BUTTE AREA ONE RESTORATION SITE

Final Draft Version
Tailings/Impacted Sediment Delineation of the Diggings East, Blacktail Creek Berm, and Northside Tailings Areas

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EXECUTIVE SUMMARY

In May 2013, scientists from the Montana Bureau of Mines and Geology (MBMG) conducted trenching, test pit, and borehole investigations in known and suspected mine wastes areas of the Blacktail Creek/Silver Bow Creek Confluence area in Butte, MT. In particular, three waste areas; Blacktail Creek (BTC) Berm, Diggings East, and the Northside Tailings, were evaluated for contaminant concentrations and volumes of impacted sediments. This work was done to quantify the aerial extent and depth of tailings and impacted sediments. This work builds on previous MBMG investigations (Tucci, 2010) of wastes that have been left in place in the Butte Area One Restoration corridor. It is meant to provide an accurate, updated characterization and volume estimate of tailings and mining impacted sediments for the State of Montana.

As a result of the data and analysis presented here, the MBMG concludes:

- The BTC Berm, Diggings East, and Northside Tailings all contain tailings/impacted sediments (IS) that exceed the failure criteria for constituents of concern (COC) concentrations established for this study in the sampling and analysis plan (SAP).
- Tailings/IS in the Diggings East area are overlain by 184,000 cubic yards of fill material, that, in general, do not exceed the COC failure criteria. The bulk majority of fill material is composed of demolition debris (wood, bricks, concrete, asphalt, etc.). Tailings/IS in the BTC Berm and Northside Tailings area are not overlain by thick units of fill material, and are closer to the surface (and are surficial at times).
- The majority of sediment samples collected just above the water table in the BTC Berm, Diggings East, and Northside Tailings areas exceeded COC failure criteria. Therefore, it is recommended that any potential future removal boundaries include sediments down to the water table.
- In total, tailings/IS and potential removal volumes for the BTC Berm, Diggings East, and Northside Tailings were estimated at 14,000, 345,000, and 49,000 cubic yards respectively. Fifty-three percent (184,000 cubic yards) of the total volume in the Diggings East area are is calculated to be fill material.
- The majority of organic silt samples meet the classification of impacted sediment. Subsequently, the dry alluvial sand observed above the water table in the Diggings East and Northside Tailings areas also meets the classification of impacted sediments that were established in the SAP. It is recommended that these units be included in any potential future removal boundaries.
- The average concentrations of As and Pb in tailings samples from the three waste areas are comparable to the average concentrations of As and Pb in Parrot Tailings samples (Tucci, 2010). However, concentrations of average copper concentrations in tailings

samples from the BTC Berm, as well as zinc concentrations in all three studied waste areas, were greater than the average Cu and Zn concentrations in Parrot Tailings samples.

- The mass of copper (3 million pounds) and zinc (7 million pounds) remaining above the water table in the three source areas evaluated during this investigation were found to be significant.
- When combined, the mass of copper and zinc remaining in the unsaturated zone of the three primary source areas (Parrot, Diggings East, and Northside Tailings) in the Upper Silver Bow Creek/Metro Storm Drain area was estimated to be 15.3 million and 24.5 million pounds, respectively.
- Analysis of 184 samples with a photo-ionization meter resulted in zero detectible photo-ionizable petroleum hydrocarbons. This data suggests zero detectable petroleum-based contamination in the samples collected.

1.0 INTRODUCTION

The State of Montana is proceeding with its evaluation and cost estimation for removing historic mine waste, smelter tailings and impacted sediments that have been left in place in the Butte Area One Restoration Corridor (fig. 1). The areas of focus for the current study are smelter tailings and impacted sediments (IS) located within the Blacktail Creek (BTC) Berm, Diggings East and Northside Tailings areas (fig. 1). The Montana Bureau of Mines and Geology (MBMG) was contracted by the Natural Resource Damage Program (NRDP) for the specific task of characterizing and quantifying the tailings/ IS in these areas. The data collected will be used by the State to evaluate the cost of removal, and may be used to prepare designs for removal actions.

In May of 2013, in an effort to ascertain the extent and volume of mining impacted sediments (IS), scientists from the MBMG and its subcontractors conducted a trenching, test pit, and drilling investigation in the waste area commonly referred to as the Blacktail/Silver Bow Creek confluence area. Lithologic logs and chemical analysis of samples from forty-four test pits, one trench, and five boreholes (fig. 1) were used to estimate the volume and extent of tailings/IS, and quantify the concentrations of constituents of concern (COCs).

1.1 Objectives

The work proposed under this investigation concentrates on the BTC Berm, Diggings East Tailings, and Northside Tailings (fig. 1). The primary objectives were to:

- delineate the aerial and vertical extent of the tailings/IS within these areas,
- quantify the aerial and vertical distribution of COCs concentrations in all lithology units observed above the water table,
- delineate a potential excavation boundary and estimate volumes of tailings/IS,
- evaluate whether the unit known as the organic silt layer and any other unit encountered above the water table meets the IS classification established under the SAP (appendix A), and
- determine whether tailings samples have been impacted by petroleum hydrocarbon contamination.

Harrison Avenue

Kaw Avenue

Upper Silver Bow Creek / Metro Storm Drain

George Street

Blacktail Creek

TP-NS-04E-50N
TP-NS-04E
TP-NS-03E-50N
TP-NS-03E
TP-NS-01E
TP-NS-02E
TP-NS-01E-50S
TP-4E
TP-6E
Trench 1
Trench 2
Trench 3
Trench 4
TP-2E
TP-3E
TP-5E
TP-NS-02
TP-NS-03
TP-NS-01
TP-18W
TP-17W
TP-16W
TP-19W
TP-16W-50S Extent
TP-10W
TP-2W
TP 1- Trench 1 -100S
TP-14W
TP-15W
TP-11W
TP 2- Trench 1-200S
TP-1E
TP-13W
TP-12W
TP-7W-50N Extent
TP-6W-100N Extent
TP-1W
TP 3-Trench 1-300S
TP-9W
TP-3W
TP-6W-50N Extent
TP-8W
TP-7W
TP-8W-100NE Extent
TP-6W
TP-4W
TP-5W
TP-8W-50S Extent
Berm 1
Berm 2
Berm 3
Berm 4
Berm 5

Figure 1. Trench and Test Pit Locations

0 125 250 500 750 1,000 Feet

Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\ArcMap\Report\Figure 1
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 HARN Montana State Plane Meters

MBMG
Montana Bureau of Mines and Geology

Location Summary	
Tailings Area	**# of Pits**
Diggings East	34
Northside	10
BTC Berm	5
Total	49

Legend

- Test Pit and borehole sampling locations
- Diggings East Trench
- Butte Area One Boundary (MBMG, 2010)
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)
- BTL Berm
- MSD Subdrain

1.2 Site Background

The study area, referred to throughout this report as the confluence area, was the historic confluence of Blacktail Creek (BTC) and Silver Bow Creek (SBC), and is a part of the Butte Area One Restoration corridor (fig. 1). The pre-mining setting of the confluence area was described as a low-flow, low-gradient wetland environment with luxuriant growth of grass and vegetation (Meinzer, 1914).

In 1879, the first large-scale mineral processing smelter (Colorado Smelter) was built on SBC, at the west end of the valley (Smith, 1955). Between 1879 and 1888, at least three more smelters of consequence [Butte Reduction Works, Parrot Smelter, M.O.P] were constructed upstream of the Colorado, which significantly altered the morphology and hydrology of both creeks. Water demands during this period increased dramatically, and the stream channels were altered siginificantly to keep up with the demand. At least three dams were constructed on upper Silver Bow Creek, for tailings impoundment and water clarification. The dam at Montana Street (Weed, 1904) was constructed for tailings settlement of tailings from upstream smelters and resulted in significant ponding on both sides of the stream.

Over time, aggrandizement of waste material became a serious issue as frequent and substantial flooding began to occur (Meinzer, 1914). In an attempt to mitigate flooding issues, berms made mostly of readily available waste were constructed throughout the confluence area. The known waste area referred to as the BTC Berm (fig. 1), one of the central focal points for the current investigation, is an historic remnant of these flood control berms. Another berm, depicted in the Valley Addition land survey conducted in the 1920s, defines the southern boundary of the detention pond that encompasses the Diggings East Tailings (fig. 2A). It is hypothesized that the berm denoted in the 1921 Valley Addition land survey (fig. 2A; “Bank of artificial lake”) represents the southern boundary of the wastes known as the Diggings East Tailings.

The tailings associated with the Diggings East and Northside areas were not derived from the activities of a single smelter, but were emplaced as a result of water detention activities - attempts made by downstream smelters operations (i.e. Butte Reduction Works) to clarify Silver Bow Creek water from the suspended tailings of upstream smelters (Parrot, M.O.P, etc.). The Diggings East area underwent further alteration as a detention pond in the 1930s during a Butte storm water infrastructure improvement project (Quivik, 1998). Unfortunately, historic tailings distribution maps do not exist for the confluence area. The only evidence that exists showing the aerial extent of the tailings in the confluence area is a 1955 aerial photograph (fig. 2B). Since that time, the tailings in the low lying confluence area has been covered by two decades of dumping material and construction demolition debris.

Figure 2. A). 1921 Valley Addition Subdivision Survey showing the "bank of artificial lake" and the extent of the Diggings East Tailings impoundment, and B). 1955 aerial image showing aerial extent of tailings and locations of trench, test pit, and borehole.

2.0 METHODS

2.1 Field Procedures, Sampling Protocol, and Analytical Methods

Field procedures, sampling protocol, and analytical methods are outlined in the project's sampling and analysis plan (SAP) (appendix A). The SAP was submitted for review to the Natural Resource Damage Program (NRDP), Montana Department of Environmental Quality (DEQ), the Environmental Protection Agency (EPA), and British Petroleum/Atlantic Richfield Company (AR). MBMG sought and received verbal or written comment on the SAP prior to the commencement of the project.

Trenching and test-pitting were conducted between 27-May-2013 and 31-May-2013. Drilling and borehole investigations were conducted by the MBMG on 6-June-2013, and were carried out using a trailer-mounted Geoprobe. During field activities, geologist Will Goldberg from Pioneer Technical Services was on-site at the request of ARCO.

2.1.2 Deviations from the SAP

The following section discusses sampling procedures and analytical methods that deviated from the project's sampling and analysis plan.

2.1.2.1 Test Pit Surveying

While horizontal survey data (x,y) for test pit and borehole locations were obtained with a resource-grade global positioning device (GPS), elevation and topographic data were obtained with a LiDAR survey (fig. 3A). Montana LiDAR was contracted to conduct the survey, using a MD520N NOTAR turbine helicopter platform with onboard GPS guidance and a Leica ALS 50-II LiDAR Corridor Mapper. With a resolution of 35 points per square meter, the survey generated over 40 million individual data points, and produced a very accurate and precise topographic data set. One-foot contour intervals and a one-meter resolution, digital elevation map (DEM) were generated during the survey (fig. 3B).

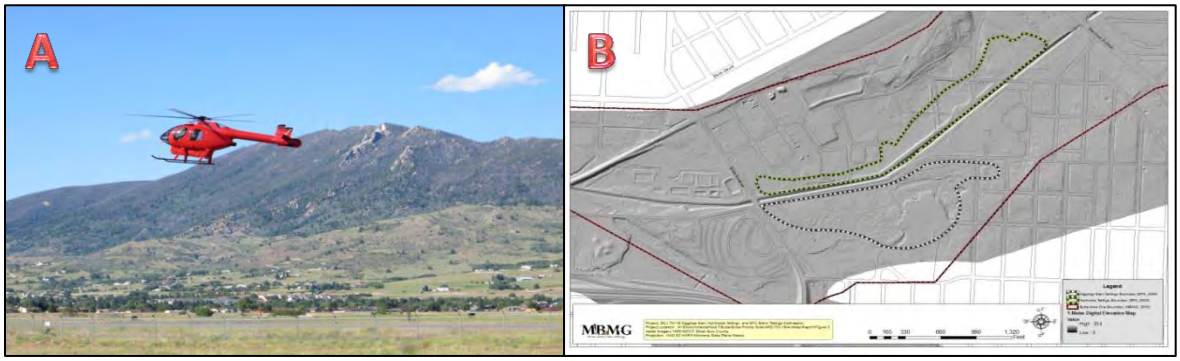


Figure 3. A). LiDAR Survey for Butte Area One Restoration corridor, and B). A portion of the 1-meter DEM produced in the LiDAR survey showing topography of the study area(B).

2.1.2.2 ICP Metals Analysis for COCs

Even though samples were screened for COCs using a portable XRF unit, the decision was made by the NRDP to submit all sediment samples collected during this investigation to ALS Geochemistry Labs for analysis of total digestible arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), and zinc (Zn) using ICP-AES (Method 200.7 CLP-M). In total, 184 samples and ten duplicate samples were submitted to ALS Labs for total digestion and ICP metals analysis. This extra step, although costly, greatly reduced experimental error associated with field XRF analysis using a portable unit, and greatly enhanced the accuracy and comparability of the data.

2.1.2.3 Total Petroleum Hydrocarbon Analysis (TPH)

Ten sediment samples (rather than five, appendix A) were submitted to the Energy Labs in Helena, MT for total petroleum hydrocarbon analysis. A background sample, composed of topsoil from an area with good vegetative cover, was submitted for comparison purposes. The nine additional samples included: five tailings samples (as per the SAP), one fill-material sample comprised of demolition debris, two organic silt samples, and one alluvial sand sample.

2.1.2.4 MBMG Access Agreements

Written access agreements had to be in place between MBMG and all property owners (Butte Silver Bow, Atlantic Richfield, and other private land owners) prior to commencement of field activities. Although this had no impact on the quality of the data collected, this process led to a considerable delay in the timeline of the project.

2.2 Volume Estimates for Impacted Sediments

Volumetric analysis was accomplished using the topographic data generated from the LiDAR survey and the GIS software program ARCMAP. The lithology records gathered during this investigation (appendix B) were combined with the ICP metals concentrations for COCs (appendix C) to depict the spatial distribution and thickness of impacted sediments in the BTC Berm, Diggings East, and Northside Tailings impoundments. A GIS database was created using the software program ARCGIS Geostatistical Analyst. A cut-and-fill model was produced to determine volumes using inverse distance weighted interpolations. The North American Datum of 1983 (NAD 83) was used for the horizontal datum, and the North American Vertical Datum of 1988 was used for the vertical datum. The 1-meter DEM produced during the LiDAR survey was used as the topographic base map for the cut-and-fill model. This topographic data has a one foot contour interval.

3.0 RESULTS

3.1 Lithology

Test pits and trenching logs are provided in appendix B. For purposes of volume estimates, sediments observed above the water table were divided into four lithologic units: fill, tailings, organic silt, and alluvium. Sediments observed overlying tailings, such as topsoil, sand and silt (fig. A-1) or landfill material (demolition debris; fig B-1), were categorically lumped as fill material. The fill thickness was highly variable (0-7 feet thick).

Figure 4A and 4B. Four lithologic units were observed above the water table in test pits; fill (unit 1), tailings (unit 2), black organic silt (unit A-3), and medium gray alluvial sand (units A-4 and B-3). Sediments were classified as fill material if they were found overlying tailings, and ranged from topsoil and fine-medium sand (A4) to landfill material (B4). Except for a few surficial deposits, tailings material in the Diggings East (A-2 & B-2) were typically encountered underlying 1-8 feet of fill material. The black organic silt layer (A-3) was observed at most-but not all-of the sites, and was encountered underlying the tailings and ranged from 0.5 feet to greater than 5 feet thick.

Tailings (fig. 4A and B, unit 2) encountered in the Diggings East varied in grain size (fine to coarse), thickness (0-3.5 feet), and color (yellow to gray); but, in general, graded from a medium-to-coarse, sand-sized material in the eastern portion to a silty-clay- to clay-sized (slickens) material in the western portion of the Diggings East. Both oxidized (tan-yellow) and gray tailings, similar in appearance to those observed by Tucci (2010), were observed in the Diggings East. Dark gray clayey tailings (slickens) were observed in the western portion (fig. 1, near Kaw Ave) of the Diggings East, this type of tail has not been reported elsewhere. The majority of tailings observed in test pits were found underlying fill material, however, surficial tailings were encountered in portions of the Diggings East. A mixed tailings/oxidized alluvial sand material, often difficult to distinguish from oxidized alluvial sand with the naked eye, were encountered in the Northside and BTC Berm areas. While the tailings in the Berm were buried, the tailings encountered in the Northside Tailings were often at or near the surface. Tailings were observed above the water table at all sites in all areas.

The organic silt unit described by Tucci (2010) was encountered in all three waste areas (fig. 4, A-3). Although a thick (3-6 feet) ubiquitous layer was observed in the BTC Berm and Northside tailings areas, the organic silt layer was not observed at all sites in the Diggings East, and ranged in thickness from 0 to 6 feet. Perched water (most likely recent precipitation) was encountered above the organic silt in the Northside Tailings area.

Medium to coarse gray alluvial sand (fig. 4, A-4 and B-3) was observed between the organic silt and the water table in the Diggings East and Northside Tailings but not in the BTC Berm. The thickness of the gray alluvial sand above the water table was between 0.5-3.5 feet thick. The organic silt layer was the underlying lithologic unit observed above the water table in the BTC Berm.

3.2 COCs Concentrations in Sediment Samples

Sediment samples (n=184) were analyzed for As, Cd, Cu, Hg, Pb, and Zn concentrations. Statistical summaries for sediment lithology units within each waste area are provided in tables 1 (BTC Berm), 2 (Diggings East), and 3 (Northside Tailings). Sediment concentrations of As, Cd, Cu, Pb, and Zn are given in tabular form in appendix C, while MSE lab results for Hg are given in appendix D. Average, maximum, and minimum COC concentrations are compared to the COC failure criteria and standard deviations. Number of exceedance and percent failure are given to quantify the analyte concentrations that exceeded the COC failure criteria.

Table 1. Statistical summary of COC concentration from sediment samples in the Blacktail Creek Berm.

Blacktail Creek Berm						
Fill (n=7)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	130	6.91	2,095	1.63	415	1,837
Max	231	16.40	9,610	2.95	641	3,360
Min	27	2.20	74	0.03	49	952
St Dev	63	6.44	4,426	1.32	265	1,057
# of excedance	1	0	3	0	0	6
% Failure	14	0	43	0	0	86
Tailings (n=3)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	396	10	3,294	14	1,263	3,360
Max	434	17	5,180	28	1,790	5,610
Min	324	1	10	0.04	10	10
St Dev	63	6	2,513	13	670	1,992
# of exceedance	3	0	2	2	2	3
% Failure	100	0	67	67	67	100
Organic Silt (n=10)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	220	11	1,755	3	565	3,088
Max	736	29	8,140	31	2,450	6,950
Min	6	1	73	0.04	27	255
St Dev	217	10	2,365	10	712	2,355
# of exceedance	5	2	6	1	1	7
% Failure	50	20	60	10	10	70
Dry Alluvium Above Water Table (n=4)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	6	0.55	70	0.09	34	102
Max	9	0.60	162	0.14	42	144
Min	5	0.50	12	0.03	23	67
St Dev	2	0.06	68	0.06	9	32
# of exceedance	0	0	0	0	0	0
% Failure	0	0	0	0	0	0
Note: All concentrations given in mg/kg						

Table 2. Statistical summary of COC concentrations from sediment samples in the Diggings East Tailings.

Diggings East Tailings						
Fill (n=14)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	75	4	559	0.40	617	1,316
Max	149	11	1,700	1.02	2,910	4,170
Min	17	1	114	0.07	113	408
St Dev	35	2	465	0.36	731	964
# of exceedance	0	0	3	0	2	8
% Failure	0	0	21	0	14	57
Tailings (n=56)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	359	14	858	2	696	4,733
Max	5,560	42	3,170	69	1,595	12,800
Min	102	1	113	0.15	217	296
St Dev	726	12	732	9	372	3,850
# of exceedance	38	19	21	1	10	47
% Failure	68	34	38	2	18	84
Organic Silt (n=22)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	411	45	5,005	7	967	9,486
Max	1,295	244	21,700	69	4,610	50,300
Min	16	1	45	0.09	51	138
St Dev	358	62	5,764	18	1,143	11,522
# of exceedance	16	11	17	3	8	18
% Failure	73	50	77	14	36	82
Dry Alluvium Above Water Table (n=38)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	451	14	4,523	1	530	3,515
Max	944	55	14,100	11	1,980	11,300
Min	10	1	39	0.05	27	123
St Dev	264	12	4,296	2	345	2,678
# of exceedance	32	10	28	2	3	34
% Failure	84	26	74	5	8	89
Note: All concentrations given in mg/kg						

Table 3. Statistical summary of COC concentrations from sediment samples in the Northside Tailings.

Northside Tailings						
Fill (n=7)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	608	10	5,426	1	511	2,936
Max	922	22	9,060	1	884	5,540
Min	145	3	189	0.21	173	950
St Dev	317	6	3,718	0.46	207	1,364
# of exceedance	6	1	6	0	0	6
% Failure	86	14	86	0	0	86
Tailings (n=6)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	390	18	1,121	1	672	5,390
Max	665	45	1,730	2	1,370	10,800
Min	193	4	465	0.36	269	1,760
St Dev	177	16	459	1	371	4,014
# of exceedance	5	2	3	0	1	6
% Failure	83	33	50	0	17	100
Organic Silt (n=11)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	222	23	3,027	5	868	3,619
Max	777	164	17,800	24	2,770	18,100
Min	21	1	68	0.04	248	456
St Dev	296	47	5,361	8	760	4,924
# of exceedance	3	2	5	1	2	10
% Failure	27	18	45	9	18	91
Dry Alluvium Above Water Table (n=6)						
	As	**Cd**	**Cu**	**Hg**	**Pb**	**Zn**
Failure Criteria	200	20	1,000	10	1,000	1,000
Average	91	3	259	0.39	438	1,419
Max	392	6	886	0.82	689	2,120
Min	9	1	110	0.03	65	271
St Dev	148	2	308	0.40	295	872
# of exceedance	1	0	0	0	0	4
% Failure	17	0	0	0	0	67
Note: All concentrations given in mg/kg						

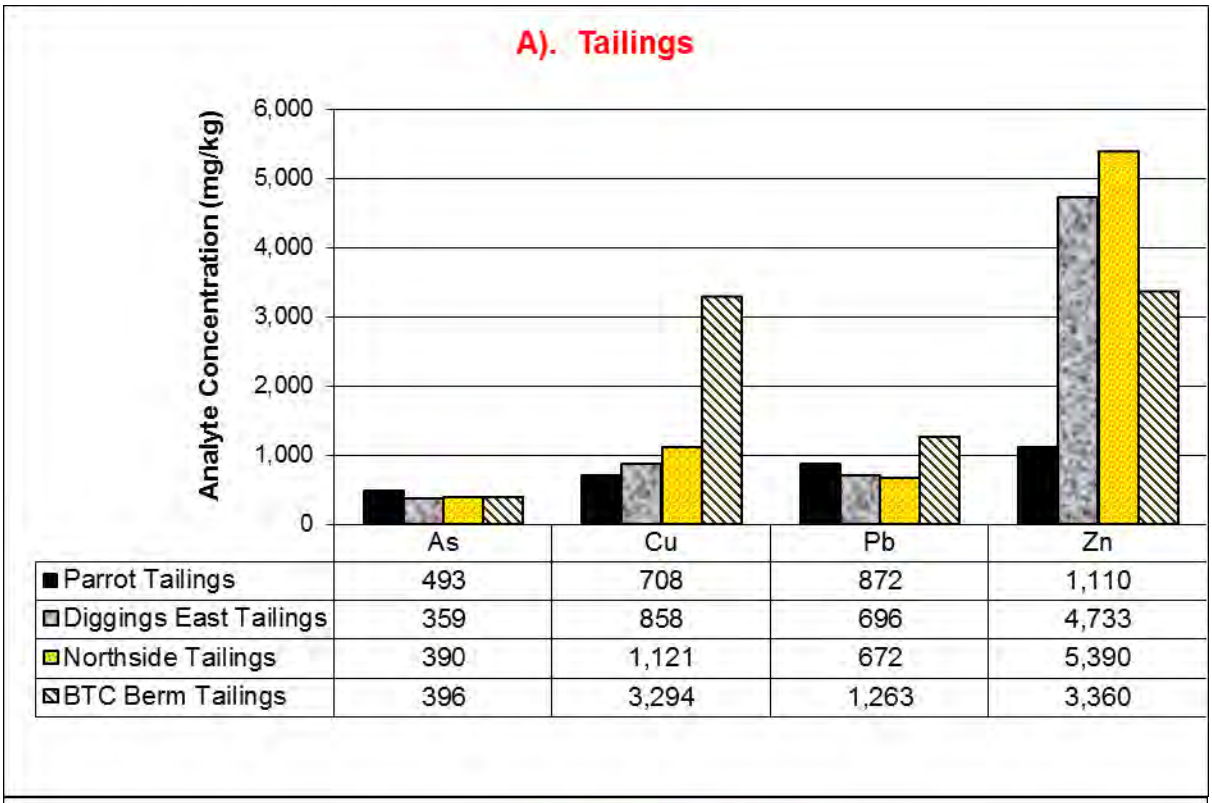
Average As, Cu, Pb, and Zn concentrations in tailings samples (fig. 5A) and organic silt (fig. 5B) samples collected during the Parrot Tailings investigation (Tucci, 2010) were compared to average concentrations from the Diggings East, Northside, and BTC Berm areas. Parrot Tailings samples contained slightly higher As and Pb concentrations, but lower Cu concentrations and much lower Zn concentrations than samples from other waste areas investigated in this study (fig. 5A). On average, organic silt samples from the Parrot area contained higher As, Cu, and Pb concentrations and significantly lower Zn concentrations (fig. 5B).

3.2.1 Spatial and Vertical Distribution of COCs

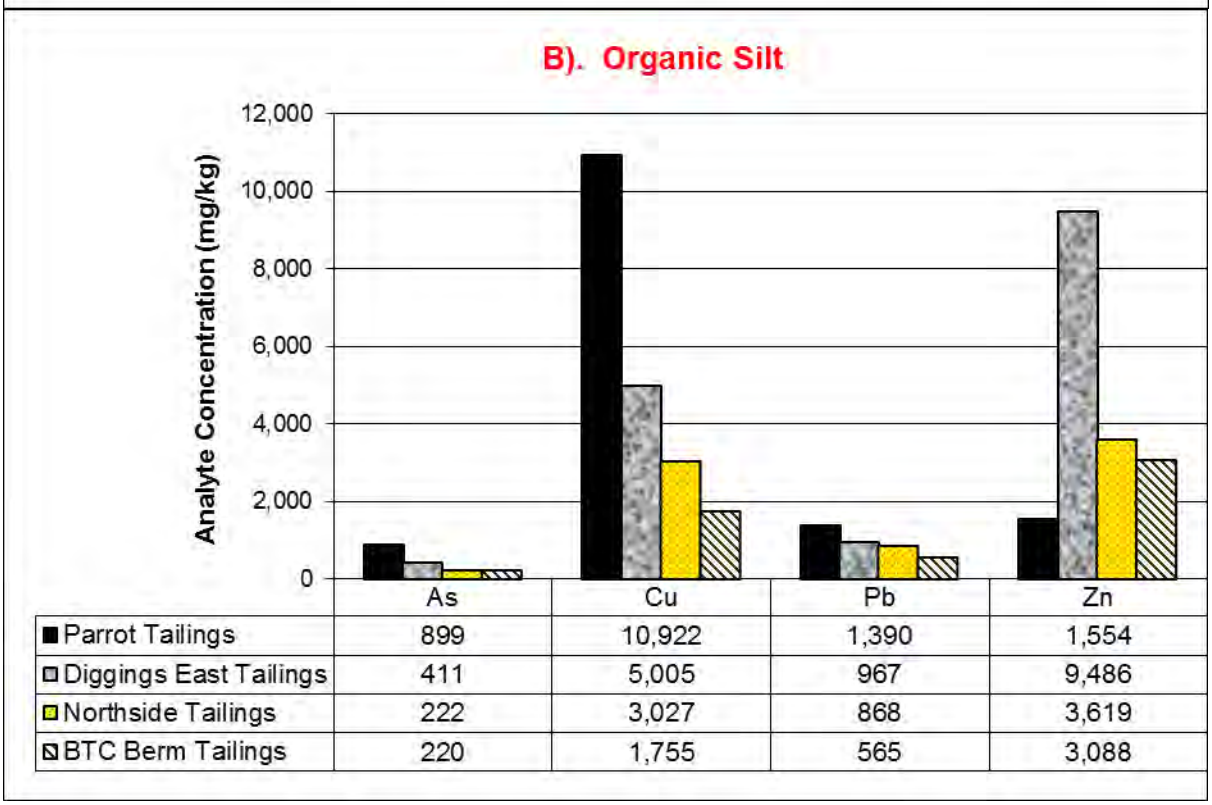
Spatial and vertical distribution of As, Cd, Cu, Hg, Pb, and Zn are provided in figures 6, 7, 8, 9, 10, and 11 respectively. Average depth to, and thicknesses of lithology units are given for fill (A), tailings (B), organic silt (C), and alluvium (D). The failure criteria for each COC are given; samples with concentrations below the failure criteria level are depicted in green and yellow, while sediment concentrations that exceed the failure criteria are demonstrated in orange and red. Sites represented by blue triangles represent sites where samples were either unable to be sampled (demolition debris or landfill material) or were absent in the lithology log.

Except for the northeast section of the Northside Tailings, the majority of fill sample concentrations were below the As failure criteria level (fig. 6A), but the majority of samples exceeded As criteria in tailings (fig. 6B), organic silt (fig. 6C), and alluvial sand samples (Diggings East only) (fig. 6D). The same trend is observed for Cd (fig. 7).

The majority of Cu (fig. 8) and Zn (fig. 11) sample concentrations exceeded the COC failure criteria (1,000 mg/kg) in all lithology units in the Diggings East, but not in the BTC Berm or the Northside Tailings (majority of alluvial samples passed). Concentrations of Cu were highest (>1% Cu in many cases) in organic silt (fig. 8C) and dry alluvial (fig. 8D) samples in the Diggings East. Concentrations of Zn were most elevated in tailings (fig. 11B), organic silt (fig. 11C), and dry alluvium samples (fig. 11D; Diggings East only), exceeding concentrations of one percent in many cases.



	As	Cu	Pb	Zn
Parrot Tailings	493	708	872	1,110
Diggings East Tailings	359	858	696	4,733
Northside Tailings	390	1,121	672	5,390
BTC Berm Tailings	396	3,294	1,263	3,360



	As	Cu	Pb	Zn
Parrot Tailings	899	10,922	1,390	1,554
Diggings East Tailings	411	5,005	967	9,486
Northside Tailings	222	3,027	868	3,619
BTC Berm Tailings	220	1,755	565	3,088

Figure 5. A). A comparison of average COCs concentrations in tailings samples, and B). organic silt samples between the Parrot Tailings (Tucci, 2010), the Diggings East, Northside Tailings, and the BTC Berm.

The high percentage of samples that failed the Cu and Zn criteria (>1,000 mg/kg) in near-surface fill samples in the BTC Berm are notable, and may be a potential source of contamination to surface water (Blacktail Creek). Bed sediment data in samples collected in Blacktail Creek adjacent to the BTC Berm (Arco, 2013a) are comparable to the data presented in this report. Combined, this data provides strong supporting evidence that the BTC Berm may be a point source of Cu and Zn loading to Blacktail Creek during run-off conditions.

In total, only ten samples exceeded the Hg failure criteria (10 mg/kg), with the highest percentage of failures being observed in the BTC Berm area (fig. 9). The low percentage of Hg concentrations (relative to the other COCs) may be due to, in part, the exceedance of laboratory holding times for Hg (appendix D).

The largest percentage of lead concentrations that exceeded failure criteria were observed in the tailings (fig. 10B) and organic silt (fig. 10C) units, and the highest Pb concentrations were observed in the organic silt unit (fig. 10C; >2,000 mg/L in many samples). Spatially, the tailings in the western portion of the Diggings East represented the highest percentage of samples where Pb concentrations exceeded the failure criteria (fig. 10B).

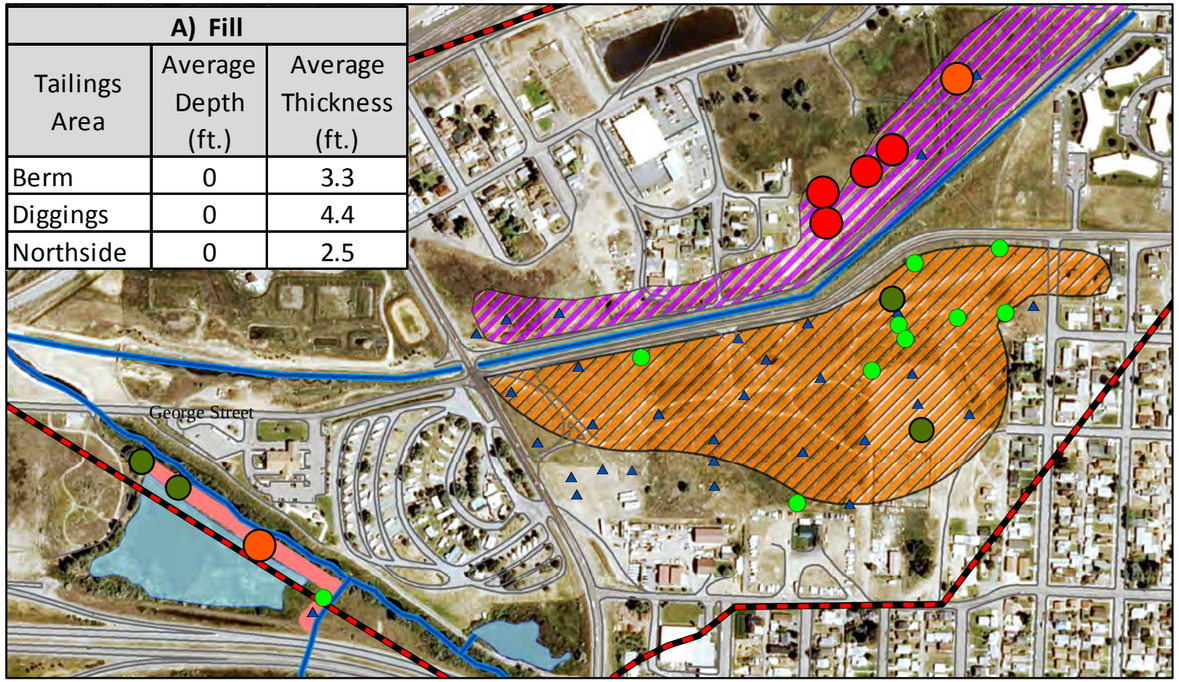
According to the SAP (Appendix A), if three of the six COCs exceed the failure criteria, the sample is considered to be impacted, and will be recommended for potential removal. However, if four of the six COCs pass the COC failure criteria, the sample will be considered to be non-impacted by the primary source. Figure 13 summarizes the number of COC failure criteria exceedances, and shows both impacted and non-impacted areas within the Diggings East, Northside, and BTC Berm areas. Because designated waste areas contain sections of discernible impacted sediments and non-impacted sediments, it was necessary to differentiate between the two by recreating boundaries different from those previously established by the EPA (Fig. 13A). Although different, the new boundaries include the bulk majority of tailings visible in the 1955 DOT aerial photograph (fig. 13B), were constructed using the new data, and provide the area necessary to calculate the volumes of waste.

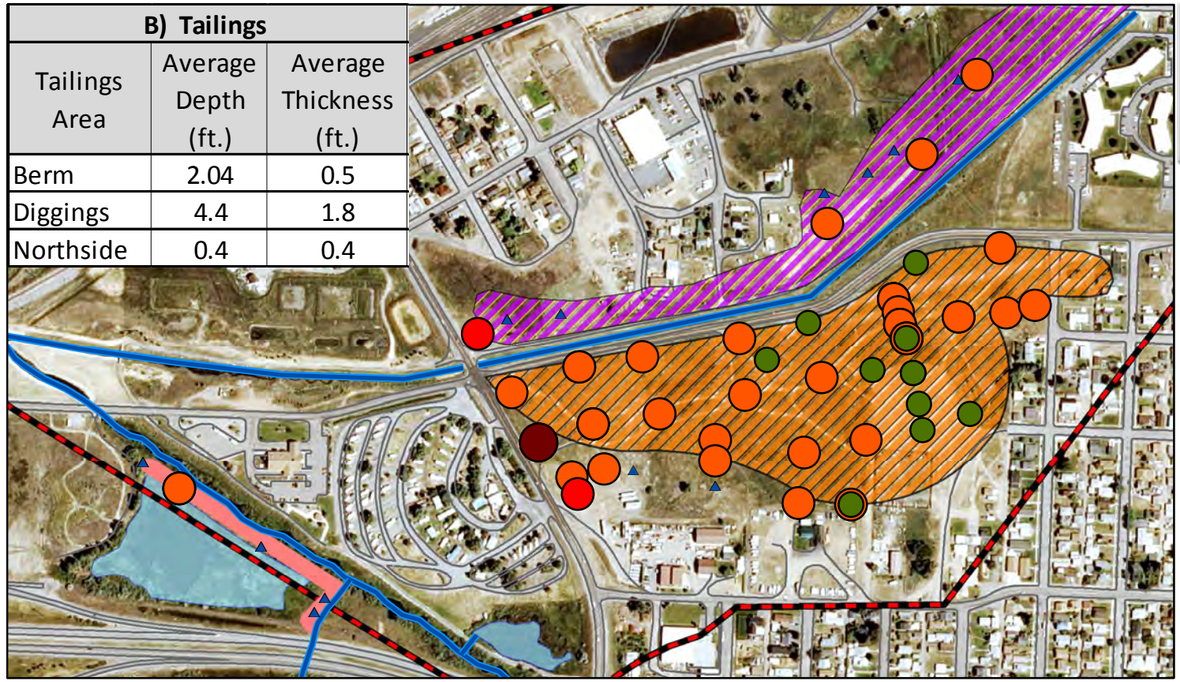
A) Fill		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5

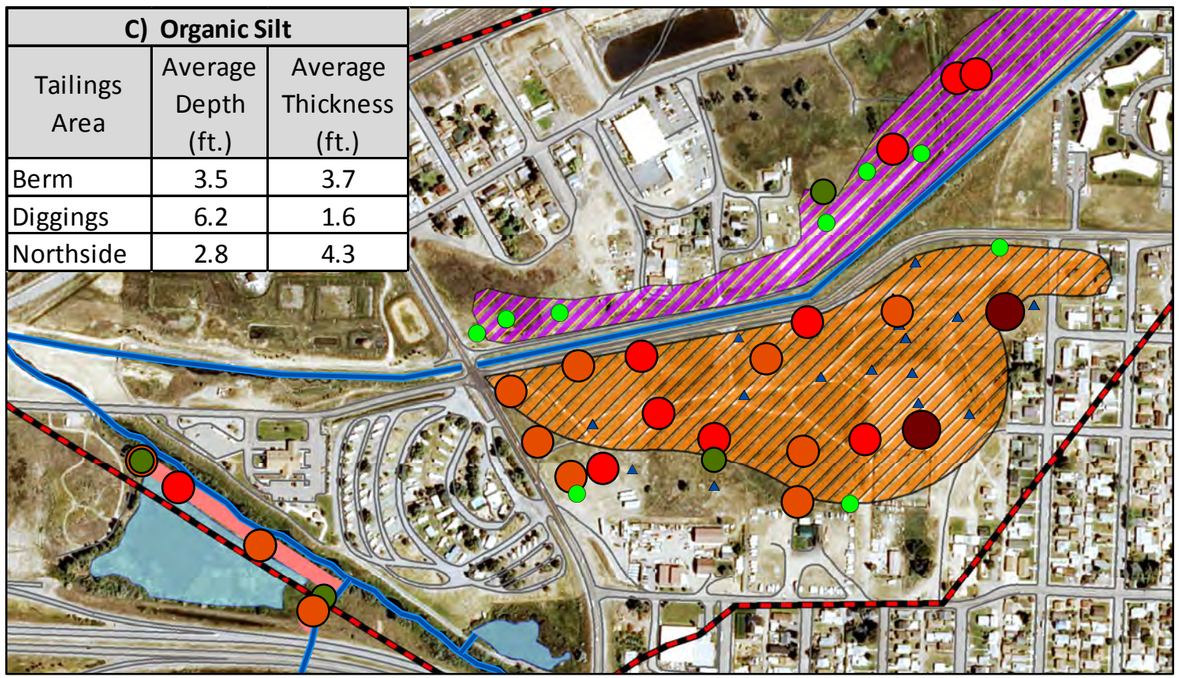
B) Tailings		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4

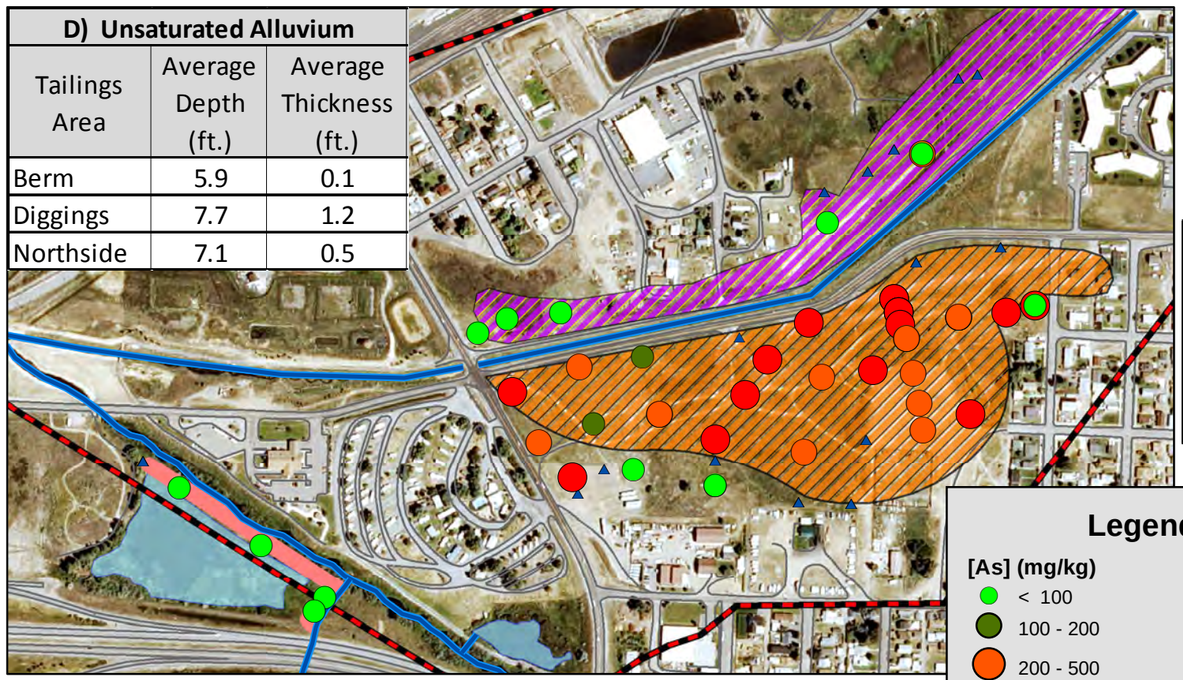
C) Organic Silt		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3

D) Unsaturated Alluvium		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5





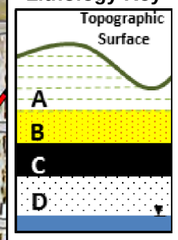




Arsenic
33
As
74.922

ARSENIC

Lithology Key



Legend

[As] (mg/kg)

- < 100
- 100 - 200
- 200 - 500
- 500 - 1,000
- > 1,000
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 6 . Arsenic concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic silt (C), unsaturated alluvium (D)

Failure Criteria = 200 mg/kg

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Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\ArcMap\Report\Fig. 6
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 Montana State Plane Feet

N W E S

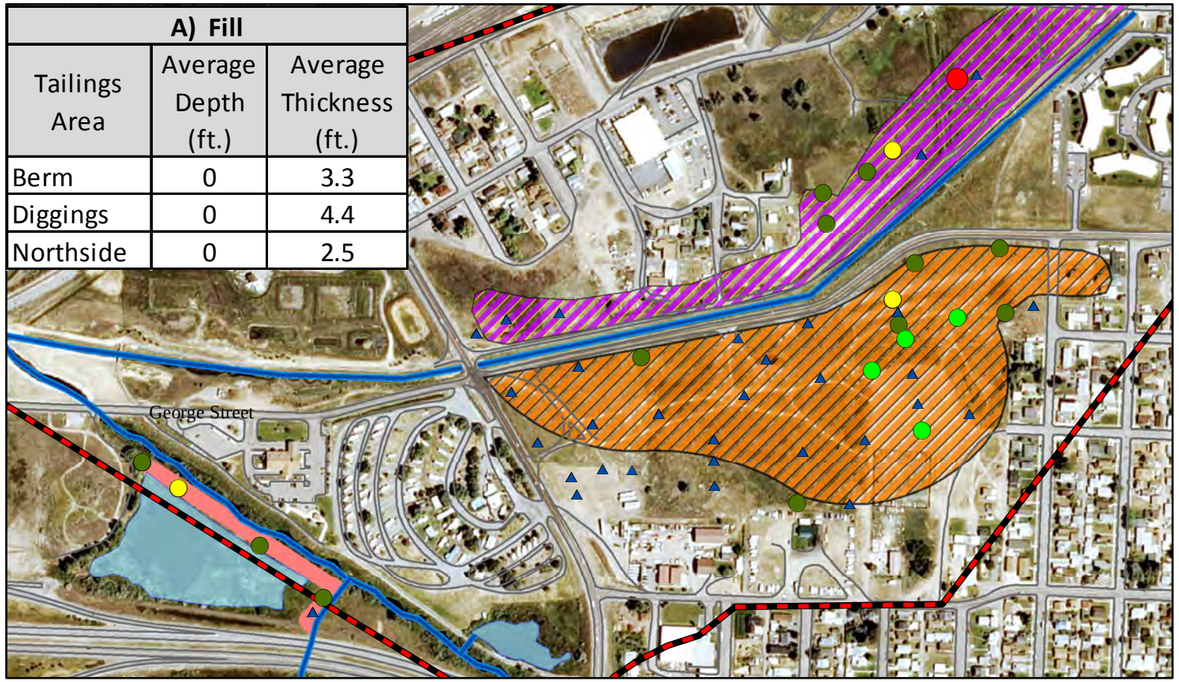
0 250 500 1,000 1,500 2,000 Feet

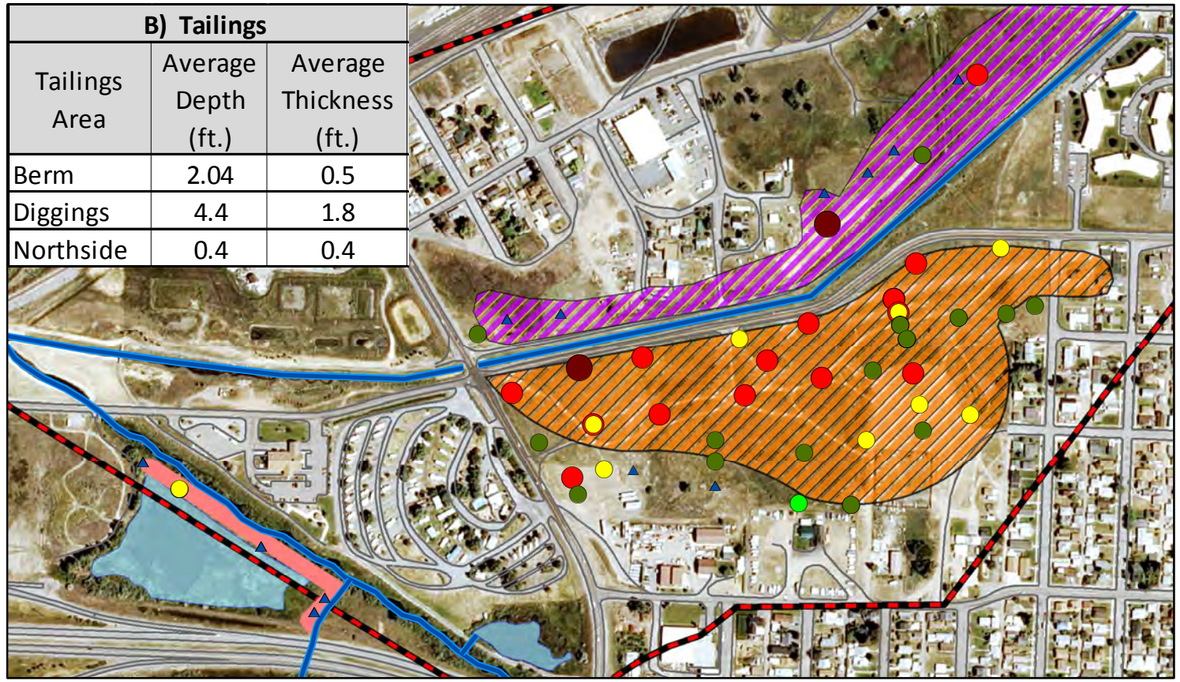
A) Fill		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5

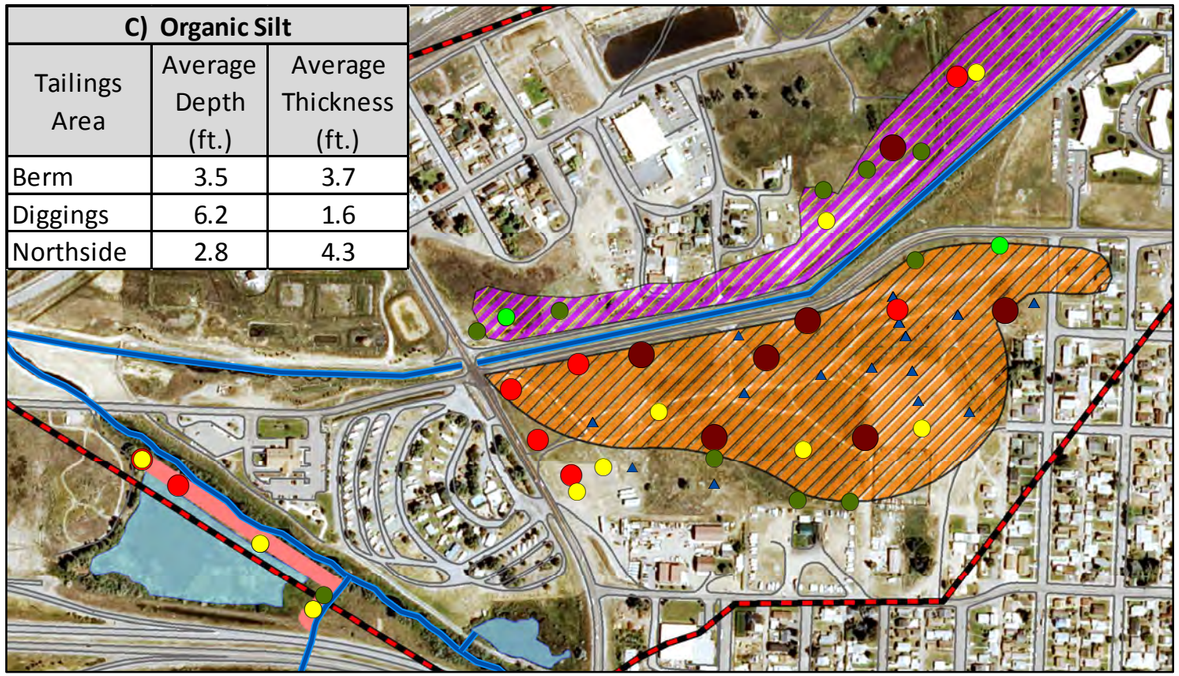
B) Tailings		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4

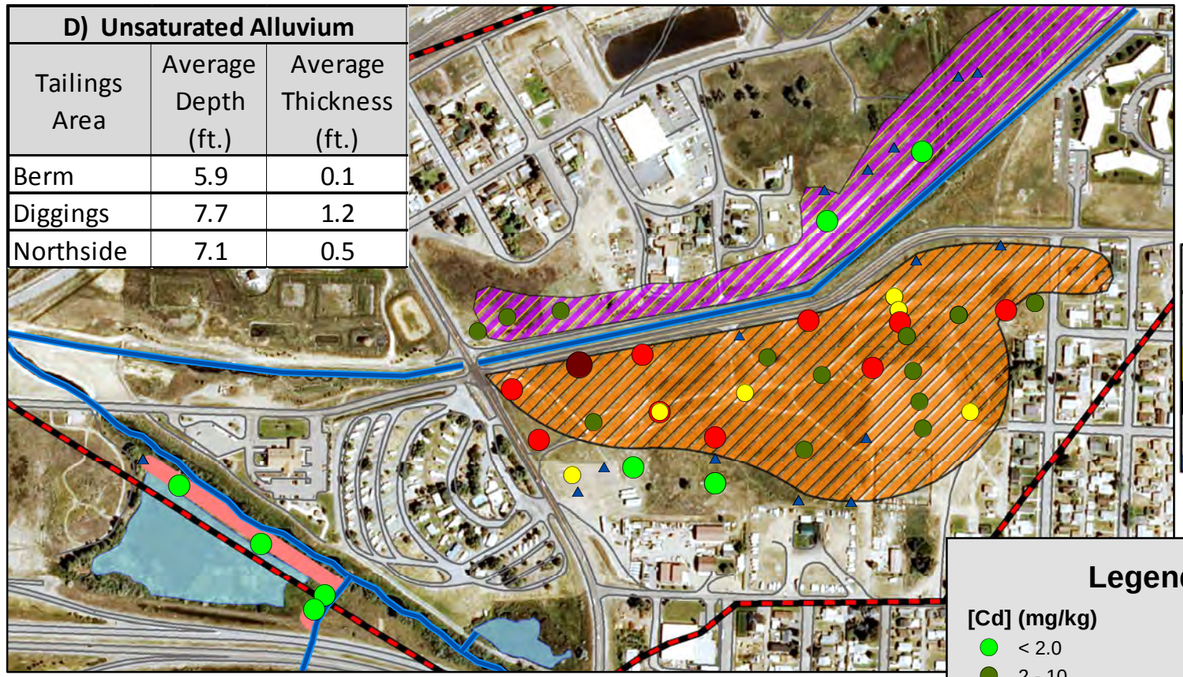
C) Organic Silt		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3

D) Unsaturated Alluvium		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5



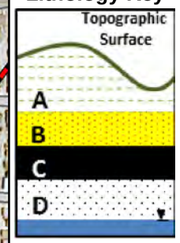






CADMIUM

Lithology Key



Legend

[Cd] (mg/kg)

- < 2.0
- 2 - 10
- 10 - 20
- 20 - 40
- > 40
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 7. Cadmium concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic Silt (C), unsaturated alluvium (D)

Failure Criteria = 20 mg/kg

N W E S

0 250 500 1,000 1,500 2,000 Feet

MBMG
Montana Bureau of Mines and Geology

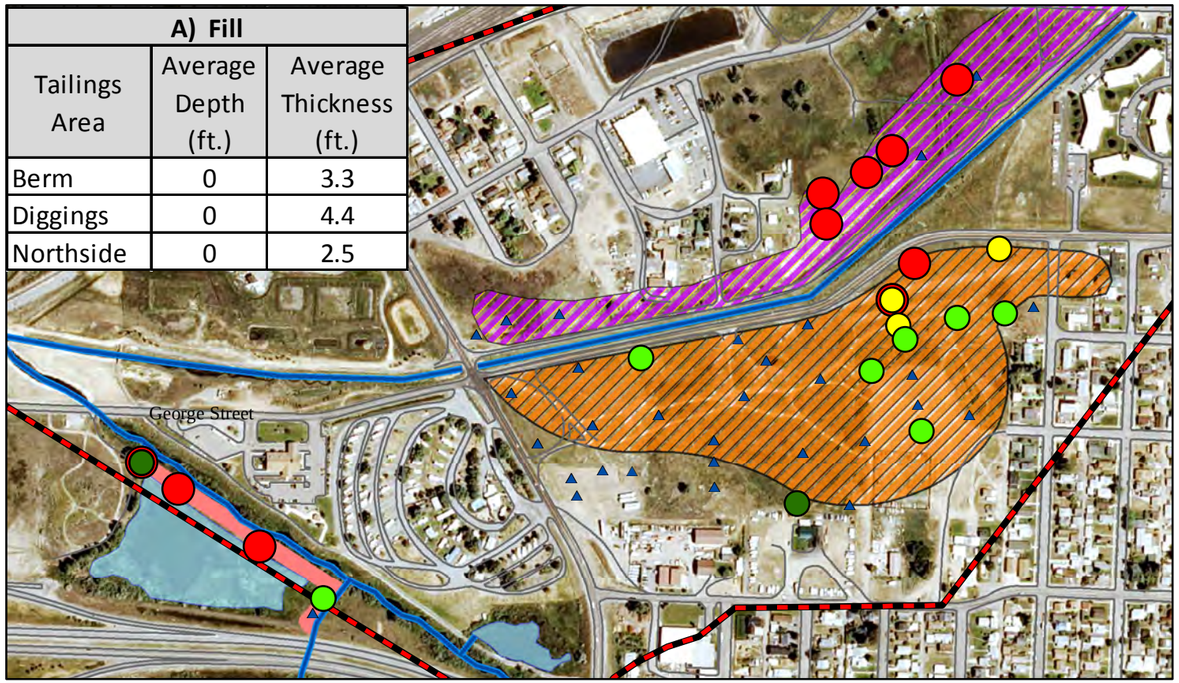
Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\ArcMap\Report\Fig. 7
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 Montana State Plane Feet

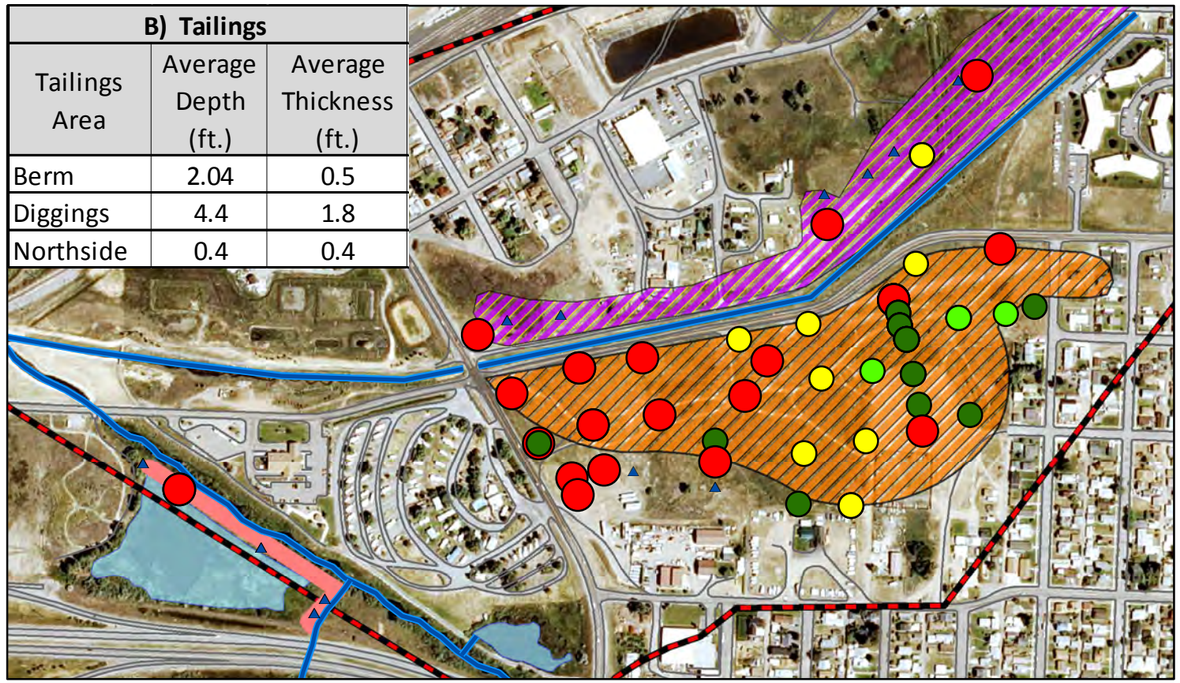
A) Fill		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5

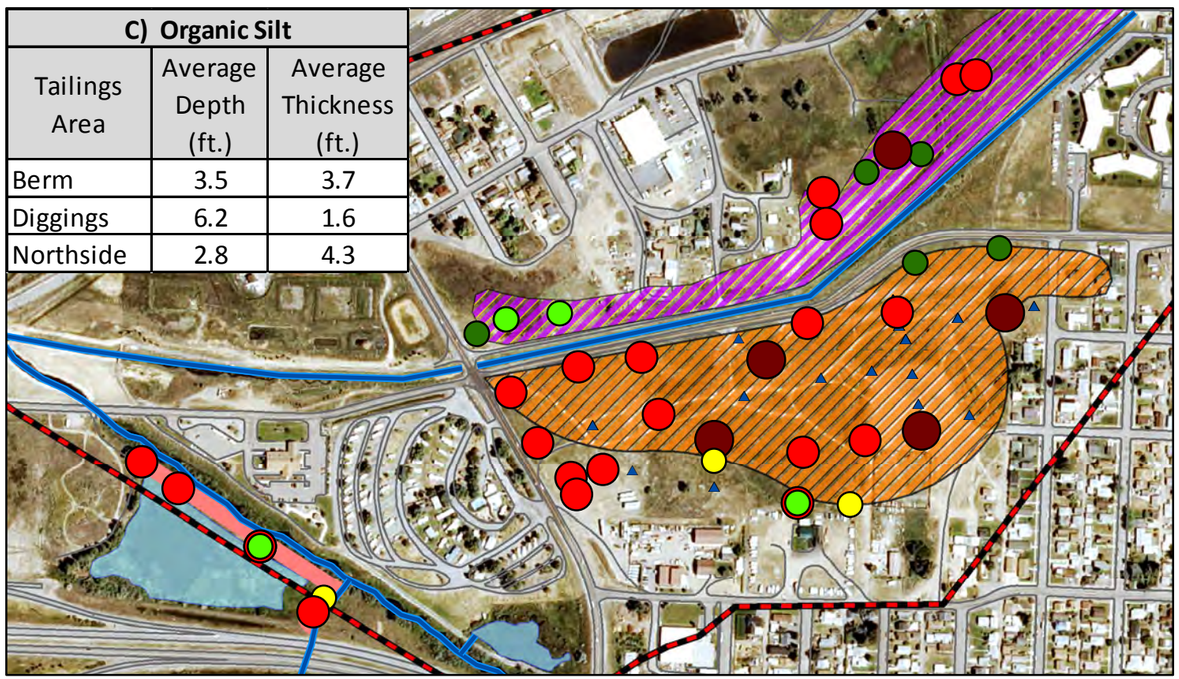
B) Tailings		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4

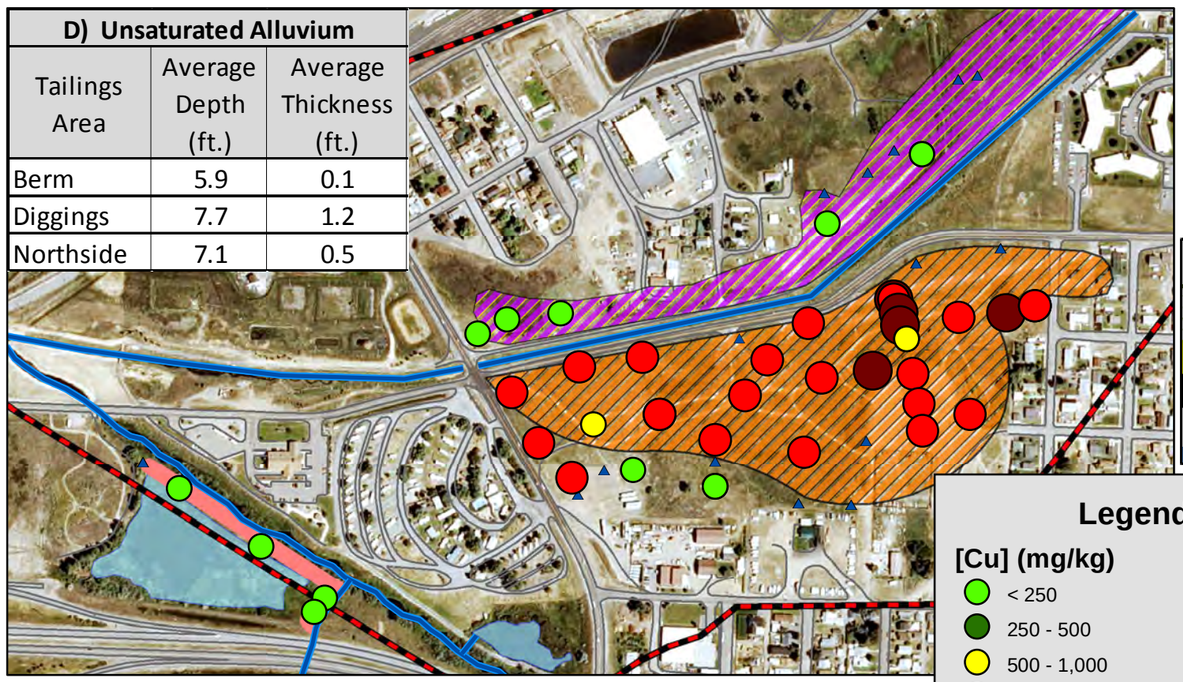
C) Organic Silt		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3

D) Unsaturated Alluvium		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5





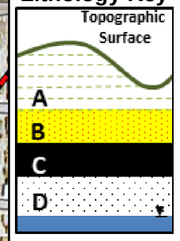




Copper
29
Cu
63.546

COPPER

Lithology Key



Legend

[Cu] (mg/kg)

- < 250
- 250 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 8. Copper concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic Silt (C), unsaturated alluvium (D)

Failure Criteria = 1,000 mg/kg

0 250 500 1,000 1,500 2,000 Feet

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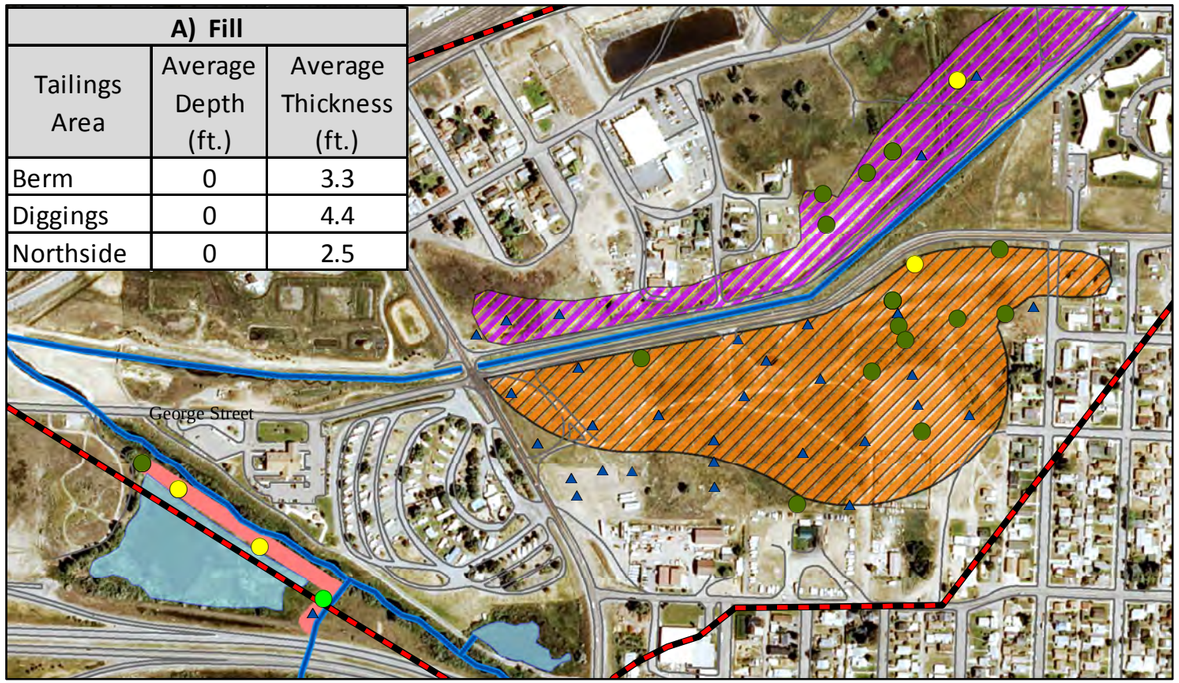
Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\ArcMap\Report\Fig. 8
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 Montana State Plane Feet

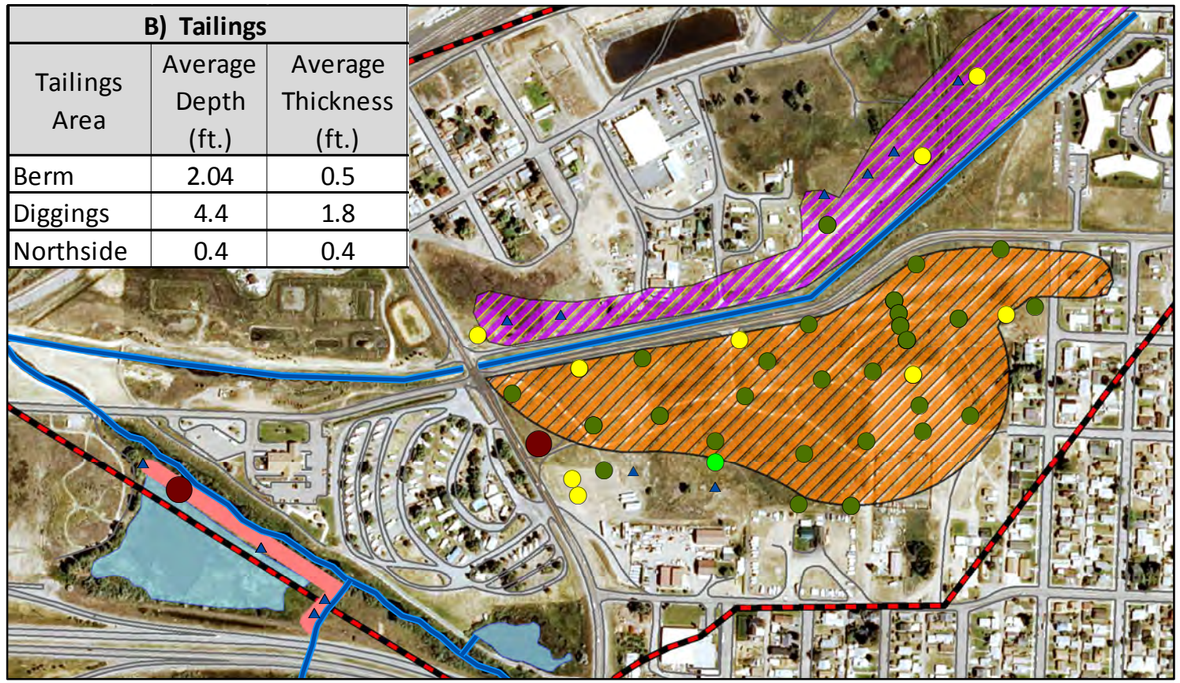
A) Fill		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5

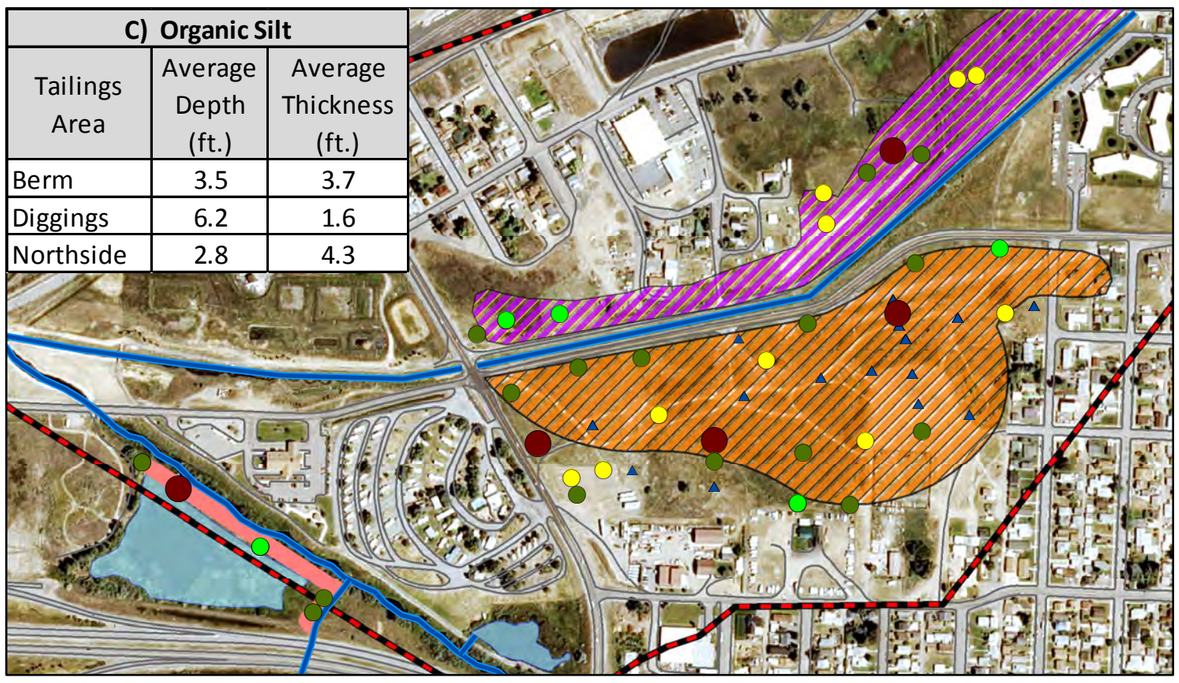
B) Tailings		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4

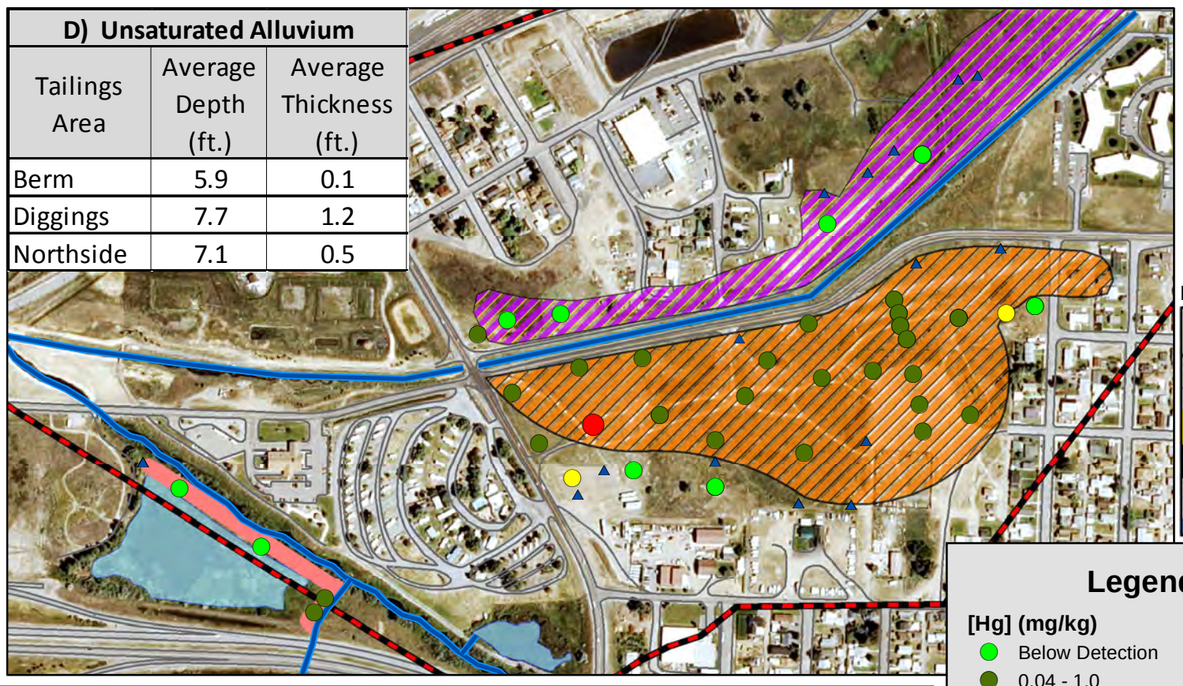
C) Organic Silt		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3

D) Unsaturated Alluvium		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5



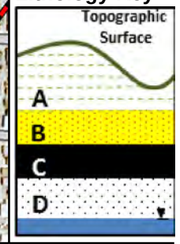






MERCURY

Lithology Key



Legend

[Hg] (mg/kg)

- Below Detection
- 0.04 - 1.0
- 1.0 - 10
- 10 - 20
- > 20
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 9. Mercury concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic silt (C), unsaturated alluvium (D)

Failure Criterial = 10 mg/kg

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Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\Report\Fig. 9
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 Montana State Plane Feet

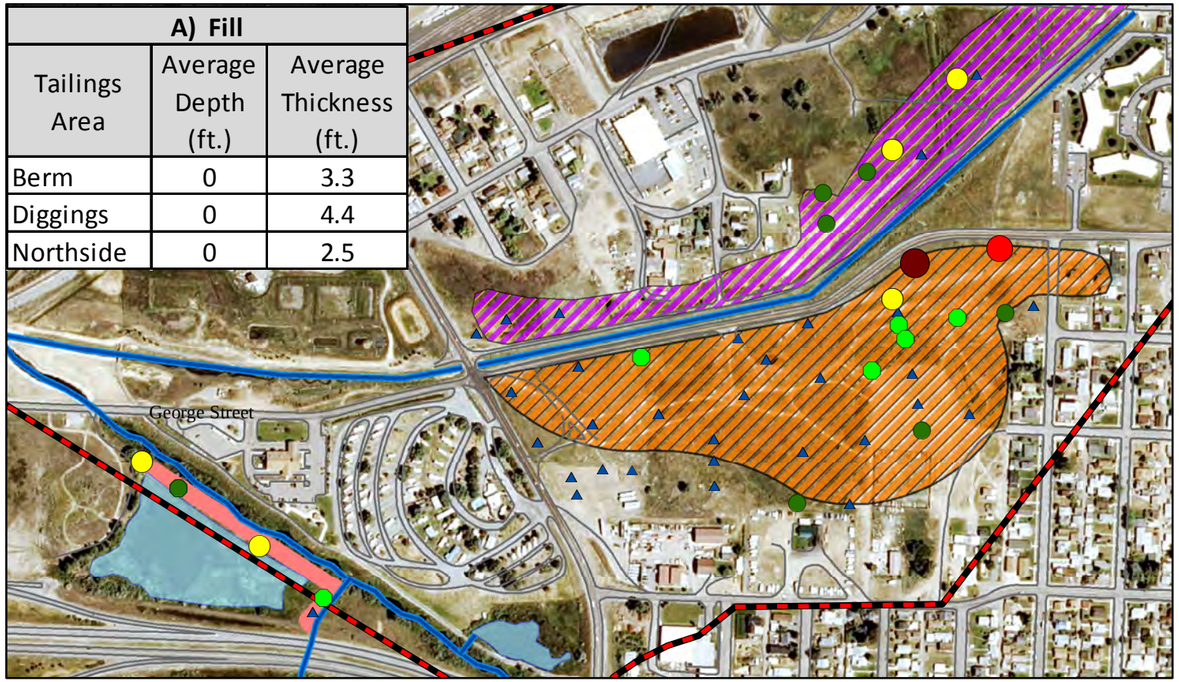
0 250 500 1,000 1,500 2,000 Feet

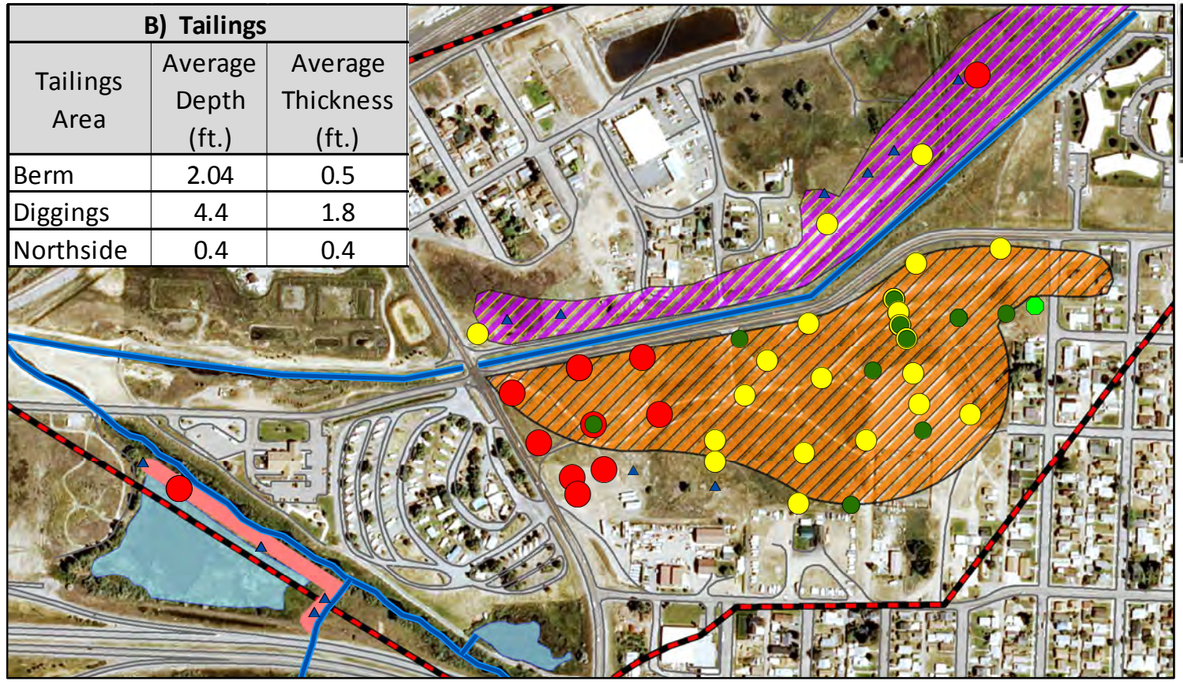
A) Fill		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5

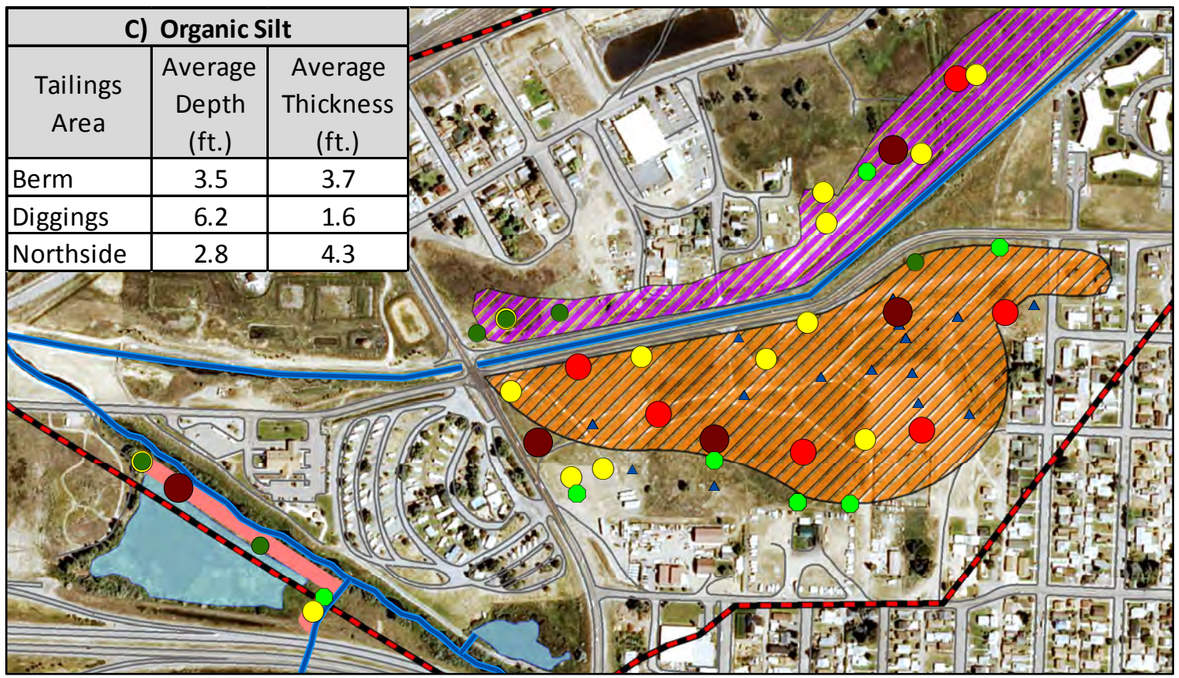
B) Tailings		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4

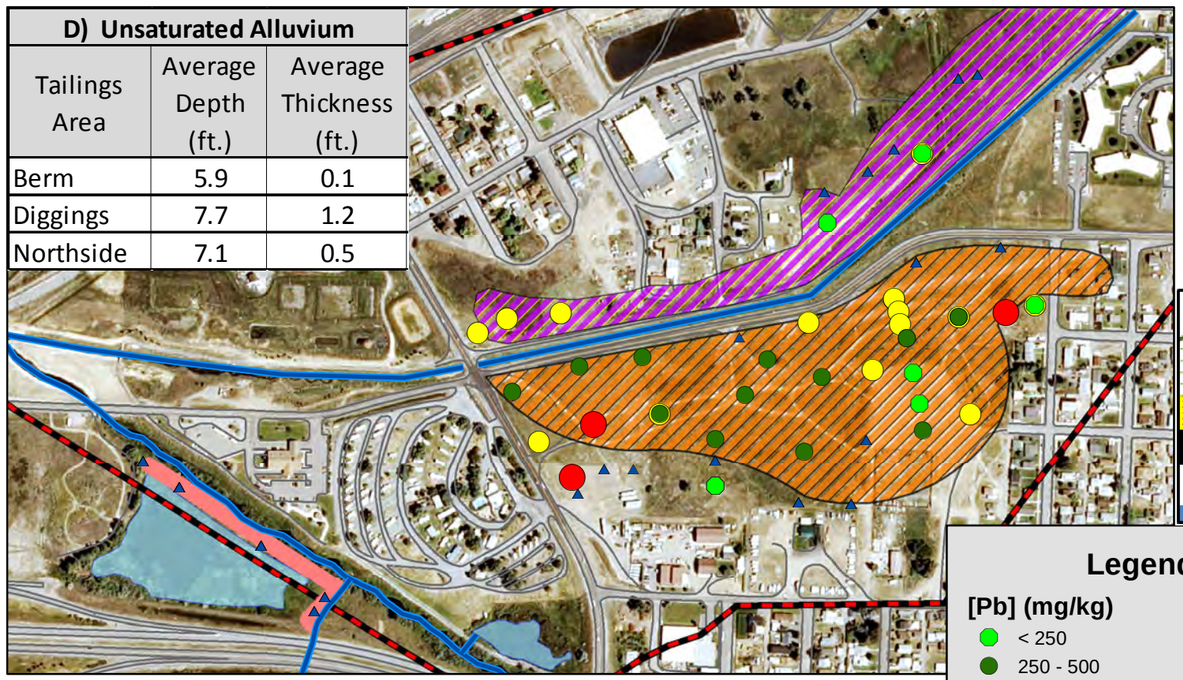
C) Organic Silt		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3

D) Unsaturated Alluvium		
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5





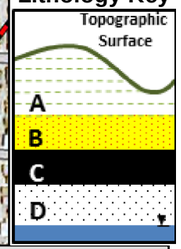




Lead
82
Pb
207.2

LEAD

Lithology Key



Legend

[Pb] (mg/kg)

- < 250
- 250 - 500
- 500 - 1,000
- 1,000 - 2,300
- > 2,300
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 10. Lead concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic silt (C), unsaturated alluvium (D)

Failure Criteria = 1,000 mg/kg

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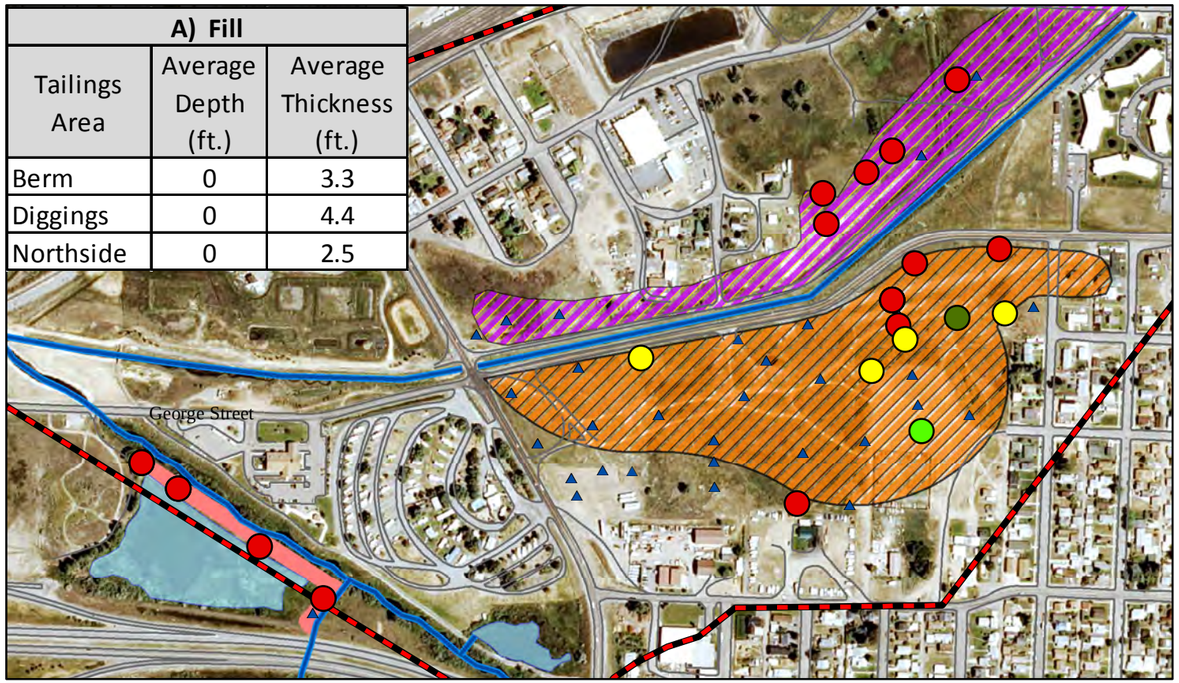
Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\Report\Figure 10
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 Montana State Plane Meters

0 250 500 1,000 1,500 2,000 Feet

N W E S

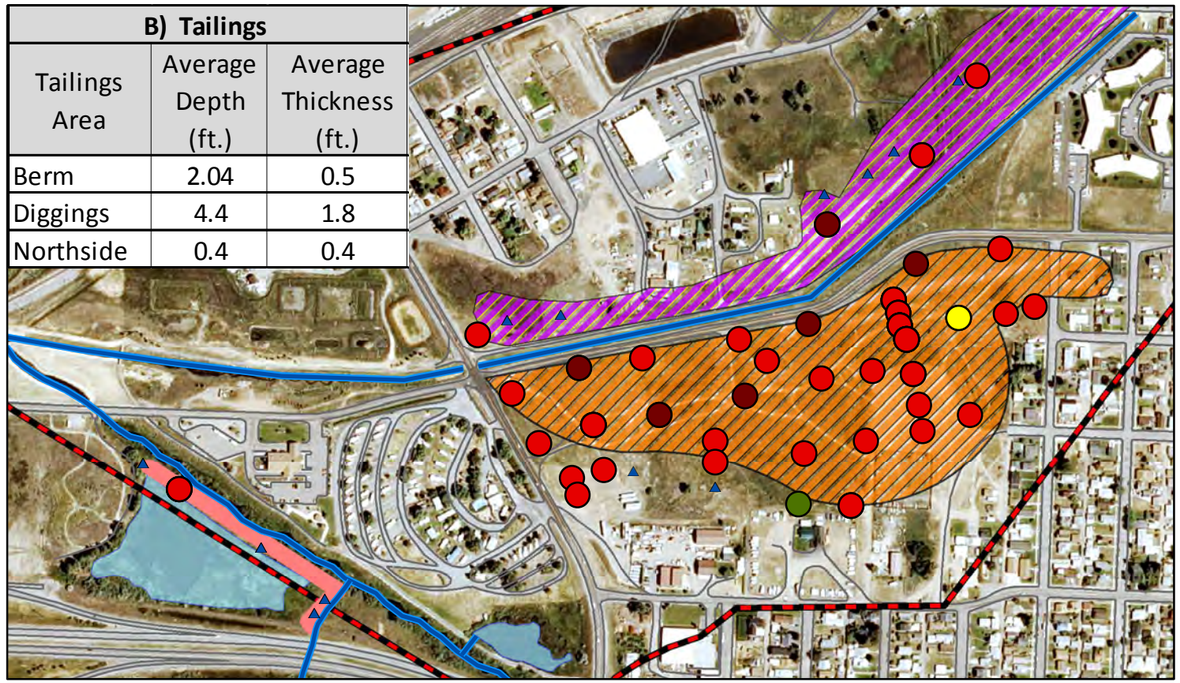
A) Fill

Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	0	3.3
Diggings	0	4.4
Northside	0	2.5



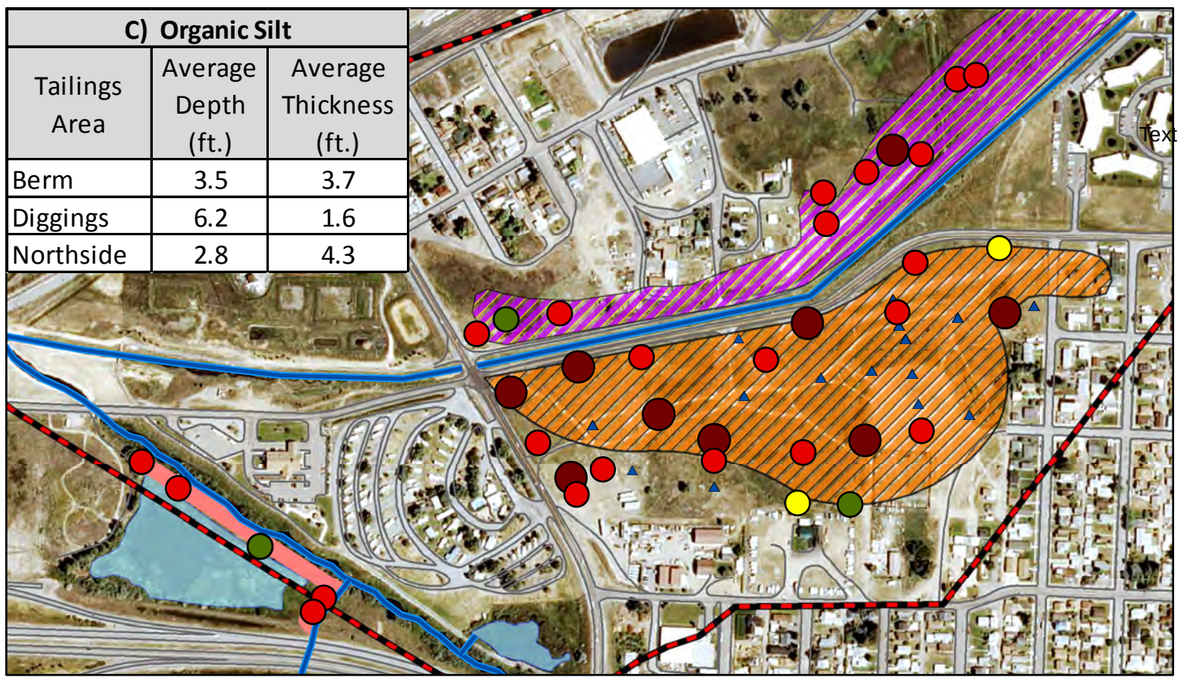
B) Tailings

Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	2.04	0.5
Diggings	4.4	1.8
Northside	0.4	0.4



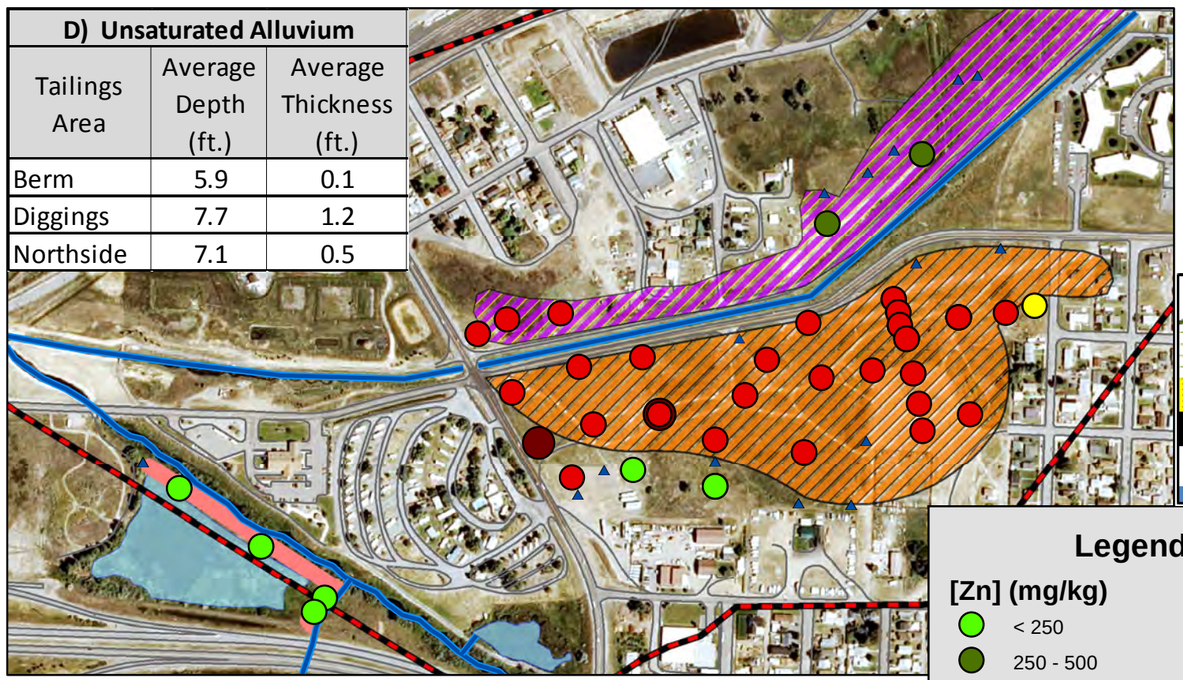
C) Organic Silt

Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	3.5	3.7
Diggings	6.2	1.6
Northside	2.8	4.3



D) Unsaturated Alluvium

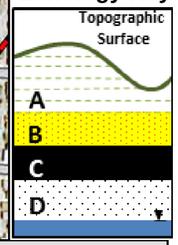
Tailings Area	Average Depth (ft.)	Average Thickness (ft.)
Berm	5.9	0.1
Diggings	7.7	1.2
Northside	7.1	0.5



Zinc
30
Zn
65.38

ZINC

Lithology Key



Legend

[Zn] (mg/kg)

- < 250
- 250 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Lithologic Not Sampled
- Butte Area One Boundary (MBMG, 2010)
- BTC Berm
- Diggings East Tailings Boundary (EPA, 2004)
- Northside Tailings Boundary (EPA, 2004)

Figure 11. Zinc concentrations in sediments observed above groundwater table
Lithologic units: fill (A), tailings (B), organic silt (C), unsaturated alluvium (D)

Criteria Failure = 1,000 mg/kg

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Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\Report\Figure 11
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 HARN Montana State Plane Meters

0 250 500 1,000 1,500 2,000 Feet

N W E S

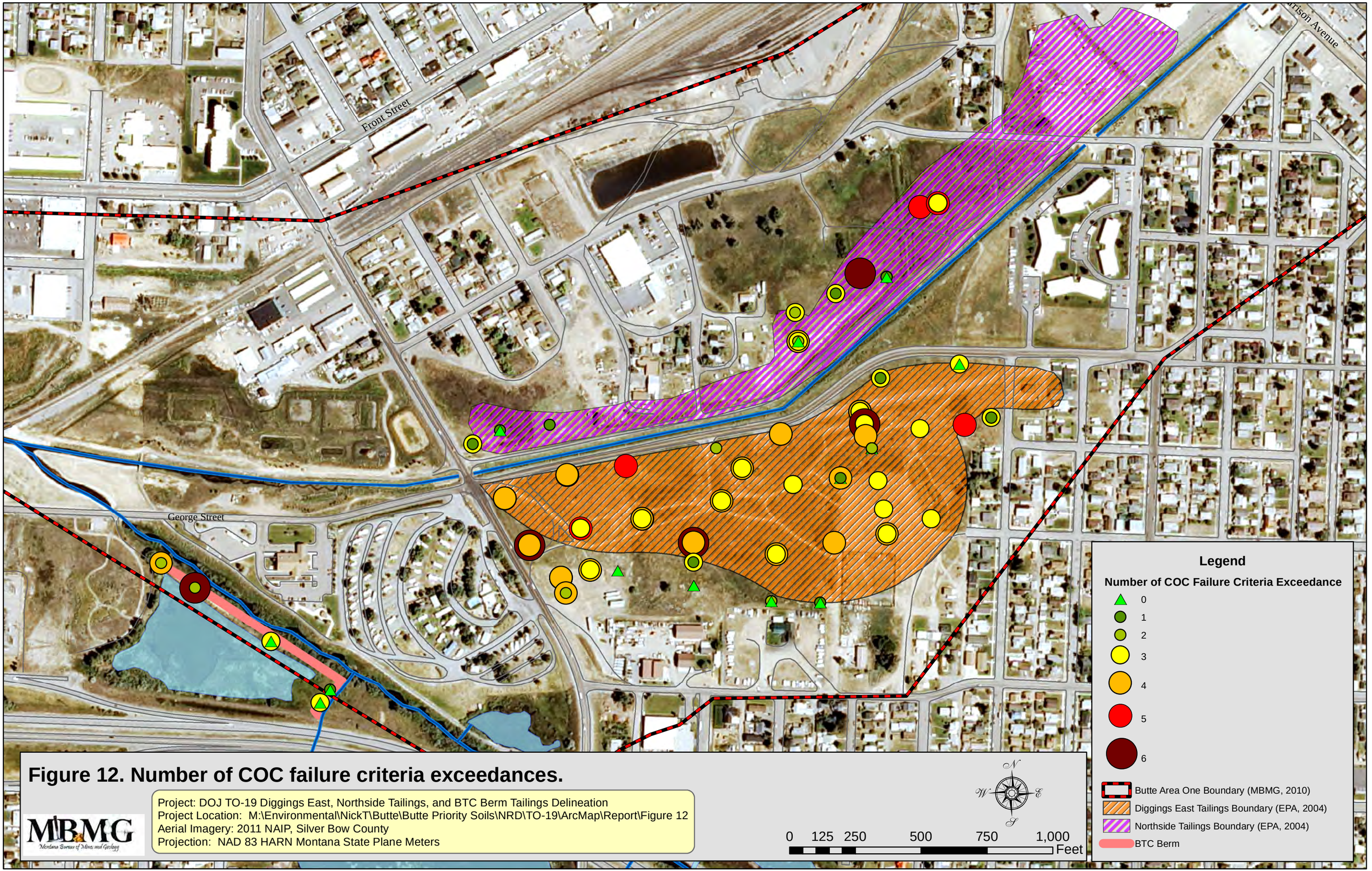

Figure 12. Number of COC failure criteria exceedances.

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Project: DOJ TO-19 Diggings East, Northside Tailings, and BTC Berm Tailings Delineation
Project Location: M:\Environmental\NickT\Butte\Butte Priority Soils\NRD\TO-19\ArcMap\Report\Figure 12
Aerial Imagery: 2011 NAIP, Silver Bow County
Projection: NAD 83 HARN Montana State Plane Meters

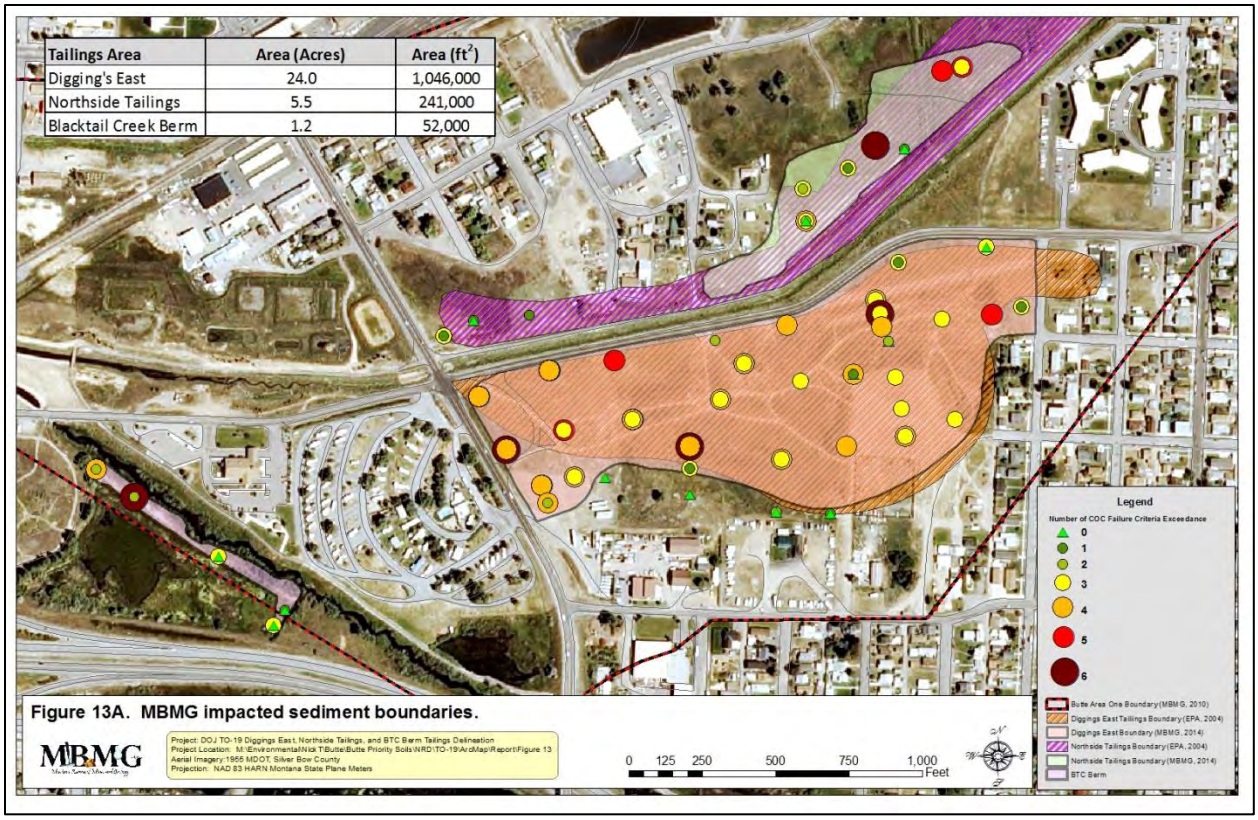


Figure 13A. MBMG impacted sediment boundaries.

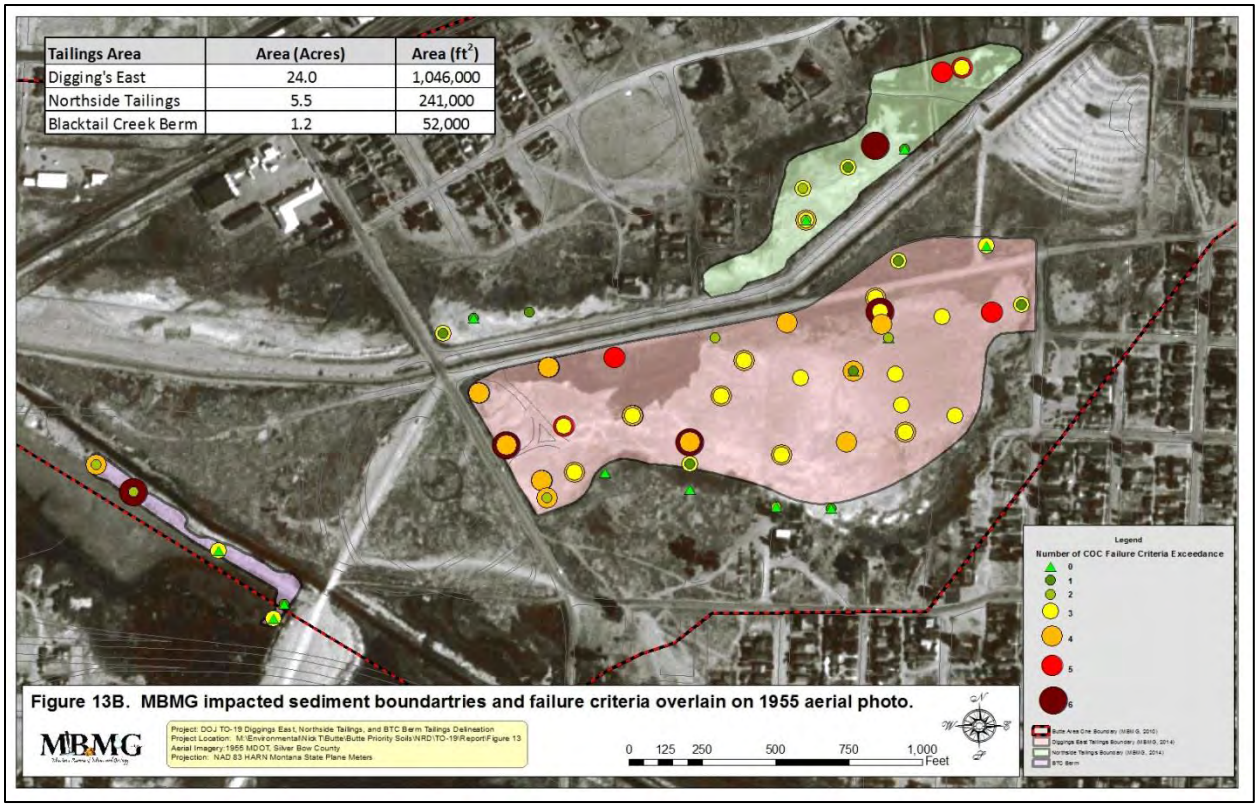
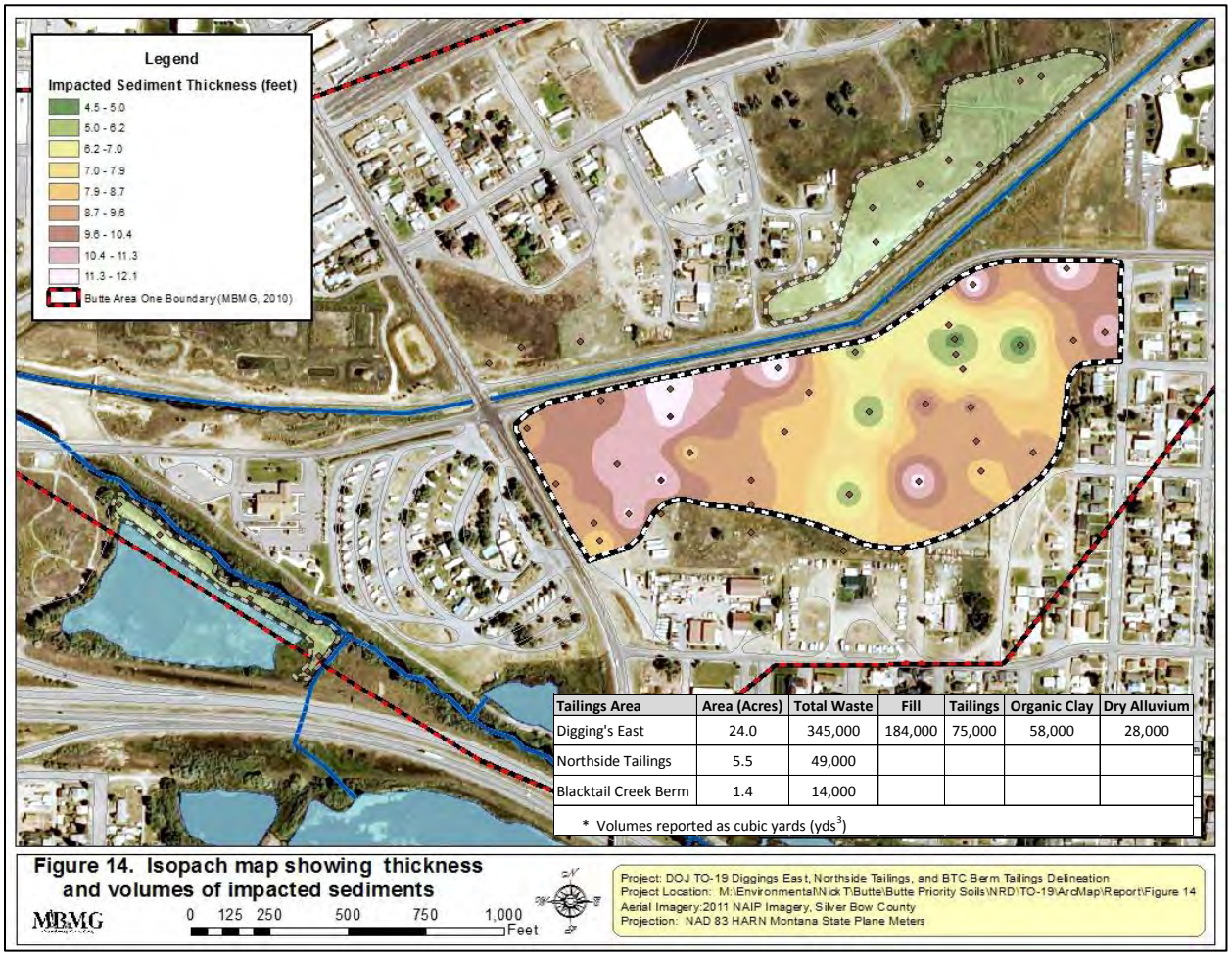


Figure 13B. MBMG impacted sediment boundartries and failure criteria overlain on 1955 aerial photo.

3.3 Volume Estimates and Thicknesses

Based on lithology, concentration of COCs, and COC failure criteria established in the SAP, data in each waste area show impacted sediment from the surface down to the water table. Impacted sediments encountered in the Northside Tailings and BTC Berm areas had thicknesses ranging between 5.0-6.0 feet, while impacted sediments in the Diggings East were between 4.5-12.1 feet thick (fig. 13). Volume calculations of total wastes for the BTC Berm, Diggings East, and Northside areas are provided in tabular form in figure 13. Because the volume of fill material comprised a much larger percentage of the total waste in the Diggings East, volumes of each lithology unit were calculated for that waste area. In total, 408,000 cubic yards of impacted sediment were calculated. Nearly half of the total waste volume (184,000 cubic yards.) is estimated to be fill material that overlie the Diggings East Tailings (topsoil, sand, demolition debris, and landfill material).



Tailings Area	Area (Acres)	Total Waste	Fill	Tailings	Organic Clay	Dry Alluvium
Digging's East	24.0	345,000	184,000	75,000	58,000	28,000
Northside Tailings	5.5	49,000				
Blacktail Creek Berm	1.4	14,000				

* Volumes reported as cubic yards (yds^3)

Figure 14. Isopach map showing thickness and volumes of impacted sediments

Figure 13. Isopach map showing thicknesses of impacted sediments in the BTC Berm, Diggings East, and Northside Tailings areas. Volumes (cubic yards) of wastes are given in tabular form.

3.3.1 Estimate of Mass of Cu and Zn within the Unsaturated Zones of the Diggings East Tailings, Northside Tailings, and BTC Berm Areas

Average Cu and Zn concentrations (section 3.2; table 2), volume estimates (section 3.4; figure 14), and assumed bulk densities for tailings (2,659 kg/m^3), organic silt (2,798 kg/m^3), and dry alluvial sand (2,655 kg/m^3) were used to calculate the mass of Cu and Zn in the Diggings East Tailings areas (table 4). Additionally, average Cu and Zn concentrations (section 3.2; tables 1 and 3), average bulk densities, and average volumes (section 3.4; figure 14) were used to calculate the mass of Cu and Zn remaining above the water table in the Northside Tailings and BTC Berm areas. Roughly 3 million pounds of Cu and 7 million pounds of Zn are estimated to remain in the three source areas in the unsaturated zone (table 4).

Table 4. Mass of Cu and Zn remaining in the unsaturated zone of primary source areas

Waste Area	Diggings East		Northside Tailings		BTC Berm		Total Impacted Sediments	
COC	Cu	Zn	Cu	Zn	Cu	Zn	Cu	Zn
Tailings	288,000	3,035,000						
Organic Silt	1,369,000	2,595,000						
Dry alluvial sand	567,000	440,000						
Total	2,224,000	6,070,000	713,000	889,000	130,000	134,000	3,067,000	7,093,000
* All masses reported in pounds								

3.3.1.1 Mass of Cu and Zn Remaining in the Unsaturated Zone of all Known Source Areas Associated with the Metro Storm Drain Subdrain

The Metro Storm Drain Subdrain, a 10-inch, perforated, french drain system designed to capture and deliver contaminated groundwater to the Butte Treatment Lagoons (BTL) may become the final groundwater remedy for the Upper Silver Bow Creek/Metro Storm Drain area under the Butte Priority Soils Operable Unit. The three known primary groundwater source areas for which the subdrain was designed are the Parrot Tailings, Diggings East Tailings, and Northside Tailings. The mass of Cu and Zn within the unsaturated tailings and impacted sediments of these areas provide an estimate of the load that has yet to leach into groundwater.

The mass of Cu and Zn in the unsaturated zone of the Parrot Tailings were calculated from data (average concentrations and volumes) provided in previous MBMG reports (Tucci, 2010). The amount of Cu and Zn remaining above the water table in the Parrot Tailings were combined with the mass in the Diggings East and Northside Tailings provided in this report. In total, 15.3 million pounds of Cu and 24.5 million pounds of Zn are estimated to remain in the unsaturated zones of the Parrot, Northside, and Diggings East tailings areas. It should be noted that these

estimates are conservative, because the bulk density for sediments used to make this calculation were on the low end.

Leaching experiments, using weakly acidic leachate solution, were performed on Parrot Tailings and organic silt sediment samples by Tucci (2010). This experiment was performed to determine if the tailings and impacted sediments that remained above the water table were still a primary source of contamination to groundwater. The leaching results indicate that the tailings and impacted sediments (organic silt) remaining in the primary source areas have the potential to continue to degrade groundwater.

Copper and zinc loading analysis of groundwater quality from the Metro Storm Drain Subdrain show that the subdrain delivers approximately 20 pounds of Cu and 60 pounds of Zn per day to the Butte Treatment Lagoons (AR, 2013b). Assuming the majority of the Cu and Zn captured by the subdrain is being leached from the wastes left in place and assuming the current leaching rate remains constant, Cu and Zn are likely to continue leaching into the groundwater for thousands of years. If the leaching rate decreases over time (a probable scenario), Cu and Zn are likely to continue leaching into the groundwater for tens of thousands of years.

3.3.2 Thickness of Fill in the Diggings East Tailings

More than half of the waste volume estimated for the Diggings East (53%) was comprised of fill material. Fill consisted of many different rock and sediment types, but the vast majority of fill observed in test pit lithology was demolition debris (bricks, wood, concrete, asphalt, etc.). The thickness of fill throughout the site was variable (fig. 15; 0-7.2 ft.). Isopach maps showing thickness of the fill in the Diggings East (fig. 15) indicate that the areas where fill was the thickest (northeast, southeast, and western portions) correlate to areas where demolition debris was encountered and observed in lithology logs (appendix B). Areas where fill was absent (fig. 15; < 1.1-ft thickness contours) are consistent to areas where tailings were observed at or near the surface.

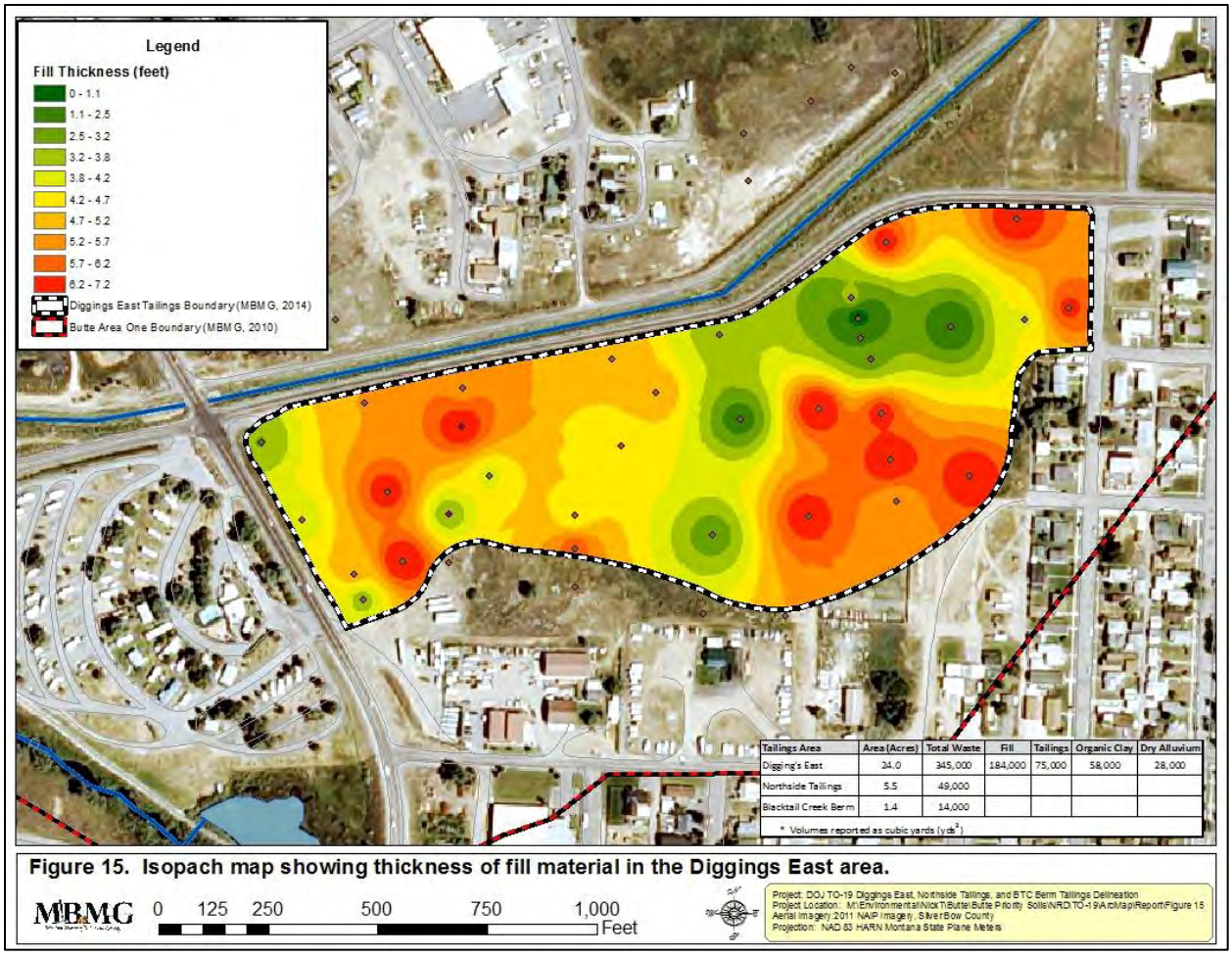


Figure 15. Isopach map showing thickness of fill material in the Diggings East area.

Figure 14. Isopach map showing thickness of fill material in the Diggings East area.

3.4 Total Petroleum Hydrocarbon Analysis

Although organic contamination is not listed as a COC for BPSOU (EPA, 2004), MBMG tested 184 samples for petroleum contamination at the request of the Environmental Protection Agency. Samples from the Diggings East, Northside and BTC Berm areas were tested for volatile petroleum contamination using a calibrated Photovac Model 2020 Pro photo-ionization (PID) meter (appendix A). All sediment sample (n = 184) PID readings reported concentrations below detection levels (table 5); all PID meter readings are given in appendix E.

Table 5. PID Meter Results

Lithologic Unit	Number of samples	PID Reading (ppm)	Comment
Fill	28	0	Below Detection
Tailings	65	0	Below Detection
Organic Silt	43	0	Below Detection
Alluvium	47	0	Below Detection
Total	184	0	Below Detection

*Factory reported instrument detection limit = 0.5 ppm

Because petroleum screening criteria efforts resulted in photo-ionizable chemical concentrations below detection (table 5), ten sediment samples were randomly selected and analyzed for total petroleum hydrocarbon analysis (TPH, EPA method E418.1M). The TPH results are given in table 6. Clean topsoil (table 6, highlighted in yellow) from an area with good vegetative cover was used as a background sample (TP-2W), and reported a TPH concentration of 110 mg/L. All sediment concentrations were less than 1,000 mg/L while fifty percent of the samples had concentrations below detection (ND).

Table 6. Total petroleum hydrocarbon (TPH) analysis in sediment samples.

Total Petroleum Hydrocarbon (Method E418.1M)			
Site	**Depth**	**Lithology**	**Result (mg/kg)**
TP-14W	9.4	Gray alluvial sand	ND
TP-2E	2	Tailings	ND
TP-2W	0 - 2	Clean Top Soil	110
TP-2W	7.2-9.4	Tailings	ND
TP-3E	5.0-6.8	Tailings	230
TP-8W	5.9-8.0	Organic Silt	25
TP-NS-02E	2.5-5.0	Organic Silt	ND
Trench 1	5	Tailings	ND
Trench 1	3.5	Fill: sand, brick, wood	820
Trench 3	4	Tailings	13
* ND = non-detect		*RL = 10 mg/L	

TPH is defined as the measurable amount of petroleum-based hydrocarbon in an environmental media, but it does not provide information on the composition. EPA Method 418.1 is not specific to hydrocarbons and does not indicate petroleum contamination (e.g. humic acid, a non-petroleum hydrocarbon, is detected by this method), but the method is often used as an additional screening tool to determine the potential for petroleum hydrocarbons.

4.0 ACKNOWLEDGEMENTS

Funding for this work was provided by the Montana Department of Justice, Natural Resource Damage Program. The author wishes to extend gratitude to the members of the BNRC, for unanimously approving the funding for this project. Hopefully the data provided in this report was able to meet their expectations. The author wishes to thank the various landowners: Atlantic Richfield Company, Butte-Silver Bow County, and the other private land owners for giving MBMG and its contractor access to private property. A significant amount of aid was given to the author during field activities by Will Goldberg of Pioneer Technical Services, and the author wishes to thank him for his expertise.

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APPENDIX A SAMPLING AND ANALYSIS PLAN

BUTTE AREA ONE RESTORATION SITE

Draft Final
Tailings/Impacted Sediment Delineation of the Diggings East and Northside Tailing Areas

2013 Sampling and Analysis Plan

Prepared by:

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Prepared for:

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Montana Department of Justice
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28-March-2013

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1.0 INTRODUCTION

The State of Montana is proceeding with its evaluation and cost estimation for removing historic mine waste/smelter tailings that have been left in place in the Butte Area One Restoration Corridor (fig 1.). Specifically, the areas of concern are the smelter tailings and impacted sediments located within the Diggings East and Northside Tailings areas (fig. 1). The Montana Bureau of Mines and Geology (MBMG) was contracted by the Natural Resources Damages Program (NRDP) for the specific task of characterizing the wastes in these areas. The data collected will be used by the State to evaluate the cost of removal, and may be used to prepare designs for removal actions.

The current sampling and analysis plan (SAP) has been prepared to document procedures used to characterize tailings and impacted sediments that directly underlie the primary sources within the Diggings East and Northside Tailings areas (fig. 1). The Blacktail Creek (BTC) berm will be the third area of concern that will be evaluated (fig. 2). The sediments targeted for analysis are the historic smelter tailings (primary source), as well as potential impacted sediments (possible secondary sources) which underlie the primary sources. Specifically, impacted sediment targeted for analysis is the soil horizon known as the organic silt layer, which has been shown to contain elevated concentrations of contaminants of concern (COCs) in other source areas (Tucci, 2010).

All procedures follow and are modified from those outlined in the methods and procedures identified in *Clark Fork River Superfund Site Investigation (CFRSSI) Standard Operating Procedures (SOPs) (Arco, 1992)*. Portions of this SAP are based on procedures developed by contractors of the Montana Department of Environmental Quality (DEQ) for the Streamside Tailings Operable Unit of the Silver Bow Creek/ Butte Area NPL Site (Pioneer Technical Service, 2011). Modifications are made to these procedures by MBMG to address the site-specific conditions in Butte Area One. Data collection and field activities conducted during this investigation are being conducted under the guidelines established in the Remedial Action Investigation Sampling Analysis Plan (SAP) for Subarea 4 Reach of the Stream Side Tailings Operable Unit (Pioneer, 2011). Data screening and evaluation are being conducted according to the screening criteria established for the DEQ (Pioneer, 2011). Minor modification in this SAP are added to include both x-ray florescence (XRF) field screening for contaminants of concern (COCs), laboratory analysis for total digested sediment for metal's analysis, and a Photo-ionization Detector (PID) for field screening of total petroleum hydrocarbons concentrations (TPH).

1.2 Purpose

The work proposed under this investigation concentrates on the areas known as the Diggings East Tailings, Northside Tailings, and the BTC Berm (fig. 2). This SAP's purpose is to define standard-field and laboratory activities necessary to;

- delineate horizontal and vertical extent of tailings within these areas, and delineate a potential excavation boundary,

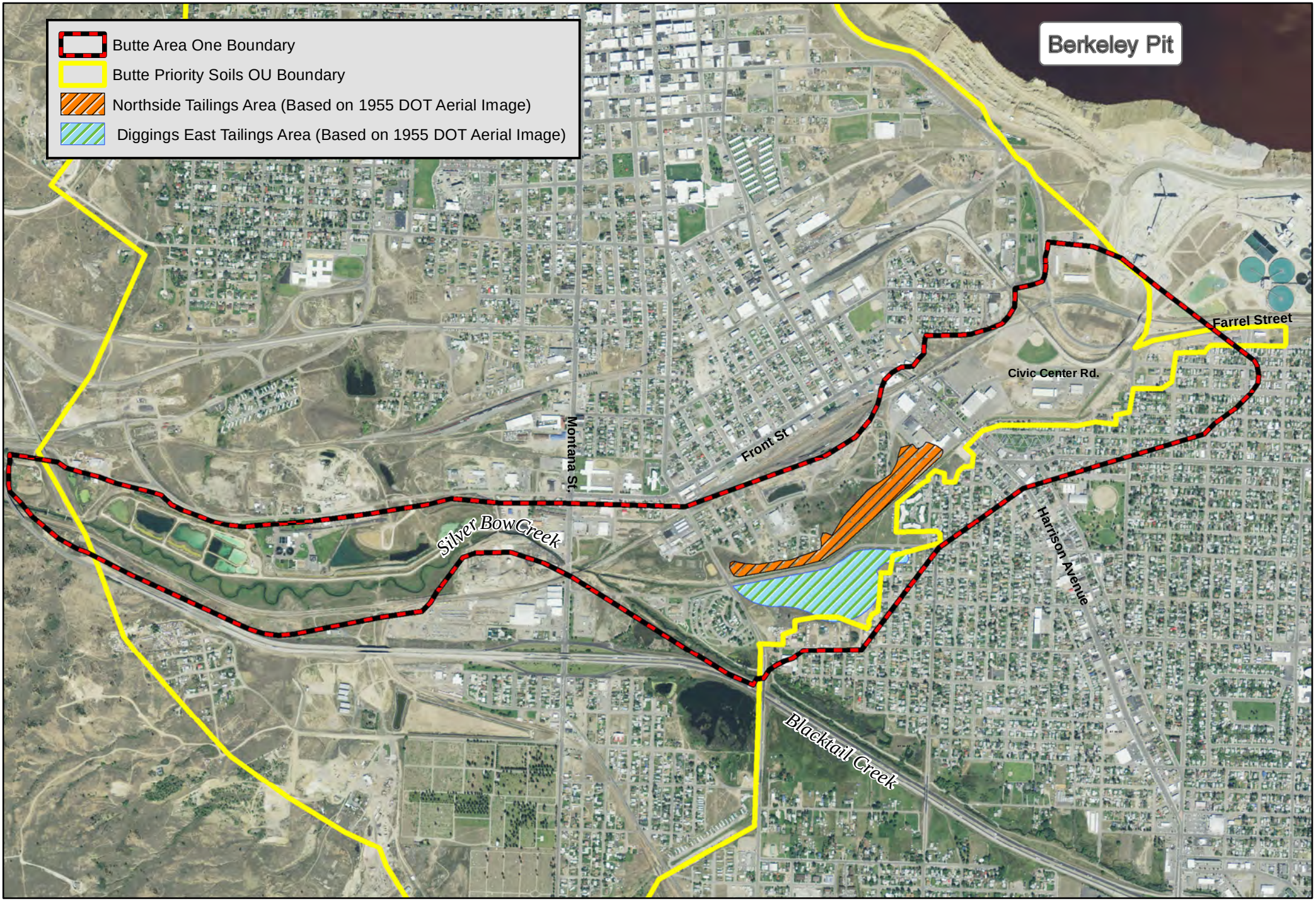

Figure 1. Diggings East and Northside Tailings Areas located within the Butte Area One boundary.

0 0.25 0.5 1 Miles

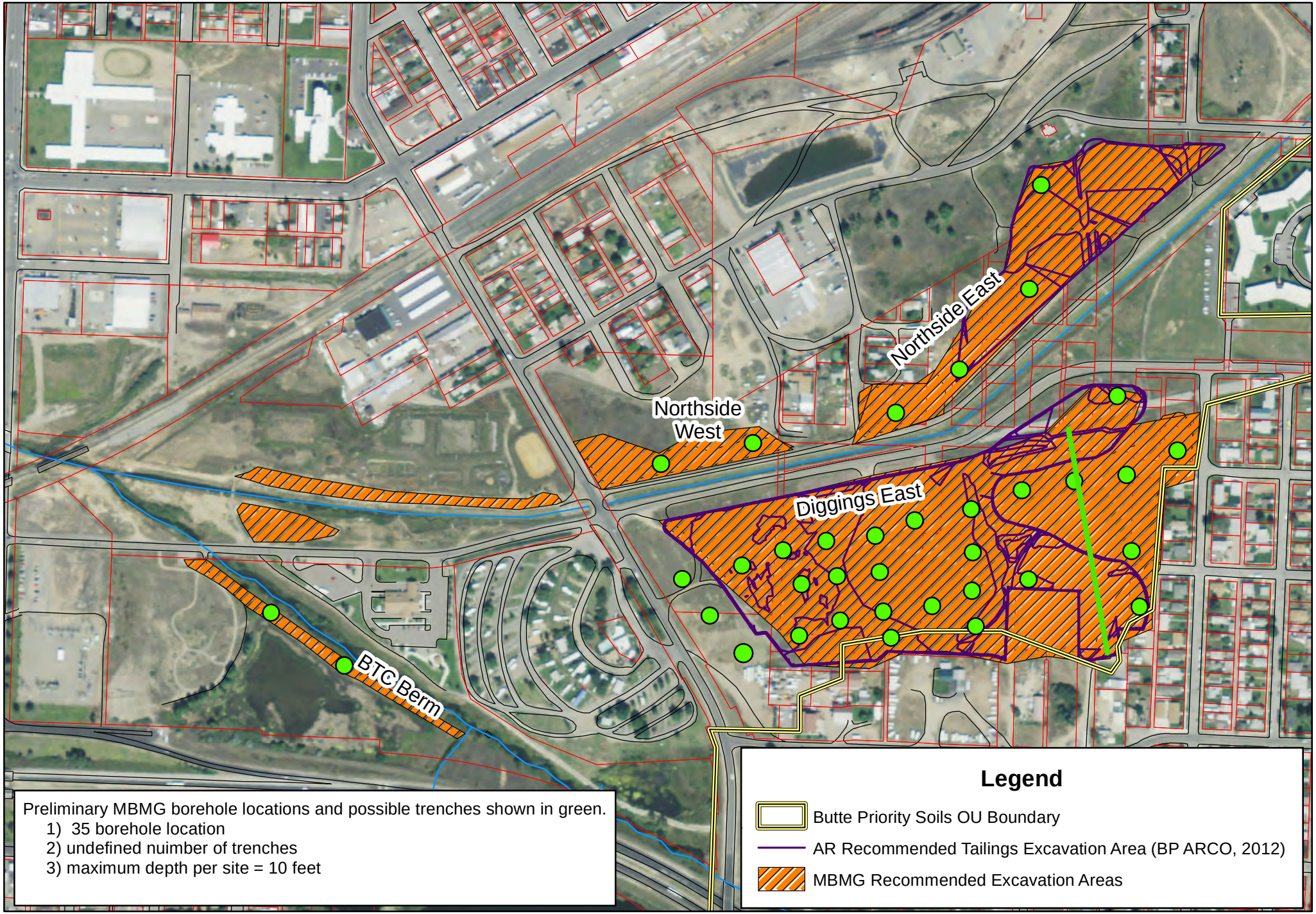

Figure 2. Location map showing potential MBMG bore hole, test-pit, and trenching sites

0 250 500 1,000 1,500 2,000 Feet

- determine whether tailings samples are impacted by petroleum hydrocarbon contamination, and
- evaluate whether the lithologic unit known as the organic silt layer should be characterized as an impacted sediment to be included under potential removal action.

This SAP utilizes tailings/impacted sediment investigation procedures developed previously by Maxim Technologies (Maxim, 2002) which were modified by Pioneer Technical Services (Pioneer, 2012) for the Montana Department of Environmental Quality (DEQ) during the remedial investigations under the SSTOU.

1.2 General Scope of Work

The current SAP presents procedures for sediment sampling and analysis, excavating and backfilling of trenches, test pits, drilling of boreholes, and surveying locations (including both groundwater and lithologic elevation). The following objectives will be accomplished during the investigation.

1) Identify the aerial extent, depth to, thickness, and volume of historic smelter tailings based on the visual inspection and lithology of backhoe test pit excavation, trenches, and boreholes.
2) Quantify the concentration of COCs in historic smelter tailings based on analysis and screening with a portable Niton XL3tGOLDD+ Portable XRF metals analyzer, and subsequent laboratory metals analysis.
3) Identify the thickness and volume of impacted sediments such as the lithologic unit known as the organic silt layer, the organic-rich soil horizon that directly underlies the tailings. The organic silt layer, and other lithologic units (clay, silts, sands) encountered during this investigation will be classified as an impacted sediment based on criteria and action levels that were previously established (Maxim, 2002; Pioneer, 2012) and are presented in this SAP.
4) Identify the depth to groundwater; determine if dewatering would be necessary based upon the presences of saturated impacted sediment.
5) Determine if tailings material identified for removal under this investigation contains petroleum hydrocarbon contamination.

2.0 LOCATION OF BOREHOLES, TEST PITS AND TRENCHES, SITE ACCESS AND SEQUENCING OF WORK

The locations of the proposed test pits/boreholes and trench are shown on Figure 2. The locations and the type of sampling method (test pit, trench, or borehole) are subject to change based on field conditions, site access considerations, general feasibility, and/or third party cooperation. The installation sequencing of individual sampling locations will be based on the availability of access agreements with property owners. Sequencing will generally start with sampling locations where access agreements have been finalized.

3.0 PROCEDURES FOR TEST PIT AND TRENCHING ACTIVITIES

Test pit and trenching activities are necessary due to a long-history of poor recovery of tailings material in core barrels when using conventional drilling techniques. Unfortunately, the poor recovery observed in the lithologic record of the near-surface is due, in most part, to large demolition debris material (concrete slabs) that has been placed above the tailings over the course of time. This debris has made the delineation of near-surface tailings in these areas challenging.

A modified version of the Backhoe Pit/ Trench excavation outlined in SOP-SS-1 of CFRSSI (Arco, 1992) and the SAP outlined in the SSTOU SAP (Pioneer, 2012). Prior to excavation or any disturbance of ground surface, local line utility locating service will be contacted 72 hours in advance and all utility locates will be completed to ensure locations are free from underground utilities and obstructions.

3.1 General Procedures for Test pit and Trenching Activities

The following procedures will be performed at each sampling location where test pit or trenching techniques are used to access the tailings.

1. Locate the clearly marked site that has been deemed free of underground utility and obstruction. Complete a visual inspection of the investigation area to identify potential hazards, waste materials, debris, obstacles, and other items that may affect the scope of work and health and safety.

2. Place the backhoe tractor in a safe position. This will be based on the operator's judgment and site conditions.

3. Begin backhoe excavation. Place excavated materials a sufficient distance (at least three feet) from the excavation so as not to return excavated materials to the pit.

4. Continue excavation of the pit to the required depth. This total depth of each site shall be based upon the bottom of the organic silt layer or the top of the groundwater table, whichever comes first (water table ~9 – 10 feet below ground surface). No person shall be allowed to enter pits or trenches.

5. Sampling personnel will not be permitted to enter the pit at any time. All sampling in pits and trenches will be done from the surface, where sampling personnel will be equipped with the appropriate fall-protection.

6. Soil profile descriptions shall be made from a surface along the pit wall. Sampling of sediment samples in pits and trenches will be conducted from the surface using extended-arm sampling equipment and the appropriate fall protection.

7. Collect samples of tailings/impacted sediments (organic silt layer) from test pit excavations and trenches using an extended sampling apparatus that allows sampling from the surface.

Collect all sediment sampling in decontaminated stainless steel or plastic sampling tools and bowls from the appropriate intervals. Transfer bulk sample to properly labeled zip-lock bags and place in sampling coolers for safe transfer to MBMG labs. Ensure enough sample is collected so that a proper archive of each location is maintained.

8. Document approximate depth-to-groundwater if the water-table is encountered.

9. Survey the test pit location and elevation using survey-grade GPS unit.

10. Photograph and log all test pits.

11. Transport sample at the end of each day to MBMG labs. Screen samples using a Niton XL3tGOLDD+ Portable XRF analyzer to quantify the metal's concentrations in tailings/impacted sediments and submit selected samples to the laboratory.

12. Screen samples using Photovac Model 2020Pro portable PID meter for photoionizable chemicals. Send selected samples that contain detectable photoionizable concentrations (as detected using PID meter) to labs for total petroleum hydrocarbon analysis. If analyzed PID samples report concentrations below instrumentation detection limits, then 5 samples will be randomly selected and sent to the lab for TPH analyses.

13. After steps 1 through 10 have been completed to the satisfaction of the lead sampler, the site pit shall be refilled with the excavated materials. Each excavation site will be filled back to original grade and seeded using EPA-approved seed mix.

14. Decontaminate all sampling equipment (SOP-G-8).

15. Move to the next site. If the previous site was the last site of the day, decontaminate the backhoe bucket, secure, and park the backhoe tractor rig for the evening. Backfill all pits and trenches to original grade before the end of each day. Open holes will not be left unattended.

3.2 Sample Locations and Identification

Test pits and trenches for the current investigation will be located on a north-south/east-west grid and based on preliminary walk-through surveys. Test pit points are on approximately 300-foot centers in the Diggings East and Northside Tailings areas, with a decrease in test pit density beyond the limits of the tailings deposition area clearly defined on historic 1955 aerial imagery. The actual test pit locations will be field adjusted in areas where the proposed location does not meet the objectives of the investigation. Approximate locations for test pit, borehole, and trench sites are shown on Figure 2.

Pit locations will be flagged with survey lath placed within one foot of the actual location. The lath will be clearly labeled with a unique designation number. The sample identification number will be derived from the pit number with the addition of four or more digits separated by a dash

to represent the depth interval. The first two digits will represent depth (in feet, accurate to the tenth of an inch) from the ground surface to the top of the interval sampled, and the second two digits will represent the depth to the bottom of the interval. For example, a sample designated DE-TP-01-0.8-1.2, describes a sample from the Diggings East, in Test Pit #1 from a depth of 0.8 feet to 1.2 feet below existing grade. The horizontal location and elevation of each test pit will be surveyed with respect to the project coordinate system. The test pit and sample numbers will be unique.

Test pit and sample identification protocol may be modified to identify horizontal extent of tailings. Extent points will be located during the investigations and will not be staked in advance. The approximate sample location will be determined by the field crew measuring from the nearest staked test pit along the appropriate north-south or east-west gridline. If the sample is not located on a gridline, the location will be estimated as close as possible measuring from the nearest test pit. These measurements will be documented in the logbook for later surveying. The lateral extent samples will be identified relative to the nearest test pit and its north-south or east-west distance from the test pit. For example, the sample identifier for a test pit located 60 feet east of Test Pit #10 in the Diggings East would be DE-LE-10-60E. The lateral extent samples will be located and field-screened as described below. The lateral extent will be marked with a pin flag, and the associated sample identifier will be recorded on the pin flag.

3.3 Test Pit Surveying

Test pits and lateral extent sample locations will be sited using resource-grade Global Positioning System (GPS) methods, staked and labeled as described above. Following completion of sampling, the location and elevation of each test pit sample will be surveyed using survey-grade GPS methods conducted by MBMG personnel. Data collected will include test pit designation, northing, easting, and elevation. The accuracy will be to within 1-foot horizontally and 0.1-foot vertically. Survey data will be collected using the Montana State Plane (NAD 83) coordinate system and North American Vertical Datum (NAVD) 1988. Surveying will be completed MBMG personnel.

3.4 Sampling Equipment

Excavation of test pits and trenches will be performed with a track-mounted excavator. Equipment utilized to collect soil samples will include:

- Stainless steel shovels, spoons, and sampling bowls;
- Field notebook and measuring tape;
- Sample containers (Zip-lock bags) and labels;
- Sharpie pens;
- *Niton XL3tGOLDD+* Portable *XRF* instrument and calibration supplies;
- *Photovac Model 2020 PRO Portable Photoionization meter*
- Chain of custody forms;
- Coolers;

- Decontamination equipment (tap water, Alconox soap, decontamination containers, paper towels, scrub brushes, and spray bottles);
- Camera;
- Portable pump; and
- Personal Protective Equipment (PPE): Level D with appropriate fall protection.

3.5 Test Pit Excavations and Trenches

Test pits will be excavated using a track-mounted excavator to provide access for sampling to soils at depth. Excavations will be in a manner preserving location and designation stake described in Section 3.2. The pits will be dug to an average depth of approximately nine (9) feet below ground surface (existing groundwater table). One wall will be prepared for evaluation and sampling as described in Section 3.6.1. Excavated materials will be stockpiled a minimum of three (3) feet from the edge of the cavity. Samples will be collected from the surface using extended arm sampling methods. Sampling personnel will be fitted with the appropriate fall protection.

After excavation, general lithology will be evaluated from the surface. This includes a general soil log of the sidewall, estimated rock content, color, soil horizon depths, tailings depth and thickness, organic silt depth and thickness, and depth-to-groundwater. Visual and lithologic information will be recorded in a field logbook for future reference. Each test pit will be photographed for future reference.

3.6 Procedures for Alternative Methods for Sediment Sampling

In areas where trenching/pit techniques are not feasible (i.e. BTC Berm area), conventional drilling techniques (i.e. auger drilling, geoprobe) will be employed in order to achieve the goals outlined in section 1.1. The procedures listed below may be modified in the field by the agreement with the lead site sampler and drill operators based on field and site conditions after appropriate annotations have been made in the appropriate field logbook. This section is only meant in substitution of section 3.1 in areas where necessary. All procedures outlined in sections 3.2 – 3.5 and 3.7 – 3.13 apply if this method is used in lieu of section 3.1.

3.6.1 Procedure for Auger Drilling or Geoprobe

The following procedures are designed to be used during the operation of auger type drill rigs or Geoprobe during soil sampling operations.

1. Locate the clearly marked site that has been deemed free of underground utility and obstruction. Complete a visual inspection of the investigation area to identify potential hazards, waste materials, debris, obstacles, and other items that may affect the scope of work and health and safety.

2. Drillers prepare rig for operation. This includes but is not limited to leveling the rig, preparing the downhole tool, preparing the auger "flights", and establishing the drill over the location.

3. Attach the split tube sampler to the "hammer tool" (approximately 150 pounds).

4. Sample the 0-2" horizon per SOP-SS-2 (Arco, 1992).

5. Place split tube sampler on the ground surface and advance sampler using the rig hammer.

6. After driving the split tube sampler its entire length (18 inches) or upon refusal of advancement, recover the split tube sampler. Refusal is defined as 50 blows with the rig hammer and less than 5 inches advancement of the sampler.

7. After recovery of the split tube sampler, open the tube and place the solid material in a core holder maintaining the intervals as sampled.

8. Repeat steps 3 to 7 until the depth of groundwater table or the bottom of the organic silt layer is encountered, whichever comes first.

9. Sampling personnel will then describe the core, subsample according to the sampling protocol outlined in section 3.6, fill out the appropriate logbooks, field profile sheets, field site sheets, and quality assurance/quality control documentation, and photographs.

10. Collect samples of tailings/impacted sediments (organic silt layer) from split-spoon sampler. Transfer bulk sample to properly labeled sample bags and place in sampling coolers for safe transfer to MBMG labs. Ensure enough sample is collected so that a proper archive of each location is maintained after all chemical analysis are performed.

11. Document approximate depth-to-groundwater in each of the test pits.

12. After items 1 through 11 have been completed to the satisfaction of the lead sampler, the borehole shall be abandoned using 3/8” bentonite chips to 1-foot below ground surface. The remainder of the hole will be filled in with native material and re-seeded using EPA-approved seed mix that will be provided by the county of Butte Silver Bow.

13. Survey the drilling location and elevation.

14. Decontaminate all sampling equipment (SOP-G-8).

15. Move to the next site. If the previous site was the last site of the day, decontaminate the drill rig tools, lower the drill mast, and secure and park the drill rig for the evening.

3.7 Sampling Methods

The following section describes the sampling protocol established for this investigation.

3.7.1 Sample Collection

Upon completion of excavation and logging, the test pit sidewall will be scraped clean of visual residue with a decontaminated shovel or trowel. Sediment samples of tailings and impacted sediments will be collected continuously in 0.5 foot vertical intervals along the scraped wall, beginning at a depth equivalent to the base of the test pit, and proceeding upward and ending at the ground surface. This methodology will prevent contamination of lower layers prior to sampling. Intervals will be measured from the ground surface. The samples will be collected in stainless steel bowls and homogenized. Soil collected from each sampling interval will be placed in sample containers according to the methods and procedures identified in *Clark Fork River Superfund Site Investigation (CFRSSI) Standard Operating Procedures (SOPs) SS-1* and *SS-6* (ARCO, 1992).

3.7.2 XRF Field Screening Protocol

Field screening protocols established for the Stream Side Tailings Operable Unit by Pioneer Technical Services (2011) will be used during the current investigation to evaluate concentrations of COCs in impacted sediment (i.e. organic silt layer or samples containing a mixture of tailings and fluvial deposits) samples (Pioneer, 2012). Individual samples will be screened using a portable XRF analyzer in accordance with U. S. Environmental Protection Agency (EPA) Method 6200 (Appendix A). The Method provides procedures for both direct readings (placing the instrument on the test pit sidewall) and field-prepared sample readings. The field-prepared sample method will be used. Field-screening will occur on samples selected for laboratory analysis as well.

Results will be compared to the concentrations listed in table 1, a set of criteria that was developed for the SSTOU and are used as the screening criteria for characterizing tailings and impacted sediments (Pioneer, 2011).

Table 1. Field XRF sample screening criteria (Pioneer, 2011).

COC	Action Level (mg/kg)
Arsenic	200
Cadmium	20
Copper	1,000
Lead	1,000
Mercury	10
Zinc	1,000

If four of the six COCs pass the field-screening criteria listed in Table 1, the sample will be considered to be non-impacted by the primary source (overlying tailings deposits). If three of the six COCs exceed the failure criteria listed in Table 1, the sample will be considered to be impacted, and recommended for potential removal. Sample screening criteria will be applied to field-identify the base and lateral extents of impacted sediments and will aid in the selection of laboratory sample selections.

3.7.3 Portable Photoionization Monitor Screening Protocol

Tailings samples will be screened for petroleum hydrocarbon contamination using a model 2020Pro portable photionization monitor in accordance with SOP A-1 of CFRSSI (Arco, 1992). Instrument specifications, calibration methods and procedures for the instrument are included in Appendix B. Samples containing detectable concentrations of photoionizable chemicals (as detected by the instrument) will be sent to a certified laboratory for Total Petroleum Hydrocarbon (TPH) analysis. If detectable concentrations of photoionizable chemicals are not observed in tailings samples, a minimum of five randomly selected samples will be prepared for analyses of TPH concentrations.

3.7.4 Extents Boundary Location

The impacted boundary will be determined by extending the gridlines perpendicularly to the general trend of the tailings deposit. A soil sample will be collected from the ground surface near the suspected edge (or boundary) of the tailings deposit (as determined by historic aerial photography). This boundary will be determined based on the positive identification of tailings material identified at each site location. The "halving the distance" method will be applied until the halved distance is equal to or less than 100 feet, and will be staked as the edge of the tailings boundary, marked in accordance with Section 3.2, and surveyed for horizontal position and elevation.

The determination of boundaries may have to account for the presence of practical boundaries; such as roads, buildings, and utility lines. For instance, the northern boundary of the Diggings East complex will most likely be dictated by the geographical orientation of George Street.

3.8 Selection of Samples for Laboratory Analysis

Upon completion of test pit evaluation, samples will be selected for laboratory analysis. The screening criteria provided in Table 1 will assist in determining the base of tailings and impacted sediments and which samples will be submitted for laboratory analyses. Identification of the 0.5-foot interval samples selected for laboratory analyses will be based on a combination of visual observation of the tailings depth and the results of the XRF field screening concentrations.

For lateral extents, there may or may not be an "order-of-magnitude" break in COC levels. Field XRF results will be used in an attempt to identify a clear break in COC concentrations; however, the criteria provided in Table 1 will be applied to laboratory analysis to determine the lateral extent of the tailings and impacted sediments wherever a clear break in concentrations cannot be identified.

Laboratory samples will be analyzed for total metal's concentrations, as described in Section 3.11. All remaining samples, not analyzed, will be archived and will be available for laboratory analysis if the samples originally submitted for laboratory analysis do not define the "order-of-magnitude" break in total metals concentrations.

3.9 Decontamination

All drilling/excavation and related equipment required to complete this scope of work will be decontaminated by the contractor prior to the project. The decontamination procedure consists of clearing drilling flights and excavation equipment of all sediment, soil, and debris. The MBMG field representative will be responsible for inspecting the cleanliness of the equipment prior to commencing drilling or excavation activities. Prior to the excavation of each new sampling pit, all tooling and sampling equipment will be decontaminated according to modified procedures described in SOP G-8 of CFRSSI (Arco, 1992). Hand tools will be used to remove gross contamination from the backhoe bucket/drilling equipment before moving to the next test pit.

All non-disposable sampling equipment will be decontaminated using a soap and tap water rinse prior to collecting each sample. Gross contamination will be removed from any hand tools used to prepare the test pit sidewalls.

3.10 Field Documentation

All significant observations, measurements, data, and results will be clearly documented in the field logbook in indelible ink according to the methods and procedures specified in *CFRSSI SOP-G-4* (ARCO, 1992). This will include the following:

- Lithologic logs of the test pit material types (e.g., sand, silt, organic silt), texture, grain-size, and color;
- Presence of visually discernible fill, tailings and other mine-waste material;
- Results of XRF field screening;
- Depths below ground surface to all soil horizons and total depth of the test pit;
- Depths to groundwater, if present;
- Sample location descriptions and designations;
- Photographs of selected sample locations; and
- Abnormal occurrences, deviations from the SAP, or other relevant observations.

3.11 Laboratory Analysis

Sample analysis parameters and the respective analysis methods are listed in table 2. Samples will be submitted to ALS Geochemistry Labs for analysis of total digestible As, Cd, Cu, Pb, and Zn. Samples will be submitted to MSE labs for total Hg. Samples will be submitted to Energy Labs for total petroleum hydrocarbon analysis.

Table 2. Parameters for Laboratory Analysis

MATERIAL TYPE	PARAMETER	METHOD	LAB
Tailings/Impacted Soils	Total Digestable Metals (As, Cd, Cu, Pb, Zn)	200.7 CLP-M	ALS
	Total Mercury	245.5 CLP-M	MSE
	Total Petroleum Hydrocarbon	SW8015B	Energy Labs

3.12 Sample Handling

All samples will be packaged and handled according to the applicable *CFRSSI SOPS* (ARCO, 1992) provided. The technician will label each with an indelible marker, record designation in field notes, and prepare a chain of custody form as specified in *CFRSSI SOP G-7* (ARCO, 1992). Labels will include sample designation, date, technician, time, and location. Samples will be transported to MBMG Labs prior to the cessation of field activities on a daily basis. Designation labels will be completed in the lab, prior to transport of the samples to the analytical facility.

A copy of the chain of custody record will accompany the shipment and serve as laboratory request forms. The chain of custody form will specify the type of analysis requested for individual samples. The original form will be maintained with the field notes and records.

3.13 Field Quality Control

Replicate XRF samples will be made every 20 samples or once a day, whichever comes first. One field duplicate every 20 samples will be collected and submitted for laboratory. The duplicate sample will be labeled in a manner not allowing the analytical laboratory to identify its location. The duplicate will be analyzed for all laboratory parameters listed in Table 1. The identification and location of the duplicate sample will be recorded in the field logbook.

Collection of field, cross-contamination, or external contamination blank samples will not be performed.

4 DRILLING OVERSIGHT

MBMG will provide the personnel to oversee all drilling, core sampling/evaluation, excavation, and abandonment activities. If third parties want a representative on-site, they will be required to

check-in and check-out with the MBMG field leader on a daily basis. The MBMG representative will be responsible for logging the borehole, collecting the appropriate samples, and management of on-site activities.

5 REPORTING

MBMG will submit a Final Report to NRDP upon the completion of sample analysis and tailings delineation.

6 HEALTH AND SAFETY

All work competed by MBMG and its contractors during execution of this SAP will be performed in accordance with all procedures outlined in MBMG's Health and Safety Plan developed for the Butte Mine Flooding Operable Unit (MBMG, 2012; Appendix C).

7 PROJECT SCHEULE

The start date will be determined obtaining signed access agreements from the property owners and the time and availability of MBMG's contractors. This work is anticipated to begin April 15, 2013 and continue for approximately 4 to 6 weeks. The excavation/test pit activities are anticipated to take 10 to 15 work days, and will be followed by drilling activities if necessary.

8 REFERENCES

ARCO (September, 1992) Clark Fork Superfund Site Investigation Standard Operating Procedures. September, 1992).

Maxim (2002) Supplemental Studies Work Plan for Tailings/Impacted Soils Investigation. Prepared for the Montana Department of Environmental Quality and U.S. Environmental Protection Agency.

Pioneer (2011) Field Screen Criteria and Procedures Phase 7 and 8 Remedial Action, SST OU Subarea 4, Reaches R and S. Streamside Tailings Operable Unit. Silver Bow Creek/Butte Area NPL Site (March, 2011).

Pioneer (2012) Final Remedial Action Sampling and Analysis Plan. Streamside Tailings Operable Unit. Silver Bow Creek/Butte Area NPL Site. (24-January-2012).

Tucci (2010) The Parrot Complex: A Drilling Investigation of Historic Mine Waste Left in Place. MBMG Open File Report 590.

APPENDIX B LITHOLOGY LOGS OF TEST PITS, TRENCH, AND BOREHOLES

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

A) DIGGINGS EAST TAILINGS LITHOLOGY LOGS

Site: Trench 1 TD = 6.5

From	To	Description
0	3.5	Fill: wood, brick, sand
3.5	5.5	Yellow tailings
5.5	6.8	Alluvium: Sand, SW, brown (GW @ 6.5)
		Groundwater @6.5'

Latitude : 45.996112
Longitude : -112.525189
NAD 83 Decimal Degrees
Elevation (ft): 5454.68
NAVD 88
Method: Trench

Site: Trench 2 TD = 6.5

From	To	Description
0	2.8	Tailings with alluvial sand
2.8	3.3	Black organic silt
3.3	4.2	Dark gray alluvial sand
4.2	4.5	Oxidized alluvial sand
		Groundwater @4.5'

Latitude : 45.995986
Longitude : -112.525116
NAD 83 Decimal Degrees
Elevation (ft): 5452.74
NAVD 88
Method: Trench

Site: Trench 3 TD = 6.5

From	To	Description
0	2.4	Fill: Clean looking top soil
2.3	4.5	Yellow tailings
4.5	4.6	Black organic silt
4.6	5.5	Gray medium to coarse alluvial sand
		Groundwater @ 5.5'

Latitude : 45.995863
Longitude : -112.525092
NAD 83 Decimal Degrees
Elevation (ft): 5454.41
NAVD 88
Method: Trench

Site: Trench 4 TD = 6.5

From	To	Description
0	3	Fill: asphault, demolition debris
3	5.8	Yellow tailings
5.8	6.25	Oxidized alluvial sand
		Groundwater @ 6.25'

Latitude : 45.995734
Longitude : -112.524992
NAD 83 Decimal Degrees
Elevation (ft): 5453.05
NAVD 88
Method: Trench

Site: TP 1- Trench 1 -100S TD = 9.8

From	To	Description
0	6.5	Fill: demolition debris
6.5	8.7	Yellow tailings
8.7	9.8	oxidized alluvial sand
		Groundwater @ 9.8'

Latitude : 45.995398
Longitude : -112.524879
NAD 83 Decimal Degrees
Elevation (ft): 5459.21
NAVD 88
Method: Test Pit

Site: TP 2- Trench 1-200S TD = 9.5

From	To	Description
0	7	Fill: demolition debris
7	8.9	Yellow tailings
8.9	9.5	oxidized alluvial sand
		Groundwater @ 9.5'

Latitude : 45.995105
Longitude : -112.524781
NAD 83 Decimal Degrees
Elevation (ft): 5458.71
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP 3-Trench 1-300S TD = 8.6

From	To	Description
0	5.3	Fill: demolition debris
5.3	7.6	Yellow tailings
7.6	8.5	Black organic silt
8.5	8.6	Alluvium: med-coarse gray sand

Groundwater @ 8.5'

Latitude : 45.994848
Longitude : -112.524715
NAD 83 Decimal Degrees
Elevation (ft): 5457.20
NAVD 88
Method: Test Pit

Site: TP-1E TD = 8.9

From	To	Description
0	6.7	Fill: demolition debris
6.7	7.7	Yellow tailings
7.7	7.9	Black organic silt
7.9	8.9	oxidized alluvial sand

Groundwater @ 8.9'

Latitude : 45.995024
Longitude : -112.524062
NAD 83 Decimal Degrees
Elevation (ft): 5459.16
NAVD 88
Method: Test Pit

Site: TP-2E TD = 4.75

From	To	Description
0	1.4	Fill: clean looking top soil and sand
1.4	2.4	Yellow tailings
2.4	4.75	Gray med - coars alluvial sand

Groundwater @ 4.75'

Latitude : 45.995959
Longitude : -112.524281
NAD 83 Decimal Degrees
Elevation (ft): 5454.35
NAVD 88
Method: Test Pit

Site: TP-3E TD = 9.4

From	To	Description
0	4.2	Fill: demolition Debris
4.2	6.8	Yellow tailings
6.8	9.5	Black sand
9	9.8	Black organic silt

Groundwater @ 9.5'

Latitude : 45.996018
Longitude : -112.523619
NAD 83 Decimal Degrees
Elevation (ft): 5457.79
NAVD 88
Method: Test Pit

Site: TP-4E TD = 11.4

From	To	Description
0	6.7	Fill: landfill debris
6.7	7.9	Yellow tailings
7.9	11.4	Black organic silt

Groundwater > 11.4'

Latitude : 45.996647
Longitude : -112.523731
NAD 83 Decimal Degrees
Elevation (ft): 5460.34
NAVD 88
Method: Test Pit

Site: TP-5E TD = 10.9

From	To	Description
0	6.3	Fill: demolition debris
6.3	8.7	Yellow tailings
8.7	10	Black organic silt
10	10.9	gray coarse alluvial sand

Groundwater @ 10.9'

Latitude : 45.996102
Longitude : -112.523227
NAD 83 Decimal Degrees
Elevation (ft): 5460.48
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-6E TD = 11.4

From	To	Description
0	6.5	Fill: landfill debris
6.5	8	Yellow tailings
8	11.4	Black organic silt
Groundwater @ > 11.4'		

Latitude : 45.99647
Longitude : -112.524901
NAD 83 Decimal Degrees
Elevation (ft): 5458.93
NAVD 88
Method: Test Pit

Site: TP-1W TD = 11.5

From	To	Description
0	6.6	Fill: demolition debris
6.6	8.2	Yellow tailings
8.2	11.5	Black organic silt
Groundwater @ 11.5'		

Latitude : 45.994735
Longitude : -112.52550
NAD 83 Decimal Degrees
Elevation (ft): 5458.23
NAVD 88
Method: Test Pit

Site: TP-2W TD = 10.2

From	To	Description
0	7.2	Fill: demolition debris
7.2	9.4	Yellow tailings
9.4	10.2	Coarse gray alluvial sand
Groundwater @ 10.2		

Latitude : 45.995412
Longitude : -112.525444
NAD 83 Decimal Degrees
Elevation (ft): 5458.40
NAVD 88
Method: Test Pit

Site: TP-3W TD = 6

From	To	Description
0	2.8	Fill: demolition debris
2.8	3.4	Yellow tailings
3.4	4.5	Black organic silt
4.5	6	Coarse gray alluvial sand
Groundwater @ 5.7'		

Latitude : 45.994592
Longitude : -112.52636
NAD 83 Decimal Degrees
Elevation (ft): 5453.40
NAVD 88
Method: Test Pit

Site: TP-4W TD = 7.3

From	To	Description
0	2.9	Fill: landfill debris
2.9	3.9	Yellow tailings
3.9	7.25	Black organic silt
7.25	7.3	Gray alluvial sand
Groundwater @ 7.3'		

Latitude : 45.9941
Longitude : -112.526408
NAD 83 Decimal Degrees
Elevation (ft): 5454.17
NAVD 88
Method: Test Pit

Site: TP-5W TD = 9.2

From	To	Description
0	4.3	Fill: demolition debris
4.3	5.1	Yellow tailings
5.1	8.2	Black organic silt
8.2	9.2	Black sand
Groundwater @ 8.2'		

Latitude : 45.994105
Longitude : -112.525675
NAD 83 Decimal Degrees
Elevation (ft): 5455.83
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-6W TD = 9.5

From	To	Description
0	0.75	Top Soil
0.75	3.25	Sandy gravel, GP
3.25	5.25	Silty sand, SM
7.25	8	Silt, MS, brown
8	9.5	Clay, CH
Groundwater @8.1'		

Latitude : 45.994232
Longitude : -112.527575
NAD 83 Decimal Degrees
Elevation (ft): 5454.02
NAVD 88
Method: Test Pit

Site: TP-6W-100N Extent TD = 9.5

From	To	Description
0	4.3	Fill: demolition debris
4.3	6.9	Yellow tailings
6.9	9	Black organic silt
9	9.5	Black sand
Groundwater @ 9.1		

Latitude : 45.994681
Longitude : -112.527603
NAD 83 Decimal Degrees
Elevation (ft): 5454.68
NAVD 88
Method: Test Pit

Site: TP-6W-50N Extent TD = 9.1

From	To	Description
0	6	Fill: demolition debris
6	6.6	Yellow tailings
6.6	9.1	Black organic silt
Groundwater @ 9.1'		

Latitude : 45.994474
Longitude : -112.527592
NAD 83 Decimal Degrees
Elevation (ft): 5455.69
NAVD 88
Method: Test Pit

Site: TP-7W TD = 10.5

From	To	Description
0	3.7	Fill: demolition debris
3.7	9.8	Silty sand, SM
Groundwater @ 9.8'		

Latitude : -112.528723
Longitude : -112.528723
NAD 83 Decimal Degrees
Elevation (ft): 5454.32
NAVD 88
Method: Test Pit

Site: TP-7W-50N Extent TD = 11.1

From	To	Description
0	3.3	Fill: demolition debris
3.3	5.3	Yellow tailings
5	11.1	Black organic silt
Groundwater @ >11.1'		

Latitude : 45.994659
Longitude : -112.528734
NAD 83 Decimal Degrees
Elevation (ft): 5453.76
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-8W TD = 10

From	To	Description
0	4.9	Fill: demolition debris
4.9	5.9	Yellow tailings
5.9	8	Black organic silt
8	10	Gray alluvial sand

Groundwater @ 9.2'

Latitude : 45.994261
Longitude : -112.529567
NAD 83 Decimal Degrees
Elevation (ft): 5453.25
NAVD 88
Method: Test Pit

Site: TP-8W-100NE Extent TD = 11.1

From	To	Description
0	7.1	Fill: demolition debris
7.1	8.3	Yellow tailings
8.3	11.1	Black organic silt

Groundwater @ >11.1

Latitude : 45.994352
Longitude : -112.529134
NAD 83 Decimal Degrees
Elevation (ft): 5455.50
NAVD 88
Method: Test Pit

Site: TP-8W-50S Extent TD = 8.3

From	To	Description
0	3.5	Fill: demolition debris
3.5	5	Yellow tailings
5	8.3	Black organic silt

Groundwater @ 7.8'

Latitude : 45.994102
Longitude : -112.529481
NAD 83 Decimal Degrees
Elevation (ft): 5452.69
NAVD 88
Method: Test Pit

Site: TP-9W TD = 9.5

From	To	Description
0	3.9	Fill: demolition debris
3.9	7.3	Yellow and gray tailings
7.3	7.9	Black organic silt
7.9	9.3	Gray alluvial sand

Groundwater @ 9.3'

Latitude : 45.994588
Longitude : -112.530054
NAD 83 Decimal Degrees
Elevation (ft): 5452.97
NAVD 88
Method: Test Pit

Site: TP-10W TD = 5.3

From	To	Description
0	2	Fill: sand
2	3.9	Yellow tailings
3.9	5.3	Gray alluvial sand

Groundwater @ 5.3'

Latitude : 45.995324
Longitude : -112.526151
NAD 83 Decimal Degrees
Elevation (ft): 5453.40
NAVD 88
Method: Test Pit

Site: TP-11W TD = 8.5

From	To	Description
0	4.4	Fill: demolition debris
4.4	7	Yellow tailings
7	7.6	Black organic silt
7.6	8.5	Gray alluvial sand

Groundwater @ 8.0'

Latitude : 45.995126
Longitude : -112.527209
NAD 83 Decimal Degrees
Elevation (ft): 5454.58
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-12W TD = 8.4

Latitude : 45.994908
Longitude : -112.528386
NAD 83 Decimal Degrees
Elevation (ft): 5454.14
NAVD 88
Method: Test Pit

From	To	Description
0	4.1	Fill: demolition debris
4.1	6.2	Yellow tailings
6.2	7.2	Black organic silt
7.2	8.4	Gray alluvial sand

Groundwater @ 8.4'

Site: TP-13W TD = 11.2

Latitude : 45.994785
Longitude : -112.5293
NAD 83 Decimal Degrees
Elevation (ft): 5455.88
NAVD 88

From	To	Description
0	6.6	Fill: demolition debris
6.6	9.5	Fine Gray tailings/ slickens
9.5	11.2	Gray alluvial sand

Groundwater @ 11.2'

Site: TP-14W TD = 9.5

Latitude : 45.995066
Longitude : -112.53045
NAD 83 Decimal Degrees
Elevation (ft): 5453.04
NAVD 88
Method: Test Pit

From	To	Description
0	3.2	Fill: demolition debris
3.2	5.3	Fine gray tailings/ slickens
5.3	7.5	Black organic silt
7.5	9.4	Gray alluvial sand

Groundwater @ 9.4'

Site: TP-15W TD = 10

Latitude : 45.995336
Longitude : -112.529529
NAD 83 Decimal Degrees
Elevation (ft): 5453.70
NAVD 88
Method: Test Pit

From	To	Description
0	5.2	Fill: demolition debris
5.2	6.2	Yellow tailings
6.2	6.4	Black organic silt
6.4	10	

Groundwater @ 9.9'

Site: TP-16W-50S Extent TD = 11.7

Latitude : 45.995212
Longitude : -112.528656
NAD 83 Decimal Degrees
Elevation (ft): 5456.87
NAVD 88
Method: Test Pit

From	To	Description
0	6.8	Fill: demolition debris
6.8	10.3	Yellow tailings
10.3	11.7	Black organic silt

Groundwater @ 11.6'

Site: TP-16W TD = 11.8

Latitude : 45.995454
Longitude : -112.52866
NAD 83 Decimal Degrees
Elevation (ft): 5455.06
NAVD 88
Method: Test Pit

From	To	Description
0	5.5	Fill: demolition debris
5.5	5.6	Yellow tailings
5.6	11.8	Black organic silt

Groundwater @ >11.8'

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-17W TD = 12

From	To	Description
0	5.1	Fill: demolition debris
5.1	8	Yellow tailings
8	11.9	Black organic silt
11.9	12	Gray alluvial sand

Groundwater @ >11.9'

Latitude : 45.995674
Longitude : -112.527321
NAD 83 Decimal Degrees
Elevation (ft): 5455.09
NAVD 88
Method: Test Pit

Site: TP-18W TD = 6.1

From	To	Description
0	3.5	Fill: demolition debris
3.5	5.1	Yellow tailings
5.1	6	Black organic silt
6	3.1	Gray alluvial sand

Groundwater @ 6.0'

Latitude : 45.995847
Longitude : -112.526362
NAD 83 Decimal Degrees
Elevation (ft): 5454.19
NAVD 88
Method: Test Pit

Site: TP-19W TD = 8.8

From	To	Description
0	5.2	Fill: demolition debris
5.2	7	Yellow tailings
7	8.5	Black organic silt
8.5	8.8	Gray alluvial sand

Groundwater @ 8.7'

Latitude : 45.995474
Longitude : -112.526916
NAD 83 Decimal Degrees
Elevation (ft): 5455.28
NAVD 88
Method: Test Pit

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

B) NORTHSIDE TAILINGS IMPOUNDMENT LITHOLOGY LOGS

Site: TP-NS-01 TD = 11.5

Latitude : 45.995619
Longitude : -112.530961
NAD 83 Decimal Degrees
Elevation (ft): 5448.46
NAVD 88
Method: Test Pit

From	To	Description
0	2.3	Top soil, clean
2.3	2.6	Oxidized alluvial sand and tailings
2.6	4.4	Medium brown sand
4.4	11	Black organic silt
		Groundwater @ 11.5'

Site: TP-NS-01E-50S TD = 7.3

Latitude : 45.996819
Longitude : -112.526155
NAD 83 Decimal Degrees
Elevation (ft): 5451.82
NAVD 88
Method: Test Pit

From	To	Description
0	1.4	Yellow oxidized tailings
1.4	3.3	Oxidised sand, no noticeable tailings
3.3	7.2	Black organic silt
7.2	7.3	Olive silty sand with gravel, alluvium
		Groundwater @ 7.25', possibly a perched system

Site: TP-NS-01E TD = 7

Latitude : 45.997118
Longitude : -112.526215
NAD 83 Decimal Degrees
Elevation (ft): 5451.44
NAVD 88
Method: Test Pit

From	To	Description
0	0.8	Top soil, clean
0.8	3.3	Oxidized alluvial sand
3.3	>7.0	Black organic silt
		Groundwater @ 3.3', perched aquifer

Site: TP-NS-02 TD = 8

Latitude : 45.995771
Longitude : -112.53056
NAD 83 Decimal Degrees
Elevation (ft): 5448.70
NAVD 88
Method: Test Pit

From	To	Description
0	1.8	Top soil, clean
1.8	6.6	Oxidised sand, no noticeable tailings
6.6	8+	Black organic silt
		Groundwater @ 7.4', perched aquifer

Site: TP-NS-02E TD = 5.5

Latitude : 45.997334
Longitude : -112.52562
NAD 83 Decimal Degrees
Elevation (ft): 5451.82
NAVD 88
Method: Test Pit

From	To	Description
0	2.6	Medium to coarse oxidized sand, no noticeable tailings
2.6	5.5	Black organic silt
		Groundwater @ 2.6' perched system

Site: TP-NS-03 TD = 10.2

Latitude : 45.995847
Longitude : -112.529821
NAD 83 Decimal Degrees
Elevation (ft): 5450.53
NAVD 88
Method: Test Pit

From	To	Description
0	2.7	Top soil, clean
2.7	4.2	Oxidized sand, no noticeable tailings
4.2	10.2	Black organic silt
		Groundwater @ 7.4'; possibly a perched system

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: TP-NS-03E TD = 5.7

Latitude : 45.997527
Longitude : -112.524871
NAD 83 Decimal Degrees
Elevation (ft): 5452.66
NAVD 88
Method: Test Pit

From	To	Description
0	0.9	Top soil, clean
0.9	1.3	Oxidized sand with tailings
1.3	1.5	Fine oxidized tailings
1.5	2	Fine-medium gray sand
2	5.6	Black organic silt
5.6	5.7	Olive silty sand with gravel
	Groundwater @ 5.6'	

Site: TP-NS-03E-50N TD = 3

Latitude : 45.997555
Longitude : -112.525269
NAD 83 Decimal Degrees
Elevation (ft): 5452.13
NAVD 88
Method: Test Pit

From	To	Description
0	1.4	Oxidized silty sand
1.4	>3.0	Black organic silt
	Groundwater @ >3'	

Site: TP-NS-04E TD = 3

Latitude : 45.998271
Longitude : -112.5244109
NAD 83 Decimal Degrees
Elevation (ft): 5455.50
NAVD 88

From	To	Description
0	0.3	Top soil
0.3	2.2	Oxidized sand, SP
2.2	>3.0	Black organic silt
	Groundwater @ >3.0'	

Site: TP-NS-04E-50N TD = 11.8

Latitude : 45.998318
Longitude : -112.524147
NAD 83 Decimal Degrees
Elevation (ft): 5455.26
NAVD 88
Method: Test Pit

From	To	Description
0	0.5	Top soil
0.5	1.4	Oxidized tailings and sand
1.4	>3.0	Black organic silt
	Groundwater @ >3.0'	

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

C) BLACKTAIL CREEK BERM LITHOLOGY LOGS

Site: Berm 1 TD = 12

From	To	Description
0	0.5	Top soil
0.5	4	Clayey sand, SC, brown
4	4.2	Tailings
4.2	4.25	Black organic silt
4.25	4.7	Sand with some gravel
4.7	5.7	Black organic silt, wet at 5.7
5.7	6.3	Silty sand, saturated
6.3	8	No recovery
8	11	Black organic silt
11	12	No recovery
		Groundwater @ 5.7'

Latitude : 45.994252
Longitude : -112.535551
NAD 83 Decimal Degrees
Elevation (ft): 5442.68
NAVD 88
Method: Geoprobe

Site: Berm 2 TD = 16

From	To	Description
0	0.3	Top soil
0.3	2.3	Clayey sand, SC, brown
2.3	2.5	Tailings
2.5	4	No recovery
4	4.25	Silty sand with some tailings
4.25	6.5	oxidized silt with orange clay
6.5	8	No recovery
8	10.8	Black organic silt, entire sample wet
10.8	12	No recovery
12	13	Oxidized orange clay
12	16	Coarse gray alluvial sand and fine gravel
		Groundwater @ ~8'

Latitude : 45.994009
Longitude : -112.535028
NAD 83 Decimal Degrees
Elevation (ft): 5439.67
NAVD 88
Method: Geoprobe

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site: Berm 3 TD = 16

Latitude : 45.99348
Longitude : -112.533863
NAD 83 Decimal Degrees
Elevation (ft): 5441.26
NAVD 88
Method: Geoprobe

From	To	Description
0	0.5	Top soil
0.5	1.6	Sand with some silt, SM
1.6	1.9	Black organic silt
1.9	4	No recovery
4	4.5	Black organic silt
4.5	6.3	Silty sand, SM, water at 5.0
6.3	8	No recovery
8	11.4	Black organic silt, saturated
11	12	No recovery
12	13	Sandy Silt grading to silty sand
13	15.5	Coarse gray sand with fine gravel, subangular
15.5	16	No recovery

Groundwater @ 5.0'

Site: Berm 4 TD = 12

Latitude : 45.993002
Longitude : -112.532949
NAD 83 Decimal Degrees
Elevation (ft): 5440.23
NAVD 88
Method: Geoprobe

From	To	Description
0	0.5	Top soil
0.5	1.5	Sand
1.5	1.8	Black organic silt
1.8	4..0	No recovery
4	6.4	Black organic silt
6.4	9.5	No recovery, water entering
9.5	9.7	Black organic silt, saturated
9.7	12	Gray, medium to coarse sand

Groundwater @ ~6.4'

APPENDIX B. TRENCH, TEST PIT, AND BOREHOLE LITHOLOGY

Site:	**Berm 5**	TD = 12	Latitude :	45.992862
From	To	Description	Longitude :	-112.53309
0	0.8	Top soil		NAD 83 Decimal Degrees
0.8	1.6	organic silt/clay	Elevation (ft):	5441.33
1.6	4	No recovery		NAVD 88
4	4.5	Silty sand		
4.5	6.9	Organic silt	Method:	Geoprobe
6.9	8	No recovery, water		
8	9.3	Organic silt		
9.3	10.5	Medium to fine sand		
10.5	10.9	Black organic silt		
10.9	12	No recovery		
	Groundwater @ ~6'			

APPENDIX C CONCENTRATIONS OF COCs

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
Berm 1	BTC Berm Geoprobe	0.25-4.00	F	clayey sand	111	2.11	14	1,760	455	3,210
Berm 1	BTC Berm Geoprobe	0.0-0.25	F	top soil	141	1.96	3	328	536	1,120
Berm 1	BTC Berm Geoprobe	4	F	silt	163	0.872	4	359	526	1,240
Berm 1	BTC Berm Geoprobe	4.0-8.0	O	organic silt	262	0.591	20	1,700	871	6,950
Berm 1	BTC Berm Geoprobe	4.0-8.0	O	organic silt	175	0.729	14	1,540	473	5,340
Berm 2	BTC Berm Geoprobe	2.3-2.5	T	tailings	434	12.4	9	4,260	1,490	2,650
Berm 2	BTC Berm Geoprobe	0.3-0.7	F	silty sand	93	1.05	4	761	215	952
Berm 2	BTC Berm Geoprobe	13-16.3	A	wet alluvium	5	0.0333	1	12	23	67
Berm 2	BTC Berm Geoprobe	12.0-13.0	O	organic silt	6	0.0536	1	73	27	255
Berm 2	BTC Berm Geoprobe	4.0-4.25	T	silt and tailings	324	1.48	5	441	509	1,820
Berm 2	BTC Berm Geoprobe	4.25-6.5	T	silt and clay, some tailings	431	27.9	17	5,180	1,790	5,610
Berm 2	BTC Berm Geoprobe	8.0-12.0	O	orange organic silt	736	31.2	29	8,140	2,450	4,310
Berm 2	BTC Berm Geoprobe	0.7-2.35	F	silty clay	147	2.95	16	9,610	481	3,360
Berm 3	BTC Berm Geoprobe	0.5-1.6	F	sand and silt	231	2.4	5	1,770	641	1,550
Berm 3	BTC Berm Geoprobe	1.6-1.9	O	organic silt	246	0.397	15	1,380	299	2,770
Berm 3	BTC Berm Geoprobe	13.0-16.0	A	coarse gray wet alluvium	9	<0.0312	1	162	42	144
Berm 3	BTC Berm Geoprobe	4.0-4.5	O	organic silt	275	0.438	15	1,750	437	4,780
Berm 3	BTC Berm Geoprobe	8.0-12.0	O	organic silt	12	0.04	1	142	48	443
Berm 4	BTC Berm Geoprobe	0.5-1.45	F	sand	27	0.0337	2	74	49	1,430
Berm 4	BTC Berm Geoprobe	1.45-1.8	O	organic silt	126	0.265	3	632	194	1,550
Berm 4	BTC Berm Geoprobe	9.7-12.0	A	coarse gray wet alluvium	5	0.142	1	80	42	91
Berm 5	BTC Berm Geoprobe	0.8-1.5	O	organic silt	23	0.0528	1	140	218	417
Berm 5	BTC Berm Geoprobe	4.5-6.9	O	organic silt	338	0.542	14	2,050	632	4,060
Berm 5	BTC Berm Geoprobe	9.2-10.5	A	wet alluvium	5	0.138	1	27	30	106
TP-10W	Diggings East Test pit	2.0-3.9	T	yellow tailings	211	0.507	25	875	659	9,760
TP-10W	Diggings East Test pit	3.9-5.3	A	dry alluvium	325	0.161	8	2,230	353	2,920
TP-11W	Diggings East Test pit	4.0-7.0	T	yellow-white tailings	209	0.398	35	1,560	674	11,550
TP-11W	Diggings East Test pit	8	A	dry alluvium	577	0.108	19	6,230	459	3,090

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
TP-12W	Diggings East Test pit	4.1-6.20	T	yellow tailings	165	0.193	3	216	453	1,190
TP-12W	Diggings East Test pit	6.2-6.5	O	organic silt	762	3.34	13	6,670	1,020	12,600
TP-12W	Diggings East Test pit	6.5-7.2	T	fine gray slickens	287	0.914	39	2,400	1,315	12,800
TP-12W	Diggings East Test pit	7.2	A	dry alluvium	246	0.382	33	1,070	603	11,100
TP-12W	Diggings East Test pit	7.2-8.0	A	dry alluvium	496	0.263	10	3,120	419	4,390
TP-13W	Diggings East Test pit	6.6-9.0	T	yellow tailings	239	0.565	7	892	705	2,730
TP-13W	Diggings East Test pit	9.5-11.2	A	dry alluvium	123	10.8	8	999	1,980	3,510
TP-13W	Diggings East Test pit	9.5	T	gray fine tailings	253	1.18	23	1,570	1,350	9,170
TP-13W	Diggings East Test pit	9.7	T	sand and tailings	234	0.172	13	1,500	468	3,900
TP-14W	Diggings East Test pit	3.2-5.3	T	fine gray and yellow tailings	362	0.839	34	2,120	1,340	7,190
TP-14W	Diggings East Test pit	5.3-7.5	O	organic silt	362	0.819	31	2,080	951	12,750
TP-14W	Diggings East Test pit	7.5-9.4	A	dry alluvium	546	0.181	21	4,730	465	4,660
TP-15W	Diggings East Test pit	5.2	T	tailings TOT	955	0.644	37	1,020	1,210	7,480
TP-15W	Diggings East Test pit	6.2	T	tailings BOT	375	1.26	42	1,620	1,585	12,150
TP-15W	Diggings East Test pit	6.2-6.4	O	organic silt	269	0.202	26	1,810	1,015	11,250
TP-15W	Diggings East Test pit	6.2-7.5	A	dry alluvium	328	0.173	55	2,080	417	2,560
TP-16W	Diggings East Test pit	0.0-5.5	F	clean fill	17	0.0743	3	192	194	860
TP-16W	Diggings East Test pit	7.7-9.1	A	dry alluvium	196	0.203	24	1,290	496	8,410
TP-16W	Diggings East Test pit	10.3-11.65	O	organic silt	539	0.256	46	4,800	573	3,700
TP-16W	Diggings East Test pit	5.5-5.6	T	tailings	294	0.858	30	1,290	1,095	8,770
TP-17W	Diggings East Test pit	5.1-8.0	T	tailings	318	1.67	15	866	473	5,070
TP-18W	Diggings East Test pit	3.5-5.0	T	tailings	191	0.962	32	904	670	10,950
TP-18W	Diggings East Test pit	5.0-6.0	O	organic silt	982	0.849	136	9,070	843	50,030
TP-18W	Diggings East Test pit	6.0-6.1	A	dry alluvium	638	0.309	33	7,120	638	3,770
TP-19W	Diggings East Test pit	5.2-7.0	T	tailings	197	0.555	28	1,090	605	9,600
TP-19W	Diggings East Test pit	7.0-8.3	O	organic silt	422	1.38	244	11,190	997	9,880
TP-19W	Diggings East Test pit	8.3-8.75	A	dry alluvium	669	0.143	7	7,680	489	2,770

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
TP-1E	Diggings East Test pit	6.7-7.7	T	gray tailings	171	0.597	15	319	608	5,580
TP-1E	Diggings East Test pit	7.7-8.9	A	dry alluvium	778	0.664	10	8,750	579	2,930
TP-1W	Diggings East Test pit	6.6-8.2	T	yellow tailings	202	0.555	14	741	657	5,260
TP-1W	Diggings East Test pit	8.2-9.2	O	top of organic silt	582	1.62	117	8,080	725	16,150
TP-2E	Diggings East Test pit	0.0-1.4	F	clean fill	60	0.181	2	197	165	451
TP-2E	Diggings East Test pit	2	T	tailings TOT	225	0.312	2	177	227	615
TP-2E	Diggings East Test pit	2.5	T	tailings BOT	238	0.368	2	194	392	829
TP-2E	Diggings East Test pit	3	A	dry alluvium	252	1.55	4	223	773	1,820
TP-2E	Diggings East Test pit	3.5	A	dry alluvium	252	0.623	3	201	454	1,230
TP-2E	Diggings East Test pit	4	A	dry alluvium	259	0.375	4	256	305	1,140
TP-2E	Diggings East Test pit	4.75	A	wet alluvium	475	0.215	6	3,470	465	2,350
TP-2W	Diggings East Test pit	9.4-10.2	A	gray dry alluvium	735	0.241	37	10,500	725	4,710
TP-2W	Diggings East Test pit	0-7.2	F	clean fill	58	0.11	2	152	227	783
TP-2W	Diggings East Test pit	7.2-9.4	T	yellow talings	131	0.597	5	140	463	1,595
TP-3E	Diggings East Test pit	0-4.2	F	clean fill, top soil	52	0.363	3	214	485	939
TP-3E	Diggings East Test pit	4.2-6.5	T	tailings	211	1.3	3	166	459	1,470
TP-3E	Diggings East Test pit	6.8-9	A	gray alluvium	750	1.05	25	14,100	1,010	5,540
TP-3E	Diggings East Test pit	9.0-9.5	O	Organic Silt	1,295	3.71	50	21,700	1,565	13,100
TP-3W	Diggings East Test pit	2.85-3.85	T	yellow and gray tailings	242	0.493	5	771	569	1,670
TP-3W	Diggings East Test pit	3.85-4.5	O	organic silt	239	0.621	19	2,590	1,075	6,790
TP-3W	Diggings East Test pit	5.0-6.0	A	dry alluvium	328	0.0707	2	1,840	326	1,065
TP-4E	Diggings East Test pit	0-6.7	F	land fill debris	56	0.965	3	803	1,165	1,370
TP-4E	Diggings East Test pit	6.7-7.9	T	yellow tailings	214	0.149	19	2,290	527	6,310
TP-4E	Diggings East Test pit	8.0+	O	Organic Silt-bottom of silt	32	<0.04	2	328	143	906
TP-4W	Diggings East Test pit	1.9-2.9	F	land fill debris	66	0.143	4	427	380	1,545
TP-4W	Diggings East Test pit	2.9-3.9	T	fine yellow tailings	207	0.632	1	347	755	449
TP-4W	Diggings East Test pit	4	O	top of organic silt	239	0.377	4	1,490	222	945
TP-4W	Diggings East Test pit	7	O	bottom of dry organic silt	16	<0.04	1	45	51	138

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
TP-5E	Diggings East Test pit	10.9	A	wet alluvium	644	0.362	13	8,690	699	4,230
TP-5E	Diggings East Test pit	6.3-8.65	T	yellow tailings	248	0.243	4	440	217	1,510
TP-5E	Diggings East Test pit	10.0-10.9	A	dry alluvium	44	0.0479	3	1,140	172	685
TP-5W	Diggings East Test pit	4.3-5.1	T	yellow tailings	203	0.307	4	431	433	1,965
TP-5W	Diggings East Test pit	5.1-6.5	T	gray tailings	102	0.147	7	658	453	2,870
TP-5W	Diggings East Test pit	8	O	bottom of dry organic silt	63	0.728	9	671	138	462
TP-6E	Diggings East Test pit	0.0-6.5	F	land fill debris	97	1.02	5	1,010	2,910	1,380
TP-6E	Diggings East Test pit	6.5-8.0	T	yellow tailings	165	0.627	29	823	734	10,085
TP-6E	Diggings East Test pit	8.0-11.3	O	organic silt	16	0.147	3	386	275	1,420
TP-6W	Diggings East Test pit	5.2	A	sand, natural undisturbed alluvium	13	<0.03	1	80	52	123
TP-6W	Diggings East Test pit	8.11	A	brown silty sand	13	<0.04	1	85	54	176
TP-6W-100N Extent	Diggings East Test pit	4.3-6.0	T	yellow tailings	274	0.189	6	483	532	2,260
TP-6W-100N Extent	Diggings East Test pit	7.0-9.0	O	organic silt	955	38.5	122	16,000	3,460	23,900
TP-6W-100N Extent	Diggings East Test pit	9.5	A	dry alluvium	553	0.538	21	5,080	433	5,360
TP-6W-50N Extent	Diggings East Test pit	6.0-6.6	T	Tailings	361	<0.04	4	1,080	774	1,405
TP-6W-50N Extent	Diggings East Test pit	7.5	O	organic silt	136	0.277	10	887	176	1,260
TP-7W	Diggings East Test pit	3.7-9.8	A	sand, native undisturbed alluvium	10	<0.04	1	39	27	150
TP-8W	Diggings East Test pit	4.9-5.9	T	fine gray tails/ slickens	395	1.28	30	3,170	1,455	7,340
TP-8W	Diggings East Test pit	5.9-8.0	O	organic silt	351	1.18	29	1,720	801	10,100
TP-8W	Diggings East Test pit	9	A	dry alluvium	810	1.32	13	9,090	1,105	4,370
TP-8W-100NE Extent	Diggings East Test pit	7.1-8.3	T	fine gray tails/ slickens	495	0.657	10	2,510	1,535	2,270
TP-8W-100NE Extent	Diggings East Test pit	8.3-11	O	organic silt	524	2.37	15	4,710	553	5,090
TP-8W-50S Extent	Diggings East Test pit	3.4-5.0	T	fine gray tails/ slickens	576	1.24	4	1,320	1,595	1,595
TP-8W-50S Extent	Diggings East Test pit	5.0-8.35	O	organic silt	87	0.0916	14	1,430	150	2,730
TP-9W	Diggings East Test pit	3.9-4.65	T	orange tailings	5,560	1.38	2	1,130	841	1,085
TP-9W	Diggings East Test pit	4.65-4.80	T	gray tailings	1,010	69.2	1	362	1,575	296
TP-9W	Diggings East Test pit	7.3-7.85	O	organic silt	358	69.2	20	4,440	4,610	5,970
TP-9W	Diggings East Test pit	7.85-9.3	A	dry alluvium	289	0.355	29	1,970	667	11,300

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
TP 1- Trench 1 -100S	Diggings East Trench	6.5-7.5	T	yellow tailings, TOT	165	0.35	1	113	345	517
TP 1- Trench 1 -100S	Diggings East Trench	7.5-8.5	T	yellow tailings, BOT	198	3.96	21	315	975	7,820
TP 1- Trench 1 -100S	Diggings East Trench	8.7-9.8	A	wet alluvium	369	0.18	3	1,790	204	1,295
TP 2- Trench 1-200S	Diggings East Trench	7.1-8.9	T	tailings	179	0.351	14	409	504	4,950
TP 2- Trench 1-200S	Diggings East Trench	8.9-9.5	A	dry alluvium	277	0.147	3	1,230	249	1,315
TP 3-Trench 1-300S	Diggings East Trench	5.3-7.6	T	yellow - white tails	172	0.689	9	1,360	466	3,510
TP 3-Trench 1-300S	Diggings East Trench	0-5.3	F	sand and woody debris	117	0.689	1	114	466	408
TP 3-Trench 1-300S	Diggings East Trench	7.6-8.4	O	Organic Silt	1,990	0.252	18	22,100	1,415	7,880
TP 3-Trench 1-300S	Diggings East Trench	8.5	A	dry alluvium	421	0.946	4	3,160	315	1,370
Trench 1	Diggings East Trench	2	F	Fill-sand, brick, wood	103	0.0913	4	1,700	312	1,195
Trench 1	Diggings East Trench	2.5	F	Fill-sand, brick, wood	31	<0.03	2	360	257	1,350
Trench 1	Diggings East Trench	3	F	Fill-sand, brick, wood	81	0.773	5	1,010	918	2,330
Trench 1	Diggings East Trench	3.5	F	Fill-sand, brick, wood	149	0.598	11	870	818	4,170
Trench 1	Diggings East Trench	4	T	tailings	356	0.506	22	1,540	842	7,830
Trench 1	Diggings East Trench	4.5	T	tailings	181	0.459	34	1,100	673	12,500
Trench 1	Diggings East Trench	5	T	tailings	213	0.303	27	1,280	544	9,850
Trench 1	Diggings East Trench	5.5	T	tailings	246	0.474	26	1,610	509	9,030
Trench 1	Diggings East Trench	6	T	tailings	278	0.441	21	1,960	460	7,590
Trench 1	Diggings East Trench	6.5	A	dry alluvium	944	0.239	20	12,550	641	6,020
Trench 1	Diggings East Trench	6.8	A	wet alluvium	695	0.249	17	9,770	767	5,460
Trench 2	Diggings East Trench	0 - 1.5	T	tailings	162	0.778	9	193	457	3,170
Trench 2	Diggings East Trench	2	T	tailings	186	0.547	21	330	547	7,850
Trench 2	Diggings East Trench	2.5	T	tailings	211	0.474	19	392	635	7,180
Trench 2	Diggings East Trench	3	O	organic silt	364	90.2	32	5,560	5,330	5,040
Trench 2	Diggings East Trench	3.5	A	dry alluvium	769	0.18	12	8,160	488	3,720
Trench 2	Diggings East Trench	4	A	dry alluvium	822	0.387	10	7,820	470	3,250
Trench 2	Diggings East Trench	4.5	A	dry alluvium	753	0.0848	17	11,550	686	5,040

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**					
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
Trench 3	Diggings East Trench	0 - 2.0	F	clean fill	96	0.156	4	586	233	1,080
Trench 3	Diggings East Trench	2.5	T	tailings	155	0.321	1	166	352	587
Trench 3	Diggings East Trench	3	T	tailings	174	0.962	3	159	561	1,360
Trench 3	Diggings East Trench	3.5	T	tailings	203	1.03	5	216	655	1,720
Trench 3	Diggings East Trench	4	T	tailings	224	1.03	8	275	617	2,500
Trench 3	Diggings East Trench	4.5	T	tailings	243	0.782	9	264	476	2,810
Trench 3	Diggings East Trench	5	A	dry alluvium	311	0.354	5	548	392	1,630
Trench 3	Diggings East Trench	5.5	A	dry alluvium	825	0.244	21	12,000	948	6,530
Trench 4	Diggings East Trench	1.8-2.5	F	fill-sand	60	0.0766	2	185	113	567
Trench 4	Diggings East Trench	3	T	yellow tailings	210	0.339	1	139	242	484
Trench 4	Diggings East Trench	3.5	T	yellow tailings	197	0.659	2	142	357	679
Trench 4	Diggings East Trench	4	T	yellow tailings	206	0.331	1	128	283	542
Trench 4	Diggings East Trench	4.5	T	gray tailings	201	0.835	4	199	619	1,495
Trench 4	Diggings East Trench	5	T	gray tailings	196	0.567	6	282	451	2,170
Trench 4	Diggings East Trench	5.5	A	dry alluvium	282	0.318	6	435	385	1,760
Trench 4	Diggings East Trench	6	A	dry alluvium	327	0.457	6	703	428	1,830
TP-NS-01	North Side Test Pit	2.2-2.6	T	oxidised sand and tailings	509	1.04	7	1,205	666	3,450
TP-NS-01	North Side Test Pit	2.6-4.4	A	dry alluvium	45	0.303	5	152	659	1,970
TP-NS-01	North Side Test Pit	8.0-11.0	O	organic silt	23	0.454	3	286	272	1,185
TP-NS-01E	North Side Test Pit	0.75-3.3	F	dry alluvium/ oxidized sand	866	0.3	7	8,150	488	2,490
TP-NS-01E	North Side Test Pit	3.3-7.0	O	organic silt	122	5.96	9	1,240	778	2,030
TP-NS-01E-50S	North Side Test Pit	0.0-0.5	T	tailings	193	0.36	17	465	269	4,520
TP-NS-01E-50S	North Side Test Pit	0.5-1.4	T	tailings	269	0.571	45	1,510	635	10,750
TP-NS-01E-50S	North Side Test Pit	1.4-3.3	F	dry alluvium/ oxidized sand	741	0.27	9	7,870	465	3,110
TP-NS-01E-50S	North Side Test Pit	3.3-4.0	O	organic silt	93	4.61	11	1,120	745	2,800
TP-NS-01E-50S	North Side Test Pit	7.25-7.5	A	dry alluvium	9	<0.04	1	141	68	271

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
TP-NS-02	North Side Test Pit	1.8-3.0	A	dry alluvium/ oxidized sand	33	0.0317	3	122	644	1,865
TP-NS-02	North Side Test Pit	6.6	O	organic silt	33	0.0797	7	132	767	2,410
TP-NS-02	North Side Test Pit	7.0-8.0	O	organic silt	56	<0.03	1	68	289	456
TP-NS-02E	North Side Test Pit	0.0-2.6	F	oxidized sand	881	0.243	9	9,060	493	2,910
TP-NS-02E	North Side Test Pit	2.5-5.0	O	organic silt	21	0.0679	2	314	248	1,160
TP-NS-03	North Side Test Pit	2.7-4.2	A	dry alluvium/ oxidized sand	44	<0.03	5	143	689	2,120
TP-NS-03	North Side Test Pit	4.2-10.2	O	organic silt	33	0.0429	4	211	467	1,890
TP-NS-03E	North Side Test Pit	0.9-1.3	T	oxidized sand and tailings	665	0.411	4	952	500	1,840
TP-NS-03E	North Side Test Pit	1.3-1.5	T	yellow tailings	422	1.01	5	864	593	1,760
TP-NS-03E	North Side Test Pit	1.5-2.0	A	dry alluvium	392	0.824	6	886	502	1,960
TP-NS-03E	North Side Test Pit	2.0-5.9	O	organic silt	53	0.0845	8	460	573	1,920
TP-NS-03E	North Side Test Pit	5.6-6.0	A	dry alluvium	25	<0.03	1	110	65	326
TP-NS-03E-50N	North Side Test Pit	0.0-1.3	F	oxidized sand	355	1.19	8	2,320	523	2,500
TP-NS-03E-50N	North Side Test Pit	1.3-1.4	F	oxidized sand	922	0.368	12	8,290	554	3,050
TP-NS-03E-50N	North Side Test Pit	1.4-1.6	O	organic silt	513	24.3	164	17,800	2,770	18,050
TP-NS-04E	North Side Test Pit	0.5-0.6	F	clean fill/ top soil	145	0.211	3	189	173	950
TP-NS-04E	North Side Test Pit	0.6-2.2	F	oxidized silty sand	349	1.26	22	2,100	884	5,540
TP-NS-04E	North Side Test Pit	2.2-4.0	O	organic silt	720	8.5	22	5,950	1,765	3,850
TP-NS-04E-50N	North Side Test Pit	0.5-1.4	T	oxidized sand and tailings	279	2.22	32	1,730	1,370	9,970
TP-NS-04E-50N	North Side Test Pit	1.6-3.0	O	organic silt	777	3.02	20	5,720	875	4,010

APPENDIX C: ICP DATA: CONCENTRATIONS OF COCs IN SEDIMENT											
Site Data/ Lithology Data					**COC Concentration**						
Site Name	**Location**	**Depth Interval**	**Soil Code**	**Soil Type**	**As**	**Hg**	**Cd**	**Cu**	**Pb**	**Zn**
					mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Failure Criteria					200	10	20	1,000	1,000	1,000
QA/QC Duplicate Samples										
TP-17W	Diggings East Test pit	5.1-8.0	T	Tailings	196		14	520	454	4,670
TP-NS-03	North Side Test Pit	2.7-4.2	A	dry alluvium/ oxidized sand	33		3	132	639	1,935
TP-NS-01E	North Side Test Pit	0.75-3.3	F	dry alluvium/ oxidized sand	884		8	8,090	475	2,550
TP-NS-01E	North Side Test Pit	3.3-7.0	O	organic silt	135		9	1,270	802	2,080
TP-NS-01E-50S	North Side Test Pit	0.5-1.4	T	tailings	266		43	1,480	616	10,800
TP-1 Trench- TR1 100S	Diggings East Trench	8.7-9.8	A	wet alluvium	367		4	1,850	272	1,370
TP-2 Trench 1-200S	Diggings East Trench	7.1-8.9	T	tailings	179		13	415	536	4,740
TP-1 Trench- TR1 100S	Diggings East Trench	7.5-8.5	T	yellow tailings, BOT	257		21	290	946	7,650
TP-3 Trench 1-300S	Diggings East Trench	0-5.3	F	sand and woody debris	322		9	1,520	555	3,380
TP-1 Trench- TR1 100S	Diggings East Trench	6.5-7.5	T	yellow tailings, TOT	162		1	117	345	531
Trench 4	Diggings East Trench	6				0.446				
TP-6W-100N Extent	Diggings East Test pit	6				0.17				
TP-16W	Diggings East Test pit	5.6-7.7	O			0.0845				
Trench 2	Diggings East Trench	2.5				0.947				
TP-6E	Diggings East Test pit	6.5-8	T			0.342				
Tp-4E	Diggings East Test pit	6.7-7.9				0.179				
TP-2E	Diggings East Test pit	3				1.44				
TP-NS-01E- 50S Extent	North Side Test Pit	3.3-4.0				0.0377				
TP-1W	Diggings East Test pit	6.6-8.2				0.314				
TP-NS-03		2.7-4.2				<0.03				

APPENDIX D MERCURY CONCENTRATIONS

Monday, September 30, 2013

Analytical Laboratory

Nick Tucci
Montana Tech
1300 W. Park Street
Butte, MT 59701

Dear Nick Tucci: Work Order: 1308116

MSE Lab Services received 195 sample(s) on 8/21/2013 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

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

Sincerely,

Sara Ward

Sara Ward
Laboratory Manager
406-494-7334

Enclosure

10/10/13

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-001A	TP-4E 0-6.7	0.965	H2	mg/Kg-dry	0.186	0.642	5	5/29/2013	9/4/2013 2:24:00 PM
1308116-002A	TP-4E 6.7-7.9	0.149	H2	mg/Kg-dry	0.0299	0.103	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-003A	TP-4E 8.0 +	ND	H2	mg/Kg-dry	0.0395	0.136	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-004A	TP-5E 6.3-8.65	0.243	H2	mg/Kg-dry	0.0317	0.109	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-005A	TP-5E 8.7-10.0	0.0479	JH2	mg/Kg-dry	0.0463	0.160	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-006A	TP-5E >10.9	0.362	H2	mg/Kg-dry	0.0322	0.111	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-007A	MBMG DUP 10	ND		mg/Kg-dry	0.0302	0.104	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-008A	MBMG DUP 9	0.314		mg/Kg-dry	0.0347	0.120	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-009A	MBMG DUP 8	0.377		mg/Kg-dry	0.0472	0.163	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-010A	MBMG DUP 7	1.44		mg/Kg-dry	0.0311	0.107	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-011A	MBMG DUP 6	0.179		mg/Kg-dry	0.0295	0.102	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-012A	MBMG DUP 5	0.342		mg/Kg-dry	0.0310	0.107	1	8/21/2013	9/4/2013 2:24:00 PM
1308116-013A	BERM 2 12-13	0.0536	JH2	mg/Kg-dry	0.0411	0.142	1	6/5/2013	9/4/2013 2:24:00 PM
1308116-014A	TP-2E 0-1.5	0.181	H2	mg/Kg-dry	0.0306	0.106	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-015A	TP-2E 2.0	0.312	H2	mg/Kg-dry	0.0306	0.105	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-016A	TP-2E 2.5	0.368	H2	mg/Kg-dry	0.0308	0.106	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-017A	TP-2E 3.0	1.55	H2	mg/Kg-dry	0.0321	0.111	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-018A	TP-2E 3.5	0.623	H2	mg/Kg-dry	0.0295	0.102	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-019A	TP-2Y 4.0	0.375	H2	mg/Kg-dry	0.0295	0.102	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-020A	TP-2E 4.75	0.215	H2	mg/Kg-dry	0.0322	0.111	1	5/29/2013	9/4/2013 2:24:00 PM
1308116-021A	TP-3E 5.0-6.8	0.363	H2	mg/Kg-dry	0.0312	0.108	1	5/29/2013	9/6/2013 8:51:00 AM
1308116-022A	TP-3E 6.0	1.30	H2	mg/Kg-dry	0.0301	0.104	1	5/29/2013	9/6/2013 8:51:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT:	Montana Bureau of Mines & Geology	**Lab Order:**	1308116
Project:	DIGGINGS EAST TO-19	**Date Received**	8/21/2013 4:45:00 PM
Analyte:	Mercury	**Matrix:**	Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-023A	TP-3E 8.5	1.05	H2	mg/Kg-dry	0.0338	0.117	1	5/29/2013	9/6/2013 8:51:00 AM
1308116-024A	TP-3E 9.5	3.71	H2	mg/Kg-dry	0.0810	0.279	2	5/29/2013	9/6/2013 8:51:00 AM
1308116-025A	TP-19W 7.0-8.3	1.38	H2	mg/Kg-dry	0.0412	0.142	1	5/30/2013	9/6/2013 8:51:00 AM
1308116-026A	BERM 1 0-4 (0.25' TAILINGS)	1.96	H2	mg/Kg-dry	0.0592	0.204	2	6/5/2013	9/6/2013 8:51:00 AM
1308116-027A	BERM 1 0-4 (1.9' OF RECOVERY)	2.11	H2	mg/Kg-dry	0.0343	0.118	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-028A	BERM 1 4-8 TAILINGS	0.872	H2	mg/Kg-dry	0.0296	0.102	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-029A	BERM 1 4.0-8.0 ORGANIC SILT	0.729	H2	mg/Kg-dry	0.0421	0.145	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-030A	BERM 1 4-8 GRAY SAND ALILURIUM	0.591	H2	mg/Kg-dry	0.0347	0.120	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-031A	BERM 2 0.3-0.7	1.05	H2	mg/Kg-dry	0.0313	0.108	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-032A	BERM 2 1.7-16	ND	H2	mg/Kg-dry	0.0331	0.114	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-033A	BERM 2 0-4	12.4	H2	mg/Kg-dry	0.335	1.15	10	6/5/2013	9/6/2013 8:51:00 AM
1308116-034A	BERM 2 4.25-6.5	27.9	H2	mg/Kg-dry	0.842	2.90	20	6/5/2013	9/6/2013 8:51:00 AM
1308116-035A	BERM 2 4-8 TAILS	1.48	H2	mg/Kg-dry	0.0345	0.119	1	6/5/2013	9/6/2013 8:51:00 AM
1308116-036A	BERM 2 8.0-12.0	31.2	H2	mg/Kg-dry	0.857	2.96	20	6/5/2013	9/6/2013 8:51:00 AM
1308116-037A	TP-NS-04E-50N 1.6-3	3.02	H2	mg/Kg-dry	0.0914	0.315	2	5/31/2013	9/6/2013 8:51:00 AM
1308116-038A	TP-NS-04E 2.2+	8.50	H2	mg/Kg-dry	0.226	0.778	5	5/31/2013	9/6/2013 8:51:00 AM
1308116-039A	TP-6E 0-6.5	1.02	H2	mg/Kg-dry	0.0403	0.139	1	5/29/2013	9/6/2013 8:51:00 AM
1308116-040A	TP-6E 6.5-8.0	0.627	H2	mg/Kg-dry	0.0323	0.111	1	5/29/2013	9/6/2013 8:51:00 AM
1308116-041A	TP-6E 8.0-11.3	0.147	JH2	mg/Kg-dry	0.0438	0.151	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-042A	TP-11W 4.0-7.0	0.398	H2	mg/Kg-dry	0.0341	0.118	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-043A	TP-13W 8.0-11.9	10.8	H2	mg/Kg-dry	0.215	0.741	5	5/30/2013	9/10/2013 10:56:00 AM
1308116-044A	TP-13W 6.6-9.0	0.565	H2	mg/Kg-dry	0.0394	0.136	1	5/30/2013	9/9/2013 3:37:00 PM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-045A	TP-13W 9.5	1.18	H2	mg/Kg-dry	0.0471	0.162	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-046A	TP-13W 9.7	0.172	H2	mg/Kg-dry	0.0304	0.105	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-047A	TP-14W 3.2-5.3	0.839	H2	mg/Kg-dry	0.0417	0.144	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-048A	TP-14W 5.3-7.5	0.819	H2	mg/Kg-dry	0.0377	0.130	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-049A	TP-4W 2.9-3.9	0.632	H2	mg/Kg-dry	0.0392	0.135	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-050A	TP-4W 4.0	0.337	H2	mg/Kg-dry	0.0414	0.143	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-051A	TP-4W 7.0	ND	H2	mg/Kg-dry	0.0392	0.135	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-052A	TP-5W 4-5	0.307	H2	mg/Kg-dry	0.0398	0.137	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-053A	TP-5W 5.1-6.5	0.147	H2	mg/Kg-dry	0.0380	0.131	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-054A	TP-5W 8.0	0.728	H2	mg/Kg-dry	0.0469	0.162	1	5/29/2013	9/9/2013 3:37:00 PM
1308116-055A	TP-15W 6.2-6.4	0.202	H2	mg/Kg-dry	0.0410	0.142	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-056A	TP-15W 5.2	0.644	H2	mg/Kg-dry	0.0383	0.132	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-057A	TP-15W 6.2	1.26	H2	mg/Kg-dry	0.0909	0.313	2	5/30/2013	9/10/2013 10:56:00 AM
1308116-058A	TP-15W 6.2-10	0.173	H2	mg/Kg-dry	0.0366	0.126	1	5/30/2013	9/9/2013 3:37:00 PM
1308116-059A	TP-NS-01-505-3.3-4.0	4.61	H2	mg/Kg-dry	0.0477	0.165	1	5/31/2013	9/9/2013 3:37:00 PM
1308116-060A	TP-NS-03E-50N 1.3-1.4	0.368	H2	mg/Kg-dry	0.0316	0.109	1	5/31/2013	9/9/2013 3:37:00 PM
1308116-061A	TP-8W 4.9-5.9	1.28	H2	mg/Kg-dry	0.0506	0.174	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-062A	TP-8W 5.9-8.0	1.18	H2	mg/Kg-dry	0.0516	0.178	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-063A	TP-8W 9.0	1.32	H2	mg/Kg-dry	0.0367	0.126	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-064A	TP-8W-505 3.45-5.0	1.24	H2	mg/Kg-dry	0.0508	0.175	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-065A	TP-8W-505 5.0-8.35	0.0916	JH2	mg/Kg-dry	0.0386	0.133	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-066A	TP-8W-100 E 7.1-4.3	0.657	H2	mg/Kg-dry	0.0427	0.147	1	5/29/2013	9/10/2013 10:56:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-067A	TP-8W-100 E 8.3-11	2.37	H2	mg/Kg-dry	0.0476	0.164	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-068A	TP-1W 6.6-8.2	0.555	H2	mg/Kg-dry	0.0363	0.125	1	5/28/2013	9/10/2013 10:56:00 AM
1308116-069A	TP-3W 3	0.493	H2	mg/Kg-dry	0.0380	0.131	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-070A	TP-3W 4	0.621	H2	mg/Kg-dry	0.0413	0.142	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-071A	TP-3W 5.0-6.0	0.0707	JH2	mg/Kg-dry	0.0361	0.125	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-072A	TP-4W 1.9-2.9	0.143	H2	mg/Kg-dry	0.0314	0.108	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-073A	TP-9W 3.9-4.65	1.38	H2	mg/Kg-dry	0.0539	0.186	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-074A	TP-9W 4.65-4.8	1.35	H2	mg/Kg-dry	0.0441	0.152	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-075A	TP-9W 7.3-7.85	69.2	H2	mg/Kg-dry	1.95	6.72	50	5/29/2013	9/10/2013 10:56:00 AM
1308116-076A	TP-9W 7.85-9.3	0.355	H2	mg/Kg-dry	0.0326	0.112	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-077A	TP-6W 5.2	ND	H2	mg/Kg-dry	0.0323	0.111	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-078A	TP-6W 8.1	ND	H2	mg/Kg-dry	0.0378	0.130	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-079A	TP-6W-50N 6.0-6.6	ND	H2	mg/Kg-dry	0.0388	0.134	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-080A	TP-6W-50N 7.5	0.277	H2	mg/Kg-dry	0.0369	0.127	1	5/29/2013	9/10/2013 10:56:00 AM
1308116-081A	TP-7W 9.0-9.8	ND	H2	mg/Kg-dry	0.0358	0.124	1	5/29/2013	9/11/2013 10:11:00 AM
1308116-082A	TP-6W-100N 6.0	0.189	H2	mg/Kg-dry	0.0388	0.134	1	5/29/2013	9/11/2013 10:11:00 AM
1308116-083A	TP-6W-100N 7.0-9.0	38.5	H2	mg/Kg-dry	1.01	3.48	20	5/29/2013	9/11/2013 10:11:00 AM
1308116-084A	TP-6W-100N 9.5	0.538	H2	mg/Kg-dry	0.0352	0.121	1	5/29/2013	9/11/2013 10:11:00 AM
1308116-085A	TP-2-TRENCH1-200 S 7.1-8.9	0.351	H2	mg/Kg-dry	0.0331	0.114	1	5/28/2012	9/11/2013 10:11:00 AM
1308116-086A	TP-2-TRENCH1-200 S 8.9-9.5	0.147	H2	mg/Kg-dry	0.0310	0.107	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-087A	TP-1E 6.7 6.7-7.7	0.567	H2	mg/Kg-dry	0.0366	0.126	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-088A	TP-1E 7.7-8.9	0.664	H2	mg/Kg-dry	0.0357	0.123	1	5/28/2013	9/11/2013 10:11:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-089A	TRENCH 2 2.5	0.474	H2	mg/Kg-dry	0.0315	0.109	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-090A	TP-12W 4.1-6.2	0.193	H2	mg/Kg-dry	0.0345	0.119	1	5/30/2013	9/11/2013 10:11:00 AM
1308116-091A	TP-12W 6.5-7.2	0.914	H2	mg/Kg-dry	0.0429	0.148	1	5/30/2013	9/11/2013 10:11:00 AM
1308116-092A	TP-12W 7.2	0.382	H2	mg/Kg-dry	0.0322	0.111	1	5/30/2013	9/11/2013 10:11:00 AM
1308116-093A	TP-16W 5.6-7.7	0.0743	JH2	mg/Kg-dry	0.0485	0.167	1	5/30/2013	9/11/2013 10:11:00 AM
1308116-094A	TP-16W 7.7-9.1	0.203	H2	mg/Kg-dry	0.0302	0.104	1	5/30/2013	9/11/2013 10:11:00 AM
1308116-095A	TP-NS-3 2.7-4.2	ND	H2	mg/Kg-dry	0.0319	0.110	1	5/31/2013	9/11/2013 10:11:00 AM
1308116-096A	TP-NS-3 4.2-10.2	0.0429	JH2	mg/Kg-dry	0.0409	0.141	1	5/31/2013	9/11/2013 10:11:00 AM
1308116-097A	TRENCH 4 4.5	0.835	H2	mg/Kg-dry	0.0307	0.106	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-098A	TRENCH 4 5.0	0.567	H2	mg/Kg-dry	0.0317	0.109	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-099A	TRENCH 4 5.5	0.318	H2	mg/Kg-dry	0.0318	0.110	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-100A	TRENCH 4 6.0	0.457	H2	mg/Kg-dry	0.0305	0.105	1	5/28/2013	9/11/2013 10:11:00 AM
1308116-101A	TP1-TRENCH 1-3005 0-5.3	0.689	H2	mg/Kg-dry	0.0328	0.113	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-102A	TP1-TRENCH 1-3005 7.6-5.3	0.252	H2	mg/Kg-dry	0.0358	0.123	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-103A	TP1-TRENCH 1-3005 8.5	0.946	H2	mg/Kg-dry	0.0354	0.122	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-104A	TP1-TRENCH 1-3005 8.5+	0.667	H2	mg/Kg-dry	0.0358	0.124	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-105A	TP1-TRENCH 1-1005 6.5-7.5	0.350	H2	mg/Kg-dry	0.0311	0.107	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-106A	TP1-TRENCH 1-1005 7.5-8.5	3.96	H2	mg/Kg-dry	0.0795	0.274	2	5/28/2013	9/13/2013 8:58:00 AM
1308116-107A	TP1-TRENCH 1-1005 8.7-9.8	0.180	H2	mg/Kg-dry	0.0319	0.110	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-108A	TP-2W 7.2-9.4	0.597	H2	mg/Kg-dry	0.0333	0.115	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-109A	TRENCH 2 4.5	0.0848	JH2	mg/Kg-dry	0.0354	0.122	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-110A	TRENCH 3 0-2.0	0.156	H2	mg/Kg-dry	0.0329	0.113	1	5/28/2013	9/13/2013 8:58:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-111A	TRENCH 3 2.5	0.321	H2	mg/Kg-dry	0.0306	0.105	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-112A	TRENCH 3 3.0	0.962	H2	mg/Kg-dry	0.0309	0.107	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-113A	TRENCH 3 3.5	1.03	H2	mg/Kg-dry	0.0299	0.103	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-114A	TRENCH 3 4.0	1.03	H2	mg/Kg-dry	0.0300	0.103	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-115A	TRENCH 3 4.5	0.782	H2	mg/Kg-dry	0.0319	0.110	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-116A	TRENCH 3 5.0	0.354	H2	mg/Kg-dry	0.0306	0.105	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-117A	TRENCH 4 1.8-2.5	0.0766	JH2	mg/Kg-dry	0.0306	0.106	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-118A	TRENCH 4 3.0	0.339	H2	mg/Kg-dry	0.0294	0.101	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-119A	TRENCH 4 3.5	0.659	H2	mg/Kg-dry	0.0312	0.108	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-120A	TRENCH 4 4.0	0.331	H2	mg/Kg-dry	0.0302	0.104	1	5/28/2013	9/13/2013 8:58:00 AM
1308116-121A	TRENCH 1 4.0	0.506	H2	mg/Kg-dry	0.0332	0.114	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-122A	TRENCH 1 4.5	0.459	H2	mg/Kg-dry	0.0318	0.110	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-123A	TRENCH 1 5.0	0.303	H2	mg/Kg-dry	0.0309	0.107	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-124A	TRENCH 1 5.5	0.474	H2	mg/Kg-dry	0.0362	0.125	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-125A	TRENCH 1 6.0	0.441	H2	mg/Kg-dry	0.0320	0.110	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-126A	TRENCH 1 6.5	0.239	H2	mg/Kg-dry	0.0324	0.112	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-127A	TRENCH 1 6.8	0.249	H2	mg/Kg-dry	0.0343	0.118	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-128A	TRENCH 2 0-1.5	0.778	H2	mg/Kg-dry	0.0312	0.107	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-129A	TRENCH 2 2.0	0.547	H2	mg/Kg-dry	0.0330	0.114	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-130A	TRENCH 2 3.0	90.2	H2	mg/Kg-dry	2.50	8.60	50	5/28/2013	9/16/2013 9:41:00 AM
1308116-131A	TRENCH 2 3.5	0.180	H2	mg/Kg-dry	0.0322	0.111	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-132A	TRENCH 2 4.0	0.387	H2	mg/Kg-dry	0.0334	0.115	1	5/28/2013	9/16/2013 9:41:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-133A	TP-NS-2 6.6	0.0797	JH2	mg/Kg-dry	0.0361	0.125	1	5/31/2013	9/16/2013 9:41:00 AM
1308116-134A	TP-NS-03E 5.6-6.0	ND	H2	mg/Kg-dry	0.0339	0.117	1	5/31/2013	9/16/2013 9:41:00 AM
1308116-135A	TP-NS-03E 2.0-5.6	0.0845	JH2	mg/Kg-dry	0.0467	0.161	1	5/31/2013	9/16/2013 9:41:00 AM
1308116-136A	TP-NS-03E -50N 0-1.3	1.19	H2	mg/Kg-dry	0.0342	0.118	1	5/31/2013	9/16/2013 9:41:00 AM
1308116-137A	TP-1W 8.2-9.2	1.62	H2	mg/Kg-dry	0.0467	0.161	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-138A	TP-2W >10.2	0.241	H2	mg/Kg-dry	0.0336	0.116	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-139A	TRENCH 3 5.5	0.244	H2	mg/Kg-dry	0.0337	0.116	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-140A	TP-2W 0-7.2	0.110	H2	mg/Kg-dry	0.0303	0.105	1	5/28/2013	9/16/2013 9:41:00 AM
1308116-141A	TRENCH 1 2.0	0.0913	JH2	mg/Kg-dry	0.0370	0.128	1	5/28/2013	9/23/2013 2:10:00 PM
1308116-142A	TRENCH 1 2.5	ND	H2	mg/Kg-dry	0.0503	0.174	1	5/28/2013	9/23/2013 2:10:00 PM
1308116-143A	TRENCH 1 3.0	0.773	H2	mg/Kg-dry	0.0663	0.229	1	5/28/2013	9/23/2013 2:10:00 PM
1308116-144A	TRENCH 1 3.5	0.598	H2	mg/Kg-dry	0.0590	0.203	1	5/28/2013	9/23/2013 2:10:00 PM
1308116-145A	TP-NS-02E 0-2.6	0.243	H2	mg/Kg-dry	0.0301	0.104	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-146A	TP-NS-01E-505 0.5-1.4	0.571	H2	mg/Kg-dry	0.0360	0.124	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-147A	TP-NS-1 2.6-4.4	0.0382	JH2	mg/Kg-dry	0.0308	0.106	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-148A	TP-NS-03E 1.3-1.5	1.01	H2	mg/Kg-dry	0.0305	0.105	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-149A	TP-NS-04E-50N 0.5-1.4	2.22	H2	mg/Kg-dry	0.0404	0.139	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-150A	TP-NS-02E 2.5-5	0.0679	JH2	mg/Kg-dry	0.0409	0.141	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-151A	TP-NS-01E 0.75-3.3	0.300	H2	mg/Kg-dry	0.0310	0.107	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-152A	TP-NS-01E 505 7.25-7.5	ND	H2	mg/Kg-dry	0.0358	0.123	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-153A	TP-NS-01E-505 1.4-3.3	0.270	H2	mg/Kg-dry	0.0338	0.117	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-154A	TP-NS-03E-50N 1.4-1.6	24.3	H2	mg/Kg-dry	0.645	2.22	10	5/31/2013	9/24/2013 9:20:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B
SW7471

CLIENT:	Montana Bureau of Mines & Geology	**Lab Order:**	1308116
Project:	DIGGINGS EAST TO-19	**Date Received**	8/21/2013 4:45:00 PM
Analyte:	Mercury	**Matrix:**	Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-155A	TP-NS-1 8.0-11.0	0.454	H2	mg/Kg-dry	0.0436	0.150	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-156A	TP-NS-03E 1.5-2.0	0.824	H2	mg/Kg-dry	0.0311	0.107	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-157A	TP-NS-2 7-8	ND	H2	mg/Kg-dry	0.0558	0.192	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-158A	TP-NS-04E 0.6-2.2	1.26	H2	mg/Kg-dry	0.0413	0.142	1	5/31/2013	9/23/2013 2:10:00 PM
1308116-159A	TP-18W 6.0+	0.309	H2	mg/Kg-dry	0.0353	0.122	1	5/30/2013	9/23/2013 2:10:00 PM
1308116-160A	BERM 5 0.8-8.0	0.542	H2	mg/Kg-dry	0.0336	0.116	1	6/5/2013	9/23/2013 2:10:00 PM
1308116-161A	TP-16W-505 6.8-9.0	0.858	H2	mg/Kg-dry	0.0401	0.138	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-162A	TP-10W 2.0-3.9	0.507	H2	mg/Kg-dry	0.0331	0.114	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-163A	TP-NS-1 2.25-2.6	1.04	H2	mg/Kg-dry	0.0415	0.143	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-164A	TP-NS-2 1.8-3.0	0.0317	JH2	mg/Kg-dry	0.0302	0.104	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-165A	TP-NS-03E 0.9-13	0.411	H2	mg/Kg-dry	0.0357	0.123	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-166A	TP-16W-505 10.3-11.65	0.256	H2	mg/Kg-dry	0.0312	0.108	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-167A	TP-11W 8.0	0.108	JH2	mg/Kg-dry	0.0366	0.126	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-168A	TP-NS-04E 0.5-0.6	0.211	H2	mg/Kg-dry	0.0303	0.105	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-169A	TP-17W 5.1-8.0	1.67	H2	mg/Kg-dry	0.0316	0.109	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-170A	TP-19W 5.2-7.0	0.555	H2	mg/Kg-dry	0.0328	0.113	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-171A	TP-18W 5-6	0.849	H2	mg/Kg-dry	0.0444	0.153	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-172A	TP-NS-01E 3.3-7	5.96	H2	mg/Kg-dry	0.226	0.778	5	5/31/2013	9/24/2013 9:20:00 AM
1308116-173A	TP-NS-01E-505 0-0.5	0.360	H2	mg/Kg-dry	0.0348	0.120	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-174A	TP-19W 8.3-8.75	0.143	H2	mg/Kg-dry	0.0342	0.118	1	5/31/2013	9/24/2013 9:20:00 AM
1308116-175A	TP-14W 9.35	0.181	H2	mg/Kg-dry	0.0348	0.120	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-176A	TP-10W 3.9-5.3	0.161	H2	mg/Kg-dry	0.0312	0.108	1	5/30/2013	9/24/2013 9:20:00 AM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

MSE Lab Services

Date: 10/7/2013

MERCURY IN SOIL/SEDIMENT - SW846 7471B SW7471

CLIENT: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19
Analyte: Mercury

Lab Order: 1308116
Date Received 8/21/2013 4:45:00 PM
Matrix: Soil

Laboratory ID	Client Sample ID	Results	Qual	Units	MDL	RL	DF	Date Collected	Date Analyzed
1308116-177A	TP-12W 6.2-6.5	3.34	H2	mg/Kg-dry	0.0949	0.327	2	5/30/2013	9/24/2013 9:20:00 AM
1308116-178A	TP-12W 7.2-8.0	0.263	H2	mg/Kg-dry	0.0317	0.109	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-179A	TP-18W 3.45-5.0	0.962	H2	mg/Kg-dry	0.0319	0.110	1	5/30/2013	9/24/2013 9:20:00 AM
1308116-180A	BERM 2	2.95	H2	mg/Kg-dry	0.0788	0.272	2	6/5/2013	9/24/2013 9:20:00 AM
1308116-181A	MBMG DUP1	0.446	H	mg/Kg-dry	0.0308	0.106	1	8/21/2013	9/24/2013 2:15:00 PM
1308116-182A	MBMG DUP2	0.170	H	mg/Kg-dry	0.0379	0.131	1	8/21/2013	9/24/2013 2:15:00 PM
1308116-183A	MBMG DUP3	0.0845	JH	mg/Kg-dry	0.0509	0.175	1	8/21/2013	9/24/2013 2:15:00 PM
1308116-184A	MBMG DUP4	0.947	H	mg/Kg-dry	0.0322	0.111	1	8/21/2013	9/24/2013 2:15:00 PM
1308116-185A	BERM 3 8-12	ND	H2	mg/Kg-dry	0.0438	0.151	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-186A	BERM 3 13-16	ND	H2	mg/Kg-dry	0.0312	0.108	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-187A	BERM 4 9.7-12	0.142	H2	mg/Kg-dry	0.0342	0.118	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-188A	BERM 4 0.5-1.45	0.0337	JH2	mg/Kg-dry	0.0311	0.107	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-189A	BERM 3 4-8	0.438	H2	mg/Kg-dry	0.0387	0.134	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-190A	BERM 5 9.2-10	0.138	H2	mg/Kg-dry	0.0333	0.115	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-191A	BERM 4 1.45-1.8	0.265	H2	mg/Kg-dry	0.0376	0.130	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-192A	BERM 5 0.8-1.5	0.0528	JH2	mg/Kg-dry	0.0333	0.115	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-193A	BERM 3 0-4	2.40	H2	mg/Kg-dry	0.0356	0.123	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-194A	BERM 3 1.6-1.9	0.397	H2	mg/Kg-dry	0.0476	0.164	1	6/5/2013	9/24/2013 2:15:00 PM
1308116-195A	TP-NS-01E	0.232	H2	mg/Kg-dry	0.0303	0.104	1	5/31/2013	9/24/2013 2:15:00 PM

Qualifiers:
MDL - Method Detection Limit
ND - Not Detected at the Method Detection Limit (MDL)
J - Detected below the Reporting Limit (RL)
DF - Dilution Factor
RL - Reporting Limit

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7118

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7118-PB***			*Method:* ***SW7471***		*Batch ID:* ***7118***				*Analysis Date: 9/4/2013 2:24:00 PM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7118***			*Method:* ***SW7471***		*Batch ID:* ***7118***				*Analysis Date: 9/4/2013 2:24:00 PM*	
Mercury	17.2	1.18	mg/Kg	21.70	79.4	80	120			S*
Sample ID: ***1308116-001A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7118***				*Analysis Date: 9/4/2013 2:24:00 PM*	
Mercury	20.3	1.52	mg/Kg-dry	27.94	69.2	75	125	17.9	35	S*H2
Sample ID: ***1308116-001A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7118***				*Analysis Date: 9/4/2013 2:24:00 PM*	
Mercury	24.3	1.55	mg/Kg-dry	27.94	83.5	75	125			H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7128

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7128-PB***			*Method:* ***SW7471***		*Batch ID:* ***7128***			*Analysis Date: 9/6/2013 8:51:00 AM*		
Mercury	ND	0.0995	mg/Kg							
Sample ID: ***LCS-7128***			*Method:* ***SW7471***		*Batch ID:* ***7128***			*Analysis Date: 9/6/2013 8:51:00 AM*		
Mercury	17.1	1.22	mg/Kg	21.70	78.8	80	120			S*
Sample ID: ***1308116-021A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7128***			*Analysis Date: 9/6/2013 8:51:00 AM*		
Mercury	19.7	1.34	mg/Kg-dry	23.99	80.5	75	125			H2
Sample ID: ***1308116-021A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7128***			*Analysis Date: 9/6/2013 8:51:00 AM*		
Mercury	21.9	1.38	mg/Kg-dry	23.99	89.7	75	125	10.7	35	H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7131

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7131-PB***			*Method:* ***SW7471***		*Batch ID:* ***7131***				*Analysis Date: 9/9/2013 3:37:00 PM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7131***			*Method:* ***SW7471***		*Batch ID:* ***7131***				*Analysis Date: 9/9/2013 3:37:00 PM*	
Mercury	16.3	1.17	mg/Kg	21.70	75.1	80	120			S*
Sample ID: ***1308116-041A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7131***				*Analysis Date: 9/9/2013 3:37:00 PM*	
Mercury	20.3	1.87	mg/Kg-dry	33.03	61.0	75	125			S*H2
Sample ID: ***1308116-041A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7131***				*Analysis Date: 9/9/2013 3:37:00 PM*	
Mercury	23.2	1.90	mg/Kg-dry	33.03	69.9	75	125	13.5	35	S*H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7132

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7132-PB***			*Method:* ***SW7471***		*Batch ID:* ***7132***					*Analysis Date: 9/10/2013 10:56:00 AM*
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7132***			*Method:* ***SW7471***		*Batch ID:* ***7132***					*Analysis Date: 9/10/2013 10:56:00 AM*
Mercury	12.4	1.22	mg/Kg	21.70	57.3	80	120			S*
Sample ID: ***1308116-061A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7132***					*Analysis Date: 9/10/2013 10:56:00 AM*
Mercury	27.6	2.01	mg/Kg-dry	37.88	69.4	75	125			S*H2
Sample ID: ***1308116-061A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7132***					*Analysis Date: 9/10/2013 10:56:00 AM*
Mercury	21.0	2.08	mg/Kg-dry	37.88	52.1	75	125	26.9	35	S*H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7147

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7147-PB***			*Method:* ***SW7471***		*Batch ID:* ***7147***					*Analysis Date: 9/11/2013 10:11:00 AM*
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7147***			*Method:* ***SW7471***		*Batch ID:* ***7147***					*Analysis Date: 9/11/2013 10:11:00 AM*
Mercury	19.6	1.17	mg/Kg	21.70	90.2	80	120			
Sample ID: ***1308116-081A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7147***					*Analysis Date: 9/11/2013 10:11:00 AM*
Mercury	22.0	1.53	mg/Kg-dry	26.72	82.4	75	125			H2
Sample ID: ***1308116-081A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7147***					*Analysis Date: 9/11/2013 10:11:00 AM*
Mercury	22.5	1.52	mg/Kg-dry	26.72	84.4	75	125	2.34	35	H2

Qualifiers: NA Sample conc. Is > 4*spike level

S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7156

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7156-PB***			*Method:* ***SW7471***		*Batch ID:* ***7156***				*Analysis Date: 9/13/2013 8:58:00 AM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7156***			*Method:* ***SW7471***		*Batch ID:* ***7156***				*Analysis Date: 9/13/2013 8:58:00 AM*	
Mercury	19.4	1.23	mg/Kg	21.70	89.4	80	120			
Sample ID: ***1308116-101A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7156***				*Analysis Date: 9/13/2013 8:58:00 AM*	
Mercury	23.5	1.32	mg/Kg-dry	24.96	91.6	75	125			H2
Sample ID: ***1308116-101A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7156***				*Analysis Date: 9/13/2013 8:58:00 AM*	
Mercury	26.2	1.33	mg/Kg-dry	24.96	102	75	125	10.6	35	H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7162

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7162-PB***			*Method:* ***SW7471***		*Batch ID:* ***7162***				*Analysis Date: 9/16/2013 9:41:00 AM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7162***			*Method:* ***SW7471***		*Batch ID:* ***7162***				*Analysis Date: 9/16/2013 9:41:00 AM*	
Mercury	19.0	1.17	mg/Kg	21.70	87.5	80	120			
Sample ID: ***1308116-121A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7162***				*Analysis Date: 9/16/2013 9:41:00 AM*	
Mercury	22.8	1.36	mg/Kg-dry	24.05	92.9	75	125			H2
Sample ID: ***1308116-121A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7162***				*Analysis Date: 9/16/2013 9:41:00 AM*	
Mercury	21.0	1.29	mg/Kg-dry	24.05	85.2	75	125	8.48	35	H2

Qualifiers: NA Sample conc. Is > 4*spike level

S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7207

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7207-PB***			*Method:* ***SW7471***		*Batch ID:* ***7207***				*Analysis Date: 9/23/2013 2:10:00 PM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7207***			*Method:* ***SW7471***		*Batch ID:* ***7207***				*Analysis Date: 9/23/2013 2:10:00 PM*	
Mercury	17.6	1.25	mg/Kg	21.70	81.3	80	120			
Sample ID: ***1308116-141A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7207***				*Analysis Date: 9/23/2013 2:10:00 PM*	
Mercury	21.1	1.46	mg/Kg-dry	27.35	76.8	75	125			H2
Sample ID: ***1308116-141A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7207***				*Analysis Date: 9/23/2013 2:10:00 PM*	
Mercury	21.9	1.49	mg/Kg-dry	27.35	79.6	75	125	3.65	35	H2

Qualifiers: NA Sample conc. Is > 4*spike level

S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7211

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7211-PB***			*Method:* ***SW7471***		*Batch ID:* ***7211***				*Analysis Date: 9/24/2013 9:20:00 AM*	
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7211***			*Method:* ***SW7471***		*Batch ID:* ***7211***				*Analysis Date: 9/24/2013 9:20:00 AM*	
Mercury	16.6	1.23	mg/Kg	21.70	76.5	80	120			S*
Sample ID: ***1308116-161A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7211***				*Analysis Date: 9/24/2013 9:20:00 AM*	
Mercury	24.9	1.72	mg/Kg-dry	29.91	80.4	75	125			H2
Sample ID: ***1308116-161A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7211***				*Analysis Date: 9/24/2013 9:20:00 AM*	
Mercury	28.8	1.70	mg/Kg-dry	29.91	93.5	75	125	14.6	35	H2

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

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Date: 07-Oct-13
Report Date: 30-Sep-13

QA/QC SUMMARY REPORT

Client: Montana Bureau of Mines & Geology
Project: DIGGINGS EAST TO-19

Work Order: 1308116
BatchID: 7212

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***7212-PB***			*Method:* ***SW7471***		*Batch ID:* ***7212***					*Analysis Date: 9/24/2013 2:15:00 PM*
Mercury	ND	0.100	mg/Kg							
Sample ID: ***LCS-7212***			*Method:* ***SW7471***		*Batch ID:* ***7212***					*Analysis Date: 9/24/2013 2:15:00 PM*
Mercury	16.8	1.23	mg/Kg	21.70	77.2	80	120			S*
Sample ID: ***1308116-181A-MS***			*Method:* ***SW7471***		*Batch ID:* ***7212***					*Analysis Date: 9/24/2013 2:15:00 PM*
Mercury	17.6	1.33	mg/Kg-dry	23.27	73.7	75	125			S* H
Sample ID: ***1308116-181A-MSD***			*Method:* ***SW7471***		*Batch ID:* ***7212***					*Analysis Date: 9/24/2013 2:15:00 PM*
Mercury	20.2	1.29	mg/Kg-dry	23.27	84.7	75	125	13.6	35	H

Qualifiers:
NA Sample conc. Is > 4*spike level
S* Spike Recovery outside limits; Manufacturer limits for mercury 11.2 - 32.3 mg/kg

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308114

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings EAST TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406 - 496 - 4795	Purchase Order #:
Fax: 406 - 496 - 4451	Sampler Name and Phone #:

SAMPLE ID	LAB ID	DATE	TIME	Arsenic E245.5							
TP-4E 0-6.7	001A	5/29/13		X							
TP-4E 6.7-7.9	002A	5/29/13		X							
TP-4E 8.0+	003A	5/29/13		X							
TP-5E 6.3-8.65	004A	5/29/13		X							
TP-5E 8.7-10.0	005A	5/29/13		X							
TP-5E > 10.9	006A	5/29/13		X							
MBMG DUP 10	007A	8/21/13		X							
MBMG DUP 9	008A	8/21/13		X							
MBMG DUP 8	009A	8/21/13		X							
MBMG DUP 7	010A	8/21/13		X							
MBMG DUP 6	011A	8/21/13		X							
MBMG DUP 5	012A	8/21/13		X							

ANALYSIS REQUESTED

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	16:45	Sara Ward	8/21/13	1645
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
			Sara Ward	MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	(Y)	N

Delivery Method: hld in Sealed cooler
Temperature (°C): _____
Preservative: several samples collected prior to informed client of 28day HT 7/24/2013
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
200 Technology Way, P.O. Box 4078
Butte, MT 59701
PH: (406) 494-7334 / FAX: (406) 494-7128
labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury E245.5

REMARKS

Turnaround Time (TAT) / Reporting

____Standard
____Next Day*
____2nd Day*
____Other*
_____

*All rush order requests must have prior approval

____Phone
____Mail
____Fax
____Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury E245.5
Berm 2 12-13	013A	6/5/13		X
TP-2E 0-1.5	014A	5/29/13		X
TP-2E 2.0	015A	5/29/13		X
TP-2E 2.5	016A	5/29/13		X
TP-2E 3.0	017A	5/29/13		X
TP-2E 3.5	018A	5/29/13		X
TP-2E 4.0	019A	5/29/13		X
TP-2E 4.75	020A	5/29/13		X
TP-3E 5.0-6.8	021A	5/29/13		X
TP-3E 6.0	022A	5/29/13		X
TP-3E 8.5	023A	5/29/13		X
TP-3E 9.5	024A	5/29/13		X

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature)	8/21/13	1645	RECEIVED BY (Signature) Sara Ward	8/21/13	1645
PRINTED NAME Nick Tucci	COMPANY MBMG		PRINTED NAME Sara Ward	COMPANY MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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Butte, MT 59701
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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 136981

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park ST	Project Name and Number: Diggings East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury CVAFS

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury CVAFS
TP-19W 7.0-8.3	025A	5/30/13		X
Berm 1 0-4 (0.25' tailings)	026A	6/5/13		X
Berm 1 0-4 (1.9' of recovery)	027A	6/5/13		X
Berm 1 4-8 tailings	028A	6/5/13		X
Berm 1 4.0-8.0 Organic silt	029A	6/5/13		X
Berm 1 4-8 gray sand alluvium	030A	6/5/13		X
Berm 2 0.3-0.7	031A	6/5/13		X
Berm 2 1.7-1.6	032A	6/5/13		X
Berm 2 0-4	033A	6/5/13		X
Berm 2 4.25-6.5	034A	6/5/13		X
Berm 2 4-8 tails	035A	6/5/13		X
Berm 2 8.0-12.0	036A	6/5/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	16:45	Sara Ward	8/21/13	1645
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury (245.5)

REMARKS

Turnaround Time (TAT) / Reporting

____Standard
____Next Day*
____2nd Day*
____Other*
_____

*All rush order requests must have prior approval

____Phone
____Mail
____Fax
____Email

SAMPLE ID	LAB ID	DATE	TIME	
TP-NS-04E-SON 1.6-3	037A	5/31/13		X
TP-NS-04E 2.2+	038A	5/31/13		X
TP-6E 0-6.5	039A	5/29/13		X
TP-6E 6.5-8.0	040A	5/29/13		X
TP-6E 8.0-11.3	041A	5/29/13		X
TP-11W 4.0-7.0	042A	5/30/13		X
TP-13W 8.0-11.9	043A	5/30/13		X
TP-13W 6.6-9.0	044A	5/30/13		X
TP-13W 9.5	045A	5/30/13		X
TP-13W 9.7	~~044A~~ 046A	5/30/13		X
TP-14W 3.2-5.3	047A	5/30/13		X
TP-14W 5.3-7.5	048A	5/30/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	16:55	Sara Ward	8/21/13	1645
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
Nicholas Tucci	MBMG		Sara Ward	MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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Butte, MT 59701
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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #: 4064964795 Nick Tucci

SAMPLE ID	LAB ID	DATE	TIME	ANALYSIS REQUESTED: Mercury E245.5
TP-4W 2.9-3.9	049A	5/29/13		X
TP-4W 4.0	050A	5/29/13		X
TP-4W 7.0	051A	5/29/13		X
TP-5W 4-5	052A	5/29/13		X
TP-5W 5.1-6.5	053A	5/29/13		X
TP-5W 8.0	054A	5/29/13		X
TP-15W 6.2-6.4	055A	5/30/13		X
TP-15W 5.2	056A	5/30/13		X
TP-15W 6.2	057A	5/30/13		X
TP-15W 6.2-10	058A	5/30/13		X
TP-NS-01-505 3.3-4.0	059A	5/31/13		X
TP-NS-03E-50N 1.3-1.4	060A	5/31/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	5/31/13	16:15	Sara Ward	6/8/2013	1645
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE-TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

REMARKS

Turnaround Time (TAT) / Reporting

___Standard ___Next Day* ___2nd Day* ___Other* _____	*All rush order requests must have prior approval	___Phone ___Mail ___Fax ___Email

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____

Temperature (°C): _____

Preservative: _____

_____

Date & Time: _____

Inspected By: _____

MSE LABORATORY SERVICES
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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury EPA 245.5

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury EPA 245.5
TP-8W 4.9-5.9	061A	5/29/13		X
TP-8W 5.9-8.0	062A	5/29/13		X
TP-8W 9.0	063A	5/29/13		X
TP-8W-50S 3.45-5.0	064A	5/29/13		X
TP-8W-50S 5.0-8.35	065A	5/29/13		X
TP-8W-100E 7.1-8.3	066A	5/29/13		X
TP-8W-100E 8.3-11	067A	5/29/13		X
TP-1W 6.6-8.2	068A	5/28/13		X
TP-3W 3	069A	5/29/13		X
TP-3W 4	070A	5/29/13		X
TP-3W 5.0-6.0	071A	5/29/13		X
TP-4W 1.9-2.9	072A	5/29/13		X

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature)	8/5/13	16:45	RECEIVED BY (Signature) Sara Ward	8/21/13	1645
PRINTED NAME Nick Tucci	COMPANY MBMG		PRINTED NAME Sara Ward	COMPANY MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: 10-19 Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #: 4064964795

ANALYSIS REQUESTED: Mercury E245.5

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	
TP-9W 3.9-4.65	073A	5/29/13		X
TP-9W 4.65-4.8	074A	5/29/13		X
TP-9W 7.3-7.85	075A	5/29/13		X
TP-9W 7.85-9.3	076A	5/29/13		X
TP-6W 5.2	077A	5/29/13		X
TP-6W 8.1	078A	5/29/13		X
TP-6W-50N 6.0-6.6	079A	5/29/13		X
TP-6W-50N 7.5	080A	5/29/13		X
TP-9W 9.0-9.8	081A	5/29/13		X
TP-6W-100N 6.0	082A	5/29/13		X
TP-6W-100N 7.0-9.0	083A	5/29/13		X
TP-6W-100N 9.5	084A	5/29/13		X

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature)	8/21/13	16:55	RECEIVED BY (Signature) Sara Ward	8/21/13	1645
PRINTED NAME Nick Tucci	COMPANY MBMG		PRINTED NAME Sara Ward	COMPANY MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308114

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED

SAMPLE ID	LAB ID	DATE	TIME	Mercury EPA 245.5
TP2-Trench 1-20S 7.1-8.9	085A	5/28/13		X
TP2-Trench 1-20S 8.9-9.5	086A	5/28/13		X
TP-1E 6.7 6.7-7.7	087A	5/28/13		X
TP-1E 7.7-8.9	088A	5/28/13		X
Trench 2 2.5	089A	5/28/13		X
TP-12W 4.1-6.2	090A	5/30/13		X
TP-12W 6.5-7.2	091A	5/30/13		X
TP-12W 2.2	092A	5/30/13		X
TP-16W 5.6-7.7	093A	5/30/13		X
TP-16W 2.7-9.1	094A	5/30/13		X
TP-NS-3 2.7-4.2	095A	5/31/13		X
TP-NS-3 4.2-10.2	096A	5/31/13		X

REMARKS

Turnaround Time (TAT) / Reporting

___Standard ___Next Day* ___2nd Day* ___Other* _____	*All rush order requests must have prior approval	___Phone ___Mail ___Fax ___Email

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature)	5/31/13	15:55	RECEIVED BY (Signature) Sara Ward	8/27/13	1645
PRINTED NAME Nick Tucci	COMPANY MBMG		PRINTED NAME Sara Ward	COMPANY MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

MSE LABORATORY SERVICES
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Butte, MT 59701
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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury E245.5
Trench Y 4.5	097A	5/28/13		X
Trench Y 5.0	098A	5/28/13		X
Trench Y 5.5	099A	5/28/13		X
Trench Y 6.0	100A	5/28/13		X
TP1-Trench 1-300S 0-5.3	101A	5/28/13		X
TP1-Trench 1-300S 2.6-5.3	102A	5/28/13		X
TP1-Trench 1-300S 8.5	103A	5/28/13		X
TP1-Trench 1-300S 8.5+	104A	5/28/13		X
TP1-Trench 1-100S 6.5-7.5	105A	5/28/13		X
TP1-Trench 1-100S 7.5-8.5	106A	5/28/13		X
TP1-Trench 1-100S 8.7-9.8	107A	5/28/13		X
TP-2W 7.2-9.4	108A	5/28/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	1645	Sara Ward	8/21/13	1645
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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Butte, MT 59701
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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1309116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury 7245.5

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury 7245.5
Trench 2 4.5	109A	5/28/13		X
Trench 3 0-2.0	110A	5/28/13		X
Trench 3 2.5	111A	5/28/13		X
Trench 3 3.0	112A	5/28/13		X
Trench 3 3.5	113A	5/28/13		X
Trench 3 4.0	114A	5/28/13		X
Trench 3 4.5	115A	5/28/13		X
Trench 3 5.0	116A	5/28/13		X
Trench 4 1.8-2.5	117A	5/28/13		X
Trench 4 3.0	118A	5/28/13		X
Trench 4 3.5	119A	5/28/13		X
Trench 4 4.0	120A	5/28/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	5/29/13	1525	Sara Ward	8/27/13	1645
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
Nick Tucci	MBMG		Sara Ward	MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
200 Technology Way, P.O. Box 4078
Butte, MT 59701
PH: (406) 494-7334 / FAX: (406) 494-7128
labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 130814

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury EPA 245.5					
Trench 1 4.0	121A	5/28/13		X					
Trench 1 4.5	122A	5/28/13		X					
Trench 1 5.0	123A	5/28/13		X					
Trench 1 5.5	124A	5/28/13		X					
Trench 1 6.0	125A	5/28/13		X					
Trench 1 6.5	126A	5/28/13		X					
Trench 1 6.8	127A	5/28/13		X					
Trench 2 0-1.5	128A	5/28/13		X					
Trench 2 2.0	129A	5/28/13		X					
Trench 2 3.0	130A	5/28/13		X					
Trench 2 3.5	131A	5/28/13		X					
Trench 2 4.0	132A	5/28/13		X					

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

MSE LABORATORY SERVICES
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Butte, MT 59701
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labinfo@mse-ta.com

FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED

SAMPLE ID	LAB ID	DATE	TIME	Mercury EPA 7.5
TP-NS-2 6.6	133A	5/31/13		X
TP-NS-03E 5.6-6.0	134A	5/31/13		X
TP-NS-03E 2.0-5.6	135A	5/31/13		X
TP-NS-03E-50N 0-1.3	136A	5/31/13		X
TP-1W 8.2-9.2	137A	5/28/13		X
TP-2W 7/10.2	138A	5/28/13		X
Trench 3 5.5	139A	5/28/13		X
TP-2W 0-7.2	140A	5/28/13		X
Trench 1 2.0	141A	5/28/13		X
Trench 1 2.5	142A	5/28/13		X
Trench 1 3.0	143A	5/28/13		X
Trench 1 3.5	144A	5/28/13		X

REMARKS

Turnaround Time (TAT) / Reporting

___Standard ___Next Day* ___2nd Day* ___Other* _____	*All rush order requests must have prior approval	___Phone ___Mail ___Fax ___Email

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Dara Ward	COMPANY: MSE-TA			
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY			
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY			

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: 10-19 Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury E245.5

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury E245.5
TP-NS-02E 0-2.6	145A	5-31-13		X
TP-NS-01E-50S 0.5-1.4	146A	5/31/13		X
TP-NS-1 2.6-4.4	147A	5/31/13		X
TP-NS-03E 1.3-1.5	148A	5/31/13		X
TP-NS-04E-50N 0.5-1.4	149A	5/31/13		X
TP-NS-02E 2.5-5	150A	5/31/13		X
TP-NS-01E 0.25-3.3	151A	5/31/13		X
TP-NS-01E-50S 7.25-7.5	152A	5/31/13		X
TP-NS-01E-50S 1.4-3.3	153A	5/31/13		X
TP-NS-03E-50N 1.4-1.6	154A	5/31/13		X
TP-NS-1 8.0-11.0	155A	5/31/13		X
TP-NS-03E 1.5-2.0	156A	5/31/13		X

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature)	8/21/13	1:57	RECEIVED BY (Signature) Sara Ward	8/21/13	1645
PRINTED NAME Nick Tucci	COMPANY MBMG		PRINTED NAME Sara Ward	COMPANY MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 130811

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: Ntucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED: Mercury E245.5

REMARKS

Turnaround Time (TAT) / Reporting

____Standard
____Next Day*
____2nd Day*
____Other*
_____

*All rush order requests must have prior approval

____Phone
____Mail
____Fax
____Email

SAMPLE ID	LAB ID	DATE	TIME	
TP-NS-2 7-8	157A	5/31/13		X
TP-NS-04E 0.6-2.2	158A	5/31/13		X
TP-18W 6.0+	159A	5/30/13		X
Berm 5 0.8-8.0	160A	6/5/13		X
TP-16W-505 6.8-9.0	161A	5/30/13		X
TP-10W 2.0-3.9	162A	5/30/13		X
TP-NS-1 2.25-2.6	163A	5/31/13		X
TP-NS-2 1.8-3.0	164A	5/31/13		X
TP-NS-03E 0.9-1.3	165A	5/31/13		X
TP-16W-505 10.3-11.65	166A	5/30/13		X
TP-11W 8.0	167A	5/30/13		X
TP-NS-04E 0.5-0.6	168A	5/31/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
	8/21/13	16:45	Sara Ward	8/21/13	1645		
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY			
Nick Tucci	MBMG		Sara Ward	MSE TA			
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY			
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME		
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY			

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

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FORM MSE-169
(Rev. 09/08)

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Diggings East PID
City: Butte State: MT Zip: 59701-8997	Email Address: Ntucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #:

ANALYSIS REQUESTED

REMARKS

Turnaround Time (TAT) / Reporting

___Standard
___Next Day*
___2nd Day*
___Other*
_____

*All rush order requests must have prior approval

___Phone
___Mail
___Fax
___Email

SAMPLE ID	LAB ID	DATE	TIME	Mercury EPA 245.7
TP-17W 5.1-8.0	169A	5/30/13		X
TP-19W 5.2-7.0	170A	5/30/13		X
TP-18W 5-6	171A	5/30/13		X
TP-NS-01E 3.3-7	172A	5/31/13		X
TP-NS-01E-SOS 0-0.5	173A	5/31/13		X
TP-19W 8.3-8.75	174A	5/31/13		X
TP-14W 9.35	175A	5/30/13		X
TP-10W 3.9-5.3	176A	5/30/13		X
TP-12W 6.2-6.5	177A	5/30/13		X
TP-12W 7.2-8.0	178A	5/30/13		X
TP-18W 3.45-5.0	179A	5/30/13		X
Berm 2	180A	6/5/13		X

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE-TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

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FORM MSE-169
(Rev. 09/08)

~~Cooler 2~~ 1 of 2 MP

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 1308116

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: NRB 1300 West Park St.	Project Name and Number: Digging East TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu.
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-4451	Sampler Name and Phone #: Nick Tucci 406496-4795

ANALYSIS REQUESTED

SAMPLE ID	LAB ID	DATE	TIME	Mercury E245.5						
MBMG Dup 1	181A	8/21/13		X						
MBMG Dup 2	182A	8/21/13		X						
MBMG Dup 3	183A	8/21/13		X						
MBMG Dup 4	184A	8/21/13		X						
Berm 3 8-12	185A	6/5/13		X						
Berm 3 13-16	186A	6/5/13		X						
Berm 4 9.7-12	187A	6/5/13		X						
Berm 4 0.5-1.45	188A	6/5/13		X						
Berm 3 4-8	189A	6/5/13		X						
Berm 5 9.2-10	190A	6/5/13		X						
Berm 4 1.45-1.8	191A	6/5/13		X						
Berm 5 0.8-1.5	192A	6/5/13		X						

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	1645	Sara Ward	8/21/13	1645
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

REMARKS

Turnaround Time (TAT) / Reporting

X Standard	*All rush order requests must have prior approval	___Phone
___Next Day*		___Mail
___2nd Day*		___Fax
___Other*		X Email
___		

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: ___

Temperature (°C): ___

Preservative: ___

___

Date & Time: ___

Inspected By: ___

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FORM MSE-169
(Rev. 09/08)

~~Cell 2 2012 NFT~~

MSE Technology Applications, Inc.
Laboratory Services

CHAIN OF CUSTODY

MSE WORK ORDER # 136811h

Company Name: MBMG	Project Manager: Nicholas Tucci
Address: 1300 W Park St	Project Name and Number: TO-19
City: Butte State: MT Zip: 59701	Email Address: NTucci@mtech.edu
Phone: 406-496-4795	Purchase Order #:
Fax: 406-496-	Sampler Name and Phone #: (406) 496-4795 Nick Tucci

ANALYSIS REQUESTED: Mercury E245.5

REMARKS

Turnaround Time (TAT) / Reporting

____Standard
____Next Day*
____2nd Day*
____Other*
_____

*All rush order requests must have prior approval

____Phone
____Mail
____Fax
____Email

SAMPLE ID	LAB ID	DATE	TIME		
~~TP-17W~~	~~TP-17W 5.1-8.0~~	~~5/30/13~~		~~X~~	~~NFT~~
~~TP-19W~~	~~TP-19W 5.2-7.0~~	~~5/30/13~~		~~X~~	~~NFT~~
~~TP-18W~~	~~TP-18W 5-6~~	~~5/30/13~~		~~X~~	~~NFT~~
	~~TP-NS-01E~~				~~NFT~~
Berm 3 0-4	193A	6/5/13		X	
Berm 3 1.6-1.9	194A	6/5/13		X	
TP-NS-01E	195A	5/31/13		X	

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
Cooler Sealed?	Y	N

Delivery Method: _____
Temperature (°C): _____
Preservative: _____
_____
Date & Time: _____
Inspected By: _____

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
	8/21/13	1655	Sara Ward	8/21/13	1645
PRINTED NAME: Nick Tucci	COMPANY: MBMG		PRINTED NAME: Sara Ward	COMPANY: MSE TA	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
PRINTED NAME	COMPANY		PRINTED NAME	COMPANY	

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MSE Lab Services

Sample Receipt Checklist

Client Name **MBMG** Date and Time Received: **8/21/2013 4:45:00 PM**

Work Order Number **1308116** RcptNo: **1** Received by **mw**

COC_ID: **1308116** CoolerID:

Checklist completed by Signature 8/23/13. Date Reviewed by Initials 8/26/13 Date

Matrix: Carrier name Hand-Delivered

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on 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?	Yes ☐	No ☑	
Container/Temp Blank temperature in compliance?	Yes ☐	No ☑	
Water - VOA vials have zero headspace?	No VOA vials submitted ☑	Yes ☐	No ☐
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Blank ☐

Adjusted? No Checked by NA/ Soil

Any No and/or NA (not applicable) response must be detailed in the comments section be

Client contacted yes Date contacted: 8/29/13 Person contacted N. Tucci

Contacted by: S. Ward Regarding: sample ID discrepancies

Comments: H/D TEMP=NA SOIL. SAMPLE019 STATES TP-2Y 4.0 ON THE COC AND TP-2E 4.0 ON THE BAG. SAMPLE058 HAS TP-15 W 6.2-7.5 ON THE BAG AND THE COC STATES TP-15W 6.2-10. SAMPLE102 STATES TP3 TRENCH1 3005 7.6-5.3 ON THE BAG AND THE COC STATES TP1 TRENCH1 3005-7.6-5.3. SAMPLE106 STATESTP-3 TRENCH 1 3005 8.5 ON THE BAG AND COC STATES TP1-TRENCH1 3005 7.5-8.5.SAMPLE 180 STATES BERM2 ON COC AND BERM 2 0.7-2.35 ON THE BAG. SAMPLE 195 STATES TP-NS-01 E ON THE COC AND THE BAG STATES TP-NS-01 E 0.75-3.3. ANY SAMPLES COLLECTED BEFORE JULY 30 ARE PASSED THE HOLDING TIME.

Corrective Action Client was made aware of Holding Time@ sample delivery.

APPENDIX E PID METER READINGS

APPENDIX E: PID METER READINGS				
Date	**Site**	**Depth Interval (feet)**	**PID Reading (ppm)**	**Area**
5/28/2013	TP-1 (Trench1)-100S	6.5-7.5	0	DE
5/28/2013	TP-1 (Trench1)-100S	7.5-8.5	0	DE
5/28/2013	TP-1 (Trench1)-100S	8.7-9.8	0	DE
5/30/2013	TP-10W	2.0-3.9	0	DE
5/30/2013	TP-10W	3.9-5.3	0	DE
5/30/2013	TP-11W	8	0	DE
5/30/2013	TP-11W	4.0-7.0	0	DE
5/30/2013	TP-12W	6.5-7.2	0	DE
5/30/2013	TP-12W	7.2-8.0	0	DE
5/30/2013	TP-12W	7.2	0	DE
5/30/2013	TP-12W	4.0-6.2	0	DE
5/30/2013	TP-12W	6.2-6.5	0	DE
5/30/2013	TP-13W	9.7	0	DE
5/30/2013	TP-13W	8.0-11.9	0	DE
5/30/2013	TP-13W	9.5	0	DE
5/30/2013	TP-13W	6.6-9.0	0	DE
5/30/2013	TP-14W	5.3-7.5	0	DE
5/30/2013	TP-14W	3.2-5.3	0	DE
5/30/2013	TP-14W	9.35	0	DE
5/30/2013	TP-15W	5.2	0	DE
5/30/2013	TP-15W	6.2	0	DE
5/30/2013	TP-15W	6.2-7.5	0	DE
5/30/2013	TP-15W	6.2-6.4	0	DE
5/30/2013	TP-16W		0	DE
5/30/2013	TP-16W		0	DE
5/30/2013	TP-16W-50S	10.3-11.65	0	DE
5/30/2013	TP-16W-50S	6.8-9.0	0	DE
5/30/2013	TP-17W	5.1-8.0	0	DE
5/30/2013	TP-18W	6.0 +	0	DE
5/30/2013	TP-18W	3.45-5.0	0	DE
5/30/2013	TP-18W	5.0-6.0	0	DE
5/30/2013	TP-19W	8.3-8.75	0	DE
5/30/2013	TP-19W	5.2-7.0	0	DE
5/30/2013	TP-19W	7.0-8.3	0	DE
5/28/2013	TP-1E	7.1-8.9	0	DE
5/28/2013	TP-1E	6.7-7.7	0	DE
5/28/2013	TP-1W	6.6-8.2	0	DE
5/28/2013	TP-1W	8.2-9.2	0	DE
5/28/2013	TP-2 (Trench1)-200S	7.1-8.9	0	DE
5/28/2013	TP-2 (Trench1)-200S	8.9-9.5	0	DE
5/29/2013	TP-2E	4.2'	0	DE
5/29/2013	TP-2E	2	0	DE
5/29/2013	TP-2E	3.2	0	DE
5/29/2013	TP-2E	2.5	0	DE
5/29/2013	TP-2E	3.5	0	DE
5/29/2013	TP-2E	0 - 1.5	0	DE
5/29/2013	TP-2E	4.75	0	DE
5/28/2013	TP-2W	0.0-7.2	0	DE
5/28/2013	TP-2W	7.2-9.4	0	DE

APPENDIX E: PID METER READINGS				
Date	**Site**	**Depth Interval (feet)**	**PID Reading (ppm)**	**Area**
5/28/2013	TP-2W	> 10.2	0	DE
5/28/2013	TP-3 (Trench1)-300S	5.3-7.6	0	DE
5/28/2013	TP-3 (Trench1)-300S	8.2	0	DE
5/28/2013	TP-3 (Trench1)-300S	8.5	0	DE
5/28/2013	TP-3 (Trench1-300S	0.0-5.3	0	DE
5/29/2013	TP-3E	5.0-6.8	0	DE
5/29/2013	TP-3E	6	0	DE
5/29/2013	TP-3E	8.5	0	DE
5/29/2013	TP-3E	9.5	0	DE
5/29/2013	TP-3W	3	0	DE
5/29/2013	TP-3W	4	0	DE
5/29/2013	TP-3W	5.0-6.0	0	DE
5/29/2013	TP-4E	0-6.7	0	DE
5/29/2013	TP-4E	6.7-7.9	0	DE
5/29/2013	TP-4E	8.0 +	0	DE
5/29/2013	TP-4W	7	0	DE
5/29/2013	TP-4W	4	0	DE
5/29/2013	TP-4W	1.9-2.9	0	DE
5/29/2013	TP-4W	2.9-3.9	0	DE
5/29/2013	TP-5E	6.3-8.65	0	DE
5/29/2013	TP-5E	8.7-10.0	0	DE
5/29/2013	TP-5E	> 10.9	0	DE
5/29/2013	TP-5W	6.5-5.1	0	DE
5/29/2013	TP-5W	8	0	DE
5/29/2013	TP-5W	4.5-5.0	0	DE
5/29/2013	TP-6E	8.0-11.3	0	DE
5/29/2013	TP-6E	6.5-8.0	0	DE
5/29/2013	TP-6E	0-6.5	0	DE
5/29/2013	TP-6W	8.1	0	DE
5/29/2013	TP-6W	5.2	0	DE
5/29/2013	TP-6W+50N	7.5	0	DE
5/29/2013	TP-6W-100N	7.0-9.0	0	DE
5/29/2013	TP-6W-100N	6	0	DE
5/29/2013	TP-6W-100N	9.5	0	DE
5/29/2013	TP-6W-50N	6.0-6.6	0	DE
5/29/2013	TP-7W	9.0?	0	DE
5/29/2013	TP-8W	4.9-5.9	0	DE
5/29/2013	TP-8W	5.9-8.0	0	DE
5/29/2013	TP-8W	9	0	DE
5/29/2013	TP-8W-100E	7.0-8.3	0	DE
5/29/2013	TP-8W-100E	8.3-11.0	0	DE
5/29/2013	TP-8W-50S	3.45-5.0	0	DE
5/29/2013	TP-8W-50S	5.0-8.35	0	DE
5/29/2013	TP-9W	4.65-4.8	0	DE
5/29/2013	TP-9W	3.9-4.65	0	DE
5/29/2013	TP-9W	7.3-7.85	0	DE
5/29/2013	TP-9W	7.85-9.3	0	DE
5/31/2013	TP-NS-01E	0.45-3.3	0	NS
5/31/2013	TP-NS-01E	2.0-3.3	0	NS
5/31/2013	TP-NS-01E-50S	7.25-7.5	0	NS

APPENDIX E: PID METER READINGS				
Date	**Site**	**Depth Interval (feet)**	**PID Reading (ppm)**	**Area**
5/31/2013	TP-NS-01E-50S	0.5-1.4	0	NS
5/31/2013	TP-NS-01E-50S		0	NS
5/31/2013	TP-NS-01E-50S	1.4-3.3	0	NS
5/31/2013	TP-NS-01E-50S	0-0.5	0	NS
5/31/2013	TP-NS-02E	2.6-5.0	0	NS
5/31/2013	TP-NS-02E	0-2.6	0	NS
5/31/2013	TP-NS-03E	2.0-5.6	0	NS
5/31/2013	TP-NS-03E	1.3-1.5	0	NS
5/31/2013	TP-NS-03E	5.6-6.0	0	NS
5/31/2013	TP-NS-03E	1.5-2.0	0	NS
5/31/2013	TP-NS-03E	0.9-1.3	0	NS
5/31/2013	TP-NS-03E-50N	1.4-1.6	0	NS
5/31/2013	TP-NS-03E-50N	0-1.3	0	NS
5/31/2013	TP-NS-03E-50N	1.3-1.4	0	NS
5/31/2013	TP-NS-04E		0	NS
5/31/2013	TP-NS-04E	0.5-0.6	0	NS
5/31/2013	TP-NS-04E	0.6-2.2	0	NS
5/31/2013	TP-NS-04E-50N	0.5-1.4	0	NS
5/31/2013	TP-NS-04E-50N		0	NS
5/31/2013	TP-NS-1	2.25-2.6	0	NS
5/31/2013	TP-NS-1	8.0-11.0 ?	0	NS
5/31/2013	TP-NS-1	2.6-4.4	0	NS
5/31/2013	TP-NS-2	6.6	0	NS
5/31/2013	TP-NS-2	1.8-3.0	0	NS
5/31/2013	TP-NS-2	7.0-8.0	0	NS
5/31/2013	TP-NS-3	4.2-10.2	0	NS
5/31/2013	TP-NS-3	2.7-4.2	0	NS
5/28/2013	Trench1	2	0	DE
5/28/2013	Trench1	2.5	0	DE
5/28/2013	Trench1	3	0	DE
5/28/2013	Trench1	3.5	0	DE
5/28/2013	Trench1	4	0	DE
5/28/2013	Trench1	4.5	0	DE
5/28/2013	Trench1	5	0	DE
5/28/2013	Trench1	5.5	0	DE
5/28/2013	Trench1	6	0	DE
5/28/2013	Trench1	6.8	0	DE
5/28/2013	Trench1	6.5	0	DE
5/28/2013	Trench2	0-1.5	0	DE
5/28/2013	Trench2	2	0	DE
5/28/2013	Trench2	2.5	0	DE
5/28/2013	Trench2	36	0	DE
5/28/2013	Trench2	3.5	0	DE
5/28/2013	Trench2	4	0	DE
5/28/2013	Trench2	4.6	0	DE
5/28/2013	Trench2	0-2.0	0	DE
5/28/2013	Trench3	2.5	0	DE
5/28/2013	Trench3	3	0	DE
5/28/2013	Trench3	3.5	0	DE
5/28/2013	Trench3	4	0	DE

APPENDIX E: PID METER READINGS				
Date	**Site**	**Depth Interval (feet)**	**PID Reading (ppm)**	**Area**
5/28/2013	Trench3	5.5	0	DE
5/28/2013	Trench3	5	0	DE
5/28/2013	Trench4	1.8-2.5	0	DE
5/28/2013	Trench4	3	0	DE
5/28/2013	Trench4	3.5	0	DE
5/28/2013	Trench4	4	0	DE
5/28/2013	Trench4	4.5	0	DE
5/28/2013	Trench4	5	0	DE
5/28/2013	Trench4	5.5	0	DE
5/28/2013	Trench4	6	0	DE