc (-60%), and iron (-11%) at the Belt Creek downstream site, compared with the total load from upstream Belt Creek and Diagonal Ditch. Decreases in load for these metals over the assessed stream reach are consistent with observed precipitates of aluminum and iron (and assumed co-precipitation of other metals) downstream of and at the confluence of Belt Creek and Diagonal Ditch. Similar to sulfate, the nickel load at the downstream Belt Creek site was virtually identical to (within about 1% of) the total load from upstream Belt Creek and Diagonal Ditch. The only parameter to show a calculated load increase possibly attributable to COF groundwater inflow was manganese, which increased from 1.67 lb/day (from upstream Belt Creek and Diagonal Ditch) to 1.84 lb/day (at downstream Belt Creek) (Table 4-1).

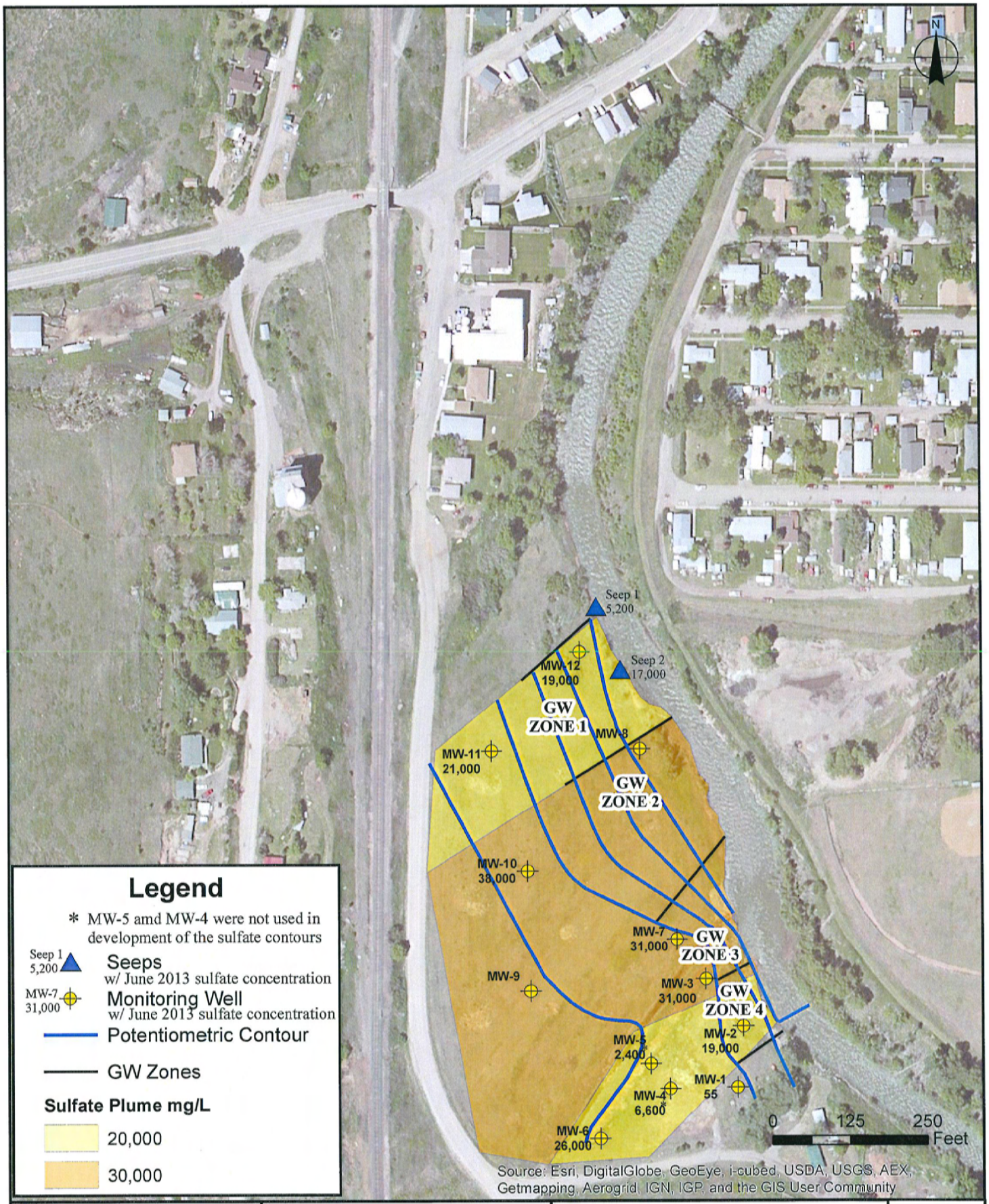
Calculation of metals loading and load increases or decreases in Belt Creek is complicated by the lack of quantifiable data (concentrations above laboratory reporting limits) at the upstream Belt Creek site for aluminum, manganese, nickel, and zinc (Table 4-1). While the data in Table 4-1 show estimated loads based on replacing below detect data with the reporting limit, other approaches may also be used (such as replacing below detect data with

zero, which assumes no upstream load contribution from Belt Creek). If nondetect data are replaced with zero rather than the reporting limit, loading calculations indicate possible load increases in Belt Creek for both manganese and nickel that might be attributable to COF groundwater inflow. Other metals (aluminum and zinc), however, continue to show overall load decreases. Overall, the assessment of metals loading to Belt Creek using surface water monitoring results is complicated by the geochemical behavior of metals under the observed conditions (highly acidic water undergoing neutralization), along with the uncertainty introduced by nondetects in the data set, and the sensitivity of loading calculations to relatively small changes in flows and/or concentrations. The sulfate loading results appear to suggest no measurable loading to Belt Creek from COF groundwater; most metals loading results also indicate no measurable loading from COF groundwater. Additional evaluation of potential COF groundwater loading to Belt Creek was conducted using information obtained from the groundwater investigation.

4.2 GROUNDWATER LOADING ANALYSIS

The April 2013 surface water loading analysis indicates that Diagonal Ditch AMD discharge is the primary source of contaminant loading to Belt Creek in the vicinity of COF. The combined sulfate load from upstream Belt Creek and the ditch outfall was approximately equal to the estimated sulfate load at the downstream Belt Creek site. These results did not identify a sulfate load increase attributable to groundwater inflow, and indicated a decrease in load for most metals, likely attributable to sorption and/or precipitation reactions.

The groundwater loading analysis was conducted for four individual zones across COF. The zones were defined based on sulfate concentrations in groundwater and/or changes in the hydraulic gradient. Figure 4-1 shows the four groundwater loading zones incorporating the June 21, 2013 potentiometric surface and a sulfate concentration plume map from the June 27 and 28, 2013 groundwater monitoring. The groundwater flux was calculated for each zone based on Darcy's Law ($Q=KAi$, where K = hydraulic conductivity in ft/day, A = aquifer cross-sectional area in ft^2, and i = hydraulic gradient in ft/ft). The hydraulic conductivity was based on the aquifer test conducted at well MW-4, and aquifer thickness and gradient were



Hydrometrics, Inc. Consulting Scientists and Engineers	COKE OVEN FLATS SEEPAGE INVESTIGATION	GROUNDWATER LOADING ZONES	FIGURE 4-1

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based on the average of wells adjacent to Belt Creek. MW-8 was not used for the loading analysis as the small saturated thickness and low concentrations of trace metals were inconsistent with data from other wells in the same zone (MW-10). Groundwater flux calculations are summarized in Table 4-2. As the table indicates, the total water flux from the four zones is approximately 1 gpm.

TABLE 4-2. GROUNDWATER FLUX CALCULATIONS

Groundwater Zone	Zone Width	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)	Gradient (ft/ft)	GW Flux (gpm)
Zone-1	285	6.4	1.5	0.04	0.57
Zone-2	170	5	1.5	0.03	0.2
Zone-3	214	2.5	1.5	0.06	0.25
Zone-4	120	3.8	1.5	0.02	0.07
Total Flux					1.09

The sulfate and metals load for each zone was calculated based on the groundwater flux for each zone and the water quality data from the well closest to Belt Creek within each zone (Figure 4-1): MW-12 (Zone-1), MW-10 (Zone-2), MW-7 (Zone-3), and MW-2 (Zone-4). The sulfate and metals load from each zone and total estimated load from the COF groundwater are shown in Table 4-3.

The groundwater flux and loading calculations indicate that, although concentrations of sulfate and metals are high in COF groundwater, the loads are limited by the low estimated groundwater discharge (about 1 gpm across the entire width of the COF area). The potential loads discharging to Belt Creek are relatively low compared with the loads discharging from Diagonal Ditch and the existing loads in Belt Creek (Table 4-1). For example, the estimated COF groundwater sulfate load of 329 lb/day is approximately ten times lower than the measured April 2013 sulfate load from the ditch (about 3,300 lb/day), and approximately 1% of the upstream April 2013 Belt Creek sulfate load of 23,475 lb/day (Table 4-1).

TABLE 4-3. CALCULATED GROUNDWATER LOAD FROM COKE OVEN FLATS

GW Zone	Zone-1	Zone-2	Zone-3	Zone-4	Total
Monitoring Well	**MW-12**	**MW-10**	**MW-7**	**MW-2**	
GW Flux	0.57	0.2	0.25	0.07	1.09
Concentration (mg/L)					
Sulfate	19,000	38,000	31,000	19,000	--
Aluminum	1,910	5,310	2,410	1,480	--
Arsenic	0.044	0.079	0.131	0.06	--
Beryllium	0.123	0.146	0.194	0.221	--
Cadmium	0.043	0.06	0.057	0.038	--
Copper	0.159	1.160	1.320	0.540	--
Iron	527	696	2,420	632	--
Manganese	8.40	10.60	10.30	3.48	--
Nickel	2.6300	4.8200	1.8300	1.6200	--
Thallium	0.002	0.002	0.002	0.001	--
Zinc	9.22	14.9	9.79	3.87	--
Load (lb/day)					
Sulfate	130	91	93	16	**329**
Aluminum	13	13	7	1	**34**
Cadmium	0.000	0.000	0.000	0.000	**0.001**
Copper	0.001	0.003	0.004	0.000	**0.008**
Iron	4	2	7	1	**13**
Manganese	0.06	0.03	0.03	0.00	**0.12**
Nickel	0.0179	0.0115	0.0055	0.0014	**0.0363**
Zinc	0.06	0.04	0.03	0.00	**0.13**

If AMD discharge from Diagonal Ditch is removed, the sulfate and metals loading to Belt Creek will be reduced by approximately 80% to 98%. Aluminum and copper show the least amount of reduction in load when Diagonal Ditch discharge is eliminated (Table 4-4). The copper groundwater load is very low (0.008 lb/day); however, the aluminum groundwater load is much higher (34 lb/day). It is unlikely that aluminum from COF groundwater discharge would impact downstream water quality in Belt Creek, since mixing of the acidic AMD water with Belt Creek causes rapid precipitation of aluminum compounds and removal of aluminum from the aqueous phase. Nevertheless, COF groundwater would continue to form areas of aluminum precipitate on the stream bank and bed in reaches where groundwater was discharging, even in the absence of surface water discharge from Diagonal Ditch.

TABLE 4-4. COMPARISON OF LOADS FROM DIAGONAL DITCH AND COKE OVEN FLATS GROUNDWATER

Constituent	Groundwater Load (lb/day)	Diagonal Ditch Load (lb/day)	Percent Reduction in Load without Diagonal Ditch Discharge
Sulfate	329	3,354	90%
Aluminum	34	183	81%
Cadmium	0.001	0.016	96%
Copper	0.008	0.04	79%
Iron	13	259	95%
Manganese	0.12	0.76	85%
Nickel	0.0363	1.54	98%
Zinc	0.13	6.6	98%

5.0 CONCLUSIONS

The COF surface water and groundwater investigation provides a detailed evaluation of the sulfate and metals loading to Belt Creek from the COF area. The surface water monitoring event provided water quality and flows that were used in the surface water loading analysis at two sites on Belt Creek (upstream and downstream of COF) and at Diagonal Ditch. Data from the groundwater investigation (potentiometric surface, water quality, and aquifer characteristics) provided sufficient information to quantify the groundwater load of sulfate and metals to Belt Creek. The results of the surface water and groundwater loading analysis are summarized below:

Surface Water

- The April 2013 sulfate load at the downstream site on Belt Creek was within 1% of the combined loads from upstream Belt Creek and Diagonal Ditch; indicating that discharge from Diagonal Ditch is the primary source of the change in sulfate load between the upstream and downstream sites on Belt Creek.
- There is no sulfate load component in Belt Creek that can be attributed to groundwater seepage from COF.
- Metals loading calculations for April 2013 in Belt Creek and Diagonal Ditch show measurable decreases in load for aluminum, cadmium, copper, zinc, and iron.

Groundwater

- Groundwater quality beneath COF is generally much higher in concentration of sulfate and metals than observed in Diagonal Ditch; with many wells having one or more constituent exceeding Montana DEQ-7 groundwater Human Health standards.
- Groundwater flow from COF to Belt Creek is significantly lower than flows in Belt Creek or Diagonal Ditch (approximately 1 gpm versus 7,524 gpm and 130 gpm in Belt Creek and Diagonal Ditch, respectively).
- Sulfate and most metals loading from groundwater beneath COF is a small fraction of the load from Diagonal Ditch Discharge.
- If AMD discharge from Diagonal Ditch is removed sulfate and metals loading to Belt Creek from COF would be reduced by approximately 80 to 98 percent.

6.0 REFERENCES

Fetter, C.W., 2001. Applied Hydrogeology Fourth Edition, Prentice-Hall, Inc.

Grant and Dawson, 1995. Isco Open Channel Flow Measurement Handbook, Fourth Edition. Isco Environmental Division, Lincoln Nebraska, 1995.

Hydrometrics, Inc., 2012. Great Falls Coal Field Water Treatment Assessment, Hydrometrics, Inc. April 2012.

MBMG, 2002. Geologic Map of the Belt 30' x 60' Quadrangle, Central Montana.

APPENDIX A

SURFACE WATER
ANALYTICAL REPORT

ANALYTICAL SUMMARY REPORT

May 19, 2013

MT DEQ-Abandoned Mines
PO Box 200901
Helena, MT 59620-0901

Workorder No.: H13040299

Project Name: 11033 Coke Flats DEQ

Energy Laboratories Inc Helena MT received the following 8 samples for MT DEQ-Abandoned Mines on 4/19/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13040299-001	BCR-1304-100	04/18/13 11:50	04/19/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Tot. Rec. Conductivity Anions by Ion Chromatography pH Metals Digestion by EPA 200.2
H13040299-002	BCR-1304-101	04/18/13 13:25	04/19/13	Aqueous	Same As Above
H13040299-003	BCR-1304-102	04/18/13 15:15	04/19/13	Aqueous	Same As Above
H13040299-004	BCR-1304-103	04/18/13 11:55	04/19/13	Aqueous	Same As Above
H13040299-005	BCR-1304-104	04/18/13 13:30	04/19/13	Aqueous	Same As Above
H13040299-006	BCR-1304-105	04/18/13 15:18	04/19/13	Aqueous	Same As Above
H13040299-007	BCR-1304-SEEP 1	04/18/13 16:50	04/19/13	Aqueous	Same As Above
H13040299-008	BCR-1304-SEEP 2	04/18/13 17:00	04/19/13	Aqueous	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Sample Delivery Group: H13040299

Revised Date: 05/19/13
Report Date: 04/26/13

CASE NARRATIVE

Received call from Tom Henderson with MT DEQ stating this should be billed to the Abandoned Mines section. Attached is the revised report with the correction. Wj 5/7/13

Tom Henderson called regarding samples BCR-1304-100 & 104 for the Al, Ni & Zn. He asked that we review the data. 5/13/13. wj

Data was reviewed by analyst, the incorrect run was reported for BCR-1304-104 for the analytes in question. The reported analysis was baised due to carry over for the analytes in question. The analyst had re-analyzed the sample, however the wrong analytical run was reported. Attached is the revised report with the analytes from the analytical run without carryover. Abb 5/17/13

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-001
Client Sample ID BCR-1304-100

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 11:50
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	04/22/13 10:01 / cmm
Conductivity @ 25 C	884	umhos/cm		1		A2510 B	04/22/13 10:01 / cmm
INORGANICS							
Sulfate	290	mg/L		1		E300.0	04/23/13 11:21 / cmm
METALS, DISSOLVED							
Aluminum	0.06	mg/L		0.03		E200.8	04/23/13 14:48 / dck
Cadmium	0.00016	mg/L		0.00003		E200.8	04/23/13 14:48 / dck
Chromium	ND	mg/L		0.001		E200.8	04/23/13 14:48 / dck
Copper	0.0005	mg/L		0.0005		E200.8	04/23/13 14:48 / dck
Manganese	0.02	mg/L		0.01		E200.8	04/23/13 14:48 / dck
Nickel	0.014	mg/L		0.002		E200.8	04/23/13 14:48 / dck
Zinc	0.033	mg/L		0.008		E200.8	04/23/13 14:48 / dck
METALS, TOTAL RECOVERABLE							
Iron	2.54	mg/L		0.02		E200.7	04/23/13 13:19 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-002
Client Sample ID BCR-1304-101

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 13:25
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1		A4500-H B	04/22/13 10:03 / cmm
Conductivity @ 25 C	855	umhos/cm		1		A2510 B	04/22/13 10:03 / cmm
INORGANICS							
Sulfate	260	mg/L		1		E300.0	04/23/13 11:34 / cmm
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	04/23/13 16:44 / dck
Cadmium	0.00003	mg/L		0.00003		E200.8	04/23/13 16:44 / dck
Chromium	ND	mg/L		0.001		E200.8	04/23/13 16:44 / dck
Copper	0.0006	mg/L		0.0005		E200.8	04/23/13 16:44 / dck
Manganese	ND	mg/L		0.01		E200.8	04/23/13 16:44 / dck
Nickel	ND	mg/L		0.002		E200.8	04/23/13 16:44 / dck
Zinc	ND	mg/L		0.008		E200.8	04/23/13 16:44 / dck
METALS, TOTAL RECOVERABLE							
Iron	0.03	mg/L		0.02		E200.8	04/25/13 00:52 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-003
Client Sample ID BCR-1304-102

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 15:15
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.9	s.u.	H	0.1		A4500-H B	04/22/13 10:06 / cmm
Conductivity @ 25 C	2690	umhos/cm		1		A2510 B	04/22/13 10:06 / cmm
INORGANICS							
Sulfate	2200	mg/L		1		E300.0	04/23/13 11:47 / cmm
METALS, DISSOLVED							
Aluminum	121	mg/L		0.03		E200.8	04/25/13 12:18 / dck
Cadmium	0.0099	mg/L	D	0.0001		E200.8	04/25/13 00:56 / dck
Chromium	0.049	mg/L		0.001		E200.8	04/23/13 16:53 / dck
Copper	0.0258	mg/L		0.0005		E200.8	04/23/13 16:53 / dck
Manganese	0.49	mg/L		0.01		E200.8	04/23/13 16:53 / dck
Nickel	0.974	mg/L		0.002		E200.8	04/25/13 00:56 / dck
Zinc	4.18	mg/L		0.008		E200.8	04/25/13 00:56 / dck
METALS, TOTAL RECOVERABLE							
Iron	166	mg/L	D	0.03		E200.7	04/24/13 14:58 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-004
Client Sample ID BCR-1304-103

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 11:55
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1		A4500-H B	04/22/13 10:08 / cmm
Conductivity @ 25 C	882	umhos/cm		1		A2510 B	04/22/13 10:08 / cmm
INORGANICS							
Sulfate	290	mg/L		1		E300.0	04/23/13 11:59 / cmm
METALS, DISSOLVED							
Aluminum	0.08	mg/L		0.03		E200.8	04/25/13 01:06 / dck
Cadmium	0.00014	mg/L		0.00003		E200.8	04/25/13 01:06 / dck
Chromium	ND	mg/L		0.001		E200.8	04/23/13 17:17 / dck
Copper	0.0008	mg/L		0.0005		E200.8	04/23/13 17:17 / dck
Manganese	0.02	mg/L		0.01		E200.8	04/23/13 17:17 / dck
Nickel	0.014	mg/L		0.002		E200.8	04/25/13 01:06 / dck
Zinc	0.031	mg/L		0.008		E200.8	04/25/13 01:06 / dck
METALS, TOTAL RECOVERABLE							
Iron	2.53	mg/L		0.02		E200.7	04/23/13 13:30 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-005
Client Sample ID BCR-1304-104

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 13:30
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1		A4500-H B	04/22/13 10:10 / cmm
Conductivity @ 25 C	853	umhos/cm		1		A2510 B	04/22/13 10:10 / cmm
INORGANICS							
Sulfate	260	mg/L		1		E300.0	04/23/13 12:12 / cmm
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	04/25/13 12:23 / dck
Cadmium	ND	mg/L		0.00003		E200.8	04/25/13 01:35 / dck
Chromium	ND	mg/L		0.001		E200.8	04/23/13 18:08 / dck
Copper	0.0006	mg/L		0.0005		E200.8	04/23/13 18:08 / dck
Manganese	ND	mg/L		0.01		E200.8	04/23/13 18:08 / dck
Nickel	ND	mg/L		0.002		E200.8	04/23/13 18:08 / dck
Zinc	ND	mg/L		0.008		E200.8	04/23/13 18:08 / dck
METALS, TOTAL RECOVERABLE							
Iron	0.03	mg/L		0.02		E200.8	04/25/13 01:44 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-006
Client Sample ID BCR-1304-105

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 15:18
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.9	s.u.	H	0.1		A4500-H B	04/22/13 10:13 / cmm
Conductivity @ 25 C	2680	umhos/cm		1		A2510 B	04/22/13 10:13 / cmm
INORGANICS							
Sulfate	2100	mg/L		1		E300.0	04/23/13 12:50 / cmm
METALS, DISSOLVED							
Aluminum	114	mg/L		0.03		E200.8	04/25/13 12:27 / dck
Cadmium	0.0104	mg/L	D	0.0001		E200.8	04/25/13 01:49 / dck
Chromium	0.050	mg/L		0.001		E200.8	04/23/13 18:17 / dck
Copper	0.0260	mg/L		0.0005		E200.8	04/23/13 18:17 / dck
Manganese	0.49	mg/L		0.01		E200.8	04/23/13 18:17 / dck
Nickel	1.00	mg/L		0.002		E200.8	04/25/13 01:49 / dck
Zinc	4.28	mg/L		0.008		E200.8	04/25/13 01:49 / dck
METALS, TOTAL RECOVERABLE							
Iron	166	mg/L	D	0.03		E200.7	04/24/13 15:02 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-007
Client Sample ID BCR-1304-SEEP 1

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 16:50
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	3.8	s.u.	H	0.1		A4500-H B	04/22/13 10:15 / cmm
Conductivity @ 25 C	4570	umhos/cm		1		A2510 B	04/22/13 10:15 / cmm
INORGANICS							
Sulfate	5200	mg/L	D	2		E300.0	04/23/13 13:02 / cmm
METALS, DISSOLVED							
Aluminum	421	mg/L	D	0.1		E200.8	04/25/13 12:32 / dck
Cadmium	0.0046	mg/L	D	0.0001		E200.8	04/25/13 01:54 / dck
Chromium	0.033	mg/L		0.001		E200.8	04/23/13 18:27 / dck
Copper	0.0534	mg/L		0.0005		E200.8	04/23/13 18:27 / dck
Manganese	2.54	mg/L		0.01		E200.8	04/23/13 18:27 / dck
Nickel	0.602	mg/L		0.002		E200.8	04/23/13 18:27 / dck
Zinc	2.04	mg/L		0.008		E200.8	04/25/13 01:54 / dck
METALS, TOTAL RECOVERABLE							
Iron	96.2	mg/L	D	0.5		E200.8	04/25/13 12:37 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ
Lab ID: H13040299-008
Client Sample ID BCR-1304-SEEP 2

Revised Date: 05/19/13
Report Date: 04/26/13
Collection Date: 04/18/13 17:00
DateReceived: 04/19/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	3.8	s.u.	H	0.1		A4500-H B	04/22/13 10:18 / cmm
Conductivity @ 25 C	8980	umhos/cm		1		A2510 B	04/22/13 10:18 / cmm
INORGANICS							
Sulfate	17000	mg/L	D	5		E300.0	04/23/13 13:15 / cmm
METALS, DISSOLVED							
Aluminum	2050	mg/L	D	0.5		E200.8	04/25/13 12:42 / dck
Cadmium	0.051	mg/L	D	0.001		E200.8	04/25/13 01:59 / dck
Chromium	0.204	mg/L		0.001		E200.8	04/23/13 18:36 / dck
Copper	0.398	mg/L		0.0005		E200.8	04/23/13 18:36 / dck
Manganese	11.1	mg/L		0.01		E200.8	04/23/13 18:36 / dck
Nickel	2.87	mg/L		0.002		E200.8	04/23/13 18:36 / dck
Zinc	11.0	mg/L		0.008		E200.8	04/25/13 02:04 / dck
METALS, TOTAL RECOVERABLE							
Iron	179	mg/L	D	0.3		E200.7	04/24/13 15:05 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**										Batch: R87799
Sample ID: **SC 150**		Initial Calibration Verification Standard				Run: PHSC_101-H_130422A				04/22/13 09:45
Conductivity @ 25 C		160	umhos/cm	1.0	105	90	110			
Sample ID: **SC 5000**		Initial Calibration Verification Standard				Run: PHSC_101-H_130422A				04/22/13 09:47
Conductivity @ 25 C		5200	umhos/cm	1.0	104	90	110			
Sample ID: **SC 20000**		Initial Calibration Verification Standard				Run: PHSC_101-H_130422A				04/22/13 09:50
Conductivity @ 25 C		21000	umhos/cm	1.0	106	90	110			
Sample ID: **SC 2ND 1000**		Laboratory Control Sample				Run: PHSC_101-H_130422A				04/22/13 09:52
Conductivity @ 25 C		1040	umhos/cm	1.0	104	90	110			
Sample ID: **H13040299-008ADUP**		Sample Duplicate				Run: PHSC_101-H_130422A				04/22/13 10:20
Conductivity @ 25 C		8970	umhos/cm	1.0				0.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-H B**									Analytical Run: PHSC_101-H_130422A	
Sample ID: **pH 7**		Initial Calibration Verification Standard							04/22/13 09:43	
pH		7.0	s.u.	0.1	100	98	102			
Method: **A4500-H B**									Batch: R87799	
Sample ID: **H13040299-008ADUP**		Sample Duplicate				Run: PHSC_101-H_130422A			04/22/13 10:20	
pH		3.8	s.u.	0.1				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130423A	
Sample ID: ICV	Initial Calibration Verification Standard								04/23/13 11:13	
Iron		3.99	mg/L	0.030	100	95	105			
Sample ID: CCV-1	Continuing Calibration Verification Standard								04/23/13 11:17	
Iron		2.47	mg/L	0.030	99	95	105			
Sample ID: ICSA	Interference Check Sample A								04/23/13 11:28	
Iron		182	mg/L	0.030	91	80	120			
Sample ID: ICSAB	Interference Check Sample AB								04/23/13 11:32	
Iron		183	mg/L	0.030	92	80	120			
Sample ID: CCV	Continuing Calibration Verification Standard								04/23/13 12:49	
Iron		2.43	mg/L	0.030	97	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								04/23/13 13:34	
Iron		2.38	mg/L	0.030	95	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								04/23/13 16:17	
Iron		2.44	mg/L	0.030	97	90	110			
Method: E200.7									Batch: 20095	
Sample ID: MB-20095	Method Blank					Run: ICP2-HE_130423A			04/23/13 12:45	
Iron		ND	mg/L	0.007						
Sample ID: LCS-20095	Laboratory Control Sample					Run: ICP2-HE_130423A			04/23/13 12:56	
Iron		2.49	mg/L	0.030	100	85	115			
Sample ID: H13040290-001CMS3	Sample Matrix Spike					Run: ICP2-HE_130423A			04/23/13 13:12	
Iron		2.82	mg/L	0.030	113	70	130			
Sample ID: H13040290-001CMSD3	Sample Matrix Spike Duplicate					Run: ICP2-HE_130423A			04/23/13 13:15	
Iron		2.80	mg/L	0.030	112	70	130	0.5	20	
Sample ID: H13040299-004CDIL	Serial Dilution					Run: ICP2-HE_130423A			04/23/13 13:42	
Iron		2.51	mg/L	0.032		0	0	0.7	10	
Sample ID: H13040299-004CMS3	Sample Matrix Spike					Run: ICP2-HE_130423A			04/23/13 13:45	
Iron		4.92	mg/L	0.030	95	70	130			
Sample ID: H13040299-004CMSD3	Sample Matrix Spike Duplicate					Run: ICP2-HE_130423A			04/23/13 13:49	
Iron		4.91	mg/L	0.030	95	70	130	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Analytical Run: ICP2-HE_130424A	
Sample ID: **ICV**		Initial Calibration Verification Standard							04/24/13 11:38	
Iron		3.94	mg/L	0.030	98	95	105			
Sample ID: **CCV-1**		Continuing Calibration Verification Standard							04/24/13 11:42	
Iron		2.46	mg/L	0.030	98	95	105			
Sample ID: **ICSA**		Interference Check Sample A							04/24/13 11:53	
Iron		180	mg/L	0.030	90	80	120			
Sample ID: **ICSAB**		Interference Check Sample AB							04/24/13 11:57	
Iron		184	mg/L	0.030	92	80	120			
Sample ID: **CCV**		Continuing Calibration Verification Standard							04/24/13 14:43	
Iron		2.34	mg/L	0.030	94	90	110			
Method: **E200.7**									Batch: 20095	
Sample ID: **MB-20095**		Method Blank				Run: ICP2-HE_130424A			04/24/13 14:54	
Iron		ND	mg/L	0.007						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130423A	
Sample ID: ICV STD	7	Initial Calibration Verification Standard							04/23/13 13:42	
Aluminum		0.306	mg/L	0.10	102	90	110			
Cadmium		0.0321	mg/L	0.0010	107	90	110			
Chromium		0.0604	mg/L	0.010	101	90	110			
Copper		0.0624	mg/L	0.010	104	90	110			
Manganese		0.315	mg/L	0.010	105	90	110			
Nickel		0.0624	mg/L	0.010	104	90	110			
Zinc		0.0617	mg/L	0.010	103	90	110			
Sample ID: ICSA	7	Interference Check Sample A							04/23/13 13:46	
Aluminum		37.8	mg/L	0.10	95	70	130			
Cadmium		0.00101	mg/L	0.0010						
Chromium		0.00160	mg/L	0.010						
Copper		0.00130	mg/L	0.010						
Manganese		0.00157	mg/L	0.010						
Nickel		0.00121	mg/L	0.010						
Zinc		0.00217	mg/L	0.010						
Sample ID: ICSAB	7	Interference Check Sample AB							04/23/13 13:51	
Aluminum		38.2	mg/L	0.10	95	70	130			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Chromium		0.0209	mg/L	0.010	105	70	130			
Copper		0.0198	mg/L	0.010	99	70	130			
Manganese		0.0214	mg/L	0.010	107	70	130			
Nickel		0.0208	mg/L	0.010	104	70	130			
Zinc		0.0105	mg/L	0.010	105	70	130			
Sample ID: ICSA	7	Interference Check Sample A							04/24/13 03:17	
Aluminum		37.6	mg/L	0.10	94	70	130			
Cadmium		0.00112	mg/L	0.0010						
Chromium		0.00158	mg/L	0.010						
Copper		0.00128	mg/L	0.010						
Manganese		0.000698	mg/L	0.010						
Nickel		0.00102	mg/L	0.010						
Zinc		0.00212	mg/L	0.010						
Sample ID: ICSAB	7	Interference Check Sample AB							04/24/13 03:22	
Aluminum		38.2	mg/L	0.10	96	70	130			
Cadmium		0.0109	mg/L	0.0010	109	70	130			
Chromium		0.0210	mg/L	0.010	105	70	130			
Copper		0.0207	mg/L	0.010	103	70	130			
Manganese		0.0197	mg/L	0.010	99	70	130			
Nickel		0.0209	mg/L	0.010	104	70	130			
Zinc		0.0110	mg/L	0.010	110	70	130			
Method: E200.8									Batch: 20095	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 20095
Sample ID: MB-20095		Method Blank				Run: ICPMS204-B_130423A				04/23/13 16:21
Iron		ND	mg/L	0.002						
Sample ID: LCS-20095		Laboratory Control Sample				Run: ICPMS204-B_130423A				04/23/13 16:25
Iron		2.43	mg/L	0.030	97	85	115			
Sample ID: H13040299-004CMS3		Sample Matrix Spike				Run: ICPMS204-B_130423A				04/23/13 17:49
Iron		4.88	mg/L	0.030	97	70	130			
Sample ID: H13040299-004CMSD3		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A				04/23/13 17:54
Iron		5.12	mg/L	0.030	107	70	130	4.9	20	
Sample ID: H13040290-001CMS3		Sample Matrix Spike				Run: ICPMS204-B_130423A				04/23/13 19:32
Iron		2.84	mg/L	0.030	98	70	130			
Sample ID: H13040290-001CMSD3		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A				04/23/13 19:37
Iron		2.94	mg/L	0.030	103	70	130	3.7	20	
Method: E200.8										Batch: R87882
Sample ID: ICB	7	Method Blank				Run: ICPMS204-B_130423A				04/23/13 14:34
Aluminum		0.0004	mg/L	0.0001						
Cadmium		8E-06	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						
Copper		ND	mg/L	3E-05						
Manganese		ND	mg/L	8E-05						
Nickel		ND	mg/L	6E-05						
Zinc		0.0005	mg/L	0.0003						
Sample ID: LFB	7	Laboratory Fortified Blank				Run: ICPMS204-B_130423A				04/23/13 14:38
Aluminum		0.0490	mg/L	0.10	97	85	115			
Cadmium		0.0508	mg/L	0.0010	102	85	115			
Chromium		0.0496	mg/L	0.010	99	85	115			
Copper		0.0504	mg/L	0.010	101	85	115			
Manganese		0.0507	mg/L	0.010	101	85	115			
Nickel		0.0510	mg/L	0.010	102	85	115			
Zinc		0.0492	mg/L	0.010	97	85	115			
Sample ID: H13040309-005AMS	7	Sample Matrix Spike				Run: ICPMS204-B_130423A				04/23/13 15:53
Aluminum		0.0464	mg/L	0.030	93	70	130			
Cadmium		0.0484	mg/L	0.0010	97	70	130			
Chromium		0.0479	mg/L	0.0050	96	70	130			
Copper		0.0487	mg/L	0.0050	96	70	130			
Manganese		0.0519	mg/L	0.0010	102	70	130			
Nickel		0.0488	mg/L	0.0050	97	70	130			
Zinc		0.0519	mg/L	0.010	95	70	130			
Sample ID: H13040309-005AMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A				04/23/13 15:57
Aluminum		0.0473	mg/L	0.030	95	70	130	1.9	20	

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R87882	
Sample ID: H13040309-005AMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A			04/23/13 15:57	
Cadmium		0.0492	mg/L	0.0010	98	70	130	1.8	20	
Chromium		0.0496	mg/L	0.0050	99	70	130	3.4	20	
Copper		0.0495	mg/L	0.0050	98	70	130	1.5	20	
Manganese		0.0501	mg/L	0.0010	99	70	130	3.5	20	
Nickel		0.0500	mg/L	0.0050	99	70	130	2.3	20	
Zinc		0.0561	mg/L	0.010	103	70	130	7.8	20	
Sample ID: H13040299-003BMS	6	Sample Matrix Spike				Run: ICPMS204-B_130423A			04/23/13 16:58	
Aluminum		81.7	mg/L	0.030		70	130			A
Chromium		0.0971	mg/L	0.0050	97	70	130			
Copper		0.0739	mg/L	0.0050	96	70	130			
Manganese		0.527	mg/L	0.0010		70	130			A
Nickel		1.00	mg/L	0.0050		70	130			A
Zinc		3.79	mg/L	0.010		70	130			A
Sample ID: H13040299-003BMSD	6	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A			04/23/13 17:03	
Aluminum		81.4	mg/L	0.030		70	130	0.0	20	A
Chromium		0.0974	mg/L	0.0050	97	70	130	0.3	20	
Copper		0.0746	mg/L	0.0050	98	70	130	1.0	20	
Manganese		0.523	mg/L	0.0010		70	130	0.8	20	A
Nickel		1.01	mg/L	0.0050		70	130	0.0	20	A
Zinc		3.77	mg/L	0.010		70	130	0.0	20	A
Sample ID: H13040290-003BMS	7	Sample Matrix Spike				Run: ICPMS204-B_130423A			04/23/13 20:24	
Aluminum		0.559	mg/L	0.030	91	70	130			
Cadmium		0.467	mg/L	0.0010	93	70	130			
Chromium		0.477	mg/L	0.0050	95	70	130			
Copper		0.486	mg/L	0.0050	96	70	130			
Manganese		5.20	mg/L	0.0010		70	130			A
Nickel		0.480	mg/L	0.0050	95	70	130			
Zinc		0.468	mg/L	0.010	92	70	130			
Sample ID: H13040290-003BMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130423A			04/23/13 20:29	
Aluminum		0.545	mg/L	0.030	88	70	130	2.5	20	
Cadmium		0.469	mg/L	0.0010	94	70	130	0.5	20	
Chromium		0.477	mg/L	0.0050	95	70	130	0.0	20	
Copper		0.485	mg/L	0.0050	96	70	130	0.0	20	
Manganese		5.03	mg/L	0.0010		70	130	3.3	20	A
Nickel		0.480	mg/L	0.0050	95	70	130	0.1	20	
Zinc		0.464	mg/L	0.010	91	70	130	0.9	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130424A	
Sample ID: ICV STD	5	Initial Calibration Verification Standard							04/24/13 11:50	
Aluminum		0.292	mg/L	0.10	97	90	110			
Cadmium		0.0312	mg/L	0.0010	104	90	110			
Iron		0.326	mg/L	0.030	109	90	110			
Nickel		0.0611	mg/L	0.010	102	90	110			
Zinc		0.0632	mg/L	0.010	105	90	110			
Sample ID: ICSA	5	Interference Check Sample A							04/24/13 11:54	
Aluminum		37.4	mg/L	0.10	93	70	130			
Cadmium		0.00100	mg/L	0.0010						
Iron		101	mg/L	0.030	101	70	130			
Nickel		0.00129	mg/L	0.010						
Zinc		0.00214	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							04/24/13 11:59	
Aluminum		37.5	mg/L	0.10	94	70	130			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Iron		99.3	mg/L	0.030	99	70	130			
Nickel		0.0214	mg/L	0.010	107	70	130			
Zinc		0.0115	mg/L	0.010	115	70	130			
Sample ID: ICSA	5	Interference Check Sample A							04/25/13 02:47	
Aluminum		38.5	mg/L	0.10	96	70	130			
Cadmium		0.00124	mg/L	0.0010						
Iron		97.8	mg/L	0.030	98	70	130			
Nickel		0.00112	mg/L	0.010						
Zinc		0.00183	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							04/25/13 02:52	
Aluminum		38.8	mg/L	0.10	97	70	130			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Iron		103	mg/L	0.030	103	70	130			
Nickel		0.0208	mg/L	0.010	104	70	130			
Zinc		0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							04/25/13 11:14	
Aluminum		0.278	mg/L	0.10	93	90	110			
Cadmium		0.0305	mg/L	0.0010	102	90	110			
Iron		0.314	mg/L	0.030	105	90	110			
Nickel		0.0600	mg/L	0.010	100	90	110			
Zinc		0.0618	mg/L	0.010	103	90	110			
Sample ID: ICSA	5	Interference Check Sample A							04/25/13 11:19	
Aluminum		33.6	mg/L	0.10	84	70	130			
Cadmium		0.00105	mg/L	0.0010						
Iron		92.1	mg/L	0.030	92	70	130			
Nickel		0.00129	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130424A	
Sample ID: ICSA	5	Interference Check Sample A							04/25/13 11:19	
Zinc		0.00193	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							04/25/13 11:25	
Aluminum		34.6	mg/L	0.10	86	70	130			
Cadmium		0.00986	mg/L	0.0010	99	70	130			
Iron		92.9	mg/L	0.030	93	70	130			
Nickel		0.0195	mg/L	0.010	98	70	130			
Zinc		0.00990	mg/L	0.010	99	70	130			
Method: E200.8									Batch: 20095	
Sample ID: MB-20095		Method Blank				Run: ICPMS204-B_130424A			04/25/13 00:09	
Iron		ND	mg/L	0.002						
Method: E200.8									Batch: R87905	
Sample ID: ICB	4	Method Blank				Run: ICPMS204-B_130424A			04/24/13 15:59	
Aluminum		0.0002	mg/L	0.0001						
Cadmium		ND	mg/L	7E-06						
Nickel		ND	mg/L	6E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: LFB	4	Laboratory Fortified Blank				Run: ICPMS204-B_130424A			04/24/13 16:03	
Aluminum		0.0472	mg/L	0.10	94	85	115			
Cadmium		0.0493	mg/L	0.0010	99	85	115			
Nickel		0.0505	mg/L	0.010	101	85	115			
Zinc		0.0516	mg/L	0.010	103	85	115			
Sample ID: H13040290-001BMS	4	Sample Matrix Spike				Run: ICPMS204-B_130424A			04/24/13 23:40	
Aluminum		0.131	mg/L	0.030	90	70	130			
Cadmium		0.0899	mg/L	0.0010	90	70	130			
Nickel		0.0970	mg/L	0.0050	95	70	130			
Zinc		0.0987	mg/L	0.010	90	70	130			
Sample ID: H13040290-001BMSD	4	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130424A			04/24/13 23:45	
Aluminum		0.129	mg/L	0.030	89	70	130	0.9	20	
Cadmium		0.0886	mg/L	0.0010	89	70	130	1.4	20	
Nickel		0.0947	mg/L	0.0050	93	70	130	2.3	20	
Zinc		0.100	mg/L	0.010	92	70	130	1.5	20	
Sample ID: H13040299-008BMS	3	Sample Matrix Spike				Run: ICPMS204-B_130424A			04/25/13 02:08	
Aluminum		1730	mg/L	0.030		70	130			A
Nickel		3.76	mg/L	0.0050	74	70	130			
Zinc		11.8	mg/L	0.010		70	130			A
Sample ID: H13040299-008BMSD	2	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130424A			04/25/13 02:13	
Nickel		3.84	mg/L	0.0050	82	70	130	2.0	20	
Zinc		12.1	mg/L	0.010		70	130	2.7	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R87905
Sample ID: H13040345-002BMS	4	Sample Matrix Spike				Run: ICPMS204-B_130424A				04/25/13 11:59
Aluminum		0.0492	mg/L	0.030	84	70	130			
Cadmium		0.0474	mg/L	0.0010	95	70	130			
Nickel		0.0470	mg/L	0.0050	93	70	130			
Zinc		0.0512	mg/L	0.010	95	70	130			
Sample ID: H13040345-002BMSD	4	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130424A				04/25/13 12:03
Aluminum		0.0499	mg/L	0.030	86	70	130	1.4	20	
Cadmium		0.0473	mg/L	0.0010	95	70	130	0.1	20	
Nickel		0.0474	mg/L	0.0050	94	70	130	0.9	20	
Zinc		0.0523	mg/L	0.010	97	70	130	2.0	20	
Sample ID: H12060321-044AMS	4	Sample Matrix Spike				Run: ICPMS204-B_130424A				04/25/13 13:35
Aluminum		0.237	mg/L	0.030	88	70	130			
Cadmium		0.235	mg/L	0.0010	94	70	130			
Nickel		0.267	mg/L	0.0050	94	70	130			
Zinc		0.237	mg/L	0.010	95	70	130			
Sample ID: H12060321-044AMSD	4	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130424A				04/25/13 13:40
Aluminum		0.237	mg/L	0.030	88	70	130	0.1	20	
Cadmium		0.238	mg/L	0.0010	95	70	130	1.3	20	
Nickel		0.271	mg/L	0.0050	96	70	130	1.4	20	
Zinc		0.248	mg/L	0.010	99	70	130	4.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 05/19/13
Report Date: 04/26/13
Work Order: H13040299

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Flats DEQ

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**									Analytical Run: IC102-H_130423A	
Sample ID: **ICV042313-12**		Initial Calibration Verification Standard							04/23/13 09:28	
Sulfate		400	mg/L	1.0	101	90	110			
Sample ID: **CCV042313-15**		Continuing Calibration Verification Standard							04/23/13 10:18	
Sulfate		410	mg/L	1.0	102	90	110			
Method: **E300.0**									Batch: R87850	
Sample ID: **ICB042313-13**		Method Blank				Run: IC102-H_130423A			04/23/13 09:41	
Sulfate		ND	mg/L	0.08						
Sample ID: **LFB042313-14**		Laboratory Fortified Blank				Run: IC102-H_130423A			04/23/13 09:53	
Sulfate		200	mg/L	1.0	100	90	110			
Sample ID: **LFBD042313-14**		Laboratory Fortified Blank				Run: IC102-H_130423A			04/23/13 10:06	
Sulfate		200	mg/L	1.0	98	90	110			
Sample ID: **H13040299-005AMS**		Sample Matrix Spike				Run: IC102-H_130423A			04/23/13 12:24	
Sulfate		470	mg/L	1.0	107	90	110			
Sample ID: **H13040299-005AMSD**		Sample Matrix Spike Duplicate				Run: IC102-H_130423A			04/23/13 12:37	
Sulfate		470	mg/L	1.0	103	90	110	1.6	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

MT DEQ-Abandoned Mines H13040299

Login completed by: Wanda Johnson
Date Received: 4/19/2013
Reviewed by: BL2000\sdull
Received by: elm
Reviewed Date: 4/23/2013
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	0.6°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

All samples are to analyzed for Total Recoverable metals on all samples - not indicated on the COC, but it is on the parameter sheet. Unpreserved sample for BCR-1304-105, SEEP 1 & SEEP 2 have a pH of 3. Wj 4/19/13

CHAIN OF CUSTODY RECORD

Hydrometrics, Inc.

3020 Bozeman Avenue • Helena, Montana 59601 • (406) 443-4150

PROJ. NO.	PROJECT NAME
11033	Coke Flats DEQ

SAMPLERS: *(Signature)*

DATE	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CON-TAINERS	Commons UF/RAW	Nutrients UF/H_2SO_4	Diss. Metal F/HNO_3	CN UF/NaOH	Total Metals UF/HNO_3	Total Recoverable Metals UF/HNO_3	BTEX	TPH	REMARKS
4/19/13	1150	X		13CR-1304-100	3	X		X						H13040299
	1325			101										
	1515			102										
	1155			103										
	1330			104										
	1518			105										
	1650			Seep 1										
	1700			Seep 2										

Relinquished *(Signature)*	Date/Time	Received by: *(Signature)*	Lab	P.O. #	Shipped via: Bus, Fed Ex, UPS
	4/19/13 1040		Energy Lab	13-11 DEQ	Other Hand delivered Air Bill #
Relinquished (Signature)	Date/Time	Received by: *(Signature)*	Remarks		
			TEMP 0.6 Hard del-ice		
Relinquished (Signature)	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time		Enclosed: ☒ Parameter sheet w/detection limits ☐ QA/QC standard mixing instructions ☐ Cover letter ☐ Other
		Esther Morris	4.19.13 10:40		Split Samples: [] Accepted [] Declined Signature

HFORM-1-5/99

Return results & electronic copy to:
QA/QC Dept. at address at top of page

Table 1. Water Sample Analytical Parameter List

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
Common Ions		
Sulfate	300	1
Trace Constituents (Dissolved)		
Aluminum (Al)	200.7/200.8	0.03
Cadmium (Cd)	200.8	low level
Chromium (Cr)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.0005
Manganese (Mn)	200.7/200.8	0.01
Nickel (Ni)	200.8	low level
Zinc (Zn)	200.8	low level
Trace Constituents (Total Recoverable)		
Iron (Fe)	200.7/200.8	0.02

Notes:

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).

APPENDIX B

MONITORING WELL LOGS
AND
AQUIFER TESTING ANALYSIS

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: MW-7

Date Hole Started: 6/7/2013 Date Hole Finished: 6/7/2013

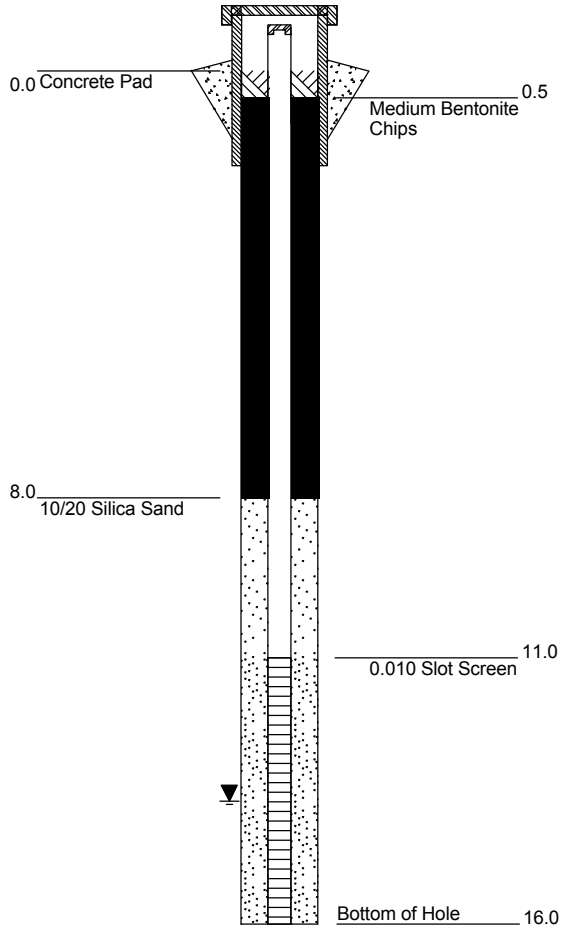
Client: Montana DEQ
Project: Coke Oven Flats Investigation
County: Cascade State: Montana
Property Owner: Montana DOT
Legal Description: SE,NW, Sec. 26, T19N, R6E,
Location Description: South of downgradient end of AMD ditch
Recorded By: LBoettcher
Drilling Company: Boland Drilling
Driller: Jason
Drilling Method: Hollow Stem Auger
Drilling Fluids Used:
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8 1/4
Total Depth Drilled (ft): 16

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 16
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	11 to 16 ft
Sand Pack?	Y	10/20 Silica Sand	8 to 16 ft
Annular Seal?	Y	Bentonite Chips	0.5 to 8
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145129.945 Easting: 1614875.496
Static Water Level Below MP: 16.18 Surface Casing Height (ft): 2
Date: 6/7/2013 Riser Height (ft): 2.49
MP Description: TOC Ground Surface Elevation (ft): 102.00
MP Height Above or Below Ground (ft): 2.49 MP Elevation (ft): 104.49

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.5' **TOPSOIL**
Clay loam, medium to dark brown. damp.
[Topsoil]

1.5 - 10.5' **COAL WASTE**
Black, fragments of coal, fine sand to gravel-sized, moist.
5 to 9 feet: no auger return
10-12 feet material is red (oxidized)
[Fill]

10.5 - 14.0' **GRAVEL with Fines**
Fines-coated, coarse, sub-angular to sub-rounded gravel, with iron coating on clasts but no interstitial precipitate or cement (not a ferricrete), moist.
[Alluvium]

14.0 - 14.5' **Silty SAND**
Orange-brown, fine to medium-grained sand, with about 10 to 15 percent fines, moist.
[Alluvium]

14.5 - 16.0' **Bedrock**
No return; assumed weathered bedrock
[Kootenai Formation?]

BEDROCK
No auger return; drilling refusal, assumed bedrock
[Kootenai Formation?]

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: MW-8

Date Hole Started: 6/7/2013 Date Hole Finished: 6/7/2013

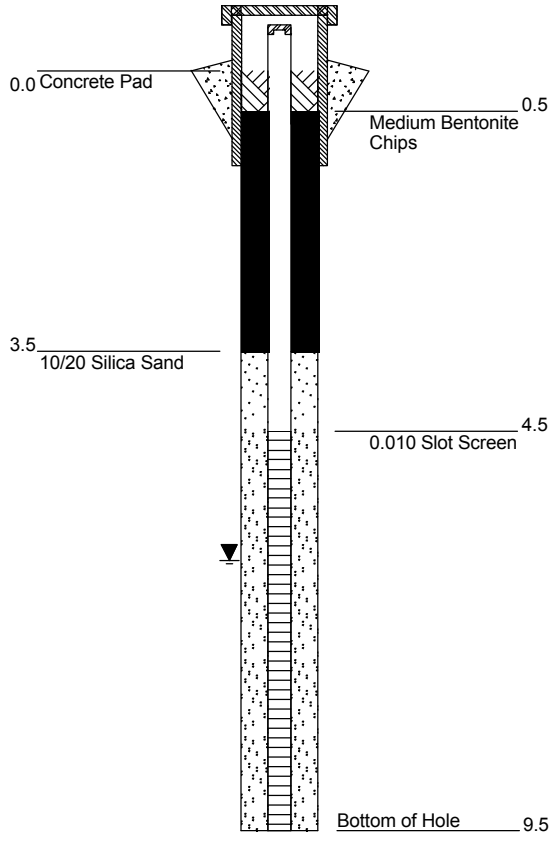
Client: Montana DEQ
Project: Coke Oven Flats Investigation
County: Cascade State: Montana
Property Owner: Montana DOT
Legal Description: SE,NW, Sec. 26, T19N, R6E,
Location Description: Near Belt Creek, between AMD ditch and MW-12
Recorded By: LBoettcher
Drilling Company: Boland Drilling
Driller: Jason
Drilling Method: Hollow Stem Auger
Drilling Fluids Used:
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8 1/4
Total Depth Drilled (ft): 9.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 9.5
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	4.5 to 9.5 ft
Sand Pack?	Y	10/20 Silica Sand	3.5 to 9.5 ft
Annular Seal?	Y	Bentonite Chips	0.5 to 3.5
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145435.323 Easting: 1614816.672
Static Water Level Below MP: 8.78 Surface Casing Height (ft): 2
Date: 6/7/2013 Riser Height (ft): 2.66
MP Description: TOC Ground Surface Elevation (ft): 90.58
MP Height Above or Below Ground (ft): 2.66 MP Elevation (ft): 93.24

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0' **TOPSOIL**
Clay loam, medium to dark brown. damp.
[Topsoil]

1.0 - 5.0' **Gravelly SAND with Silt**
Red-brown fine to medium-grained sand, red, yellow, white and dark grains; 20 percent fine to coarse (1.5-inch), sub-angular to sub-rounded multi-lithic gravel, coated in fines, some yellow iron coating; fines 10 to 15 percent; moist.
[Alluvium]

5.0 - 7.5' **Sandy GRAVEL with Silt**
Medium brown, medium to coarse-, sub-angular to sub-rounded multi-lithic gravel with orange and red iron coating, not cemented; about 20 percent medium brown sand; moist.
6 feet return becoming sandier
6.5 to 7.5 feet cobbles? rig bouncing
[Alluvium]

7.5 - 9.0' **Gravelly SAND with Silt**
Light to medium brown fine to coarse grained sand; about 15 to 20 percent fine to coarse gravel and about 10 to 15 percent fines; dense, moist.
[Alluvium]

9.0 - 9.5' **Silty Cobbles and Gravels**
Cobbles and coarse gravel in sandy clay matrix.
[Alluvium]

BEDROCK
No auger return; drilling refusal, assumed bedrock contact
[Kootenai Formation?]

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Hole Name: MW-9

Date Hole Started: 6/6/2013 Date Hole Finished: 6/6/2013

Client: Montana DEQ

Project: Coke Oven Flats Investigation

County: Cascade State: Montana

Property Owner: Montana DOT

Legal Description: SE,NW, Sec. 26, T19N, R6E,

Location Description: South of Upgradient end of AMD ditch

Recorded By: LBoettcher

Drilling Company: Boland Drilling

Driller: Jason

Drilling Method: Hollow Stem Auger

Drilling Fluids Used:

Purpose of Hole: Install Monitor Well

Target Aquifer: First Water

Hole Diameter (in): 8 1/4

Total Depth Drilled (ft): 20.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 20.5
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	10.5 to 20.5 ft
Sand Pack?	Y	10/20 Silica Sand	7 to 20.5 ft
Annular Seal?	Y	Bentonite Chips	0.5 to 7
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145046.479 Easting: 1614639.29

Static Water Level Below MP: 23.48

Date: 6/7/2013

MP Description: TOC

MP Height Above or Below Ground (ft): 2.69

Surface Casing Height (ft): 2

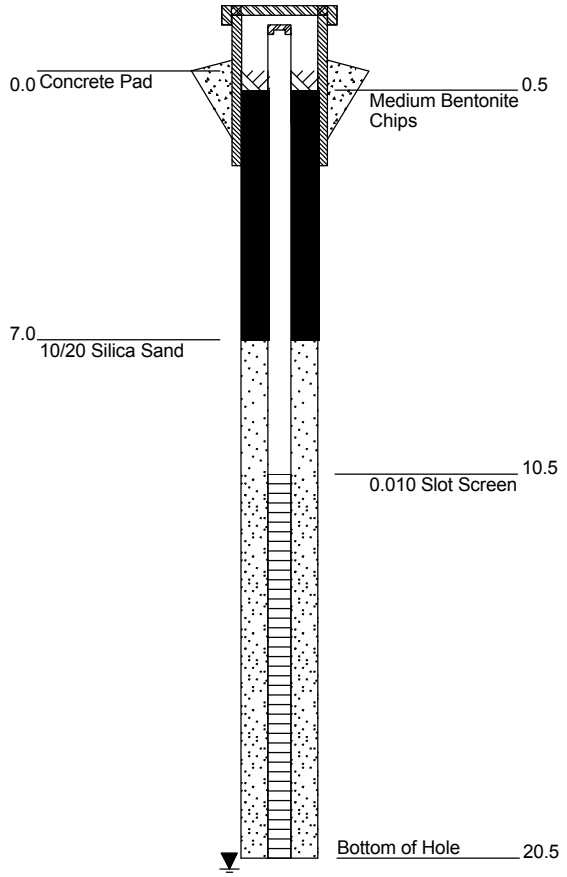
Riser Height (ft): 2.69

Ground Surface Elevation (ft): 110.95

MP Elevation (ft): 113.64

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0' **TOPSOIL**
Medium brown sandy loam; moist.
[Topsoil]

1.0 - 20.0' **Gravelly SAND with Silt**
Dark brown to dark brownish red, poorly sorted fine to medium-grained sand; 25 to 30 percent sub-angular fine to coarse-grained (up to 1.5-inch) multi-lithic gravel; about 15 to 20 percent fines; moist.

4.5 feet saturated (wetting front)

5 to 7 feet spoon is dry

8 to 10 feet auger return is wet to saturated.

10 to 12 feet spoon grains have red and some yellow (iron?) and white (salt?) coatings

12 feet auger return appears to have ferricrete--cemented gravels with orange and red-brown coating

15 to 17 foot spoon is more sorted than above; 15 to 20 percent fine gravel; 5 to 10 percent fines; very moist.
[Alluvium]

20.0 - 20.5' **BEDROCK**
No auger return; drilling refusal, assumed bedrock contact
[Kootenai Formation?]

STANDARD_REV4 K:\GINT\PROJECTS\11033.GPJ HYDHLN2.GDT 8/29/13

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Hole Name: MW-10

Date Hole Started: 6/7/2013 Date Hole Finished: 6/7/2013

Client: Montana DEQ

Project: Coke Oven Flats Investigation

County: Cascade State: Montana

Property Owner: Montana DOT

Legal Description: SE,NW, Sec. 26, T19N, R6E,

Location Description: West edge of COF near Center of field

Recorded By: LBoettcher

Drilling Company: Boland Drilling

Driller: Jason

Drilling Method: Hollow Stem Auger

Drilling Fluids Used:

Purpose of Hole: Install Monitor Well

Target Aquifer: First Water

Hole Diameter (in): 8 1/4

Total Depth Drilled (ft): 32

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 32
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	12 to 32 ft
Sand Pack?	Y	10/20 Silica Sand	9.8 to 32
Annular Seal?	Y	Bentonite Chips	0.5 to 9.8
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145239.185 Easting: 1614635.174

Static Water Level Below MP: 29.07 Surface Casing Height (ft): 2

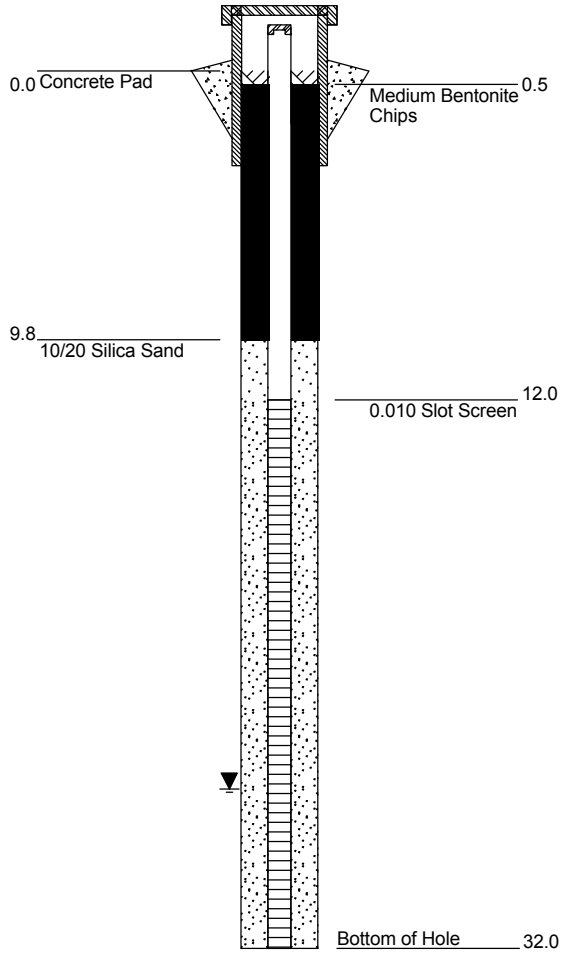
Date: 6/7/2013 Riser Height (ft): 2.88

MP Description: TOC Ground Surface Elevation (ft): 114.77

MP Height Above or Below Ground (ft): 2.88 MP Elevation (ft): 117.65

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0' **TOPSOIL**
Medium brown clay loam mixed with coal fragments; damp.
[Topsoil]

1.0 - 17.0' **COAL WASTE**
Black, granular, coal waste, texture ranges from fine to coarse sand and fine gravel; moist.

3 to 3.5 feet return is very moist.

5 to 7 feet black coal waste mixed with some coarse sand to fine gravel-sized bedrock fragments; red and yellow coating/staining on grains.

8 feet auger return becoming red in color, consistency slightly clayey and somewhat cohesive; 15 to 20 percent fines; damp to moist.

10 to 12 foot no recovery in spoon; drilled to 12 feet

12 to 14 feet black coal waste, very fine to coarse particles; some white (salt?) coatings on grains
[Fill]

17.0 - 28.0' **Gravelly Sandy SILT**
Multi-lithic, fines coated, sub-angular to sub-rounded, fine to coarse (to 1-inch) gravel in return; 15 to 20 percent medium to coarse-grained sand; moist.

26 feet very moist to wet. Increasing sand content.
[Alluvium]

28.0 - 32.0' **Clayey SAND**
Light yellow tan, moderately sorted, very fine to medium-grained sand; fines about 20 percent, cohesive; saturated.
[Alluvium]

BEDROCK
No auger return; drilling refusal, assumed bedrock contact
[Kootenai Formation?]

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: MW-11

Date Hole Started: 6/6/2013 Date Hole Finished: 6/6/2013

Client: Montana DEQ
Project: Coke Oven Flats Investigation
County: Cascade State: Montana
Property Owner: Montana DOT
Legal Description: SE,NW, Sec. 26, T19N, R6E,
Location Description: SW corner of COF

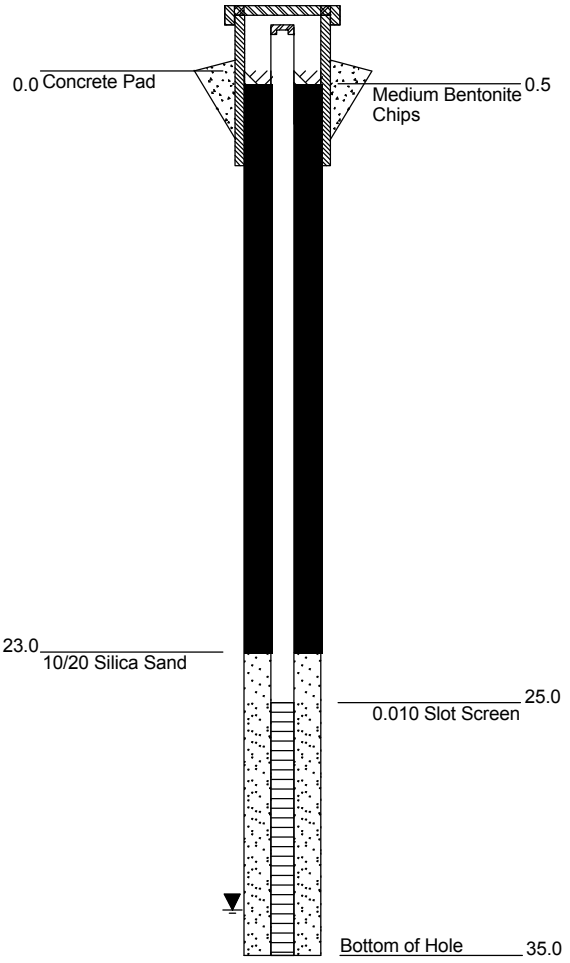
Recorded By: LBoettcher
Drilling Company: Boland Drilling
Driller: Jason
Drilling Method: Hollow Stem Auger
Drilling Fluids Used:
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8 1/4
Total Depth Drilled (ft): 35

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 35
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	25 to 35 ft
Sand Pack?	Y	10/20 Silica Sand	23 to 35 ft
Annular Seal?	Y	Bentonite Chips	0.5 to 23
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145432.023 Easting: 1614578.09
Static Water Level Below MP: 35.49
Date: 6/7/2013
MP Description: TOC
MP Height Above or Below Ground (ft): 2.28
Surface Casing Height (ft): 2
Riser Height (ft): 2.28
Ground Surface Elevation (ft): 120.08
MP Elevation (ft): 122.36

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0' **TOPSOIL**
Medium brown to black clay loam; damp.
[Topsoil]

1.0 - 21.0' **Gravelly SAND**
Fine to medium-grained sand; about 10 to 20 percent sub-angular to angular fines-coated multi-lithic gravel, trace fines; damp.
Split spoons encountered alternating horizons that were white (salt? aluminum?), black, dark brown, red-brown, red (iron?), and yellow (iron?) throughout this interval.

Auger return is black, consistent texture; moist. Not coal waste.

12 feet Driller reported "Easier drilling"

17 to 21 feet auger return appears to be finer-grained; moist.
[Alluvium]

21.0 - 26.0' **SAND and GRAVEL with Clay**
Dark brown fine to coarse sand and fine sub-rounded gravel; with 10 to 15 percent fines; moist.

24 to 25 feet Auger return: Clay content increasing to 25 percent; moist.
[Alluvium]

26.0 - 35.0' **BEDROCK**
No auger return; very hard drilling; assumed weathered bedrock

28 feet: Let rig sit to cool down; SWL indicator was moist but no water.

35 feet: Encountered water.
[Kootenai Formation?]

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: MW-12

Date Hole Started: 6/6/2013 Date Hole Finished: 6/6/2013

Client: Montana DEQ
Project: Coke Oven Flats Investigation
County: Cascade State: Montana
Property Owner: Montana DOT
Legal Description: SE,NW, Sec. 26, T19N, R6E,
Location Description: SE corner of COF near Belt Creek

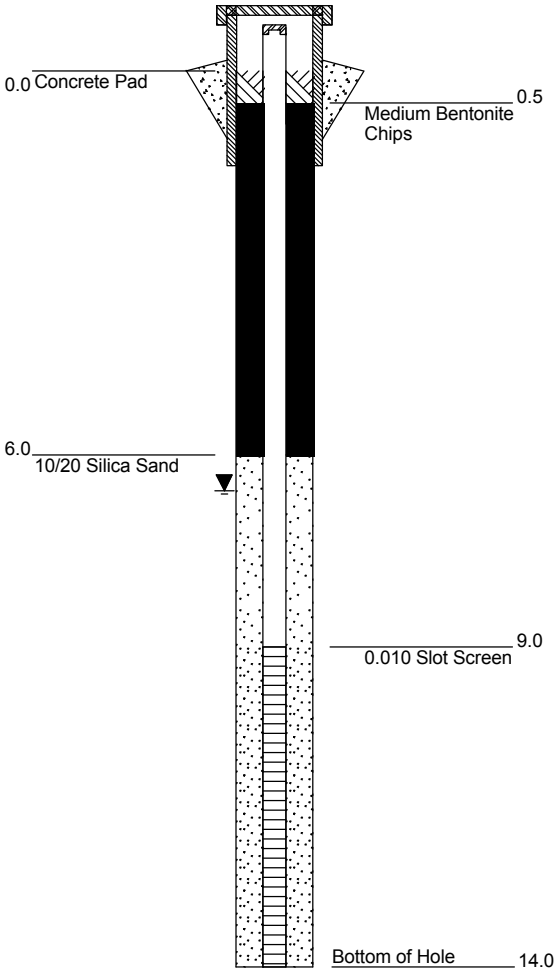
Recorded By: LBoettcher
Drilling Company: Boland Drilling
Driller: Chris
Drilling Method: Hollow Stem Auger
Drilling Fluids Used:
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8 1/4
Total Depth Drilled (ft): 14

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	-2.5 to 14
Surface Casing Used?	Y	6-inch steel	-2 to 3
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	9 to 14 ft
Sand Pack?	Y	10/20 Silica Sand	6 to 14 ft
Annular Seal?	Y	Bentonite Chips	0.5 to 6
Surface Seal?	Y	Concrete	0 to 0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Bail/Pump	
Water Samples Taken?	Y	Sulfate/Trace Metals	
Boring Samples Taken?	Y	Trace Metals	

Northing: 1145590.051 Easting: 1614720.659
Static Water Level Below MP: 9.45 Surface Casing Height (ft): 2
Date: 6/7/2013 Riser Height (ft): 2.89
MP Description: TOC Ground Surface Elevation (ft): 89.87
MP Height Above or Below Ground (ft): 2.89 MP Elevation (ft): 92.76

Remarks:

WELL CONSTRUCTION



SAMPLE NOTES

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 2.5' **TOPSOIL**
Dark brown clay loam; moist.
[Topsoil]

2.5 - 10.0' **Gravelly SAND with Silt**
Pale tan to red and red-brown, coarse sand with 10 to 15 percent angular medium gravel clasts; moist.

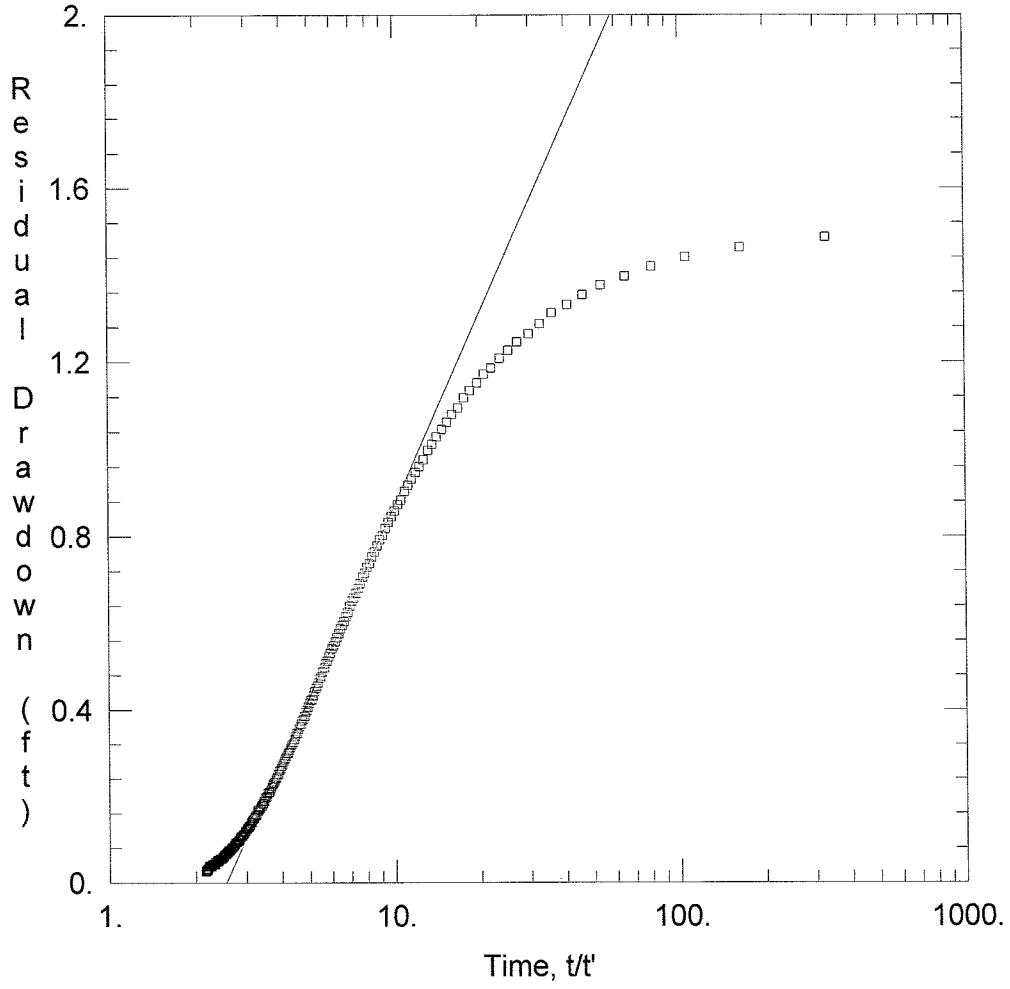
3 feet: Auger return is light tan to medium brown colored sand; gravels sub-angular to sub-rounded; about 10 to 15 percent fines; moist.

7.5 feet: Auger return clay content appears to be increasing up to 25 percent.
[Alluvium]

10.0 - 10.5' **SAND**
Medium brown dense, fine to coarse-grained, well sorted sand, very moist.
[Alluvium]

10.5 - 14.0' **Gravel and sand in SILT**
Multi-lithic, sub-rounded gravel in silt matrix; logged from auger return; uncertain percentage of fines and sand; some return may be from above interval. Assume >10 percent fines based on slow water level recovery during well development and monitoring.
[Alluvium]

BEDROCK
No auger return; drilling refusal, assumed bedrock contact
[Kootenai Formation?]



WELL TEST ANALYSIS

Data Set: K:\project\11033 GFCF\Coke Oven Flats\MW-4_ Pumping Test Data\MW-4 recovery.aqt
Date: 08/29/13 Time: 11:22:58

PROJECT INFORMATION

Company: Hydrometrics
Client: Montana DEQ
Project: 11033
Location: Belt, MT
Test Well: MW-4

AQUIFER DATA

Saturated Thickness: 8. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-4	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ MW-4	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 12. ft^2/day S/S' = 2.548

APPENDIX C

SUB-SURFACE SOIL
ANALYTICAL REPORT

ANALYTICAL SUMMARY REPORT

August 13, 2013

MT DEQ-Abandoned Mines
PO Box 200901
Helena, MT 59620-0901

Workorder No.: H13060186 Quote ID: H868 - Great Falls Coal Field/Coke Flats-Oven/Belt

Project Name: 11033 DEQ AML Coke Oven Flats

Energy Laboratories Inc Helena MT received the following 10 samples for MT DEQ-Abandoned Mines on 6/12/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13060186-001	COF1306-100	06/07/13 10:47	06/12/13	Waste	Metals by ICP/ICPMS, Total Metals by ICP/ICPMS, Total Acid/Base Potential Lime Requirement, SMP Buffer pH, Saturated Paste Digestion, Total Metals Lime Percentage Saturated Paste Extraction Sulfur Forms Soil Preparation SPLP Extraction, Regular
H13060186-002	COF1306-101	06/07/13 11:02	06/12/13	Waste	Metals by ICP/ICPMS, Total Acid/Base Potential Lime Requirement, SMP Buffer pH, Saturated Paste Digestion, Total Metals Lime Percentage Saturated Paste Extraction Sulfur Forms Soil Preparation SPLP Extraction, Regular
H13060186-003	COF1306-102	06/07/13 12:44	06/12/13	Waste	Metals by ICP/ICPMS, Total pH, Saturated Paste Digestion, Total Metals Saturated Paste Extraction
H13060186-004	COF1306-103	06/06/13 16:20	06/12/13	Waste	Same As Above
H13060186-005	COF1306-104	06/07/13 8:22	06/12/13	Waste	Same As Above
H13060186-006	COF1306-105	06/07/13 8:42	06/12/13	Waste	Metals by ICP/ICPMS, Total Metals by ICP/ICPMS, Total Acid/Base Potential Lime Requirement, SMP Buffer pH, Saturated Paste Digestion, Total Metals Lime Percentage Saturated Paste Extraction Sulfur Forms Soil Preparation SPLP Extraction, Regular
H13060186-007	COF1306-106	06/07/13 8:50	06/12/13	Waste	Metals by ICP/ICPMS, Total pH, Saturated Paste Digestion, Total Metals Saturated Paste Extraction
H13060186-008	COF1306-107	06/06/13 13:10	06/12/13	Waste	Same As Above

ANALYTICAL SUMMARY REPORT

H13060186-009	COF1306-108	06/06/13 13:20	06/12/13	Waste	Metals by ICP/ICPMS, Total Metals by ICP/ICPMS, Total Acid/Base Potential Lime Requirement, SMP Buffer pH, Saturated Paste Digestion, Total Metals Lime Percentage Saturated Paste Extraction Sulfur Forms Soil Preparation SPLP Extraction, Regular
H13060186-010	COF1306-109	06/06/13 8:15	06/12/13	Waste	Metals by ICP/ICPMS, Total pH, Saturated Paste Digestion, Total Metals Saturated Paste Extraction

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats
Sample Delivery Group: H13060186

Revised Date: 08/13/13
Report Date: 07/10/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

Additional sampling requested for SPLP analysis for samples 001, 002, 006 & 009. Insufficient sample volume to complete the SPLP analysis for sample 002, client does not want us to analyze for this one. Wj 7/22/13

Comments imported for SUBBED Workorder: B13070999
Per client request on 8/5/13, add SPLP Boron to the following samples:

COF1306-100 (H13060186-001)
COF1306-105 (H13060186-006)
COF1306-108 (H13060186-009)

The report has been revised and replaces any previously issued report in its entirety.
End of comments imported for SUBBED Workorder: B13070999

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Date Received: 06/12/13

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats
Workorder: H13060186

		Analysis		pH, SMP Buffer	Lime Requireme	pH-SatPst	Neut Potential	Acid Potential	Acid/Base Potential	Sulfur, Total	Sulfur, Hot Water	Sulfur, HCl Extractable	Sulfur, HNO3	Sulfur, Residual
		Units		s_u_	Tons/1000T	s_u_	t/kt	t/kt	t/kt	%	%	%	%	%
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13060186-001	COF1306-100	0	0	4.3	19	2.1	-6	21	-27	2.9	0.16	0.03	0.69	2.0
H13060186-002	COF1306-101	0	0	2.4	33	1.6	-31	34	-65	5.0	1.1	0.20	1.1	2.6
H13060186-003	COF1306-102	0	0			6.9								
H13060186-004	COF1306-103	0	0			6.8								
H13060186-005	COF1306-104	0	0			2.6								
H13060186-006	COF1306-105	0	0	3.5	25	2.0	-13	12	-26	2.0	0.53	0.74	0.40	0.30
H13060186-007	COF1306-106	0	0			2.1								
H13060186-008	COF1306-107	0	0			4.7								
H13060186-009	COF1306-108	0	0	6.4	4	4.4	-2	2.8	-5	0.37	0.12	0.14	0.09	0.02
H13060186-010	COF1306-109	0	0			6.8								

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Date Received: 06/12/13

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats
Workorder: H13060186

		Analysis		Al-T	As-T	Be-T	B-T	Cd-T	Cu-T	Fe-T	Mn-T	Ni-T	Pb-T	Tl-T
		Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13060186-001	COF1306-100	0	0	2960	4	3	29	< 1	3	3830	4	2	12	1
H13060186-002	COF1306-101	0	0	4820	71	< 1	17	< 1	8	35300	28	4	45	1
H13060186-003	COF1306-102	0	0	9810	19	< 1	6	< 1	15	29400	163	18	47	< 1
H13060186-004	COF1306-103	0	0	1660	2	< 1	< 1	< 1	5	11700	6	10	3	< 1
H13060186-005	COF1306-104	0	0	1860	18	< 1	4	< 1	7	21300	6	3	3	< 1
H13060186-006	COF1306-105	0	0	1450	15	< 1	3	< 1	11	73300	11	6	< 1	< 1
H13060186-007	COF1306-106	0	0	2130	7	< 1	2	< 1	4	41500	7	4	< 1	< 1
H13060186-008	COF1306-107	0	0	27100	24	1	10	< 1	10	22500	16	5	22	< 1
H13060186-009	COF1306-108	0	0	15700	11	2	13	< 1	17	10800	4	13	6	< 1
H13060186-010	COF1306-109	0	0	15800	8	1	8	< 1	18	28900	68	16	10	< 1

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Date Received: 06/12/13

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats
Workorder: H13060186

		Analysis		Zn-T	Al-SPLP	Be-SPLP	B-SPLP	Cu-SPLP	Fe-SPLP	Mn-SPLP	Ni-SPLP	Tl-SPLP	Zn-SPLP	As-SPLP
		Units		mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13060186-001	COF1306-100	0	0	4	9.3	< 0.001	0.29	0.006	16	0.085	< 0.005	< 0.0005	0.03	< 0.001
H13060186-002	COF1306-101	0	0	26										
H13060186-003	COF1306-102	0	0	76										
H13060186-004	COF1306-103	0	0	18										
H13060186-005	COF1306-104	0	0	3										
H13060186-006	COF1306-105	0	0	6	38	0.004	0.35	0.057	12	0.14	0.023	< 0.0005	0.05	< 0.001
H13060186-007	COF1306-106	0	0	4										
H13060186-008	COF1306-107	0	0	9										
H13060186-009	COF1306-108	0	0	13	0.04	< 0.001	0.10	< 0.005	< 0.03	0.010	0.012	< 0.0005	< 0.01	< 0.001
H13060186-010	COF1306-109	0	0	60										

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Date Received: 06/12/13

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats
Workorder: H13060186

		Analysis		Cd-SPLP	Pb-SPLP
		Units		mg/L	mg/L
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**
H13060186-001	COF1306-100	0	0	< 0.001	0.002
H13060186-002	COF1306-101	0	0		
H13060186-003	COF1306-102	0	0		
H13060186-004	COF1306-103	0	0		
H13060186-005	COF1306-104	0	0		
H13060186-006	COF1306-105	0	0	< 0.001	< 0.001
H13060186-007	COF1306-106	0	0		
H13060186-008	COF1306-107	0	0		
H13060186-009	COF1306-108	0	0	< 0.001	0.005
H13060186-010	COF1306-109	0	0		

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA12-3**										Batch: R89788
Sample ID: **LCS-R89788**		Laboratory Control Sample				Run: MISC SOILS_130716D				07/16/13 08:00
pH, SMP Buffer		7.60	s.u.	0.10	101	70	130			
Sample ID: **H13060186-009A**	2	Sample Duplicate				Run: MISC SOILS_130716D				07/16/13 08:00
pH, SMP Buffer		6.39	s.u.	0.10						
Lime Requirement, SMP buffer		4.00	Tons/1000T	1.0						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASAM10-3.2**									Analytical Run: SOIL PH METER_130617A	
Sample ID: **CCV_1_130613_1**		Continuing Calibration Verification Standard							06/14/13 06:42	
pH, sat. paste		7.02	s.u.	0.10	100	98.6	101.4			
Sample ID: **CCV1_1_130613_1**		Continuing Calibration Verification Standard							06/14/13 06:43	
pH, sat. paste		4.02	s.u.	0.10	100	97.5	102.5			
Sample ID: **ICV_1_130613_1**		Initial Calibration Verification Standard							06/14/13 06:43	
pH, sat. paste		9.97	s.u.	0.10	100	99	101			
Method: **ASAM10-3.2**									Batch: 20629	
Sample ID: **LCS-20629**		Laboratory Control Sample				Run: SOIL PH METER_130617A			06/14/13 06:46	
pH, sat. paste		7.53	s.u.	0.10	100	95	105			
Sample ID: **H13060186-010ADUP**		Sample Duplicate				Run: SOIL PH METER_130617A			06/14/13 06:55	
pH, sat. paste		6.80	s.u.	0.10				0.1	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130618C	
Sample ID: ICV	2	Initial Calibration Verification Standard							06/18/13 14:38	
Manganese		3.95	mg/L	0.010	99	90	110			
Zinc		0.804	mg/L	0.010	100	90	110			
Sample ID: ICSA	2	Interference Check Sample A							06/18/13 14:53	
Manganese		0.000160	mg/L	0.010		0	0			
Zinc		0.0127	mg/L	0.010		0	0			
Sample ID: ICSAB	2	Interference Check Sample AB							06/18/13 14:57	
Manganese		0.476	mg/L	0.010	95	80	120			
Zinc		1.02	mg/L	0.010	102	80	120			
Method: E200.7									Analytical Run: ICP2-HE_130619B	
Sample ID: ICV	3	Initial Calibration Verification Standard							06/19/13 11:19	
Aluminum		4.08	mg/L	0.10	102	90	110			
Boron		0.812	mg/L	0.10	101	90	110			
Zinc		0.821	mg/L	0.010	103	90	110			
Sample ID: ICSA	3	Interference Check Sample A							06/19/13 11:34	
Aluminum		521	mg/L	0.10	104	80	120			
Boron		-0.00549	mg/L	0.10		0	0			
Zinc		0.0116	mg/L	0.010		0	0			
Sample ID: ICSAB	3	Interference Check Sample AB							06/19/13 11:38	
Aluminum		522	mg/L	0.10	104	80	120			
Boron		1.12	mg/L	0.10	112	80	120			
Zinc		1.04	mg/L	0.010	104	80	120			
Method: E200.7									Analytical Run: ICP2-HE_130621B	
Sample ID: ICV	2	Initial Calibration Verification Standard							06/21/13 11:39	
Boron		0.801	mg/L	0.10	100	90	110			
Zinc		0.808	mg/L	0.010	101	90	110			
Sample ID: ICSA	2	Interference Check Sample A							06/21/13 11:53	
Boron		-0.00747	mg/L	0.10		0	0			
Zinc		0.0118	mg/L	0.010		0	0			
Sample ID: ICSAB	2	Interference Check Sample AB							06/21/13 11:58	
Boron		1.11	mg/L	0.10	111	80	120			
Zinc		1.01	mg/L	0.010	101	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Analytical Run: ICP2-HE_130626B	
Sample ID: **ICV**	Initial Calibration Verification Standard								06/26/13 09:02	
Iron		3.99	mg/L	0.030	100	90	110			
Sample ID: **ICSA**	Interference Check Sample A								06/26/13 09:17	
Iron		183	mg/L	0.030	92	80	120			
Sample ID: **ICSAB**	Interference Check Sample AB								06/26/13 09:21	
Iron		184	mg/L	0.030	92	80	120			
Method: **E200.7**									Analytical Run: ICP2-HE_130628B	
Sample ID: **ICV**	Initial Calibration Verification Standard								06/28/13 09:02	
Aluminum		4.05	mg/L	0.10	101	90	110			
Sample ID: **ICSA**	Interference Check Sample A								06/28/13 09:17	
Aluminum		516	mg/L	0.10	103	80	120			
Sample ID: **ICSAB**	Interference Check Sample AB								06/28/13 09:21	
Aluminum		518	mg/L	0.10	104	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: Sobek Modified										Batch: R89886
Sample ID: LCS1307191239	5	Laboratory Control Sample				Run: LECO632_130722A				07/19/13 12:39
Sulfur, Total		0.82	%	0.010	105	80	120			
Sulfur, Hot Water Extractable		0.34	%	0.010	97	70	130			
Sulfur, HCl Extractable		0.18	%	0.010	87	52	148			
Sulfur, HNO3 Extractable		0.22	%	0.010	86	69	131			
Sulfur, Residual		0.083	%	0.010	114	70	130			
Sample ID: H13060186-001A	5	Sample Duplicate				Run: LECO632_130722A				07/19/13 12:57
Sulfur, Total		2.9	%	0.010				1.2	30	
Sulfur, Hot Water Extractable		0.20	%	0.010				21	30	
Sulfur, HCl Extractable		0.024	%	0.010				15	30	
Sulfur, HNO3 Extractable		0.68	%	0.010				0.6	30	
Sulfur, Residual		2.0	%	0.010				0.3	30	
Method: Sobek Modified										Batch: 20936
Sample ID: MB-20936		Method Blank				Run: MAN-TECH_130712A				07/12/13 10:15
Neutralization Potential		0.3	t/kt							
Sample ID: LCS-20936		Laboratory Control Sample				Run: MAN-TECH_130712A				07/12/13 10:23
Neutralization Potential		53	t/kt		99	70	130			
Sample ID: H13060186-001ADUP		Sample Duplicate				Run: MAN-TECH_130712A				07/12/13 10:39
Neutralization Potential		-5.6	t/kt					0.2	20	
Method: Sobek Modified										Batch: 20936
Sample ID: H13060186-001ADUP	2	Sample Duplicate				Run: MISC SOILS_130722C				07/12/13 11:46
Acid Potential		21	t/kt	0.010				0.6	20	
Acid/Base Potential		-27	t/kt					0.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B										Batch: 20626
Sample ID: H13060186-010AMS	3	Sample Matrix Spike				Run: ICP2-HE_130617B				06/18/13 09:43
Aluminum		17900	mg/kg	5.0		75	125			A
Boron		49.1	mg/kg	1.0	85	75	125			
Zinc		105	mg/kg	1.0	87	75	125			
Sample ID: H13060186-010AMSD	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130617B				06/18/13 09:47
Aluminum		16600	mg/kg	5.0		75	125	7.6	20	A
Boron		49.1	mg/kg	1.0	83	75	125	0.1	20	
Zinc		112	mg/kg	1.0	100	75	125	6.6	20	
Method: SW6010B										Batch: 20661
Sample ID: MB-20661	3	Method Blank				Run: ICP2-HE_130618C				06/18/13 23:26
Boron		0.3	mg/kg	0.2						
Manganese		ND	mg/kg	0.03						
Zinc		ND	mg/kg	0.1						
Sample ID: LFB-20661	3	Laboratory Fortified Blank				Run: ICP2-HE_130618C				06/18/13 23:30
Boron		50.6	mg/kg	1.0	101	80	120			
Manganese		236	mg/kg	1.0	94	80	120			
Zinc		46.9	mg/kg	1.0	94	80	120			
Sample ID: LCS-20661	3	Laboratory Control Sample				Run: ICP2-HE_130618C				06/18/13 23:34
Boron		65.9	mg/kg	1.0	70	59.4	101.9			
Manganese		346	mg/kg	1.0	94	80.8	115.7			
Zinc		176	mg/kg	1.0	83	74.2	109.9			
Sample ID: H13060186-002AMS	3	Sample Matrix Spike				Run: ICP2-HE_130618C				06/18/13 23:59
Boron		217	mg/kg	3.4	101	75	125			
Manganese		966	mg/kg	1.0	94	75	125			
Zinc		223	mg/kg	2.4	98	75	125			
Sample ID: H13060186-002AMSD	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130618C				06/19/13 00:03
Boron		197	mg/kg	3.3	95	75	125	9.4	20	
Manganese		917	mg/kg	1.0	92	75	125	5.2	20	
Zinc		194	mg/kg	2.3	87	75	125	14	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B										Batch: 20626
Sample ID: MB-20626	3	Method Blank				Run: ICP2-HE_130619B				06/20/13 01:38
Aluminum		ND	mg/kg	0.5						
Boron		0.2	mg/kg	0.2						
Zinc		0.1	mg/kg	0.1						
Sample ID: H13060186-010AMS	3	Sample Matrix Spike				Run: ICP2-HE_130619B				06/20/13 02:33
Aluminum		21200	mg/kg	5.0		75	125			A
Boron		55.7	mg/kg	1.7	96	75	125			
Zinc		118	mg/kg	1.1	99	75	125			
Sample ID: H13060186-010AMSD	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130619B				06/20/13 02:37
Aluminum		19300	mg/kg	5.0		75	125	9.3	20	A
Boron		56.3	mg/kg	1.7	95	75	125	1.1	20	
Zinc		124	mg/kg	1.2	110	75	125	5.4	20	
Method: SW6010B										Batch: 20661
Sample ID: MB-20661	3	Method Blank				Run: ICP2-HE_130619B				06/20/13 00:58
Boron		0.3	mg/kg	0.2						
Manganese		ND	mg/kg	0.03						
Zinc		0.1	mg/kg	0.1						
Sample ID: LFB-20661	3	Laboratory Fortified Blank				Run: ICP2-HE_130619B				06/20/13 01:02
Boron		49.8	mg/kg	1.0	99	80	120			
Manganese		233	mg/kg	1.0	93	80	120			
Zinc		46.5	mg/kg	1.0	93	80	120			
Sample ID: LCS-20661	3	Laboratory Control Sample				Run: ICP2-HE_130619B				06/20/13 01:05
Boron		64.7	mg/kg	1.0	69	59.4	101.9			
Manganese		341	mg/kg	1.0	92	80.8	115.7			
Zinc		173	mg/kg	1.0	81	74.2	109.9			
Sample ID: H13060186-002AMS	3	Sample Matrix Spike				Run: ICP2-HE_130619B				06/20/13 01:23
Boron		214	mg/kg	3.4	99	75	125			
Manganese		956	mg/kg	1.0	93	75	125			
Zinc		221	mg/kg	2.4	97	75	125			
Sample ID: H13060186-002AMSD	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130619B				06/20/13 01:34
Boron		201	mg/kg	3.3	96	75	125	6.4	20	
Manganese		932	mg/kg	1.0	94	75	125	2.5	20	
Zinc		197	mg/kg	2.3	89	75	125	12	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B										Batch: 20626
Sample ID: MB-20626	3	Method Blank				Run: ICP2-HE_130621B				06/21/13 13:47
Aluminum		0.6	mg/kg	0.3						
Boron		ND	mg/kg	0.2						
Zinc		0.1	mg/kg	0.1						
Sample ID: LFB-20626	3	Laboratory Fortified Blank				Run: ICP2-HE_130621B				06/21/13 13:51
Aluminum		243	mg/kg	5.0	97	80	120			
Boron		46.9	mg/kg	1.0	94	80	120			
Zinc		48.0	mg/kg	1.0	96	80	120			
Sample ID: LCS-20626	3	Laboratory Control Sample				Run: ICP2-HE_130621B				06/21/13 13:55
Aluminum		11200	mg/kg	5.0	77	50.7	131.3			
Boron		63.7	mg/kg	1.0	68	59.4	101.9			
Zinc		163	mg/kg	1.0	76	74.2	109.9			
Sample ID: H13060186-010AMS	3	Sample Matrix Spike				Run: ICP2-HE_130621B				06/21/13 14:49
Aluminum		17400	mg/kg	5.0		75	125			A
Boron		46.0	mg/kg	1.0	79	75	125			
Zinc		94.8	mg/kg	1.0	72	75	125			S
Sample ID: H13060186-010AMSD	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130621B				06/21/13 14:53
Aluminum		15900	mg/kg	5.0		75	125	9.2	20	A
Boron		46.4	mg/kg	1.0	78	75	125	0.7	20	
Zinc		102	mg/kg	1.0	84	75	125	7.0	20	
Method: SW6010B										Batch: 20748
Sample ID: MB-20748	2	Method Blank				Run: ICP2-HE_130626B				06/26/13 12:18
Aluminum		ND	mg/kg	0.5						
Iron		2	mg/kg	0.4						
Sample ID: LFB-20748	2	Laboratory Fortified Blank				Run: ICP2-HE_130626B				06/26/13 12:22
Aluminum		242	mg/kg	5.0	97	80	120			
Iron		242	mg/kg	5.0	96	80	120			
Sample ID: LCS-20748	2	Laboratory Control Sample				Run: ICP2-HE_130626B				06/26/13 12:25
Aluminum		11600	mg/kg	5.0	79	50.7	131.3			
Iron		17700	mg/kg	5.0	77	39.6	138.3			
Sample ID: H13060186-002AMS	2	Sample Matrix Spike				Run: ICP2-HE_130626B				06/26/13 12:43
Aluminum		17100	mg/kg	9.7		75	125			A
Iron		38100	mg/kg	7.6		75	125			A
Sample ID: H13060186-002AMSD	2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130626B				06/26/13 12:47
Aluminum		21000	mg/kg	9.4		75	125	20	20	AR
Iron		28900	mg/kg	7.3		75	125	27	20	AR

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B										Batch: 20748
Sample ID: MB-20748	2	Method Blank				Run: ICP2-HE_130628B				06/28/13 14:08
Aluminum		0.5	mg/kg	0.5						
Iron		3	mg/kg	0.4						
Sample ID: LFB-20748	2	Laboratory Fortified Blank				Run: ICP2-HE_130628B				06/28/13 14:12
Aluminum		236	mg/kg	5.0	94	80	120			
Iron		235	mg/kg	5.0	93	80	120			
Sample ID: LCS-20748	2	Laboratory Control Sample				Run: ICP2-HE_130628B				06/28/13 14:15
Aluminum		12000	mg/kg	5.0	82	50.7	131.3			
Iron		18100	mg/kg	5.0	79	39.6	138.3			
Sample ID: H13060186-002AMS	2	Sample Matrix Spike				Run: ICP2-HE_130628B				06/28/13 14:33
Aluminum		17900	mg/kg	9.7		75	125			A
Iron		39000	mg/kg	7.6		75	125			A
Sample ID: H13060186-002AMSD	2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130628B				06/28/13 14:37
Aluminum		21500	mg/kg	9.4		75	125	18	20	A
Iron		29300	mg/kg	7.3		75	125	28	20	AR

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Analytical Run: SUB-B208425	
Sample ID: QCS	2	Initial Calibration Verification Standard							07/18/13 11:03	
Aluminum		4.0	mg/L	0.10	101	90	110			
Iron		4.1	mg/L	0.030	102	90	110			
Sample ID: ICSA	2	Interference Check Sample A							07/18/13 11:18	
Aluminum		490	mg/L	0.10	98	80	120			
Iron		180	mg/L	0.030	90	80	120			
Sample ID: ICSAB	2	Interference Check Sample AB							07/18/13 11:22	
Aluminum		480	mg/L	0.10	96	80	120			
Iron		180	mg/L	0.030	88	80	120			
Method: SW6010B									Batch: B_72867	
Sample ID: MB-72867	3	Method Blank				Run: SUB-B208425			07/18/13 21:48	
Aluminum		0.03	mg/L	0.01						
Boron		0.09	mg/L	0.002						
Iron		0.004	mg/L	0.002						
Sample ID: LCS-72867	3	Laboratory Control Sample				Run: SUB-B208425			07/18/13 22:00	
Aluminum		2.5	mg/L	0.030	98	85	115			
Boron		0.56	mg/L	0.050	96	85	115			
Iron		2.5	mg/L	0.030	99	85	115			
Sample ID: LCSD-72867	3	Laboratory Control Sample Duplicate				Run: SUB-B208425			07/18/13 22:04	
Aluminum		2.5	mg/L	0.030	98	85	115	0.0	20	
Boron		0.56	mg/L	0.050	96	85	115	0.0	20	
Iron		2.5	mg/L	0.030	100	85	115	0.0	20	
Sample ID: H13060186-001A	3	Serial Dilution				Run: SUB-B208425			07/18/13 22:11	
Aluminum		9.3	mg/L	0.057		0	0	0.1	20	
Boron		0.29	mg/L	0.050		0	0	1.9	20	
Iron		17	mg/L	0.030		0	0	2.7	20	
Sample ID: H13060186-001A	3	Sample Matrix Spike				Run: SUB-B208425			07/18/13 22:15	
Aluminum		12	mg/L	0.030	111	75	125			
Boron		0.78	mg/L	0.050	99	75	125			
Iron		19	mg/L	0.030		75	125			A
Sample ID: H13060186-006A	3	Sample Matrix Spike				Run: SUB-B208425			07/18/13 22:23	
Aluminum		40	mg/L	0.030		75	125			A
Boron		0.82	mg/L	0.050	95	75	125			
Iron		15	mg/L	0.030		75	125			A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Analytical Run: SUB-B208940	
Sample ID: QCS	2	Initial Calibration Verification Standard							07/26/13 11:48	
Boron		0.78	mg/L	0.10	98	90	110			
Iron		4.0	mg/L	0.030	101	90	110			
Sample ID: ICSA	2	Interference Check Sample A							07/26/13 12:03	
Boron		0.047	mg/L	0.10						
Iron		170	mg/L	0.030	87	80	120			
Sample ID: ICSAB	2	Interference Check Sample AB							07/26/13 12:07	
Boron		5.8	mg/L	0.10	116	80	120			
Iron		180	mg/L	0.030	89	80	120			
Method: SW6010B									Batch: B_73085	
Sample ID: MB-73085	2	Method Blank				Run: SUB-B208940			07/26/13 15:20	
Boron		ND	mg/L	0.002						
Iron		ND	mg/L	0.002						
Sample ID: LCS-73085	2	Laboratory Control Sample				Run: SUB-B208940			07/26/13 15:24	
Boron		0.49	mg/L	0.050	98	85	115			
Iron		2.5	mg/L	0.030	100	85	115			
Sample ID: LCSD-73085	2	Laboratory Control Sample Duplicate				Run: SUB-B208940			07/26/13 15:35	
Boron		0.49	mg/L	0.050	99	85	115	0.0	20	
Iron		2.5	mg/L	0.030	100	85	115	0.0	20	
Sample ID: H13060186-009A	2	Serial Dilution				Run: SUB-B208940			07/26/13 15:43	
Boron		0.11	mg/L	0.050		0	0	4.1	20	
Iron		ND	mg/L	0.030		0	0		20	
Sample ID: H13060186-009A	2	Sample Matrix Spike				Run: SUB-B208940			07/26/13 15:47	
Boron		0.59	mg/L	0.050	98	75	125			
Iron		2.5	mg/L	0.030	98	75	125			
Method: SW6010B									Batch: B_72867	
Sample ID: MB-72867		Method Blank				Run: SUB-B209751			08/09/13 12:24	
Boron		0.08	mg/L	0.002						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: ICPMS204-B_130617C	
Sample ID: ICV STD	9	Initial Calibration Verification Standard							06/18/13 09:18	
Arsenic		0.0606	mg/L	0.0010	101	90	110			
Beryllium		0.0309	mg/L	0.0010	103	90	110			
Cadmium		0.0317	mg/L	0.0010	106	90	110			
Copper		0.0619	mg/L	0.0010	103	90	110			
Iron		0.311	mg/L	0.0010	104	90	110			
Lead		0.0604	mg/L	0.0010	101	90	110			
Manganese		0.298	mg/L	0.0010	99	90	110			
Nickel		0.0616	mg/L	0.0010	103	90	110			
Thallium		0.0602	mg/L	0.0010	100	90	110			
Sample ID: ICV STD	9	Initial Calibration Verification Standard							06/18/13 21:46	
Arsenic		0.0576	mg/L	0.0010	96	90	110			
Beryllium		0.0300	mg/L	0.0010	100	90	110			
Cadmium		0.0316	mg/L	0.0010	105	90	110			
Copper		0.0597	mg/L	0.0010	100	90	110			
Iron		0.297	mg/L	0.0010	99	90	110			
Lead		0.0589	mg/L	0.0010	98	90	110			
Manganese		0.294	mg/L	0.0010	98	90	110			
Nickel		0.0599	mg/L	0.0010	100	90	110			
Thallium		0.0595	mg/L	0.0010	99	90	110			
Sample ID: ICV STD	9	Initial Calibration Verification Standard							06/19/13 23:29	
Arsenic		0.0613	mg/L	0.0010	102	90	110			
Beryllium		0.0302	mg/L	0.0010	101	90	110			
Cadmium		0.0323	mg/L	0.0010	108	90	110			
Copper		0.0616	mg/L	0.0010	103	90	110			
Iron		0.302	mg/L	0.0010	101	90	110			
Lead		0.0601	mg/L	0.0010	100	90	110			
Manganese		0.297	mg/L	0.0010	99	90	110			
Nickel		0.0612	mg/L	0.0010	102	90	110			
Thallium		0.0606	mg/L	0.0010	101	90	110			
Method: SW6020									Batch: 20626	
Sample ID: LCS-20626		Laboratory Control Sample				Run: ICPMS204-B_130617C			06/18/13 18:18	
Beryllium		39.6	mg/kg	1.0	78	76.3	108.6			
Sample ID: LFB-20626		Laboratory Fortified Blank				Run: ICPMS204-B_130617C			06/18/13 18:23	
Beryllium		25.3	mg/kg	1.0	101	80	120			
Sample ID: LCS-20626	8	Laboratory Control Sample				Run: ICPMS204-B_130617C			06/19/13 20:59	
Arsenic		260	mg/kg	1.0	76	72.3	106.4			
Cadmium		110	mg/kg	1.0	81	73	105.1			
Copper		237	mg/kg	1.0	85	77.5	109.6			
Iron		18900	mg/kg	9.6	82	39.6	138.3			
Lead		162	mg/kg	1.0	87	75.9	108.6			
Manganese		376	mg/kg	1.0	102	80.8	115.7			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020										Batch: 20626
Sample ID: LCS-20626	8	Laboratory Control Sample				Run: ICPMS204-B_130617C				06/19/13 20:59
Nickel		52.0	mg/kg	1.0	85	72.3	103.4			
Thallium		73.6	mg/kg	1.0	81	71.7	109.5			
Sample ID: LFB-20626	8	Laboratory Fortified Blank				Run: ICPMS204-B_130617C				06/19/13 21:04
Arsenic		50.0	mg/kg	1.0	100	80	120			
Cadmium		26.9	mg/kg	1.0	108	80	120			
Copper		51.1	mg/kg	1.0	102	80	120			
Iron		274	mg/kg	9.6	109	80	120			
Lead		50.6	mg/kg	1.0	101	80	120			
Manganese		256	mg/kg	1.0	102	80	120			
Nickel		51.7	mg/kg	1.0	103	80	120			
Thallium		50.6	mg/kg	1.0	101	80	120			
Sample ID: H13060186-010AMS	9	Sample Matrix Spike				Run: ICPMS204-B_130617C				06/19/13 22:21
Arsenic		58.1	mg/kg	1.0	103	75	125			
Beryllium		24.3	mg/kg	1.0	96	75	125			
Cadmium		25.7	mg/kg	1.0	105	75	125			
Copper		73.1	mg/kg	1.0	113	75	125			
Iron		37800	mg/kg	9.3		75	125			A
Lead		58.2	mg/kg	1.0	99	75	125			
Manganese		332	mg/kg	1.0	109	75	125			
Nickel		68.8	mg/kg	1.0	108	75	125			
Thallium		50.1	mg/kg	1.0	103	75	125			
Sample ID: H13060186-010AMSD	9	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130617C				06/19/13 22:26
Arsenic		59.4	mg/kg	1.0	104	75	125	2.2	20	
Beryllium		24.2	mg/kg	1.0	93	75	125	0.2	20	
Cadmium		25.8	mg/kg	1.0	103	75	125	0.4	20	
Copper		73.6	mg/kg	1.0	112	75	125	0.7	20	
Iron		38400	mg/kg	9.5		75	125	1.6	20	A
Lead		60.6	mg/kg	1.0	102	75	125	4.1	20	
Manganese		378	mg/kg	1.0	125	75	125	13	20	
Nickel		68.8	mg/kg	1.0	106	75	125	0.0	20	
Thallium		50.6	mg/kg	1.0	102	75	125	0.9	20	
Method: SW6020										Batch: 20661
Sample ID: MB-20661	8	Method Blank				Run: ICPMS204-B_130617C				06/19/13 19:37
Arsenic		0.2	mg/kg	0.1						
Beryllium		ND	mg/kg	0.05						
Cadmium		ND	mg/kg	0.07						
Copper		ND	mg/kg	0.3						
Lead		0.03	mg/kg	0.03						
Manganese		0.2	mg/kg	0.1						
Nickel		ND	mg/kg	0.2						
Thallium		ND	mg/kg	0.02						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020										Batch: 20661
Sample ID: LCS-20661	8	Laboratory Control Sample				Run: ICPMS204-B_130617C				06/19/13 19:41
Arsenic		292	mg/kg	1.0	85	72.3	106.4			
Beryllium		41.7	mg/kg	1.0	82	76.3	108.6			
Cadmium		124	mg/kg	1.0	90	73	105.1			
Copper		264	mg/kg	1.0	94	77.5	109.6			
Lead		180	mg/kg	1.0	97	75.9	108.6			
Manganese		399	mg/kg	1.0	108	80.8	115.7			
Nickel		58.0	mg/kg	1.0	95	72.3	103.4			
Thallium		83.2	mg/kg	1.0	91	71.7	109.5			
Sample ID: LFB-20661	8	Laboratory Fortified Blank				Run: ICPMS204-B_130617C				06/19/13 19:46
Arsenic		49.6	mg/kg	1.0	99	80	120			
Beryllium		23.4	mg/kg	1.0	94	80	120			
Cadmium		27.3	mg/kg	1.0	109	80	120			
Copper		51.2	mg/kg	1.0	102	80	120			
Lead		50.8	mg/kg	1.0	102	80	120			
Manganese		253	mg/kg	1.0	101	80	120			
Nickel		50.5	mg/kg	1.0	101	80	120			
Thallium		49.9	mg/kg	1.0	100	80	120			
Sample ID: H13060186-002AMS	8	Sample Matrix Spike				Run: ICPMS204-B_130617C				06/19/13 20:35
Arsenic		234	mg/kg	1.0	81	75	125			
Beryllium		91.5	mg/kg	1.0	91	75	125			
Cadmium		104	mg/kg	1.0	104	75	125			
Copper		211	mg/kg	1.2	101	75	125			
Lead		236	mg/kg	1.0	96	75	125			
Manganese		1010	mg/kg	1.0	98	75	125			
Nickel		200	mg/kg	1.0	98	75	125			
Thallium		179	mg/kg	1.0	89	75	125			
Sample ID: H13060186-002AMSD	8	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130617C				06/19/13 20:40
Arsenic		231	mg/kg	1.0	83	75	125	1.3	20	
Beryllium		93.9	mg/kg	1.0	97	75	125	2.6	20	
Cadmium		102	mg/kg	1.0	106	75	125	2.0	20	
Copper		206	mg/kg	1.2	103	75	125	2.6	20	
Lead		225	mg/kg	1.0	94	75	125	5.0	20	
Manganese		989	mg/kg	1.0	100	75	125	2.4	20	
Nickel		200	mg/kg	1.0	102	75	125	0.1	20	
Thallium		177	mg/kg	1.0	92	75	125	0.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: ICPMS204-B_130622A	
Sample ID: ICV STD		Initial Calibration Verification Standard							06/21/13 08:41	
Beryllium		0.0302	mg/L	0.0010	101	90	110			
Sample ID: ICV STD		Initial Calibration Verification Standard							06/22/13 00:22	
Beryllium		0.0305	mg/L	0.0010	102	90	110			
Sample ID: ICV STD		Initial Calibration Verification Standard							06/22/13 12:58	
Beryllium		0.0301	mg/L	0.0010	100	90	110			
Method: SW6020									Batch: 20626	
Sample ID: MB-20626	9	Method Blank				Run: ICPMS204-B_130622A			06/22/13 01:54	
Arsenic		ND	mg/kg	0.1						
Beryllium		ND	mg/kg	0.05						
Cadmium		ND	mg/kg	0.07						
Copper		ND	mg/kg	0.3						
Iron		ND	mg/kg	10						
Lead		ND	mg/kg	0.03						
Manganese		ND	mg/kg	0.1						
Nickel		ND	mg/kg	0.2						
Thallium		ND	mg/kg	0.02						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: SUB-B208476	
Sample ID: QCS	10	Initial Calibration Verification Standard							07/18/13 15:12	
Arsenic		0.0517	mg/L	0.0010	103	90	110			
Barium		0.0514	mg/L	0.0010	103	90	110			
Beryllium		0.0262	mg/L	0.0010	105	90	110			
Cadmium		0.0267	mg/L	0.0010	107	90	110			
Copper		0.0532	mg/L	0.0010	106	90	110			
Lead		0.0511	mg/L	0.0010	102	90	110			
Manganese		0.257	mg/L	0.0010	103	90	110			
Nickel		0.0527	mg/L	0.0010	105	90	110			
Thallium		0.0516	mg/L	0.0010	103	90	110			
Zinc		0.0551	mg/L	0.0010	110	90	110			
Sample ID: ICSA	10	Interference Check Sample A							07/18/13 15:20	
Arsenic		-0.000190	mg/L	0.0010						
Barium		0.000290	mg/L	0.0010						
Beryllium		1.00E-05	mg/L	0.0010						
Cadmium		0.000500	mg/L	0.0010						
Copper		0.00130	mg/L	0.0010						
Lead		0.000380	mg/L	0.0010						
Manganese		0.000240	mg/L	0.0010						
Nickel		0.00161	mg/L	0.0010						
Thallium		0.000230	mg/L	0.0010						
Zinc		0.00205	mg/L	0.0010						
Sample ID: ICSAB	10	Interference Check Sample AB							07/18/13 15:23	
Arsenic		0.00784	mg/L	0.0010	78	70	130			
Barium		0.000300	mg/L	0.0010		0	0			
Beryllium		1.00E-05	mg/L	0.0010		0	0			
Cadmium		0.00804	mg/L	0.0010	80	70	130			
Copper		0.0164	mg/L	0.0010	82	70	130			
Lead		0.000220	mg/L	0.0010		0	0			
Manganese		0.0162	mg/L	0.0010	81	70	130			
Nickel		0.0166	mg/L	0.0010	83	70	130			
Thallium		5.00E-05	mg/L	0.0010		0	0			
Zinc		0.00925	mg/L	0.0010	93	70	130			
Method: SW6020									Batch: B_72867	
Sample ID: MB-72867	10	Method Blank				Run: SUB-B208476			07/18/13 22:25	
Beryllium		ND	mg/L	2E-05						
Copper		0.0004	mg/L	0.0001						
Manganese		0.0004	mg/L	2E-05						
Nickel		0.0001	mg/L	5E-05						
Thallium		0.0002	mg/L	1E-05						
Zinc		0.001	mg/L	0.0001						
Arsenic		ND	mg/L	0.0004						
Barium		0.004	mg/L	3E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13

Client: MT DEQ-Abandoned Mines

Report Date: 07/10/13

Project: 11033 DEQ AML Coke Oven Flats

Work Order: H13060186

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020										Batch: B_72867
Sample ID: MB-72867	10	Method Blank				Run: SUB-B208476				07/18/13 22:25
Cadmium		ND	mg/L	5E-05						
Lead		0.0001	mg/L	2E-05						
Sample ID: H13060186-006A	10	Serial Dilution				Run: SUB-B208476				07/18/13 22:33
Beryllium		0.0043	mg/L	0.0010		0	0	16	20	
Copper		0.060	mg/L	0.0050		0	0	5.5	20	
Manganese		0.14	mg/L	0.0010		0	0	1.6	20	
Nickel		0.024	mg/L	0.0050		0	0	2.3	20	
Thallium		ND	mg/L	0.00050		0	0		20	
Zinc		0.060	mg/L	0.010		0	0	27	20	R
Arsenic		ND	mg/L	0.0019		0	0		20	
Barium		0.10	mg/L	0.050		0	0	1.8	20	
Cadmium		0.00065	mg/L	0.0010		0	0		20	N
Lead		0.00025	mg/L	0.0010		0	0		20	N
Sample ID: LCS-72867	10	Laboratory Control Sample				Run: SUB-B208476				07/18/13 22:36
Beryllium		0.25	mg/L	0.0010	101	85	115			
Copper		0.55	mg/L	0.0050	109	85	115			
Manganese		2.6	mg/L	0.0010	105	85	115			
Nickel		0.54	mg/L	0.0050	107	85	115			
Thallium		0.52	mg/L	0.00050	104	85	115			
Zinc		0.54	mg/L	0.010	107	85	115			
Arsenic		0.51	mg/L	0.0038	101	85	115			
Barium		5.6	mg/L	0.050	101	85	115			
Cadmium		0.26	mg/L	0.0010	102	85	115			
Lead		0.53	mg/L	0.0010	106	85	115			
Sample ID: LCSD-72867	10	Laboratory Control Sample Duplicate				Run: SUB-B208476				07/18/13 22:39
Beryllium		0.25	mg/L	0.0010	102	85	115	0.0	20	
Copper		0.55	mg/L	0.0050	110	85	115	0.0	20	
Manganese		2.6	mg/L	0.0010	106	85	115	0.0	20	
Nickel		0.54	mg/L	0.0050	109	85	115	0.0	20	
Thallium		0.52	mg/L	0.00050	105	85	115	0.0	20	
Zinc		0.53	mg/L	0.010	106	85	115	0.0	20	
Arsenic		0.51	mg/L	0.0038	103	85	115	0.0	20	
Barium		5.5	mg/L	0.050	101	85	115	0.0	20	
Cadmium		0.26	mg/L	0.0010	102	85	115	0.0	20	
Lead		0.53	mg/L	0.0010	105	85	115	0.0	20	
Sample ID: H13060186-001A	10	Sample Matrix Spike				Run: SUB-B208476				07/18/13 22:42
Beryllium		0.21	mg/L	0.0010	82	75	125			
Copper		0.50	mg/L	0.0050	100	75	125			
Manganese		2.6	mg/L	0.0010	102	75	125			
Nickel		0.50	mg/L	0.0050	100	75	125			
Thallium		0.51	mg/L	0.00050	102	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

N - The analyte concentration was not sufficiently high to calculate a RPD for the serial dilution test.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020										Batch: B_72867
Sample ID: H13060186-001A	10	Sample Matrix Spike				Run: SUB-B208476				07/18/13 22:42
Zinc		0.41	mg/L	0.010	76	75	125			
Arsenic		0.40	mg/L	0.0010	80	75	125			
Barium		5.3	mg/L	0.050	96	75	125			
Cadmium		0.21	mg/L	0.0010	83	75	125			
Lead		0.50	mg/L	0.0010	100	75	125			
Sample ID: H13060186-006A	10	Sample Matrix Spike				Run: SUB-B208476				07/18/13 22:44
Beryllium		0.21	mg/L	0.0010	83	75	125			
Copper		0.56	mg/L	0.0050	100	75	125			
Manganese		2.7	mg/L	0.0010	104	75	125			
Nickel		0.53	mg/L	0.0050	102	75	125			
Thallium		0.53	mg/L	0.00050	105	75	125			
Zinc		0.43	mg/L	0.010	77	75	125			
Arsenic		0.40	mg/L	0.0010	81	75	125			
Barium		5.5	mg/L	0.050	98	75	125			
Cadmium		0.21	mg/L	0.0010	85	75	125			
Lead		0.52	mg/L	0.0010	103	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: SUB-B208935	
Sample ID: QCS	11	Initial Calibration Verification Standard							07/25/13 11:04	
Aluminum		0.228	mg/L	0.0010	91	90	110			
Arsenic		0.0508	mg/L	0.0010	102	90	110			
Barium		0.0480	mg/L	0.0010	96	90	110			
Beryllium		0.0245	mg/L	0.0010	98	90	110			
Cadmium		0.0248	mg/L	0.0010	99	90	110			
Copper		0.0503	mg/L	0.0010	101	90	110			
Lead		0.0486	mg/L	0.0010	97	90	110			
Manganese		0.246	mg/L	0.0010	98	90	110			
Nickel		0.0490	mg/L	0.0010	98	90	110			
Thallium		0.0488	mg/L	0.0010	98	90	110			
Zinc		0.0496	mg/L	0.0010	99	90	110			
Sample ID: ICSA	11	Interference Check Sample A							07/25/13 11:26	
Aluminum		40.3	mg/L	0.0010	101	70	130			
Arsenic		-7.00E-05	mg/L	0.0010						
Barium		0.000290	mg/L	0.0010						
Beryllium		3.00E-05	mg/L	0.0010						
Cadmium		0.000770	mg/L	0.0010						
Copper		0.00113	mg/L	0.0010						
Lead		0.000440	mg/L	0.0010						
Manganese		0.000320	mg/L	0.0010						
Nickel		0.00249	mg/L	0.0010						
Thallium		6.00E-05	mg/L	0.0010						
Zinc		-0.000220	mg/L	0.0010						
Sample ID: ICSAB	11	Interference Check Sample AB							07/25/13 11:29	
Aluminum		38.5	mg/L	0.0010	96	70	130			
Arsenic		0.0101	mg/L	0.0010	101	70	130			
Barium		0.000120	mg/L	0.0010		0	0			
Beryllium		ND	mg/L	0.0010		0	0			
Cadmium		0.0110	mg/L	0.0010	110	70	130			
Copper		0.0200	mg/L	0.0010	100	70	130			
Lead		0.000260	mg/L	0.0010		0	0			
Manganese		0.0202	mg/L	0.0010	101	70	130			
Nickel		0.0217	mg/L	0.0010	108	70	130			
Thallium		-4.00E-05	mg/L	0.0010		0	0			
Zinc		0.00924	mg/L	0.0010	92	70	130			
Method: SW6020									Batch: B_73085	
Sample ID: MB-73085	11	Method Blank				Run: SUB-B208935			07/26/13 04:02	
Aluminum		0.005	mg/L	0.0002						
Beryllium		ND	mg/L	2E-05						
Copper		0.003	mg/L	0.0001						
Manganese		0.0003	mg/L	2E-05						
Nickel		0.0001	mg/L	5E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: B_73085	
Sample ID: MB-73085	11	Method Blank				Run: SUB-B208935			07/26/13 04:02	
Thallium		0.0003	mg/L	1E-05						
Zinc		ND	mg/L	0.0001						
Arsenic		ND	mg/L	0.0004						
Barium		0.0004	mg/L	3E-05						
Cadmium		8E-05	mg/L	5E-05						
Lead		0.0004	mg/L	2E-05						
Sample ID: H13060186-009A	11	Serial Dilution				Run: SUB-B208935			07/26/13 04:08	
Aluminum		0.050	mg/L	0.030		0	0	13	20	
Beryllium		0.00015	mg/L	0.0010		0	0		20	N
Copper		ND	mg/L	0.0050		0	0		20	
Manganese		0.0086	mg/L	0.0010		0	0	10	20	
Nickel		0.011	mg/L	0.0050		0	0	9.9	20	
Thallium		ND	mg/L	0.00050		0	0		20	
Zinc		ND	mg/L	0.010		0	0		20	
Arsenic		ND	mg/L	0.0019		0	0		20	
Barium		0.048	mg/L	0.050		0	0		20	
Cadmium		ND	mg/L	0.0010		0	0		20	
Lead		0.0046	mg/L	0.0010		0	0	8.8	20	
Sample ID: LCS-73085	11	Laboratory Control Sample				Run: SUB-B208935			07/26/13 04:11	
Aluminum		2.3	mg/L	0.030	94	85	115			
Beryllium		0.25	mg/L	0.0010	98	85	115			
Copper		0.53	mg/L	0.0050	105	85	115			
Manganese		2.5	mg/L	0.0010	100	85	115			
Nickel		0.52	mg/L	0.0050	105	85	115			
Thallium		0.49	mg/L	0.00050	98	85	115			
Zinc		0.47	mg/L	0.010	94	85	115			
Arsenic		0.47	mg/L	0.0019	95	85	115			
Barium		5.3	mg/L	0.050	96	85	115			
Cadmium		0.24	mg/L	0.0010	97	85	115			
Lead		0.50	mg/L	0.0010	99	85	115			
Sample ID: LCSD-73085	11	Laboratory Control Sample Duplicate				Run: SUB-B208935			07/26/13 04:25	
Aluminum		2.4	mg/L	0.030	96	85	115	0.0	20	
Beryllium		0.26	mg/L	0.0010	102	85	115	0.0	20	
Copper		0.55	mg/L	0.0050	109	85	115	0.0	20	
Manganese		2.6	mg/L	0.0010	104	85	115	0.0	20	
Nickel		0.53	mg/L	0.0050	107	85	115	0.0	20	
Thallium		0.49	mg/L	0.00050	99	85	115	0.0	20	
Zinc		0.49	mg/L	0.010	98	85	115	0.0	20	
Arsenic		0.48	mg/L	0.0019	97	85	115	0.0	20	
Barium		5.2	mg/L	0.050	95	85	115	0.0	20	
Cadmium		0.24	mg/L	0.0010	97	85	115	0.0	20	
Lead		0.51	mg/L	0.0010	102	85	115	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

N - The analyte concentration was not sufficiently high to calculate a RPD for the serial dilution test.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/13/13
Report Date: 07/10/13
Work Order: H13060186

Client: MT DEQ-Abandoned Mines
Project: 11033 DEQ AML Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020										Batch: B_73085
Sample ID: LCSD-73085	11	Laboratory Control Sample Duplicate				Run: SUB-B208935				07/26/13 04:25
Sample ID: H13060186-009A	11	Sample Matrix Spike				Run: SUB-B208935				07/26/13 04:28
Aluminum		2.2	mg/L	0.030	87	75	125			
Beryllium		0.23	mg/L	0.0010	92	75	125			
Copper		0.47	mg/L	0.0050	94	75	125			
Manganese		2.4	mg/L	0.0010	97	75	125			
Nickel		0.48	mg/L	0.0050	94	75	125			
Thallium		0.48	mg/L	0.00050	95	75	125			
Zinc		0.39	mg/L	0.010	77	75	125			
Arsenic		0.39	mg/L	0.0010	78	75	125			
Barium		5.0	mg/L	0.050	89	75	125			
Cadmium		0.20	mg/L	0.0010	82	75	125			
Lead		0.48	mg/L	0.0010	95	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

3020 Bozeman Avenue • Helena, Montana 59601 • (406) 443-4150

PROJ. NO.	PROJECT NAME
11033	DEQ AML Coke Oven Flats

SAMPLERS: *(Signature)* Lisa M Boettcher

DATE 2013	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS S-soil W-waste	Commons UF/RAW	Nutrients UF/H_2SO_4	Diss. Metal F/HNO_3	CN UF/NaOH	Total Metals UF/HNO_3	Total Recoverable Metals UF/HNO_3	BTEX	TPH	3050/6010 metals listed in correct letter	pH						REMARKS
6-7	10:47		X	COF1306-100	3-W									X	X		1713060186				Please retain all remaining samples for other analyses pending results
6-7	11:07		X	COF1306-101	2-W									X	X						
6-7	12:44		X	COF1306-102	2-W									X	X						
6-6	16:20		X	COF1306-103	3-W									X	X						
6-7	08:22		X	COF1306-104	3-W									X	X						
6-7	08:42		X	COF1306-105	2-W									X	X						
6-7	08:50		X	COF1306-106	2-W									X	X						
6-6	13:10		X	COF1306-107	3-W									X	X						
6-6	13:20		X	COF1306-108	3-W									X	X						
6-6	08:15		X	COF1306-109	2-W									X	X						

Relinquished *(Signature)*	Date/Time	Received by: *(Signature)*	Lab	P.O. #	Shipped via: Bus, Fed Ex, UPS
Lisa M Boettcher	6-12-13 11:54				Other Air Bill #
Relinquished *(Signature)*	Date/Time	Received by: *(Signature)*	Remarks Bill to DEQ AML address in cover sheet Please copy sample results to Tom Henderson and Lisa Boettcher		
	6-12-13 11:54		841-5052 THenderson@mt.gov 443-4150 X157 LBoettcher@Hydrometrics.com		
Relinquished *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Enclosed: ☐ Parameter sheet w/detection limits ☐ QA/QC standard mixing instructions ☐ Cover letter ☐ Other	
				Split Samples: [] Accepted [] Declined Signature	

HFORM-1-5/99

Return results & electronic copy to:
QA/QC Dept. at address at top of page

Temp 9.0 hand del.

Sample Analysis Soil/Waste (10)	Method	Detection Limit
Initial Analyses:		
Physical Properties		
pH		0.1 s.u.
Total Metals-Digestion	E3050	
Aluminum	E6010	5 mg/kg
Arsenic	E6010	5 mg/kg
Beryllium	E6010	5 mg/kg
Boron	E6010	5 mg/kg
Cadmium	E6010	1 mg/kg
Copper	E6010	5 mg/kg
Iron	E6010	5 mg/kg
Lead	E6010	5 mg/kg
Manganese	E6010	5 mg/kg
Nickel	E6010	5 mg/kg
Thallium	E6010	
Zinc	E6010	5 mg/kg
Subsequent Analyses: telephone for instructions after analysis complete		
SPLP	E1312	
Parameters to be chosen based upon initial analyses; may be all or a portion of the above metal analytes		
Acid-Base Accounting Modified Sobek Method		
SMP Single Buffer Lime Requirement	ASA Mono.#9, Part 2, Method 12-3.4.4	

APPENDIX D

GROUNDWATER
ANALYTICAL REPORT

ANALYTICAL SUMMARY REPORT

August 08, 2013

MT DEQ-Abandoned Mines
PO Box 200901
Helena, MT 59620-0901

Workorder No.: H13070011 Quote ID: H677 - Great Falls Coal Field

Project Name: 11033 Coke Oven Flats

Energy Laboratories Inc Helena MT received the following 13 samples for MT DEQ-Abandoned Mines on 7/1/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13070011-001	COF-1306-200	06/27/13 14:00	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Conductivity Anions by Ion Chromatography pH
H13070011-002	COF-1306-201	06/28/13 15:15	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Preparation, Dissolved Filtration
H13070011-003	COF-1306-202	06/27/13 14:45	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Conductivity Anions by Ion Chromatography pH
H13070011-004	COF-1306-203	06/27/13 15:05	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Conductivity Anions by Ion Chromatography pH Metals Digestion by EPA 200.2
H13070011-005	COF-1306-204	06/27/13 15:15	07/01/13	Aqueous	Same As Above
H13070011-006	COF-1306-205	06/27/13 16:00	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Preparation, Dissolved Filtration
H13070011-007	COF-1306-206	06/27/13 16:20	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Conductivity Anions by Ion Chromatography pH
H13070011-008	COF-1306-207	06/28/13 11:30	07/01/13	Aqueous	Same As Above
H13070011-009	COF-1306-208	06/28/13 12:25	07/01/13	Aqueous	Same As Above
H13070011-010	COF-1306-209	06/28/13 14:40	07/01/13	Aqueous	Same As Above
H13070011-011	COF-1306-210	06/28/13 13:30	07/01/13	Aqueous	Same As Above
H13070011-012	COF-1306-211	06/28/13 14:00	07/01/13	Aqueous	Same As Above
H13070011-013	COF-1306-212	06/28/13 14:30	07/01/13	Aqueous	Metals by ICP/ICPMS, Dissolved Conductivity Anions by Ion Chromatography pH Preparation, Dissolved Filtration

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

ANALYTICAL SUMMARY REPORT

Report Approved By:

CLIENT: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Sample Delivery Group: H13070011

Revised Date: 08/08/13
Report Date: 07/26/13

CASE NARRATIVE

Client requested additional analysis of Dissolved Arsenic, Beryllium & Thallium. Attached is the revised report with the additional parameters. Wj 8/8/13

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-001
Client Sample ID COF-1306-200

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 14:00
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	4.0	s.u.	H	0.1		A4500-H B	07/02/13 09:00 / glj
Conductivity @ 25 C	9590	umhos/cm		1		A2510 B	07/02/13 09:00 / glj
INORGANICS							
Sulfate	19000	mg/L	D	5		E300.0	07/24/13 11:00 / cmm
METALS, DISSOLVED							
Aluminum	1910	mg/L	D	0.09		E200.7	07/09/13 12:49 / sld
Arsenic	0.044	mg/L		0.003		E200.8	07/08/13 22:40 / dck
Beryllium	0.123	mg/L		0.001		E200.8	07/08/13 22:40 / dck
Cadmium	0.043	mg/L	D	0.003		E200.8	07/11/13 11:08 / dck
Chromium	0.220	mg/L		0.001		E200.8	07/03/13 03:03 / dck
Copper	0.159	mg/L		0.0005		E200.8	07/03/13 03:03 / dck
Iron	527	mg/L	D	0.05		E200.7	07/09/13 12:49 / sld
Manganese	8.40	mg/L		0.01		E200.7	07/09/13 12:49 / sld
Nickel	2.63	mg/L	D	0.003		E200.8	07/08/13 22:40 / dck
Thallium	0.002	mg/L		0.001		E200.8	07/03/13 03:03 / dck
Zinc	9.22	mg/L	D	0.02		E200.8	07/08/13 22:40 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-002
Client Sample ID COF-1306-201

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 15:15
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Aluminum	0.35	mg/L		0.03		E200.8	07/08/13 22:54 / dck
Arsenic	ND	mg/L		0.003		E200.8	07/03/13 03:32 / dck
Beryllium	ND	mg/L		0.001		E200.8	07/03/13 03:32 / dck
Cadmium	0.0104	mg/L	D	0.0003		E200.8	07/08/13 22:54 / dck
Chromium	ND	mg/L		0.001		E200.8	07/03/13 03:32 / dck
Copper	0.016	mg/L	D	0.001		E200.8	07/08/13 22:54 / dck
Iron	0.05	mg/L		0.02		E200.8	07/16/13 22:44 / dck
Manganese	16.0	mg/L		0.01		E200.7	07/09/13 12:37 / sld
Nickel	0.225	mg/L		0.0001		E200.8	07/03/13 03:32 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 03:32 / dck
Zinc	0.040	mg/L		0.001		E200.8	07/03/13 03:32 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-003
Client Sample ID COF-1306-202

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 14:45
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.7	s.u.	H	0.1		A4500-H B	07/02/13 09:05 / glj
Conductivity @ 25 C	12700	umhos/cm		1		A2510 B	07/02/13 09:05 / glj
INORGANICS							
Sulfate	21000	mg/L	D	10		E300.0	07/02/13 23:59 / jaw
METALS, DISSOLVED							
Aluminum	2740	mg/L	D	0.09		E200.7	07/09/13 13:03 / sld
Arsenic	0.018	mg/L		0.003		E200.8	07/03/13 03:36 / dck
Beryllium	0.042	mg/L		0.001		E200.8	07/03/13 03:36 / dck
Cadmium	0.049	mg/L	D	0.003		E200.8	07/11/13 11:23 / dck
Chromium	0.047	mg/L		0.001		E200.8	07/03/13 03:36 / dck
Copper	0.0555	mg/L		0.0005		E200.8	07/03/13 03:36 / dck
Iron	145	mg/L	D	0.05		E200.7	07/09/13 13:03 / sld
Manganese	8.46	mg/L		0.01		E200.7	07/09/13 13:03 / sld
Nickel	3.27	mg/L	D	0.003		E200.8	07/08/13 22:59 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 03:36 / dck
Zinc	7.54	mg/L	D	0.02		E200.8	07/08/13 22:59 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-004
Client Sample ID COF-1306-203

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 15:05
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	3.2	s.u.	H	0.1		A4500-H B	07/02/13 09:07 / glj
Conductivity @ 25 C	18100	umhos/cm		1		A2510 B	07/02/13 09:07 / glj
INORGANICS							
Sulfate	38000	mg/L	D	10		E300.0	07/03/13 00:11 / jaw
METALS, DISSOLVED							
Aluminum	5310	mg/L	D	0.5		E200.8	07/19/13 00:38 / dck
Arsenic	0.079	mg/L		0.003		E200.8	07/15/13 17:15 / dck
Beryllium	0.146	mg/L		0.001		E200.8	07/15/13 17:15 / dck
Cadmium	0.06	mg/L	D	0.01		E200.8	07/18/13 04:36 / dck
Chromium	0.370	mg/L		0.001		E200.8	07/15/13 17:15 / dck
Copper	1.16	mg/L		0.0005		E200.8	07/15/13 17:15 / dck
Iron	696	mg/L		0.02		E200.8	07/15/13 17:15 / dck
Manganese	10.6	mg/L		0.01		E200.8	07/15/13 17:15 / dck
Nickel	4.82	mg/L	D	0.0006		E200.8	07/16/13 22:48 / dck
Thallium	0.002	mg/L		0.001		E200.8	07/15/13 17:15 / dck
Zinc	14.9	mg/L	D	0.2		E200.8	07/18/13 04:36 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-005
Client Sample ID COF-1306-204

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 15:15
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	3.3	s.u.	H	0.1		A4500-H B	07/02/13 09:10 / glj
Conductivity @ 25 C	17800	umhos/cm		1		A2510 B	07/02/13 09:10 / glj
INORGANICS							
Sulfate	38000	mg/L	D	10		E300.0	07/03/13 00:24 / jaw
METALS, DISSOLVED							
Aluminum	4340	mg/L	D	1		E200.8	07/18/13 04:40 / dck
Arsenic	0.066	mg/L		0.003		E200.8	07/15/13 17:20 / dck
Beryllium	0.128	mg/L		0.001		E200.8	07/15/13 17:20 / dck
Cadmium	0.049	mg/L	D	0.003		E200.8	07/16/13 22:53 / dck
Chromium	0.330	mg/L		0.001		E200.8	07/15/13 17:20 / dck
Copper	1.04	mg/L		0.0005		E200.8	07/15/13 17:20 / dck
Iron	681	mg/L		0.02		E200.8	07/15/13 17:20 / dck
Manganese	9.71	mg/L		0.01		E200.8	07/15/13 17:20 / dck
Nickel	5.28	mg/L	D	0.03		E200.8	07/16/13 22:53 / dck
Thallium	0.002	mg/L		0.001		E200.8	07/15/13 17:20 / dck
Zinc	15.4	mg/L	D	0.2		E200.8	07/16/13 22:53 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-006
Client Sample ID COF-1306-205

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 16:00
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Aluminum	0.25	mg/L		0.03		E200.7	07/09/13 12:41 / sld
Arsenic	ND	mg/L		0.003		E200.8	07/03/13 03:51 / dck
Beryllium	ND	mg/L		0.001		E200.8	07/03/13 03:51 / dck
Cadmium	0.001	mg/L	D	0.001		E200.8	07/08/13 23:41 / dck
Chromium	ND	mg/L		0.001		E200.8	07/03/13 03:51 / dck
Copper	0.020	mg/L	D	0.001		E200.8	07/08/13 23:41 / dck
Iron	0.30	mg/L		0.02		E200.8	07/03/13 03:51 / dck
Manganese	9.15	mg/L		0.01		E200.7	07/09/13 12:41 / sld
Nickel	0.0845	mg/L		0.0001		E200.8	07/03/13 03:51 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 03:51 / dck
Zinc	0.061	mg/L		0.001		E200.8	07/03/13 03:51 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-007
Client Sample ID COF-1306-206

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/27/13 16:20
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.4	s.u.	H	0.1		A4500-H B	07/02/13 09:12 / glj
Conductivity @ 25 C	15400	umhos/cm		1		A2510 B	07/02/13 09:12 / glj
INORGANICS							
Sulfate	31000	mg/L	D	10		E300.0	07/03/13 00:37 / jaw
METALS, DISSOLVED							
Aluminum	2410	mg/L	D	0.2		E200.7	07/09/13 13:47 / sld
Arsenic	0.131	mg/L		0.003		E200.8	07/08/13 23:45 / dck
Beryllium	0.194	mg/L		0.001		E200.8	07/08/13 23:45 / dck
Cadmium	0.0570	mg/L	D	0.0003		E200.8	07/08/13 23:45 / dck
Chromium	0.383	mg/L		0.001		E200.8	07/03/13 03:55 / dck
Copper	1.32	mg/L		0.0005		E200.8	07/03/13 03:55 / dck
Iron	2420	mg/L	D	0.09		E200.7	07/09/13 13:47 / sld
Manganese	10.3	mg/L		0.01		E200.7	07/09/13 13:47 / sld
Nickel	1.83	mg/L	D	0.0003		E200.8	07/03/13 03:55 / dck
Thallium	0.002	mg/L		0.001		E200.8	07/03/13 03:55 / dck
Zinc	9.79	mg/L	D	0.02		E200.8	07/08/13 23:45 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-008
Client Sample ID COF-1306-207

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 11:30
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	4.2	s.u.	H	0.1		A4500-H B	07/02/13 09:15 / glj
Conductivity @ 25 C	5100	umhos/cm		1		A2510 B	07/02/13 09:15 / glj
INORGANICS							
Sulfate	6600	mg/L	D	2		E300.0	07/03/13 00:49 / jaw
METALS, DISSOLVED							
Aluminum	606	mg/L		0.03		E200.7	07/09/13 11:55 / sld
Arsenic	0.007	mg/L		0.003		E200.8	07/03/13 04:20 / dck
Beryllium	0.025	mg/L		0.001		E200.8	07/03/13 04:20 / dck
Cadmium	0.0189	mg/L	D	0.0003		E200.8	07/08/13 23:50 / dck
Chromium	0.006	mg/L		0.001		E200.8	07/03/13 04:20 / dck
Copper	0.0839	mg/L		0.0005		E200.8	07/03/13 04:20 / dck
Iron	67.7	mg/L		0.02		E200.7	07/09/13 11:55 / sld
Manganese	16.0	mg/L		0.01		E200.7	07/09/13 11:55 / sld
Nickel	1.14	mg/L	D	0.003		E200.8	07/08/13 23:50 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:20 / dck
Zinc	2.34	mg/L	D	0.02		E200.8	07/08/13 23:50 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-009
Client Sample ID COF-1306-208

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 12:25
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	5.8	s.u.	H	0.1		A4500-H B	07/02/13 09:17 / glj
Conductivity @ 25 C	2700	umhos/cm		1		A2510 B	07/02/13 09:17 / glj
INORGANICS							
Sulfate	55	mg/L	D	2		E300.0	07/03/13 17:13 / cmm
METALS, DISSOLVED							
Aluminum	2.06	mg/L		0.03		E200.8	07/08/13 23:55 / dck
Arsenic	ND	mg/L		0.003		E200.8	07/03/13 04:25 / dck
Beryllium	ND	mg/L		0.001		E200.8	07/03/13 04:25 / dck
Cadmium	ND	mg/L	D	0.001		E200.8	07/08/13 23:55 / dck
Chromium	ND	mg/L		0.001		E200.8	07/03/13 04:25 / dck
Copper	0.0028	mg/L		0.0005		E200.8	07/03/13 04:25 / dck
Iron	0.41	mg/L		0.02		E200.8	07/03/13 04:25 / dck
Manganese	0.50	mg/L		0.01		E200.7	07/09/13 11:59 / sld
Nickel	0.0420	mg/L		0.0001		E200.8	07/03/13 04:25 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:25 / dck
Zinc	0.065	mg/L		0.001		E200.8	07/03/13 04:25 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-010
Client Sample ID COF-1306-209

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 14:40
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.4	s.u.	H	0.1		A4500-H B	07/02/13 09:20 / glj
Conductivity @ 25 C	10700	umhos/cm		1		A2510 B	07/02/13 09:20 / glj
INORGANICS							
Sulfate	19000	mg/L	D	10		E300.0	07/03/13 17:25 / cmm
METALS, DISSOLVED							
Aluminum	1480	mg/L	D	0.09		E200.7	07/09/13 13:51 / sld
Arsenic	0.060	mg/L		0.003		E200.8	07/03/13 04:29 / dck
Beryllium	0.221	mg/L		0.001		E200.8	07/08/13 23:59 / dck
Cadmium	0.038	mg/L	D	0.001		E200.8	07/08/13 23:59 / dck
Chromium	0.252	mg/L		0.001		E200.8	07/03/13 04:29 / dck
Copper	0.540	mg/L		0.0005		E200.8	07/03/13 04:29 / dck
Iron	632	mg/L	D	0.05		E200.7	07/09/13 13:51 / sld
Manganese	3.48	mg/L		0.01		E200.7	07/09/13 13:51 / sld
Nickel	1.62	mg/L	D	0.0003		E200.8	07/03/13 04:29 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:29 / dck
Zinc	3.87	mg/L	D	0.02		E200.8	07/08/13 23:59 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-011
Client Sample ID COF-1306-210

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 13:30
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	2.1	s.u.	H	0.1		A4500-H B	07/02/13 09:22 / glj
Conductivity @ 25 C	12900	umhos/cm		1		A2510 B	07/02/13 09:22 / glj
INORGANICS							
Sulfate	31000	mg/L	D	20		E300.0	07/03/13 17:38 / cmm
METALS, DISSOLVED							
Aluminum	1050	mg/L	D	0.2		E200.7	07/09/13 13:55 / sld
Arsenic	0.457	mg/L		0.003		E200.8	07/03/13 04:49 / dck
Beryllium	0.061	mg/L		0.001		E200.8	07/09/13 00:04 / dck
Cadmium	0.0293	mg/L	D	0.0003		E200.8	07/09/13 00:04 / dck
Chromium	0.256	mg/L		0.001		E200.8	07/03/13 04:49 / dck
Copper	1.07	mg/L		0.0005		E200.8	07/03/13 04:49 / dck
Iron	4440	mg/L	D	0.09		E200.7	07/09/13 13:55 / sld
Manganese	3.67	mg/L		0.01		E200.7	07/09/13 13:55 / sld
Nickel	1.58	mg/L	D	0.0003		E200.8	07/03/13 04:49 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:49 / dck
Zinc	6.27	mg/L	D	0.02		E200.8	07/09/13 00:04 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-012
Client Sample ID COF-1306-211

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 14:00
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	5.5	s.u.	H	0.1		A4500-H B	07/02/13 09:24 / glj
Conductivity @ 25 C	3210	umhos/cm		1		A2510 B	07/02/13 09:24 / glj
INORGANICS							
Sulfate	2400	mg/L	D	2		E300.0	07/03/13 17:50 / cmm
METALS, DISSOLVED							
Aluminum	11.3	mg/L		0.03		E200.8	07/09/13 00:08 / dck
Arsenic	ND	mg/L		0.003		E200.8	07/03/13 04:54 / dck
Beryllium	ND	mg/L		0.001		E200.8	07/09/13 00:08 / dck
Cadmium	0.0020	mg/L	D	0.0003		E200.8	07/09/13 00:08 / dck
Chromium	ND	mg/L		0.001		E200.8	07/03/13 04:54 / dck
Copper	0.0036	mg/L		0.0005		E200.8	07/03/13 04:54 / dck
Iron	0.52	mg/L		0.02		E200.8	07/03/13 04:54 / dck
Manganese	2.12	mg/L		0.01		E200.7	07/09/13 12:11 / sld
Nickel	0.218	mg/L		0.0001		E200.8	07/03/13 04:54 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:54 / dck
Zinc	0.290	mg/L		0.001		E200.8	07/03/13 04:54 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats
Lab ID: H13070011-013
Client Sample ID COF-1306-212

Revised Date: 08/08/13
Report Date: 07/26/13
Collection Date: 06/28/13 14:30
DateReceived: 07/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	3.9	s.u.	H	0.1		A4500-H B	07/02/13 09:29 / glj
Conductivity @ 25 C	11800	umhos/cm		1		A2510 B	07/02/13 09:29 / glj
INORGANICS							
Sulfate	26000	mg/L	D	10		E300.0	07/03/13 18:03 / cmm
METALS, DISSOLVED							
Aluminum	2990	mg/L	D	0.09		E200.7	07/09/13 13:58 / sld
Arsenic	0.031	mg/L		0.003		E200.8	07/03/13 04:58 / dck
Beryllium	0.166	mg/L		0.001		E200.8	07/09/13 00:13 / dck
Cadmium	0.045	mg/L	D	0.003		E200.8	07/11/13 11:37 / dck
Chromium	0.030	mg/L		0.001		E200.8	07/03/13 04:58 / dck
Copper	0.0342	mg/L		0.0005		E200.8	07/03/13 04:58 / dck
Iron	4.28	mg/L	D	0.05		E200.7	07/09/13 13:58 / sld
Manganese	10.6	mg/L		0.01		E200.7	07/09/13 13:58 / sld
Nickel	2.00	mg/L	D	0.003		E200.8	07/09/13 00:13 / dck
Thallium	ND	mg/L		0.001		E200.8	07/03/13 04:58 / dck
Zinc	4.26	mg/L	D	0.02		E200.8	07/09/13 00:13 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B										Batch: R89447
Sample ID: SC 150		Initial Calibration Verification Standard				Run: PHSC_101-H_130702A				07/02/13 08:40
Conductivity @ 25 C		150	umhos/cm	1.0	100	90	110			
Sample ID: SC 5000		Initial Calibration Verification Standard				Run: PHSC_101-H_130702A				07/02/13 08:42
Conductivity @ 25 C		4900	umhos/cm	1.0	99	90	110			
Sample ID: SC 20000		Initial Calibration Verification Standard				Run: PHSC_101-H_130702A				07/02/13 08:44
Conductivity @ 25 C		20000	umhos/cm	1.0	101	90	110			
Sample ID: SC 2ND 717.5		Laboratory Control Sample				Run: PHSC_101-H_130702A				07/02/13 08:47
Conductivity @ 25 C		710	umhos/cm	1.0	98	90	110			
Sample ID: H13070011-001ADUP		Sample Duplicate				Run: PHSC_101-H_130702A				07/02/13 09:03
Conductivity @ 25 C		9590	umhos/cm	1.0				0.1	10	
Sample ID: H13070011-012ADUP		Sample Duplicate				Run: PHSC_101-H_130702A				07/02/13 09:27
Conductivity @ 25 C		3210	umhos/cm	1.0				0.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-H B**									Analytical Run: PHSC_101-H_130702A	
Sample ID: **pH 7**	Initial Calibration Verification Standard								07/02/13 08:37	
pH		7.0	s.u.	0.1	100	98	102			
Method: **A4500-H B**									Batch: R89447	
Sample ID: **H13070011-001ADUP**	Sample Duplicate					Run: PHSC_101-H_130702A			07/02/13 09:03	
pH		4.0	s.u.	0.1				0.3	3	
Sample ID: **H13070011-012ADUP**	Sample Duplicate					Run: PHSC_101-H_130702A			07/02/13 09:27	
pH		5.5	s.u.	0.1				0.2	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130709A	
Sample ID: ICV	3	Initial Calibration Verification Standard							07/09/13 09:18	
Aluminum		3.93	mg/L	0.10	98	95	105			
Iron		3.89	mg/L	0.030	97	95	105			
Manganese		3.89	mg/L	0.010	97	95	105			
Sample ID: CCV-1	3	Continuing Calibration Verification Standard							07/09/13 09:21	
Aluminum		2.47	mg/L	0.10	99	95	105			
Iron		2.44	mg/L	0.030	98	95	105			
Manganese		2.42	mg/L	0.010	97	95	105			
Sample ID: ICSA	3	Interference Check Sample A							07/09/13 09:32	
Aluminum		509	mg/L	0.10	102	80	120			
Iron		187	mg/L	0.030	93	80	120			
Manganese		0.00602	mg/L	0.010		0	0			
Sample ID: ICSAB	3	Interference Check Sample AB							07/09/13 09:37	
Aluminum		508	mg/L	0.10	102	80	120			
Iron		184	mg/L	0.030	92	80	120			
Manganese		0.476	mg/L	0.010	95	80	120			
Sample ID: CCV	3	Continuing Calibration Verification Standard							07/09/13 10:52	
Aluminum		2.50	mg/L	0.10	100	90	110			
Iron		2.45	mg/L	0.030	98	90	110			
Manganese		2.44	mg/L	0.010	98	90	110			
Sample ID: CCV	3	Continuing Calibration Verification Standard							07/09/13 11:36	
Aluminum		2.48	mg/L	0.10	99	90	110			
Iron		2.43	mg/L	0.030	97	90	110			
Manganese		2.41	mg/L	0.010	97	90	110			
Sample ID: CCV	3	Continuing Calibration Verification Standard							07/09/13 12:22	
Aluminum		2.50	mg/L	0.10	100	90	110			
Iron		2.45	mg/L	0.030	98	90	110			
Manganese		2.43	mg/L	0.010	97	90	110			
Sample ID: CCV	3	Continuing Calibration Verification Standard							07/09/13 13:33	
Aluminum		2.49	mg/L	0.10	100	90	110			
Iron		2.46	mg/L	0.030	98	90	110			
Manganese		2.45	mg/L	0.010	98	90	110			
Method: E200.7									Batch: R89598	
Sample ID: ICB	3	Method Blank				Run: ICP2-HE_130709A			07/09/13 09:44	
Aluminum		ND	mg/L	0.004						
Iron		ND	mg/L	0.005						
Manganese		ND	mg/L	0.0005						
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICP2-HE_130709A			07/09/13 09:48	
Aluminum		4.89	mg/L	0.10	98	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines

Report Date: 07/26/13

Project: 11033 Coke Oven Flats

Work Order: H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R89598
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICP2-HE_130709A				07/09/13 09:48
Iron		4.82	mg/L	0.030	96	85	115			
Manganese		4.80	mg/L	0.010	96	85	115			
Sample ID: H13070011-001BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130709A				07/09/13 11:25
Aluminum		1720	mg/L	0.046		70	130			A
Iron		482	mg/L	0.030		70	130			A
Manganese		26.7	mg/L	0.0027	77	70	130			
Sample ID: H13070011-001BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130709A				07/09/13 11:29
Aluminum		1720	mg/L	0.046		70	130	0.0	20	A
Iron		480	mg/L	0.030		70	130	0.4	20	A
Manganese		26.7	mg/L	0.0027	76	70	130	0.1	20	
Sample ID: H13070011-012BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130709A				07/09/13 12:18
Aluminum		21.8	mg/L	0.030	102	70	130			
Iron		10.0	mg/L	0.030	97	70	130			
Manganese		11.8	mg/L	0.0011	96	70	130			
Sample ID: H13070011-012BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130709A				07/09/13 12:29
Aluminum		21.9	mg/L	0.030	103	70	130	0.6	20	
Iron		10.0	mg/L	0.030	97	70	130	0.4	20	
Manganese		11.8	mg/L	0.0011	97	70	130	0.6	20	
Sample ID: H13070011-001BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130709A				07/09/13 12:56
Aluminum		1980	mg/L	0.093		70	130			A
Iron		570	mg/L	0.048		70	130			A
Manganese		51.9	mg/L	0.0054	87	70	130			
Sample ID: H13070011-001BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130709A				07/09/13 13:00
Aluminum		1960	mg/L	0.093		70	130	1.0	20	A
Iron		565	mg/L	0.048		70	130	1.0	20	A
Manganese		51.2	mg/L	0.0054	86	70	130	1.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130702B	
Sample ID: ICV STD	8	Initial Calibration Verification Standard							07/02/13 11:56	
Arsenic		0.0603	mg/L	0.0050	100	90	110			
Beryllium		0.0310	mg/L	0.0010	103	90	110			
Chromium		0.0617	mg/L	0.010	103	90	110			
Copper		0.0616	mg/L	0.010	103	90	110			
Iron		0.307	mg/L	0.030	102	90	110			
Nickel		0.0621	mg/L	0.010	104	90	110			
Thallium		0.0618	mg/L	0.10	103	90	110			
Zinc		0.0627	mg/L	0.010	104	90	110			
Sample ID: ICSA	8	Interference Check Sample A							07/02/13 12:00	
Arsenic		0.000367	mg/L	0.0050						
Beryllium		-2.00E-06	mg/L	0.0010						
Chromium		0.00109	mg/L	0.010						
Copper		0.000462	mg/L	0.010						
Iron		95.3	mg/L	0.030	95	70	130			
Nickel		0.000228	mg/L	0.010						
Thallium		6.70E-05	mg/L	0.10						
Zinc		0.00133	mg/L	0.010						
Sample ID: ICSAB	8	Interference Check Sample AB							07/02/13 12:05	
Arsenic		0.0102	mg/L	0.0050	102	70	130			
Beryllium		1.00E-06	mg/L	0.0010		0	0			
Chromium		0.0216	mg/L	0.010	108	70	130			
Copper		0.0202	mg/L	0.010	101	70	130			
Iron		97.2	mg/L	0.030	97	70	130			
Nickel		0.0205	mg/L	0.010	103	70	130			
Thallium		2.50E-05	mg/L	0.10		0	0			
Zinc		0.0111	mg/L	0.010	111	70	130			
Sample ID: ICV STD	8	Initial Calibration Verification Standard							07/02/13 19:32	
Arsenic		0.0598	mg/L	0.0050	100	90	110			
Beryllium		0.0308	mg/L	0.0010	103	90	110			
Chromium		0.0614	mg/L	0.010	102	90	110			
Copper		0.0616	mg/L	0.010	103	90	110			
Iron		0.300	mg/L	0.030	100	90	110			
Nickel		0.0615	mg/L	0.010	103	90	110			
Thallium		0.0608	mg/L	0.10	101	90	110			
Zinc		0.0614	mg/L	0.010	102	90	110			
Sample ID: ICSA	8	Interference Check Sample A							07/02/13 19:37	
Arsenic		0.000260	mg/L	0.0050						
Beryllium		2.00E-06	mg/L	0.0010						
Chromium		0.00119	mg/L	0.010						
Copper		0.000366	mg/L	0.010						
Iron		98.2	mg/L	0.030	98	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130702B	
Sample ID: ICSA	8	Interference Check Sample A							07/02/13 19:37	
Nickel		0.000639	mg/L	0.010						
Thallium		5.40E-05	mg/L	0.10						
Zinc		0.00112	mg/L	0.010						
Sample ID: ICSAB	8	Interference Check Sample AB							07/02/13 19:42	
Arsenic		0.0106	mg/L	0.0050	106	70	130			
Beryllium		7.00E-06	mg/L	0.0010		0	0			
Chromium		0.0221	mg/L	0.010	110	70	130			
Copper		0.0202	mg/L	0.010	101	70	130			
Iron		100	mg/L	0.030	100	70	130			
Nickel		0.0213	mg/L	0.010	106	70	130			
Thallium		2.20E-05	mg/L	0.10		0	0			
Zinc		0.0104	mg/L	0.010	104	70	130			
Method: E200.8									Batch: R89517	
Sample ID: ICB	8	Method Blank				Run: ICPMS204-B_130702B			07/02/13 13:58	
Arsenic		ND	mg/L	7E-05						
Beryllium		ND	mg/L	2E-05						
Chromium		ND	mg/L	4E-05						
Copper		ND	mg/L	3E-05						
Iron		0.0008	mg/L	0.0002						
Nickel		ND	mg/L	6E-05						
Thallium		ND	mg/L	1E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: LFB	8	Laboratory Fortified Blank				Run: ICPMS204-B_130702B			07/02/13 14:03	
Arsenic		0.0492	mg/L	0.0050	98	85	115			
Beryllium		0.0503	mg/L	0.0010	101	85	115			
Chromium		0.0504	mg/L	0.010	101	85	115			
Copper		0.0493	mg/L	0.010	99	85	115			
Iron		0.167	mg/L	0.030	111	85	115			
Nickel		0.0498	mg/L	0.010	100	85	115			
Thallium		0.0511	mg/L	0.10	102	85	115			
Zinc		0.0514	mg/L	0.010	103	85	115			
Sample ID: H13070011-001BMS	8	Sample Matrix Spike				Run: ICPMS204-B_130702B			07/03/13 03:08	
Arsenic		0.0738	mg/L	0.0010	106	70	130			
Beryllium		0.0598	mg/L	0.0010	29	70	130			S
Chromium		0.254	mg/L	0.0050		70	130			A
Copper		0.195	mg/L	0.0050	72	70	130			
Iron		500	mg/L	0.030		70	130			A
Nickel		2.10	mg/L	0.0050		70	130			A
Thallium		0.0550	mg/L	0.00050	106	70	130			
Zinc		7.09	mg/L	0.010		70	130			A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89517	
Sample ID: H13070011-001BMSD	8	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130702B			07/03/13 03:12	
Arsenic		0.0771	mg/L	0.0010	113	70	130	4.4	20	
Beryllium		0.0579	mg/L	0.0010	26	70	130	3.3	20	S
Chromium		0.256	mg/L	0.0050		70	130	1.0	20	A
Copper		0.200	mg/L	0.0050	81	70	130	2.3	20	
Iron		514	mg/L	0.030		70	130	2.8	20	A
Nickel		2.13	mg/L	0.0050		70	130	1.2	20	A
Thallium		0.0555	mg/L	0.00050	107	70	130	0.9	20	
Zinc		7.18	mg/L	0.010		70	130	1.2	20	A
Sample ID: H13070011-010BMS	7	Sample Matrix Spike				Run: ICPMS204-B_130702B			07/03/13 04:34	
Arsenic		0.316	mg/L	0.0010	102	70	130			
Chromium		0.487	mg/L	0.0050	94	70	130			
Copper		0.772	mg/L	0.0050	93	70	130			
Iron		708	mg/L	0.030		70	130			A
Nickel		1.82	mg/L	0.0050		70	130			A
Thallium		0.270	mg/L	0.00050	108	70	130			
Zinc		3.29	mg/L	0.010		70	130			A
Sample ID: H13070011-010BMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130702B			07/03/13 04:39	
Arsenic		0.329	mg/L	0.0010	107	70	130	4.1	20	
Chromium		0.498	mg/L	0.0050	98	70	130	2.3	20	
Copper		0.779	mg/L	0.0050	96	70	130	0.8	20	
Iron		716	mg/L	0.030		70	130	1.0	20	A
Nickel		1.85	mg/L	0.0050		70	130	1.9	20	A
Thallium		0.271	mg/L	0.00050	108	70	130	0.4	20	
Zinc		3.28	mg/L	0.010		70	130	0.2	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Analytical Run: ICPMS204-B_130708A		
Sample ID: ICV STD	7	Initial Calibration Verification Standard							07/08/13 16:15	
Aluminum		0.299	mg/L	0.10	100	90	110			
Arsenic		0.0598	mg/L	0.0050	100	90	110			
Beryllium		0.0307	mg/L	0.0010	102	90	110			
Cadmium		0.0316	mg/L	0.0010	105	90	110			
Copper		0.0616	mg/L	0.010	103	90	110			
Nickel		0.0610	mg/L	0.010	102	90	110			
Zinc		0.0624	mg/L	0.010	104	90	110			
Sample ID: ICSA	7	Interference Check Sample A							07/08/13 16:20	
Aluminum		39.9	mg/L	0.10	100	70	130			
Arsenic		0.000593	mg/L	0.0050						
Beryllium		ND	mg/L	0.0010						
Cadmium		0.00119	mg/L	0.0010						
Copper		0.000354	mg/L	0.010						
Nickel		0.000675	mg/L	0.010						
Zinc		0.00116	mg/L	0.010						
Sample ID: ICSAB	7	Interference Check Sample AB							07/08/13 16:24	
Aluminum		39.5	mg/L	0.10	99	70	130			
Arsenic		0.0114	mg/L	0.0050	114	70	130			
Beryllium		ND	mg/L	0.0010		0	0			
Cadmium		0.0112	mg/L	0.0010	112	70	130			
Copper		0.0214	mg/L	0.010	107	70	130			
Nickel		0.0219	mg/L	0.010	110	70	130			
Zinc		0.0119	mg/L	0.010	119	70	130			
Sample ID: ICV STD	7	Initial Calibration Verification Standard							07/08/13 18:55	
Aluminum		0.292	mg/L	0.10	97	90	110			
Arsenic		0.0600	mg/L	0.0050	100	90	110			
Beryllium		0.0307	mg/L	0.0010	102	90	110			
Cadmium		0.0321	mg/L	0.0010	107	90	110			
Copper		0.0622	mg/L	0.010	104	90	110			
Nickel		0.0614	mg/L	0.010	102	90	110			
Zinc		0.0623	mg/L	0.010	104	90	110			
Sample ID: ICSA	7	Interference Check Sample A							07/08/13 18:59	
Aluminum		39.2	mg/L	0.10	98	70	130			
Arsenic		0.000579	mg/L	0.0050						
Beryllium		5.00E-06	mg/L	0.0010						
Cadmium		0.00115	mg/L	0.0010						
Copper		0.000378	mg/L	0.010						
Nickel		0.000686	mg/L	0.010						
Zinc		0.00115	mg/L	0.010						
Sample ID: ICSAB	7	Interference Check Sample AB							07/08/13 19:04	
Aluminum		39.8	mg/L	0.10	99	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130708A	
Sample ID: ICSAB	7	Interference Check Sample AB							07/08/13 19:04	
Arsenic		0.0114	mg/L	0.0050	114	70	130			
Beryllium		8.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0117	mg/L	0.0010	117	70	130			
Copper		0.0218	mg/L	0.010	109	70	130			
Nickel		0.0226	mg/L	0.010	113	70	130			
Zinc		0.0114	mg/L	0.010	114	70	130			
Method: E200.8									Batch: R89585	
Sample ID: ICB	7	Method Blank				Run: ICPMS204-B_130708A			07/08/13 16:54	
Aluminum		ND	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		1E-05	mg/L	7E-06						
Copper		ND	mg/L	3E-05						
Nickel		ND	mg/L	6E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: LFB	7	Laboratory Fortified Blank				Run: ICPMS204-B_130708A			07/08/13 16:59	
Aluminum		0.0521	mg/L	0.10	104	85	115			
Arsenic		0.0531	mg/L	0.0050	106	85	115			
Beryllium		0.0534	mg/L	0.0010	107	85	115			
Cadmium		0.0531	mg/L	0.0010	106	85	115			
Copper		0.0533	mg/L	0.010	107	85	115			
Nickel		0.0533	mg/L	0.010	107	85	115			
Zinc		0.0549	mg/L	0.010	110	85	115			
Sample ID: H13070011-003BMS	7	Sample Matrix Spike				Run: ICPMS204-B_130708A			07/08/13 23:04	
Aluminum		2780	mg/L	0.030		70	130			A
Arsenic		2.71	mg/L	0.0033	107	70	130			
Beryllium		2.56	mg/L	0.0010	99	70	130			
Cadmium		1.94	mg/L	0.0010	76	70	130			
Copper		2.88	mg/L	0.0050	111	70	130			
Nickel		5.99	mg/L	0.0050	109	70	130			
Zinc		10.3	mg/L	0.017	110	70	130			
Sample ID: H13070011-003BMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130708A			07/08/13 23:08	
Aluminum		2700	mg/L	0.030		70	130	2.9	20	A
Arsenic		2.68	mg/L	0.0033	106	70	130	1.3	20	
Beryllium		2.44	mg/L	0.0010	94	70	130	5.1	20	
Cadmium		1.90	mg/L	0.0010	74	70	130	2.0	20	
Copper		2.82	mg/L	0.0050	109	70	130	2.1	20	
Nickel		5.80	mg/L	0.0050	101	70	130	3.2	20	
Zinc		10.1	mg/L	0.017	101	70	130	2.4	20	
Sample ID: H13070011-013BMS	6	Sample Matrix Spike				Run: ICPMS204-B_130708A			07/09/13 00:37	
Aluminum		2760	mg/L	0.030		70	130			A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89585	
Sample ID: H13070011-013BMS	6	Sample Matrix Spike				Run: ICPMS204-B_130708A			07/09/13 00:37	
Arsenic		2.59	mg/L	0.0033	102	70	130			
Beryllium		2.45	mg/L	0.0010	92	70	130			
Cadmium		2.04	mg/L	0.0010	80	70	130			
Nickel		4.50	mg/L	0.0050	100	70	130			
Zinc		6.82	mg/L	0.017	102	70	130			
Sample ID: H13070011-013BMSD	6	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130708A			07/09/13 00:41	
Aluminum		2840	mg/L	0.030		70	130	2.8	20	A
Arsenic		2.62	mg/L	0.0033	103	70	130	1.3	20	
Beryllium		2.44	mg/L	0.0010	91	70	130	0.7	20	
Cadmium		2.03	mg/L	0.0010	80	70	130	0.4	20	
Nickel		4.63	mg/L	0.0050	105	70	130	2.8	20	
Zinc		9.80	mg/L	0.017	221	70	130	36	20	SR

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130711A	
Sample ID: ICV STD		Initial Calibration Verification Standard							07/11/13 09:54	
Cadmium		0.0324	mg/L	0.0010	108	90	110			
Sample ID: ICSA		Interference Check Sample A							07/11/13 09:58	
Cadmium		0.00109	mg/L	0.0010						
Sample ID: ICSAB		Interference Check Sample AB							07/11/13 10:04	
Cadmium		0.0104	mg/L	0.0010	104	70	130			
Sample ID: ICSA		Interference Check Sample A							07/12/13 00:47	
Cadmium		0.000926	mg/L	0.0010						
Sample ID: ICSAB		Interference Check Sample AB							07/12/13 00:52	
Cadmium		0.00991	mg/L	0.0010	99	70	130			
Sample ID: ICV STD		Initial Calibration Verification Standard							07/12/13 09:28	
Cadmium		0.0330	mg/L	0.0010	110	90	110			
Sample ID: ICSA		Interference Check Sample A							07/12/13 09:33	
Cadmium		0.000999	mg/L	0.0010						
Sample ID: ICSAB		Interference Check Sample AB							07/12/13 09:37	
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Method: E200.8									Batch: R89664	
Sample ID: ICB		Method Blank				Run: ICPMS204-B_130711A			07/11/13 10:31	
Cadmium		7E-06	mg/L	7E-06						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICPMS204-B_130711A			07/11/13 10:36	
Cadmium		0.0513	mg/L	0.0010	103	85	115			
Sample ID: H13060325-009BMS		Sample Matrix Spike				Run: ICPMS204-B_130711A			07/11/13 10:50	
Cadmium		0.497	mg/L	0.0010	98	70	130			
Sample ID: H13060325-009BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130711A			07/11/13 10:55	
Cadmium		0.497	mg/L	0.0010	98	70	130	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Analytical Run: ICPMS204-B_130715A		
Sample ID: ICV STD	7	Initial Calibration Verification Standard							07/15/13 11:46	
Arsenic		0.0602	mg/L	0.0050	100	90	110			
Beryllium		0.0312	mg/L	0.0010	104	90	110			
Chromium		0.0618	mg/L	0.010	103	90	110			
Copper		0.0631	mg/L	0.010	105	90	110			
Iron		0.316	mg/L	0.030	105	90	110			
Manganese		0.297	mg/L	0.010	99	90	110			
Thallium		0.0642	mg/L	0.10	107	90	110			
Sample ID: ICSA	7	Interference Check Sample A							07/15/13 11:51	
Arsenic		0.000199	mg/L	0.0050						
Beryllium		-1.00E-06	mg/L	0.0010						
Chromium		0.00131	mg/L	0.010						
Copper		0.000289	mg/L	0.010						
Iron		97.3	mg/L	0.030	97	70	130			
Manganese		0.000470	mg/L	0.010						
Thallium		3.90E-05	mg/L	0.10						
Sample ID: ICSAB	7	Interference Check Sample AB							07/15/13 11:56	
Arsenic		0.0108	mg/L	0.0050	108	70	130			
Beryllium		5.00E-06	mg/L	0.0010		0	0			
Chromium		0.0226	mg/L	0.010	113	70	130			
Copper		0.0210	mg/L	0.010	105	70	130			
Iron		98.1	mg/L	0.030	98	70	130			
Manganese		0.0208	mg/L	0.010	104	70	130			
Thallium		2.40E-05	mg/L	0.10		0	0			
Sample ID: ICV STD	7	Initial Calibration Verification Standard							07/15/13 16:05	
Arsenic		0.0603	mg/L	0.0050	100	90	110			
Beryllium		0.0306	mg/L	0.0010	102	90	110			
Chromium		0.0606	mg/L	0.010	101	90	110			
Copper		0.0620	mg/L	0.010	103	90	110			
Iron		0.313	mg/L	0.030	104	90	110			
Manganese		0.311	mg/L	0.010	104	90	110			
Thallium		0.0604	mg/L	0.10	101	90	110			
Sample ID: ICSA	7	Interference Check Sample A							07/15/13 16:09	
Arsenic		0.000181	mg/L	0.0050						
Beryllium		2.10E-05	mg/L	0.0010						
Chromium		0.00120	mg/L	0.010						
Copper		0.000297	mg/L	0.010						
Iron		100	mg/L	0.030	100	70	130			
Manganese		0.000441	mg/L	0.010						
Thallium		4.80E-05	mg/L	0.10						
Sample ID: ICSAB	7	Interference Check Sample AB							07/15/13 16:14	
Arsenic		0.0109	mg/L	0.0050	109	70	130			

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QA/QC Summary Report

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Revised Date: 08/08/13
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Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130715A	
Sample ID: ICSAB	7	Interference Check Sample AB							07/15/13 16:14	
Beryllium		2.70E-05	mg/L	0.0010		0	0			
Chromium		0.0226	mg/L	0.010	113	70	130			
Copper		0.0212	mg/L	0.010	106	70	130			
Iron		99.6	mg/L	0.030	100	70	130			
Manganese		0.0220	mg/L	0.010	110	70	130			
Thallium		2.80E-05	mg/L	0.10		0	0			
Sample ID: ICV STD	7	Initial Calibration Verification Standard							07/15/13 21:17	
Arsenic		0.0598	mg/L	0.0050	100	90	110			
Beryllium		0.0308	mg/L	0.0010	103	90	110			
Chromium		0.0616	mg/L	0.010	103	90	110			
Copper		0.0625	mg/L	0.010	104	90	110			
Iron		0.304	mg/L	0.030	101	90	110			
Manganese		0.308	mg/L	0.010	103	90	110			
Thallium		0.0603	mg/L	0.10	101	90	110			
Sample ID: ICSA	7	Interference Check Sample A							07/15/13 21:22	
Arsenic		0.000297	mg/L	0.0050						
Beryllium		6.00E-06	mg/L	0.0010						
Chromium		0.00123	mg/L	0.010						
Copper		0.000276	mg/L	0.010						
Iron		98.7	mg/L	0.030	99	70	130			
Manganese		0.000570	mg/L	0.010						
Thallium		5.60E-05	mg/L	0.10						
Sample ID: ICSAB	7	Interference Check Sample AB							07/15/13 21:26	
Arsenic		0.0106	mg/L	0.0050	106	70	130			
Beryllium		7.00E-06	mg/L	0.0010		0	0			
Chromium		0.0226	mg/L	0.010	113	70	130			
Copper		0.0209	mg/L	0.010	105	70	130			
Iron		96.9	mg/L	0.030	97	70	130			
Manganese		0.0220	mg/L	0.010	110	70	130			
Thallium		3.20E-05	mg/L	0.10		0	0			
Method: E200.8									Batch: R89734	
Sample ID: ICB	7	Method Blank				Run: ICPMS204-B_130715A			07/15/13 12:52	
Arsenic		ND	mg/L	7E-05						
Beryllium		ND	mg/L	2E-05						
Chromium		ND	mg/L	4E-05						
Copper		3E-05	mg/L	3E-05						
Iron		0.004	mg/L	0.0002						
Manganese		ND	mg/L	8E-05						
Thallium		ND	mg/L	1E-05						
Sample ID: LFB	7	Laboratory Fortified Blank				Run: ICPMS204-B_130715A			07/15/13 12:56	
Arsenic		0.0511	mg/L	0.0050	102	85	115			

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QA/QC Summary Report

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Revised Date: 08/08/13
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Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R89734
Sample ID: LFB	7	Laboratory Fortified Blank				Run: ICPMS204-B_130715A				07/15/13 12:56
Beryllium		0.0498	mg/L	0.0010	100	85	115			
Chromium		0.0507	mg/L	0.010	101	85	115			
Copper		0.0510	mg/L	0.010	102	85	115			
Iron		0.166	mg/L	0.030	108	85	115			
Manganese		0.0528	mg/L	0.010	106	85	115			
Thallium		0.0558	mg/L	0.10	112	85	115			
Sample ID: H13070193-001BMS	7	Sample Matrix Spike				Run: ICPMS204-B_130715A				07/15/13 17:44
Arsenic		0.0521	mg/L	0.0010	104	70	130			
Beryllium		0.0485	mg/L	0.0010	97	70	130			
Chromium		0.0507	mg/L	0.0050	101	70	130			
Copper		0.0537	mg/L	0.0050	105	70	130			
Iron		0.212	mg/L	0.030	105	70	130			
Manganese		0.0797	mg/L	0.0010	101	70	130			
Thallium		0.0567	mg/L	0.00050	113	70	130			
Sample ID: H13070193-001BMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130715A				07/15/13 17:48
Arsenic		0.0512	mg/L	0.0010	102	70	130	1.7	20	
Beryllium		0.0486	mg/L	0.0010	97	70	130	0.2	20	
Chromium		0.0500	mg/L	0.0050	100	70	130	1.4	20	
Copper		0.0521	mg/L	0.0050	101	70	130	3.0	20	
Iron		0.210	mg/L	0.030	104	70	130	0.5	20	
Manganese		0.0761	mg/L	0.0010	94	70	130	4.6	20	
Thallium		0.0563	mg/L	0.00050	113	70	130	0.7	20	

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

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Revised Date: 08/08/13

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Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Analytical Run: ICPMS204-B_130716A		
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/16/13 11:41	
Aluminum		0.291	mg/L	0.10	97	90	110			
Cadmium		0.0318	mg/L	0.0010	106	90	110			
Iron		0.299	mg/L	0.030	100	90	110			
Nickel		0.0606	mg/L	0.010	101	90	110			
Zinc		0.0620	mg/L	0.010	103	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/16/13 11:45	
Aluminum		36.5	mg/L	0.10	91	70	130			
Cadmium		0.00118	mg/L	0.0010						
Iron		93.4	mg/L	0.030	93	70	130			
Nickel		0.000736	mg/L	0.010						
Zinc		0.00123	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/16/13 11:57	
Aluminum		37.0	mg/L	0.10	93	70	130			
Cadmium		0.0103	mg/L	0.0010	103	70	130			
Iron		93.2	mg/L	0.030	93	70	130			
Nickel		0.0208	mg/L	0.010	104	70	130			
Zinc		0.0105	mg/L	0.010	105	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/16/13 17:06	
Aluminum		0.300	mg/L	0.10	100	90	110			
Cadmium		0.0328	mg/L	0.0010	109	90	110			
Iron		0.325	mg/L	0.030	108	90	110			
Nickel		0.0636	mg/L	0.010	106	90	110			
Zinc		0.0646	mg/L	0.010	108	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/16/13 17:10	
Aluminum		38.1	mg/L	0.10	95	70	130			
Cadmium		0.00116	mg/L	0.0010						
Iron		97.9	mg/L	0.030	98	70	130			
Nickel		0.000686	mg/L	0.010						
Zinc		0.00107	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/16/13 17:14	
Aluminum		38.1	mg/L	0.10	95	70	130			
Cadmium		0.0108	mg/L	0.0010	108	70	130			
Iron		99.6	mg/L	0.030	100	70	130			
Nickel		0.0219	mg/L	0.010	109	70	130			
Zinc		0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/17/13 00:59	
Aluminum		0.302	mg/L	0.10	101	90	110			
Cadmium		0.0326	mg/L	0.0010	109	90	110			
Iron		0.314	mg/L	0.030	105	90	110			
Nickel		0.0607	mg/L	0.010	101	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Analytical Run: ICPMS204-B_130716A		
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/17/13 00:59	
Zinc		0.0631	mg/L	0.010	105	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/17/13 01:03	
Aluminum		37.6	mg/L	0.10	94	70	130			
Cadmium		0.00110	mg/L	0.0010						
Iron		93.3	mg/L	0.030	93	70	130			
Nickel		0.000619	mg/L	0.010						
Zinc		0.000902	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/17/13 01:08	
Aluminum		36.9	mg/L	0.10	92	70	130			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Iron		91.0	mg/L	0.030	91	70	130			
Nickel		0.0212	mg/L	0.010	106	70	130			
Zinc		0.0102	mg/L	0.010	102	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/17/13 09:50	
Aluminum		0.291	mg/L	0.10	97	90	110			
Cadmium		0.0324	mg/L	0.0010	108	90	110			
Iron		0.312	mg/L	0.030	104	90	110			
Nickel		0.0616	mg/L	0.010	103	90	110			
Zinc		0.0631	mg/L	0.010	105	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/17/13 09:54	
Aluminum		36.9	mg/L	0.10	92	70	130			
Cadmium		0.00116	mg/L	0.0010						
Iron		93.8	mg/L	0.030	94	70	130			
Nickel		0.000713	mg/L	0.010						
Zinc		0.00118	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/17/13 09:59	
Aluminum		36.1	mg/L	0.10	90	70	130			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Iron		95.2	mg/L	0.030	95	70	130			
Nickel		0.0212	mg/L	0.010	106	70	130			
Zinc		0.0108	mg/L	0.010	108	70	130			
Sample ID: ICSA	5	Interference Check Sample A							07/18/13 04:59	
Aluminum		36.2	mg/L	0.10	91	70	130			
Cadmium		0.000928	mg/L	0.0010						
Iron		95.6	mg/L	0.030	96	70	130			
Nickel		0.000750	mg/L	0.010						
Zinc		0.00123	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/18/13 05:03	
Aluminum		36.4	mg/L	0.10	91	70	130			

Qualifiers:

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QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A	
Sample ID: ICSAB	5	Interference Check Sample AB							07/18/13 05:03	
Cadmium		0.0116	mg/L	0.0010	116	70	130			
Iron		94.6	mg/L	0.030	95	70	130			
Nickel		0.0219	mg/L	0.010	109	70	130			
Zinc		0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/18/13 09:04	
Aluminum		0.306	mg/L	0.10	102	90	110			
Cadmium		0.0328	mg/L	0.0010	109	90	110			
Iron		0.318	mg/L	0.030	106	90	110			
Nickel		0.0617	mg/L	0.010	103	90	110			
Zinc		0.0638	mg/L	0.010	106	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/18/13 09:08	
Aluminum		37.0	mg/L	0.10	92	70	130			
Cadmium		0.00111	mg/L	0.0010						
Iron		92.2	mg/L	0.030	92	70	130			
Nickel		0.000741	mg/L	0.010						
Zinc		0.00103	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/18/13 09:13	
Aluminum		37.2	mg/L	0.10	93	70	130			
Cadmium		0.0106	mg/L	0.0010	106	70	130			
Iron		93.6	mg/L	0.030	94	70	130			
Nickel		0.0209	mg/L	0.010	104	70	130			
Zinc		0.0105	mg/L	0.010	105	70	130			
Sample ID: ICV STD	5	Initial Calibration Verification Standard							07/18/13 16:56	
Aluminum		0.296	mg/L	0.10	99	90	110			
Cadmium		0.0323	mg/L	0.0010	108	90	110			
Iron		0.331	mg/L	0.030	110	90	110			
Nickel		0.0616	mg/L	0.010	103	90	110			
Zinc		0.0644	mg/L	0.010	107	90	110			
Sample ID: ICSA	5	Interference Check Sample A							07/18/13 17:00	
Aluminum		37.4	mg/L	0.10	94	70	130			
Cadmium		0.00115	mg/L	0.0010						
Iron		96.7	mg/L	0.030	97	70	130			
Nickel		0.000687	mg/L	0.010						
Zinc		0.00102	mg/L	0.010						
Sample ID: ICSAB	5	Interference Check Sample AB							07/18/13 17:04	
Aluminum		36.3	mg/L	0.10	91	70	130			
Cadmium		0.0106	mg/L	0.0010	106	70	130			
Iron		92.8	mg/L	0.030	93	70	130			
Nickel		0.0202	mg/L	0.010	101	70	130			
Zinc		0.0101	mg/L	0.010	101	70	130			

Qualifiers:

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QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13

Client: MT DEQ-Abandoned Mines **Report Date:** 07/26/13

Project: 11033 Coke Oven Flats **Work Order:** H13070011

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R89782
Sample ID: ICB	5	Method Blank				Run: ICPMS204-B_130716A				07/16/13 14:56
Aluminum		0.001	mg/L	0.0001						
Cadmium		ND	mg/L	7E-06						
Iron		0.0006	mg/L	0.0002						
Nickel		ND	mg/L	6E-05						
Zinc		0.0005	mg/L	0.0003						
Sample ID: LFB	5	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/16/13 15:01
Aluminum		0.0507	mg/L	0.10	99	85	115			
Cadmium		0.0542	mg/L	0.0010	108	85	115			
Iron		0.167	mg/L	0.030	111	85	115			
Nickel		0.0540	mg/L	0.010	108	85	115			
Zinc		0.0553	mg/L	0.010	109	85	115			
Sample ID: H13070251-001AMS	2	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/16/13 23:55
Aluminum		0.0487	mg/L	0.030	97	70	130			
Cadmium		0.0514	mg/L	0.0010	103	70	130			
Sample ID: H13070251-001AMSD	2	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/17/13 00:00
Aluminum		0.0475	mg/L	0.030	95	70	130	2.4	20	
Cadmium		0.0518	mg/L	0.0010	104	70	130	0.7	20	
Sample ID: LFB	5	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/17/13 16:05
Aluminum		0.0500	mg/L	0.10	99	85	115			
Cadmium		0.0530	mg/L	0.0010	106	85	115			
Iron		0.150	mg/L	0.030	100	85	115			
Nickel		0.0506	mg/L	0.010	101	85	115			
Zinc		0.0529	mg/L	0.010	102	85	115			
Sample ID: H13070211-008CMS	5	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/18/13 05:40
Aluminum		2.92	mg/L	0.030	96	70	130			
Cadmium		2.59	mg/L	0.0010	101	70	130			
Iron		32.3	mg/L	0.030	104	70	130			
Nickel		3.64	mg/L	0.0050	101	70	130			
Zinc		3.70	mg/L	0.017	99	70	130			
Sample ID: H13070211-008CMSD	5	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/18/13 05:44
Aluminum		2.80	mg/L	0.030	92	70	130	4.2	20	
Cadmium		2.50	mg/L	0.0010	98	70	130	3.3	20	
Iron		32.0	mg/L	0.030	100	70	130	1.0	20	
Nickel		3.64	mg/L	0.0050	101	70	130	0.2	20	
Zinc		3.66	mg/L	0.017	97	70	130	1.1	20	
Sample ID: ICB	5	Method Blank				Run: ICPMS204-B_130716A				07/18/13 17:32
Aluminum		0.00199	mg/L	0.030						
Cadmium		ND	mg/L	0.00030						
Iron		0.000762	mg/L	0.020						

Qualifiers:

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QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R89782
Sample ID: ICB	5	Method Blank				Run: ICPMS204-B_130716A				07/18/13 17:32
Nickel		ND	mg/L	0.00010						
Zinc		0.000927	mg/L	0.0010						
Sample ID: LFB	5	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/18/13 17:36
Aluminum		0.0513	mg/L	0.10	99	85	115			
Cadmium		0.0530	mg/L	0.0010	106	85	115			
Iron		0.153	mg/L	0.030	102	85	115			
Nickel		0.0504	mg/L	0.010	101	85	115			
Zinc		0.0538	mg/L	0.010	106	85	115			
Sample ID: H13070185-001BMS	5	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/19/13 00:52
Aluminum		1.01	mg/L	0.030	97	70	130			
Cadmium		0.939	mg/L	0.0010	94	70	130			
Iron		3.10	mg/L	0.030	103	70	130			
Nickel		1.04	mg/L	0.0050	97	70	130			
Zinc		0.939	mg/L	0.010	91	70	130			
Sample ID: H13070185-001BMSD	5	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/19/13 00:56
Aluminum		1.01	mg/L	0.030	96	70	130	0.3	20	
Cadmium		0.935	mg/L	0.0010	94	70	130	0.4	20	
Iron		3.15	mg/L	0.030	104	70	130	1.4	20	
Nickel		1.05	mg/L	0.0050	98	70	130	0.9	20	
Zinc		0.949	mg/L	0.010	92	70	130	1.1	20	

Qualifiers:

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QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC102-H_130702A	
Sample ID: ICV	Initial Calibration Verification Standard								07/02/13 09:42	
Sulfate		400	mg/L	1.0	100	90	110			
Sample ID: CCV070213-5	Continuing Calibration Verification Standard								07/02/13 22:05	
Sulfate		400	mg/L	1.0	100	90	110			
Sample ID: CCV070213-6	Continuing Calibration Verification Standard								07/03/13 01:02	
Sulfate		400	mg/L	1.0	100	90	110			
Method: E300.0									Batch: R89481	
Sample ID: ICB	Method Blank					Run: IC102-H_130702A			07/02/13 09:55	
Sulfate		ND	mg/L	0.08						
Sample ID: LFB	Laboratory Fortified Blank					Run: IC102-H_130702A			07/02/13 10:07	
Sulfate		190	mg/L	1.0	96	90	110			
Sample ID: H13060511-009AMS	Sample Matrix Spike					Run: IC102-H_130702A			07/02/13 23:21	
Sulfate		260	mg/L	1.0	104	90	110			
Sample ID: H13060511-009AMSD	Sample Matrix Spike Duplicate					Run: IC102-H_130702A			07/02/13 23:34	
Sulfate		260	mg/L	1.0	105	90	110	0.9	20	
Method: E300.0									Analytical Run: IC102-H_130703A	
Sample ID: ICV	Initial Calibration Verification Standard								07/03/13 12:23	
Sulfate		410	mg/L	1.0	102	90	110			
Sample ID: CCV070313-2	Continuing Calibration Verification Standard								07/03/13 15:44	
Sulfate		400	mg/L	1.0	100	90	110			
Method: E300.0									Batch: R89526	
Sample ID: ICB	Method Blank					Run: IC102-H_130703A			07/03/13 12:36	
Sulfate		ND	mg/L	0.08						
Sample ID: LFB	Laboratory Fortified Blank					Run: IC102-H_130703A			07/03/13 12:48	
Sulfate		210	mg/L	1.0	106	90	110			
Sample ID: H13070011-013AMS	Sample Matrix Spike					Run: IC102-H_130703A			07/03/13 18:16	
Sulfate		46000	mg/L	11	99	90	110			
Sample ID: H13070011-013AMSD	Sample Matrix Spike Duplicate					Run: IC102-H_130703A			07/03/13 18:28	
Sulfate		45000	mg/L	11	94	90	110	2.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/08/13
Report Date: 07/26/13
Work Order: H13070011

Client: MT DEQ-Abandoned Mines
Project: 11033 Coke Oven Flats

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**									Analytical Run: IC102-H_130724A	
Sample ID: **ICV**		Initial Calibration Verification Standard							07/24/13 09:57	
Sulfate		410	mg/L	1.0	101	90	110			
Sample ID: **CCV072413-1**		Continuing Calibration Verification Standard							07/24/13 10:35	
Sulfate		400	mg/L	1.0	100	90	110			
Method: **E300.0**									Batch: R89955	
Sample ID: **ICB**		Method Blank				Run: IC102-H_130724A			07/24/13 10:09	
Sulfate		ND	mg/L	0.08						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: IC102-H_130724A			07/24/13 10:22	
Sulfate		210	mg/L	1.0	104	90	110			
Sample ID: **H13070181-009AMS**		Sample Matrix Spike				Run: IC102-H_130724A			07/24/13 13:06	
Sulfate		200	mg/L	1.0	98	90	110			
Sample ID: **H13070181-009AMSD**		Sample Matrix Spike Duplicate				Run: IC102-H_130724A			07/24/13 13:18	
Sulfate		200	mg/L	1.0	98	90	110	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

MT DEQ-Abandoned Mines H13070011

Login completed by: Tracy L. Lorash
Date Received: 7/1/2013
Reviewed by: BL2000\sdull
Received by: wjj
Reviewed Date: 7/8/2013
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☐	No ☑	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	4.8°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Received extremely limited sample volume for COF-1306-201 and 205. We are only able to analyze for Dissolved metals.
We were unable to pH sample COF-1306-201 due to sample matrix.
Samples COF-1306-201, 205 and 212 for Dissolved Metals/Hardness were subsampled, filtered, and preserved to pH <2 with 2 mL of Nitric acid per 250 mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection. TI 7/2/13.
Additional metals - Arsenic, Beryllium, Thallium, added per Tom Henderson. TI 8/5/13

CHAIN OF CUSTODY RECORD

Hydrometrics, Inc.

3020 Bozeman Ave. • Helena, MT 59601 • (406) 443-4150

PROJ. NO.	PROJECT NAME
11033	Coke oven Flats

SAMPLERS: *(Signature)*

DATE	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CON-TAINERS	Commons UF / RAW	Nutrients UF / H_2SO_4	Diss. Metal F / HNO_3	CN UF / NaOH	Total Metals UF / HNO_3	Total Recoverable Metals UF / HNO_3	BTEX	TPH	REMARKS
6/27/13	1400		X	COF-1306-200	2	X		X						H13070017
6/28/13	1515			COF-1306-201	1	X		X						Lab Filter
6/27/13	1445			COF-1306-202	2	X		X						
6/27/13	1505			COF-1306-203	2	X		X						
6/27/13	1515			COF-1306-204	2	X		X						
6/27/13	1600			COF-1306-205	1			X						Lab Filter
6/27/13	1620			COF-1306-206	2	X		X						
6/28/13	1130			COF-1306-207	2	X		X						
	1225			COF-1306-208	2	X		X						
	1440			COF-1306-209	2	X		X						
	1330			COF-1306-210	2	X		X						
	1400			COF-1306-211	2	X		X						
	1430			COF-1306-212	2	X		X						Lab Filter

Relinquished *(Signature)*	Date / Time	Received by *(Signature)*	Lab	P.O. #	Shipped via: Bus FedEx UPS
	7/1/13 15:40		Energy Lab	HLN-6540	Other Hand delivered
					Air Bill #

Relinquished *(Signature)*	Date / Time	Received by *(Signature)*	Remarks
			Temp 4.8 TB / On Ice / hand del / cooler

Relinquished *(Signature)*	Date / Time	Received for Laboratory by *(Signature)*	Date / Time	Enclosed: ❑ Parameter sheet w/detection limits ❑ QA / AC standard mixing instructions ❑ Cover letter ❑ Other
			7-1-13 15:40	

Split Samples: ❑ Accepted ❑ Declined _____ Signature

HFORM-1 07/11
TNO 406-443-8550

Return results & electronic copy to:
QA / QC Dept. at address at top of page

Hydrometrics, Inc.
consulting scientists and engineers

3020 Bozeman Avenue
Helena, MT 59601
(406) 443-4150
Fax: (406) 443-4155
www.hydrometrics.com

July 1, 2013

Energy Laboratories, Inc
Helena, MT 59601

RE: Great Falls Coal Fields – Coke Oven Flats Groundwater Investigations

Dear Energy Labs:

Enclosed are 13 groundwater samples collected at the Great Falls Coal Field – Coke Oven Flats Area in Belt Montana in June 2013. Samples should be analyzed for common constituents and dissolved metals according to the attached parameter list and chain-of-custody. Three samples (COF-1306-201, COF-1306-205, and COF-1306-212) did not have enough water to filter them in the field; therefore they were left unpreserved in the field. Please filter these samples in the lab if there is sufficient water to do so. If insufficient water to filter and analyze please contact me to discuss.

The data reports for analytical work should be directed to Greg Bryce and Tom Henderson. Invoice for the analyses should be directed to Tom Henderson. If you have any questions about the samples or analysis please call me at 406-443-4150 x155.

Sincerely,

Greg Bryce
Hydrogeologist

Enclosures

K:\project\11033 GFCF\Coke Oven Flats\L1307_EnergyLabCoverLetter-GW.docx

6/20/2013 11:18 AM

Table 1. Groundwater Sample Analytical Parameter List

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
Common Ions		
Sulfate	300	1
Trace Constituents (Dissolved)		
Aluminum (Al)	200.7/200.8	0.03
Cadmium (Cd)	200.8	low level
Chromium (Cr)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.0005
Iron (Fe)	200.7/200.8	0.02
Manganese (Mn)	200.7/200.8	0.01
Nickel (Ni)	200.8	low level
Zinc (Zn)	200.8	low level

Notes:

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).