APPENDIX E

POTENTIAL REPOSITORY SITE IDENTIFICATION AND CHARACTERIZATION INFORMATION

- USFS REPOSITORY SITING INVESTIGATION REPORT
- MDEQ REPOSITORY SITING INVESTIGATION REPORT
- PAYMASTER REPOSITORY SITE INFORMATION
- FIRST GULCH REPOSITORY SITE INFORMATION
- HORSEFLY CREEK REPOSITORY SITE INFORMATION

USFS REPOSITORY SITING INVESTIGATION REPORT

DRAFT
PRELIMINARY REPOSITORY SITING INVESTIGATION FOR THE MIKE HORSE DAM, IMPOUNDED TAILINGS AND FLOODPLAIN WASTES REMOVAL ACTION ALTERNATIVES

Submitted to

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1.0 INTRODUCTION

In 2002, Asarco Incorporated (Asarco) and the United States Department of Agriculture Forest Service-Northern Region (USFS) entered into an Administrative Order on Consent (AOC) fore development of an Engineering Evaluation/Cost Analysis (EE/CA) at the Upper Blackfoot Mining Complex (UBMC). The purpose of the EE/CA is to determine and evaluate removal action requirements and alternatives to address historic mining related impacts to the environment on USFS lands at the UBMC. This preliminary repository siting investigation has been prepared by the USDA Forest Service to identify potential mine waste disposal locations and evaluate the locations against physical, biological and social parameters to determine the most technically viable, and cost effective waste disposal locations for the mine wastes identified in the Alternatives Technical Memorandum for Mine Waste Removal at the Upper Blackfoot Mining Complex, Lewis and Clark County, MT (Hydrometrics, January 2005) and Alternatives Technical Memorandum for the Mike Horse Dam and Impounded Tailings at the Upper Blackfoot Mining Complex, Lewis and Clark County, MT (USDA Forest Service, February, 2006). This information will be incorporated into the evaluation of the removal alternative options in the EE/CA.

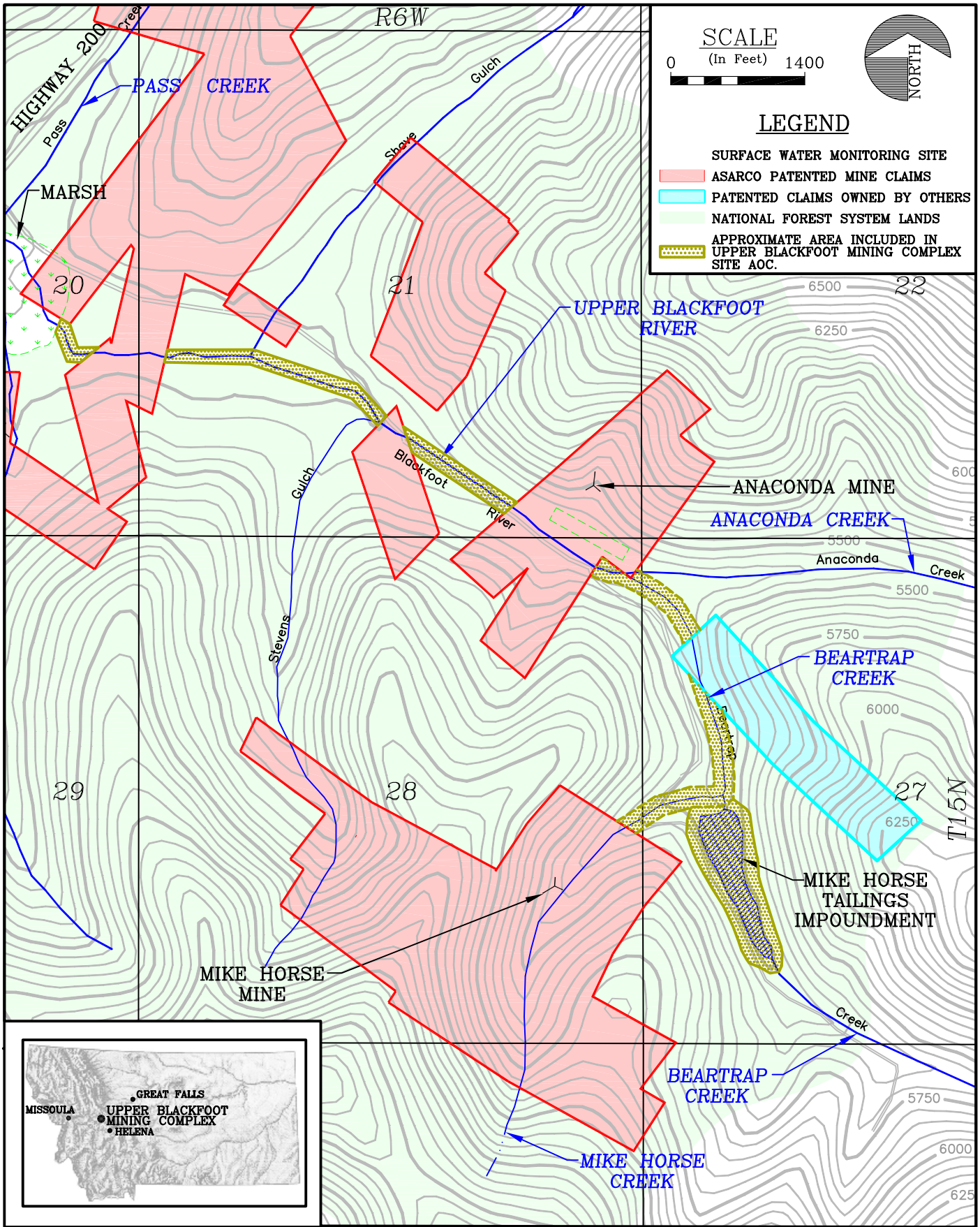
These potential repository sites may be used (one or more) to place mine wastes containing elevated levels of lead, zinc, cadmium, copper, iron, manganese and aluminum, as well as other metals.

1.1 PURPOSE AND SCOPE

This repository investigation presents a preliminary identification and evaluation of potential repository sites to determine if there were any sites individually or in combination that could hold the volume of wastes that potentially could be removed with the Total Removal Alternative options identified in the Technical Memoranda above. This investigation included Helena Forest GIS layers, interdisciplinary team field walk throughs and research using available reference material. Follow up site investigation studies to further evaluate physical parameters would be conducted for sites considered in detail, including groundwater wells, backhoe test pits, soils analysis and others

1.2 SITE LOCATION

The Upper Blackfoot Mining Complex, part of the Heddleston Mining District, is located approximately 15 miles east of Lincoln, Montana (Figure 1-1). The UBMC is characterized generally by heavily forested, steep mountainous terrain. Elevations range from 5200 feet above mean sea level to over 7500 feet above sea level along the Continental Divide. Climatic conditions are typical of intermediate to high elevation regions of the Northern Rocky Mountains with winter temperatures less than 0 degrees F not uncommon. Precipitation falls mainly as snow and averages 18 inches per year.



UPPER BLACKFOOT MINING COMPLEX AND SURROUNDING AREA

FIGURE 1-1

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Hydrometrics, Inc.
Consulting Scientists and Engineers

The primary drainages of the UBMC include Mike Horse Creek, Beartrap Creek, Anaconda Creek, Stevens Gulch and Shaue (Shave) Gulches.

2.0 METHODOLOGY AND SITING CRITERIA

An initial GIS exercise was conducted to identify preliminary potential sites in this mountainous and heavily vegetated area. The preliminary GIS exercise included evaluating slopes less than 10%, areas greater than 500 feet from perennial or intermittent drainages, areas greater than 10 acres in size, and areas located within a 5 mile radius of the Mike Horse dam. Base GIS layers used were taken from the Helena Forest oil and gas leasing analysis GIS layers prepared in the mid-late 1990's. No sites were found with this effort. The minimum acreage amount was reduced to 5 acres, and slopes increased to less than 20% and several possible sites were identified.

However, some of the locations that resulted from this computer exercise were not near any of the existing roads, and the review team identified that there were known potential sites closer to the Mike Horse dam if we dropped the criteria of 500 feet away from drainages. Thus, the team identified potential sites on 7 ½ minute topographic quadrangles in addition to the GIS exercise and then conducted field reviews of as many of these sites as time allowed in the Fall of 2004 and May 2005. Asarco identified two other possible locations that they wanted the field review team to consider for the purposes of either material staging or oversize wasting or disposal. The sites reviewed in the field are identified on Figure 4-1.

All sites were identified through use of a GPS unit. The resulting set of parameters identified in the initial review and through field investigation and from the State of Montana is described below. Not all sites were evaluated in this preliminary review by all parameters.

1. Landownership – determined using existing, detailed landownership maps created by Hydrometrics for Asarco, Helena Forest landownership map layer, and on the ground survey markers. Site location was determined through GPS and interpretation of 7 ½ minute topographic maps.

2. Heritage resources – for the purposes of this report, heritage resources are described generally if they were evidenced during the field review of a site

3. Slope, aspect – GIS, topographic map and field reconnaissance

4. Size – field estimate

5. Access – Based on existing mapped roads. Notes taken if unmapped roads encountered during field review

6. Geology and Distance to Bedrock – Area geology based on published references. Localized geology based on field review and visual parameters.

7. Soils, Evidence for unstable landforms – soil information provided by Helena Forest Soil Survey. Unstable landforms indicated on inventory or determined through field review.

8. Surface water proximity in feet, Evidence of shallow groundwater (plants, seeps) – GIS, topographic maps and field review

9. Wildlife, Vegetation, Special Habitats – Wildlife sign, vegetation identification and notation of potential special habitats was conducted during field reviews. Habitat considerations to be evaluated in detail are numerous as this area has Threatened and Endangered Species (TES) , including grizzly bear, and includes tributaries to occupied bull trout (TES) habitat. Vegetation was noted during field review.

10. Distance from waste sources – estimated using existing roads overlain on 7 ½ minute topographic map and various Asarco analysis maps.

11. Bedrock chemistry – Two sites showed visible indicators of the oxidized ore body that was the subject of extensive exploration by The Anaconda Company in this area in the 1960's and 70's, Site 3 near Paymaster Creek and Site 8 north of Shave Gulch.

12. Potential volume that could be contained – Three sites were surveyed by Forest Service surveyors to calculate potential waste volumes that could be placed, including Site 4-Paymaster area , Site 9-Area west of Impoundment and Site 10 – Area southwest of Impoundment.

13. Evidence of Previous Disturbance – determined through field review.

More detailed and technical follow up evaluation that would need to be done for the selected site(s) would include subsurface investigations, groundwater table identification, ability to meet State of Montana Solid Waste Management Requirements (Appendix A) and others. Notes of the field reviews are found in Appendix B.

3.0 FIELD INVESTIGATION

Three reconnaissance level field investigations were conducted to review the identified sites. The following personnel were in attendance during these field reviews:

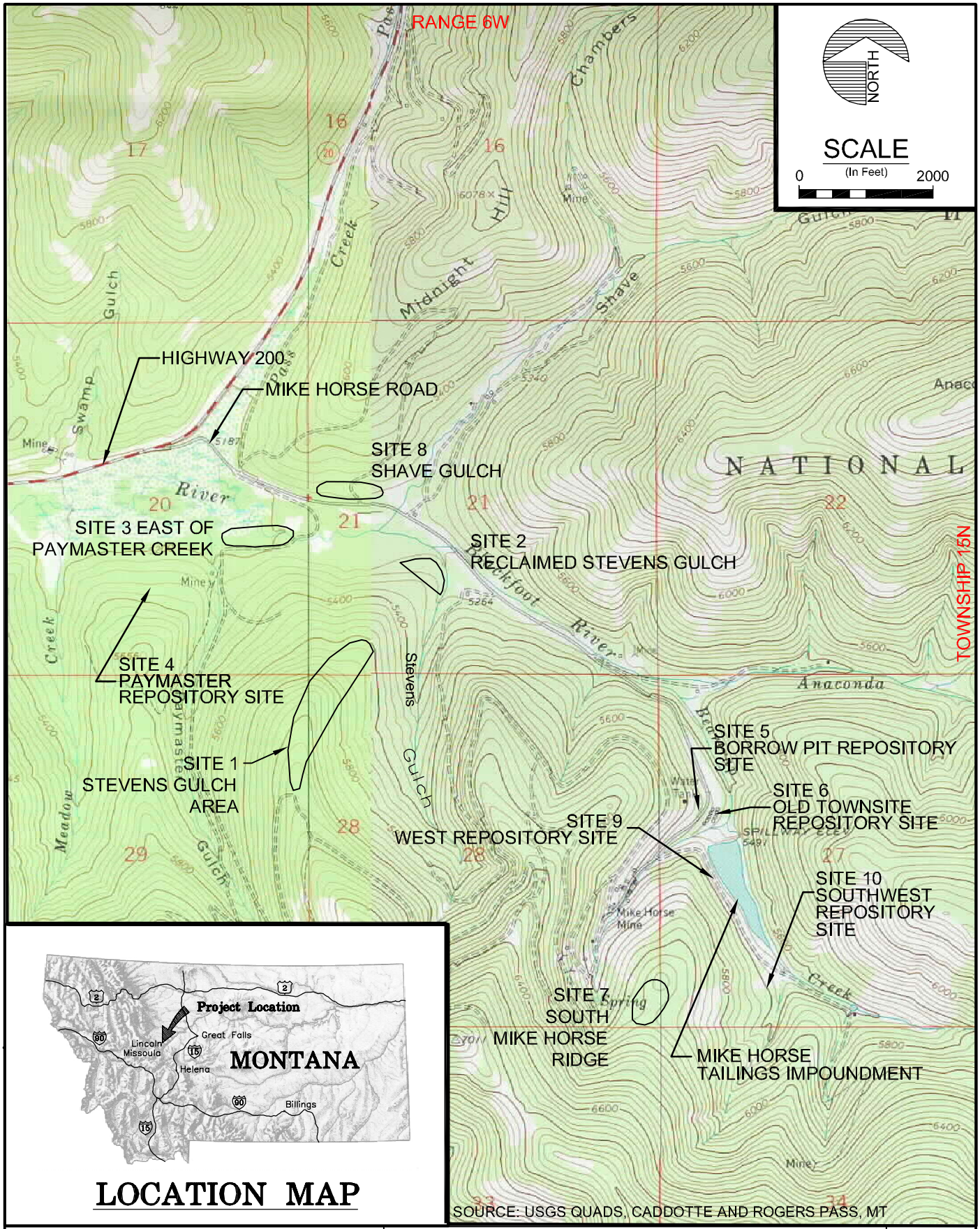
Pam Hergett – Forest Service civil engineer – Site Visits 1 and 2
Laura Burns- Forest Service fisheries biologist – Site Visit 1
Todd Burbridge – Forest Service seasonal forestry technician – Site Visit 1
Dan Seifert – Forest Service NEPA Coordinator – Site Visit 1
Sue Farley – Forest Service soil scientist – Site Visit 2

Bo Stuart – Forest Service hydrologist – Site Visit 2
Beth Ihle – Forest Service geologist – Site Visits 1 - 3
Mandy Alvino – Forest Service Resources Assistant – Site Visit 3
Jake Morrill- Forest Service engineering technician – Site Visit 3
David Bowers – DEQ CECRA project manager – Site Visits 1-3

The notes of the field investigations are included in Appendix B.

4.0 DESCRIPTION OF POTENTIAL REPOSITORY SITES

Ten sites were reviewed in the field for their suitability as potential repository sites. All of these sites are within the UBMC area above the confluence of Pass Creek (Figure 4-1). Two sites have had follow-up engineering survey to determine potential volume that could be contained, including Site 4 - Paymaster Repository Area, and Site 9 – Area west of Impounded Tailings.



UPPER BLACKFOOT MINING COMPLEX
POTENTIAL REPOSITORY SITES

FIGURE
4-1

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Hydrometrics, Inc.
Consulting Scientists and Engineers

4.1 Site 1 Stevens Gulch area Sections 21, 28, 29

Landownership	National Forest
Heritage Resources	None identified
Slope and Aspect	10-20% N-NE
Size	less than 5 acres in elongate shape
Access	2 miles on existing roads
Site Geology	Porphyry oxidized, mineralized material grading into meta-sediments on the west side. Outcrop on edge of parcel, expected depth to bedrock is less than 10 feet.
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	none observed
Ground water	several seeps noted in area suggesting shallow groundwater spots
Wildlife, Vegetation, Special Habitats	area used by big game species and small mammals; lodgepole pine regeneration 10-20 feet tall understory forbs, small shrubs and grasses; no special habitats
Bedrock Chemistry	No obvious evidence of highly oxidized bedrock. Porphyry bedrock may indicate soils that tend toward acidic pH.
Distance from waste sources	2 miles on existing roads
Potential Volume	3-4 acres
Evidence of Previous Disturbance	old exploration drill roads traverse area

The area traversed was the SW1/4 of Section 21, through Section 28 and into the NE ¼ of Section 29. The narrow ridge on the east side of Section 29 was ruled out. There were several old drill roads in this area. The area is seepy and the geology is highly oxidized with mineralized porphyry visible at surface. This area is unsuitable due to the ground water being close to the surface and also because of the size limitation.

Site 1 is located on the north trending ridge and sideslopes that is located west of Stevens Gulch in the northeast corner of Section 29 trending into the southwest corner of Section 21. The ridgetop is relatively narrow-less than 200 feet and the sideslopes were steeper than expected during topographic map review. An elongated repository area shape would result in only 3-4 acres of potential repository size. Several old exploration drill roads course the area and are mostly revegetated. Seeps were evident in the field suggesting some shallow groundwater.

Site 1 is not considered suitable for detailed investigation due to size limitation and evidence of seeps.

4.2 Site 2 Reclaimed Bulk Sample area near Stevens Gulch Section 21

Site 2 is located in the southwest corner of Section 21 west of Stevens Gulch and is about 1 acre in size. It was an area where The Anaconda Company drove an exploration adit and removed a bulk sample. The area has been reclaimed. Site 2 was not considered suitable for investigation due to size limitation.

4.3 Site 3 Below road east of Paymaster Creek in Section 20

Landownership	mixed private and National Forest
Heritage Resources	none identified
Slope and Aspect	less than 10% S-SE
Size	estimated at 5 acres
Access	existing road
Site Geology	Red-stained soil area beside creek is fairly extensive indicating possible ferricrete deposits. Fractured angular shale bedrock found in colluvium in prospect pits. Depth to bedrock estimated at 10-30 feet and varying within the area.
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	Paymaster Creek
Ground water	proximity to the Blackfoot River upper marsh area suggests the area has shallow groundwater
Wildlife, Vegetation, Special Habitats	area used by big game species and small mammals; lodgepole pine, understory forbs, small shrubs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	2 miles on existing roads
Potential Volume	
Evidence of Previous Disturbance	old exploration pits nearby

The area above the road and east of Paymaster Creek is similar to the area below the road. There are rock fragments in soil. The area is covered with extensive Lodge Pole Pine. The combined area above and below the road is estimated to be 5 acres in size.

Site 3 is located on the east side of Paymaster Creek adjacent to the access road to the Paymaster Repository. The area is approximately 5 acres in size. There are several old exploration pits within this site that showed rocky colluvium and localized, heavily iron stained soils. While the area is relatively low sloping and somewhat larger than most of the others, the proximity to the Blackfoot River upper marsh area suggests the area has shallow groundwater.

4.4 Site 4 Paymaster Repository Area

Landownership	private
Heritage Resources	none identified
Slope and Aspect	less than 10%, N-NW
Size	less than 5 acres
Access	2 miles
Site Geology	Paymaster area is overlain by a relatively thick layer of colluvial material derived from primarily metasedimentary shales. Gravels in colluvium are angular suggesting bedrock is Proterozoic Belt shales and fine quartzites. Depth to bedrock was not determined during soil excavations in 1994. It is at least deeper than 10 feet.
Soils	Soils were excavated in 1994 during test pit sampling at the current Paymaster Repository site. Sampling results indicate a top foot of clayey silt topsoil, 5 feet of silty to clayey sand and gravel and then 4 feet of well graded gravelly sand to sandy gravel (Hydrometrics, February 2006). 480 – Typic Cryoboralfs, mountain slopes
Surface water	none observed
Ground water	no indication of shallow groundwater observed
Wildlife, Vegetation, Special Habitats	area used by big game species and small mammals; sparse lodgepole pine, understory forbs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	2 miles near existing roads
Potential Volume	218,000 cubic yards
Evidence of Previous Disturbance	minimal

The slopes on this site are favorable approximately at 10% percent. There is no evidence of slumps or seeps and relatively little underbrush. The primary concern with this site is that the repository could be visible from the Highway 200. This site was surveyed and preliminary volume calculations were completed using the average end area method. A conservative estimate for this site assuming the material would be placed 20’ deep is approximately 218,000 cubic yards.

Site 4 is located adjacent to the existing Paymaster Repository, primarily on the northwest side of the repository. This site has more existing information than any of the sites in the area as it has already been excavated and developed. The size of available area, proximity to access and current repository and some known soils and subsurface parameters suggests that this site should be evaluated in detail for consideration as a location for wastes in the EE/CA.

4.5 Site 5 Borrow pit above County Road Section 27

Landownership	National Forest
Heritage Resources	historic mining paraphernalia just north of site
Slope and Aspect	10-20%, S-SE
Size	150 ft wide x 300 ft long
Access	County road (Mike Horse)
Site Geology	Fractured bedrock exposed at surface. There are oxidized belt shales, quartzites that break into coarse fragments. Area appears non-mineralized
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	none observed
Ground water	none observed
Wildlife, Vegetation, Special Habitats	none; none; none
Bedrock Chemistry	
Distance from waste sources	less than 1 mile
Potential Volume	
Evidence of Previous Disturbance	Area all disturbed.

This site is limited due to size and it also contains heritage features including a water tank and housing foundations bordering the north edge of this site. This site was surveyed.

Site 5 was identified by Asarco to be evaluated for some kind of use during removal construction, including oversize wasting, staging or other logistical purpose. A suggestion was made that Site 5 and 6 could be combined by rerouting the county road and a much larger area could be utilized.

4.6 Site 6 Old Mike Horse townsite in Section 27

Landownership	National Forest
Heritage Resources	none at surface, site is at old townsite
Slope and Aspect	less than 5%, S
Size	100 ft wide x 400 ft long
Access	County road (Mike Horse)
Site Geology	is an alluvial surface that includes 6 inch minus gravel/soil surface material. Surface has been reclaimed. Expected depth to bedrock is less than 10 feet.
Soils	101 – Aquolls, floodplains and terraces (this is a terrace)
Surface water	none present
Ground water	no evidence of shallow groundwater
Wildlife, Vegetation, Special Habitats	area used by big game species and small mammals; forbs, small shrubs and grasses; no special habitats

Bedrock Chemistry	
Distance from waste sources	less than 1 mile
Potential Volume	
Evidence of Previous Disturbance	site of old townsite

This site is appealing as both a location for treating the material before it is placed in a repository as well as a location for storing waste. It was surveyed.

Site 5 was identified by Asarco similar to Site 5, primarily due to its proximity to the Mike Horse dam, impounded tailings and floodplain waste removal areas.

4.7 Site 7 Ridge south of Mike Horse Creek and west of impoundment

Landownership	National Forest
Heritage Resources	none observed
Slope and Aspect	less than 10% at ridgetop, steep side hills to access ridgetop. Aspect ridgetop.
Size	3-4 acres
Access	500 feet from an old road
Site Geology	Broken Belt shales seen in prospect pits, no evidence of mineralization. (snow covered at the time). Depth to bedrock is estimated at 10-20 feet as this is a ridgetop location.
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	none observed
Ground water	no evidence of shallow groundwater
Wildlife, Vegetation, Special Habitats	area used by big game species and small mammals; lodgepole pine, understory forbs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	2 miles
Potential Volume	
Evidence of Previous Disturbance	none observed

The site is long and narrow which would make it difficult to maneuver large equipment. The location at the top of the ridge would result in difficult, costly access to the site.

Site 7 in Section 28 (SE ¼) was identified on the topographic map as possibly having a large, flat area on the ridgetop. However, upon field review, the ridgetop was more elongate and had relatively steep sideslopes. An old road traversed nearly to the top from the north side of the area.

4.8 Site 8 Area north of Shave/Shaue Gulch and East of County road

Landownership	mixed private and National Forest
Heritage Resources	Cabins in Shave Gulch.
Slope and Aspect	5-20%, S, SE
Size	Estimated to be >10 acres
Access	500 feet from County road (Mike Horse). There are numerous old parallel drill roads that cross a portion of the area. A repository here would likely be viewable from Highway 200 which lies a mile to the NW.
Site Geology	Appears to be intrusive granite that is highly oxidized for the most part and fractured shales to the south. Distance to bedrock varies, estimated at less than 10 feet to over 30 feet. There is vegetative evidence of shallow groundwater or seeps on the northeastern portion of the reviewed area.
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	None observed
Ground water	No evidence of shallow groundwater in most of area although there is vegetative evidence of shallow groundwater or seeps on the northeastern portion of the reviewed area.
Wildlife, Vegetation, Special Habitats	area used by big game species, black bear and small mammals; lodgepole pine, understory forbs, shrubs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	less than 3 miles
Potential Volume	
Evidence of Previous Disturbance	The site is traversed by numerous, closely spaced exploration drill holes. It also showed evidence of the near surface oxidized mineral deposit that was the subject of the exploraton effort.

This site, although not extremely close to the site has a great deal of potential based on its physical characteristics. It is suitable in terms of slope and of the sites is by far the most acceptable in terms of size. There are many issues at this site that would have to be resolved such as land ownership, heritage, and viewshed. It was felt by the review team that although this site is very desirable, it was a lower priority than the sites in the immediate proximity to Mike Horse Dam because it would be more costly to develop.

Site 8 is located in Section 21 (NW ¼) on the northwest side of Shave Gulch and north of the county road. The site is traversed by numerous, closely spaced exploration drill holes. It also showed evidence of the near surface oxidized mineral deposit that was the subject of the exploraton effort. While having generally better size and slope characteristics than some of the other sites, concerns for siting a repository on a mineral body are warranted.

4.9 Site 9 Area directly west of Mike Horse tailings impoundment reservoir

Landownership	National Forest
Heritage Resources	Evidence of historical mining workings
Slope and Aspect	5-10%, NE-E
Size	Approximate 4 acres above the current water line
Access	Adjacent to County road (Mike Horse)
Site Geology	Site includes fractured, siltite and quartzite shales of Belt Formation-see Geology Appendix C. Distance to bedrock is variable and is estimated to range from less than 10 feet to 25 feet. Outcrop exposed in road cut.
Soils	480 – Typic Cryoboralfs, mountain slopes
Surface water	None observed
Ground water	No evidence of shallow groundwater
Wildlife, Vegetation, Special Habitats	area used by big game species, black bear and small mammals; sparse lodgepole pine, understory forbs, shrubs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	Adjacent to impoundment
Potential Volume	
Evidence of Previous Disturbance	None observed

This site has potential but is limited in size. It was surveyed and evaluated for potential use.

Site 9 includes the area directly west of the reservoir edge in Section 27 (SW ¼). While size is somewhat limited and the topography under the reservoir is unknown, the proximity of this site to the wastes to be removed and the existence of conventional engineering remedies that could respond to site issues (Moon Gulch Repository Site) led to the Forest Service conducting a site survey in 2005. The potential capacity of the area would also be increased if the county road were relocated.

4.10 Site 10 Area southwest of Mike Horse tailings impoundment reservoir

Landownership	National Forest
Heritage Resources	Evidence of historical mining workings
Slope and Aspect	Greater than 20%, NE-E
Size	Approximately 9 acres above the current water line
Access	Adjacent to County road (Mike Horse)
Site Geology	No outcrop at surface. Surface float indicates Belt shales and quartzite.
Soils	480 – Typic Cryoboralfs, mountain slopes and 101 – Aquolls, floodplains and terraces
Surface water	Approximately 200 feet of this area closet to impoundment has wetland characteristics. The rest of the

	area has no surface water present.
Ground water	Approximately 200 feet of this area closet to impoundment has wetland characteristics. The rest of the area shows no evidence of shallow groundwater.
Wildlife, Vegetation, Special Habitats	area used by big game species, black bear and small mammals; sparse lodgepole pine, understory forbs, shrubs and grasses; no special habitats
Bedrock Chemistry	
Distance from waste sources	Less than 1 mile from impoundment
Potential Volume	
Evidence of Previous Disturbance	None observed

This area is approximately 9 acres in size and has an access road to the area from the dam. The slope of the site is in excess of 20% and the bottom 200 feet of the site is a wetlands. The site continues to the edge of the stream. Preliminary analysis of this site indicates that it could potentially hold approximately 80,000 cubic yards of material doing minimal excavation and stacking the material. This site has potential to be used as one small repository.

Site 10 is located further southwest of the impoundment in Section 27 (SW ¼).

5.0 EVALUATION OF REPOSITORY SITES

With the possible exception of site 8 which will require extensive evaluation, there is not one site in the area of Mike Horse impoundment that will accommodate the entire estimated volume of tailings behind the reservoir. Most of the identified sites exceed the maximum slope requirements for what has been traditional repository development in the state of Montana; however, they are within the boundaries of what is being done in other areas of the country such as the Moon Gulch Repository which is entirely located on slopes that exceed 10%. A combination of sites 4,5, 6 and 9 should be given additional consideration as it would provide the least cost alternative for waste removal simply based on the proximately to the reservoir. It is possible that the cost of developing site 8 with the increase in travel distance could be comparable to the cost of developing 4 different sites with a minimal travel distance.

6.0 REFERENCES

Hergett, P., 2005, Mike Horse Tailings Volume Calculations, USDA Forest Service, Helena National Forest, Unpublished data.

Hydrometrics, 2006, 2006 Reclamation Work Plan for the Upper Blackfoot Mining Complex , draft, February 2006.

APPENDIX A. STATE OF MONTANA SOLID WASTE REQUIREMENTS

The full text of the ENVIRONMENTAL QUALITY, CHAPTER 50, SOLID WASTE MANAGEMENT, Sub-Chapter 5, Refuse Disposal can be found at http://deq.mt.gov/dir/Legal/Chapters/CH50-05.pdf

ADMINISTRATIVE RULES OF MONTANA 6/30/97 17-4195
SOLID WASTE MANAGEMENT 17.50.505
17.50.505 STANDARDS FOR SOLID WASTE MANAGEMENT FACILITIES
(1) There are locational and design requirements with which both facility classifications must comply. In addition, there are other requirements that are applicable only to specific classifications. The general locational requirements that all facilities must meet include:
(a) a sufficient acreage of suitable land must be available for solid waste management;
(b) where public use or year round access is contemplated, access roads and bridges must be capable of supporting loaded vehicles during all types of weather;
(c) facilities may not be located in a 100 year floodplain;
(d) facilities may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems;
(e) drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas;
(f) where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connected to a proposed disposal facility, only Class III disposal facilities may be approved; and
(g) facilities must be located to allow for reclamation and reuse of the land.
(2) Special requirements include:
(a) Facilities licensed and operated as Class II landfills must confine solid waste and leachate to the disposal facility, unless department approval is obtained for treatment at another facility. If there is a potential for leachate migration, it must be demonstrated to the satisfaction of the department that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters according to the criteria specified in ARM 17.50.506.
(b) Adequate separation of Group II wastes from underlying or adjacent water must be provided. The extent of the separation required must be established on a case-by-case basis,

considering terrain, type of underlying soil formations, and facility design.

(c) The following airport safety requirements apply to all facilities which manage Group II waste:

(i) Facilities may not be located or operated within 10,000 feet (3,048 meters) of any airport runway used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway used by only piston-type aircraft unless the owner or operator can demonstrate to the department's satisfaction that the facility is designed and can be operated so that it does not pose a bird hazard to aircraft. That demonstration must be submitted to the department and the federal aviation administration (FAA) and placed in the facility's operating record.

(ii) An owner or operator proposing to license a facility or a lateral expansion within a 5 mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the FAA.

(iii) The owner or operator (or applicant in the case of a new license application) must submit copies of the required notifications and responses received from the affected airport and FAA within 30 days of the date they were sent or received.

(d) New disposal units or lateral expansions may not be located in wetlands.

(e) New disposal units or lateral expansions may not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates to the department that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the disposal unit and will be protective of human health and the environment.

(f) Class II disposal units or lateral expansions may not be located in seismic impact zones, unless the owner or operator demonstrates to the department that all containment structures, including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(g) Owners or operators of new Class II disposal units, existing Class II disposal units, and lateral expansions located in an unstable area must demonstrate to the department that engineering measures have been incorporated into the unit's design to ensure that the integrity of the structural components of the landfill unit will not be disrupted. The department will consider the following factors, at a minimum, when determining whether an area is unstable:

(i) on-site or local soil conditions that may result in significant differential settling;
(ii) on-site or local geologic or geomorphic features; and
(iii) on-site or local human-made features or events (both surface and subsurface).
(h)(i) Existing facilities that cannot make the demonstration specified in (2)(c) above pertaining to airports, (1)(c) of this rule pertaining to floodplains, or (2)(g) above pertaining to unstable areas, must close by October 9, 1996, in accordance with ARM 17.50.530 and conduct post-closure activities in accordance with ARM 17.50.531.
(ii) The deadline for closure required by (i) above may be extended up to 2 years if the owner or operator demonstrates to the department that:
(A) there is no available waste management alternative; and
(B) there is no immediate threat to human health and the environment.
(i) Owners and operators should be aware that Montana has local water quality protection districts. This protection program may impose additional requirements on owners or operators of solid waste management systems other than those set forth in this subchapter.
(j) Class III landfills may not be located on the banks of or in a live or intermittent stream or water saturated areas, such as marshes or deep gravel pits which contain exposed ground water.
(k) A Class IV landfill unit may not be located in wetlands or in a 100 year floodplain. (History: 75-10-204, MCA; IMP, 75-10-204, MCA, Eff. 12/31/72; AMD, Eff. 7/5/74; AMD, 1977 MAR p. 1170, Eff. 12/24/77; AMD, 1993 MAR p. 1645, Eff. 10/9/93; TRANS, from DHES.

APPENDIX B. FIELD TRIP NOTES

Upper Blackfoot Mining Complex Site
Identification of possible repository sites and Field Reconnaissance Results
September 13, 2004

In attendance: DEQ-David Bowers
FS-Laura Burns, Pam Hergett, Todd Burbridge (GPS operator), Dan Seifert, Beth Ihle

Criteria for Siting:

We discussed criteria provided by DEQ for siting landfills (handout) and David identified which parameters had most applicability for this project which included the Solid Waste Management Requirements (location specific), Floodplain management order, Protection of Wetlands order, Floodplain and Floodway Management Act and Requirements.

Pam Hergett provided a matrix of evaluation criteria for repositories based on other FS repository evaluations (Little Blackfoot, Armstrong-Beatrice). The criteria included are landownership, slope, size, access, faults/geology, landslide or other unstable deposits, surface water proximity, wildlife, wetlands, and veg type. We also added a few other criteria including distance to groundwater, costs, distance from waste source and basic bedrock chemistry.

Mapping Potential Sites:

The group identified possible sites on the topographic map using topography as a primary indicator. We included several sites identified by Chris Pfahl and Hydrometrics including the borrow site and old Mike Horse townsite, Paymaster Repository area and the meadow area near Shave Gulch. We also identified areas south and west of the Mike Horse mine site along the ridgetops.

Field Reconnaissance:

Group proceeded to UBMC area and started by making a traverse of possible sites near Stevens Gulch .

Site 1: Stevens Gulch area Sections 28, 21

Geology-porphyry oxidized, mineralized material grading into metasediments on west side
Slope: 10-20%
Veg: lpp regeneration 10-20 feet tall
Aspect: N-NE

Size: -see map
Landownership: FS
We traversed the SW1/4 of Section 21 into the NE ¼ of Section 29. Ruled out the narrow ridge on the east side of Section 29. Traversed through many old drill roads. Area is seepy, geology is highly oxidized, mineralized porphyry visible at surface.

Site 2: Reclaimed bulk sample area near Stevens Gulch in Section 21. Not sure if the waste was hauled away or reclaimed in place

Site 3: Below road east of Paymaster Creek in Section 20?

Redstained soil area beside creek is fairly extensive. Dave thought ferricrete deposits. Good slopes (less than 10%). Landownership mixed. Size less than 5 acres.

Above road east of Paymaster Creek – similar to area below road. More rock frags in soil. Lpp extensive. Acres – 5?

Site 4: Area around Paymaster Repository - saw a moose

Slopes range from 10-20+ percent. No evidence of slumps or seeps. Relatively little underbrush. Visible from highway. Consistent slope. Found survey markers at waypoints 12,13 and 14.

Discussed setting another field day to view the other sites.

Upper Blackfoot Mining Complex Site
Identification of possible repository sites and Field Reconnaissance Results
2nd field trip November 4, 2004

In attendance: DEQ-David Bowers
FS- Pam Hergett, Beth Ihle, Sue Farley-GPS, Bo Stuart

Mapping Potential Sites:

The group identified possible sites on the topographic map using topography as a primary indicator. We included several sites identified by Chris Pfahl and Hydrometrics including the borrow site and old Mike Horse townsite, Paymaster Repository area and the meadow area near Shave Gulch. We also identified areas south and west of the Mike Horse mine site along the ridgetops. The first four sites (#1-4) were reviewed in September, 04. This inspection includes sites #5-8.

Field Reconnaissance:

Site 5: Rock borrow pit to the northwest of Mikehorse Creek above the county road in Section 27 (NW ¼)
Geology-fractured, oxidized belt shales, coarse fragments – doesn't appear mineralized
Slope: 10-20%
Veg: none
Aspect: S-SE
Size: 150 ft high x 300 ft long
Landownership: FS
We traversed the borrow pit and adjacent areas. Several heritage features border the north side (water tank, foundations).

Site 6: Old Mikehorse Town site - reclaimed , Section 27 on north side of Mike Horse and Beartrap Creeks, below county road. An existing access road enters townsite area from the north parallel to the county road.

Geology – alluvial surface that includes 6 inch minus material, has been reclaimed
Slope – less than 5%
Size – 100 ft wide x 400 ft long

Discussion: Road between sites 5 and 6 could be rerouted so that these two sites could be combined for waste placement. Would need to find suitable optional site for the road.

Site #7 Ridgetop area south of Mikehorse mine site and south of Mike Horse Creek. Section 27, east half, Section 28 west half
Description: Elongate topographic ridgetop, has exploration trenches and some old access roads. Steep sidehills to get to the top. Geology appears to be broken Belt shales (snow covered at the time). Estimated size is 3-4 acres total but very narrow areas.

Discussion: Does not appear to be suitable site due to size constraints.

Site #8 Area north of Shave Gulch and east of main county road in Section 21 (NW1/4)

Vegetation-dog haired pine, shrub understory. Density varies. Old exploration roads have more dense vegetative growth than undisturbed forest areas.

Landownership – private

Geology – appears to be intrusive granite for the most part and fractured shales to the south (need to define better-get a geo map of area)

Groundwater – no evidence of shallow groundwater
Heritage – cabins in Shave Gulch
Cultural – numerous parallel drill roads criss cross a portion of the area
Slopes – 5-20%
Size – estimate of 10+ acres

Views – potential to impact Highway 200 viewshed as you go north
Habitat – lot of animal sign (elk, bear)

Discussion: Site #8 was the most sizable, potentially suitable site we have seen in the area other than adjacent to the Paymaster Repository area.

APPENDIX C. GENERALIZED GEOLOGY OF THE HEDDLESTON MINING DISTRICT

By Beth Ihle, Helena Forest Geologist

From: Tysdal and others, 1996, Mineral and Energy Resource Assessment of the Helena National Forest West-Central Montana, US Geological Survey Open File Report 96-683-A.

The Heddleston district is largely underlain by quartzite and siltite of the Middle Proterozoic Spokane and Empire formations, and hornblende diorite and gabbro sill-like intrusive masses of Late Proterozoic age. Multiple Tertiary felsic igneous bodies intrude the Proterozoic rocks. The Tertiary intrusives are a series of feldspar porphyries, related breccia intrusions, and quartz porphyry. The largest intrusion, a quartz monzonite porphyry, is cut by zones of complex brecciation.

The granitic intrusions are believed to be younger than the Boulder Batholith and an age of 44.5 mybp or middle Eocene is suggested. Two prominent faults offset rocks in the district. Both contain mineralized rock, but the northeast-striking set seems to have influenced intrusion emplacement, whereas vein deposits seem to have been controlled by the northwest –striking set. The Mike Horse mine occurs on the northeast striking fault system.

Early mineral develop was initiated prior to the turn of the century and resulted in numerous mines being developed in the district. Exploration and development work by the Anaconda Company in the 1960s-70's resulted in the identification of several significant porphyry copper-molybdenum prospects that are amenable to open pit mining.

APPENDIX D – Waste Volume Calculations

Mike Horse Tailings Volume Calculations

Introduction
Following is a brief summary of the process employed to estimate the volume of tailings located at Mike Horse Dam and Retention Pond. A four-step process was used to estimate the volume of tailings at the site:

1. Survey the site using hand held survey equipment rather than flight data
2. Import the points into AUTOCAD (ACAD) and add points where necessary using interpolation and calculations
3. Build a Digital Terrain Model (DTM) using appropriate surfaces
4. Calculate volumes using composite volume calculation features in ACAD

Given the equipment used there was no way to accurately measure the bottom elevation of the retention pond. The assumptions used to determine the bottom elevation are described in the following paragraphs. Recognizing that there is room for significant variation in calculations using these methods, every attempt was made to be conservative in order to estimate the maximum volume at the site.

A Brief Overview of ACAD

Construction of a Digital Terrain Model entails placing enough points within a drawing to accurately represent the site and having ACAD triangulate between the points to determine the shape of the surface. In order to create a DTM, ACAD must have points outside the area of consideration in order to establish the edge of the surface. These points for this exercise were placed manually in areas where there were little variations in slope along side the retention pond.

The procedure for calculating the volumes is to create "surfaces" for both the top and bottom of the site and then use the composite volume cacluation to calculate the volumes. There are common points for both the top and bottom layer which connects the surfaces allowing ACAD to look at a closed, three dimensional polygon to determine volumes.

1. Survey and importing points into ACAD

A site survey was completed on August 6, 2004. This survey included the entire dam, the waters edge, 10 feet up from the waters edge, the toe of the sam, the area below the toe and between the streams, the centerline of Mike Horse Creek upstream of the retention pond and centerline of Mike Horse dam downstream of the retention pond. Where I was unable to obtain points, I estimated slopes and distances to place points electronicallt in the ACAD drawing. This was used, in particular to place points to represent the edge of the tailings within the retention pond. The material was too soft to walk on and we were not using a boat for this exercise. I also placed points electronically to represent the uphill

side of the retention pond. These points were also not used in volume calculations but were used in the construction of the DTM.

I used long profile information to estimate the bottom elevation of the pond. I measured the upstream elevation of the stream outside the area of influence of the retention pond as well as the elevation of the stream downstream of the dam. I was able to locate bedrock below the dam as well as solid material upstream of the dam. I assumed that the slope between those two points would represent the maximum scour of the stream and therefore the bottom most elevation of the retention pond in a worst case scenario. I then used ACAD to interpolate points along that slope to develop a bottom profile of the reservoir. I measured bank full width up and downstream to be approximately 10 feet and used that as a base width for the retention pond.

Digital Terrain Model (DTM)

Once the points were established in ACAD, I determined which points would be necessary to represent each of the following four surfaces necessary to complete these calculations:

1. All Material: This surface runs from the edge of the tailings, to the bottom elevation of the pond, and includes all of the points representing the dam.
2. Base of tailings: This surface is a flat surface representing the bottom most elevation of the tailings. Points were placed to represent two feet below the bottom elevation in order to include material below the tailings that may be contaminated.
3. Clean material: This surface represents the material above the high water line of the dam. This is material that should not be contaminated and although will require removal, will probably not require treatment and can be wasted in a typical manner rather than placed in a repository.
4. Base of clean material: This surface was placed at the high water line approximately in the center of the dam. It is a flat surface through the center of the dam that represents the base of clean material to be removed from the site.

Volume Calculations

I used the composite volume calculations available in ACAD 2000 to determine volumes for both the tailings and the clean material. I identified the following two stratums: base of tailings and all material; base of clean material and top of dam. I calculated the volumes for each of those and determined the difference to be the quantity of material requiring treatment. The remaining material would be relocated but will likely be free of contamination.

Results

The resulting volumes from these calculations are:
All Material – 503,130 cubic yards
Clean Material – 7,082 cubic yards

Contaminated Material – 496,048 cubic yards

Additional Measurements

The dry area adjacent to the upstream face of the dam on the west side of the retention pond, bounded by the road, spillway intake and the dam was measured to be less than two acres.

Summary

This effort was undertaken in an attempt to validate the 800,000 cubic yards of tailings mentioned in previous reports. Recognizing that the assumptions made during this process were broad and that there are a variety of methods that can be used to calculate volumes, there is significant room for variation in these numbers. That said, this gives some idea of the size of repository required to accommodate this material. Almost 100 percent of this material will be saturated, creating a difficult disposal situation. One alternative would be to treat the material with lime, which will effectively double the amount of material to be placed in a repository. If the material is not treated, it will be difficult if not impossible to place the material at any significant depth without allowing it to dry. DEQ advised me that this material will not stand at a depth of even 10 feet if it is not treated or not given substantial opportunity to dry. For estimating purposed, it was assumed a depth of five feet would be the absolute maximum placement depth for untreated material. For that condition, a repository in excess of 60 acres would be required to accommodate this volume of material.

Submitted by

Pamela K. Hergett
Civil Engineer
Helena National Forest

MDEQ REPOSITORY SITING INVESTIGATION REPORT

TETRA TECH, INC.

September 6, 2006

Mr. David Bowers
Montana Department of Environmental Quality
1100 North Last Chance Gulch
P.O. Box 20091
Helena, MT 59620-0901

Re: Repository Screening Evaluation *for the Upper Blackfoot Mining Complex*

Dear Mr. Bowers:

This letter presents results of a screening level evaluation of potential repository locations for mine waste from the Upper Blackfoot Mining Complex (UBMC). The evaluation was conducted under Modification D for Contract Number 402014, Task Order Number 43 between the Montana Department of Environmental Quality (MDEQ) and Tetra Tech, EM, Inc. (Tetra Tech).

The objective of the evaluation is to identify locations near the UBMC that are potentially suitable for construction of a mine waste repository. To meet this objective, Tetra Tech compiled existing information for the site vicinity and screened the information using Geographic Information System (GIS) technology. Criteria such as slope, areal size, proximity to roads and surface water, and ownership were used to identify suitable locations (State of Montana, 2006a, 2006c, 2006d; USDA, 2006).

Methods

The study area consists of a circle with a ten-mile radius centered at the base of the Mike Horse Dam (Figure 1). The initial screening criteria potential repository locations must meet include:

- A slope of a potential location must be less than or equal to ten percent; and,
- The location must be greater than or equal to 20 acres.

The potential locations were then buffered 100 meters from existing surface water and 15 meters from known roads based on information provided by the United States Forest Service (USDA, 2006; Figure 1).

Based on the above screening criteria, 90 potential locations were evaluated. Further evaluation to narrow the potential locations included:

- Eliminating locations owned by three or more private owners;
- Eliminating locations greater than 20 road miles from the Mike Horse Dam;
- Eliminating locations where a mountain pass would have to be traveled during hauling; and,
- Eliminating locations that are inaccessible by an existing road.

303 Irene Street, Helena, MT 59601
PO Box 4699, Helena, MT 59604
Tel 406 443 5210 Fax 406 449 3729
www tetratech com

Results

After further evaluation, 60 potential locations met all the screening criteria (Figure 2). The 60 potential locations were then grouped according to physical location into six areas: 1) Alice Creek, 2) Willow Creek, 3) Horsefly Creek, 4) McDonald Meadow, 5) Blackfoot River, and 6) Landers Fork. The six areas are further described in Table 1. The descriptions include the number of potential repository locations in each, the range of acreage for the locations in each area, the ownership of each location (USDA, 2006, State of Montana, 2006d), the general geology of each area (State of Montana, 2006b), the general soil composition in each area (NRCS, 2004), the distance from the UBMC, and general comments further describing each location.

The Alice Creek area contains the greatest number of locations with 24 while the Horsefly Creek area only contains one suitable location. The ownership is predominately private land for each area; however, Montana State Trust lands comprise seven locations and the Nature Conservancy owns three locations. The geology of the area consists primarily of sedimentary glacial moraines with boulders, cobble, pebbles and sand and sedimentary alluvium with gravelly sandy silt. The soils of the area consist primarily of gravelly loam with sand, clay, and some silts. The distance from the UBMC to each of the areas varies from six to almost 12 miles along Montana State Highway 200 and up to seven miles on unimproved Forest Service roads.

Because all identified sites are at least 20 acres in size and have slopes less than ten percent, all sites should be able to contain all waste potentially projected to be removed from the UBMC (about 800,000 cubic yards). This assumption will need to be verified at individual sites during site visits.

This screening evaluation can be used for planning purposes in determining general areas that are suitable for disposing of mine wastes. Site-specific environmental information would be needed to further assess the suitability of a particular location for construction of a mine waste repository.

If you have any questions regarding this evaluation, please fell free to give me or Bill Bucher a call.

Sincerely,

Bill Bucher /for

Blaine Hardy, P.E.
Project Engineer

Attachment A: Figures
Attachment B: Table
Attachment C: References

ATTACHMENT A
FIGURES

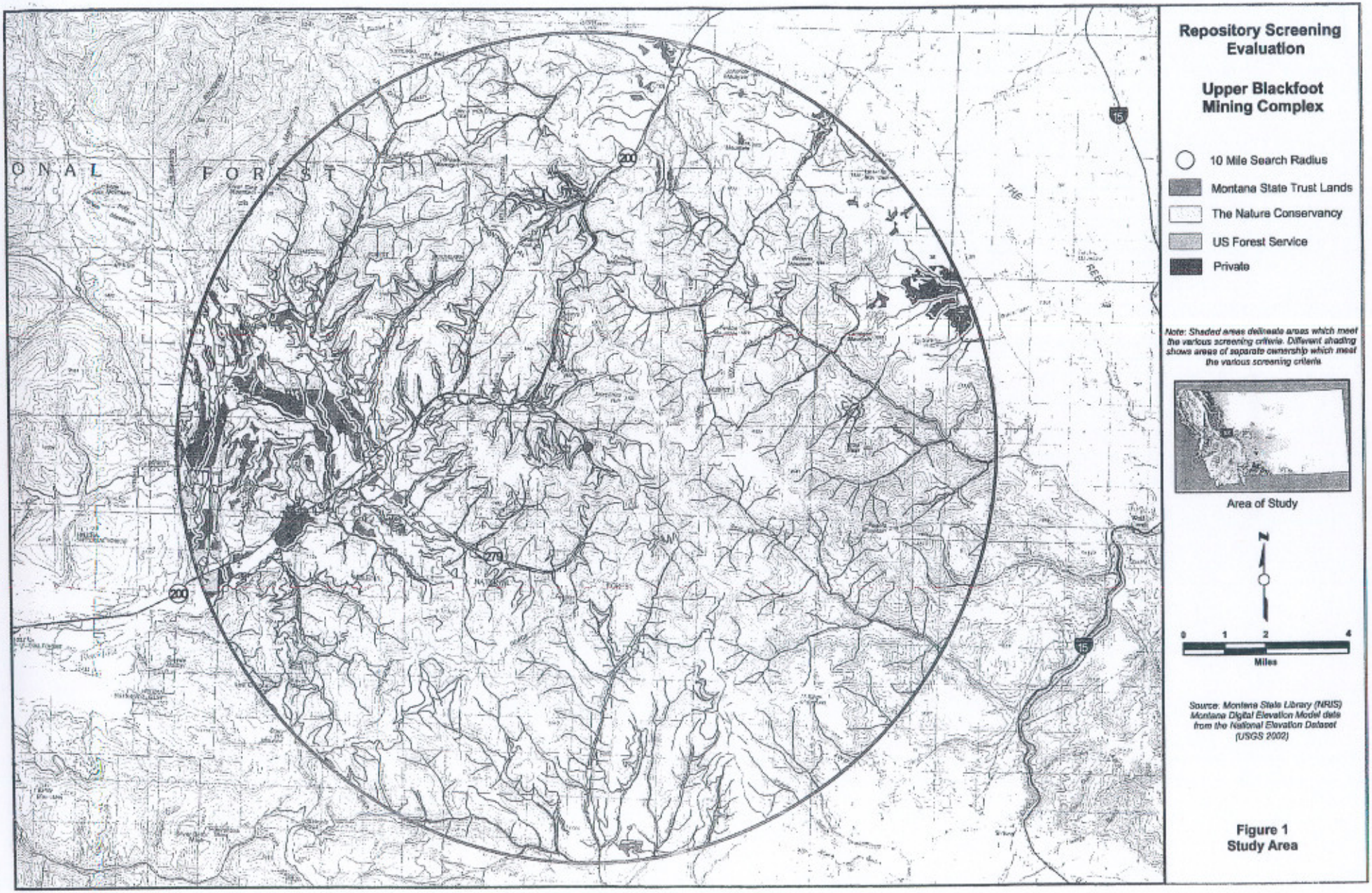


Figure 1
Study Area

Figure 2
Prospective Repository Sites

ATTACHMENT B
TABLE

TABLE 1. REPOSITORY SCREENING EVALUATION

UPPER BLACKFOOT MINING COMPLEX (UBMC)
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

	1. ALICE CREEK AREA	2. WILLOW CREEK AREA	3. HORSEFLY CREEK AREA	4. MCDONALD MEADOW AREA	5. BLACKFOOT RIVER AREA	6. LANDERS FORK AREA
Number of Locations	24	2	1	9	7	17
Area Range	22 - 220 Acres	23 - 34 Acres	74 Acres	22 - 102 Acres	28 - 229 Acres	21 - 122 Acres
Ownership	2 Locations - Montana State Trust Lands 3 Locations - The Nature Conservancy 19 Locations - Private	2 Locations - Private	1 Location - Private	1 Location - Montana State Trust Lands 8 Locations - Private	1 Location - Montana State Trust Lands 6 Locations - Private	3 Locations - Montana State Trust Lands 14 Locations - Private
Geology	The north and south two-thirds of the area consists of sedimentary glacial moraine with boulders, cobble, pebbles and sand and may contain alluvium near the stream channels. The middle third of the area consists of sedimentary alluvium with gravelly sandy silt. The middle third of the area may also contain terrace deposits and glacial drift. A fault is projected into the western point of the area and one may exist near the southern point of the area.	The area primarily consists of sedimentary glacial moraine with boulders, cobble, pebbles and sand and may contain alluvium near the stream channels.	The area consists of sedimentary alluvium with gravelly sandy silt. The area may also contain terrace deposits and glacial drift.	The area consists of the Belt Series of Newland limestone with argillaceous, dolmitic limestone, and some argillite. A fault is projected into the northern portion of the area and one may exist near the southeastern border.	The western two-thirds of the area consists of sedimentary alluvium with gravelly sandy silt. The western two-thirds of the area may also contain terrace deposits and glacial drift. The eastern third of the area consists of sedimentary glacial moraine with boulders, cobble, pebbles and sand and may contain alluvium near the stream and river channels. A fault may exist in the eastern tip of the area.	The western half of the area consists of sedimentary alluvium with gravelly sandy silt. The western half of the area may also contain terrace deposits and glacial drift. The eastern half of the area consists of sedimentary glacial moraine with boulders, cobble, pebbles and sand and may contain alluvium near the stream channels. Two faults are projected through the upper half of the area into the northern portion of the McDonald Meadow area and the western edge of the Alice Creek area.
Soils	Soils in the area primarily consist of a gravelly, cobbly clay loam to approximately five feet deep with particle size increasing with depth. To a lesser extent, soils in the area consist of an extremely gravelly loamy sand with particle size increasing with depth. Soils are well drained with moderately high saturated hydraulic conductivity.	Soils in the area primarily consist of a gravelly sandy loam with some clay to approximately five feet deep with particle size increasing with depth. Bedrock escarpments are seen running southeast along the southern border of the area. Soils are well drained with moderately high saturated hydraulic conductivity.	Soils in the area primarily consist of a very gravelly clay loam to approximately five feet deep with particle size increasing with depth. Soils are well drained with high saturated hydraulic conductivity.	Soils in the area primarily consist of a very gravelly/stony clay loam to approximately five feet deep with particle size increasing with depth. Soils are moderately drained with moderate saturated hydraulic conductivity.	Soils in the area primarily consist of a gravelly sandy clay loam which changes to extremely gravelly sand to approximately five feet deep with particle size increasing with depth. To a lesser extent, soils in the area consist of a silty clay loam which changes to cobbly clay loam to approximately five feet deep with particle size increasing with depth. Soils are well drained with moderately high saturated hydraulic conductivity.	Soils in the area primarily consist of a gravelly sandy clay loam which changes to extremely gravelly/stony sand to approximately five feet deep with particle size increasing with depth. To a lesser extent, soils in the area consist of a silty clay loam which changes to cobbly clay loam to approximately five feet deep with particle size increasing with depth. Bedrock encountered at a depth of approximately 45 inches in areas and bedrock escarpments are seen running north within the area. Soils are well drained with moderately high saturated hydraulic conductivity.
Distance from UBMC & Access	6.2 - 7.9 miles along MT 200 Up to 6 miles off MT 200 along Alice Creek Road (County) and unimproved roads (USFS)	6.6 miles along MT 200 0.4 - 0.9 miles off MT 200 along MT 279	8.3 miles along MT 200 1.6 miles off MT 200 along unimproved roads (USFS)	8.9 - 10.1 miles along MT 200 Up to 6 miles off MT 200 along unimproved roads (USFS)	8.8 - 11.6 miles along MT 200 Up to 0.3 miles off MT 200 along unimproved roads (USFS)	11.6 miles along MT 200 Up to 7.2 miles off MT 200 along Landers Fork Road (County) and unimproved roads (USFS)
General Comments	Eight privately owned areas each owned by two parties.	Each area owned by two parties.	Area owned by Stimson Lumber Company.	Two privately owned areas each owned by two parties.	Two privately owned areas each owned by two parties.	Seven privately owned areas each owned by two parties.

ATTACHMENT C
REFERENCES

REFERENCES

State of Montana, 2006a. Montana State Library – Natural Resource Information System (NRIS) –Digital Raster Graphics – Tiff Images – 1:24,000 and 1:100,000 scales. Available on-line at (http://nris.state.mt.us/nsdi/drgpages/tifstate.html).

State of Montana, 2006b. Montana State Library – Natural Resource Information System (NRIS) – Geology of Montana – 1:500,000 scale. Available on-line at (http://nris.state.mt.us/gis/gisdatalib/gisDataList.aspx).

State of Montana, 2006c. Montana State Library – Natural Resource Information System (NRIS) – Montana Digital Elevation Model data from the National Elevation Dataset (NED). Available on-line at (http://nris.mt.gov/nsdi/nris/el10/dems.html).

State of Montana, 2006d. Montana Cadastral Mapping – Lewis and Clark County. Available on-line at (http://gis.mt.gov/).

USDA, 2006. USDA Forest Service: Helena National Forest – GIS Coverages – Ownership, Streams, Roads and Buffered Fish Layers, provided via CD from HNF September 29, 2006.

PAYMASTER REPOSITORY

SITE INFORMATION

HYDROMETRICS INC.

Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

TEST PIT AND PIEZOMETER CONSTRUCTION

Hole Name: PMTP-1

State: Montana County: Lewis and Clark Date Hole Started: 10/25/94 Date Hole Finished: 10/25/94

Project: UPPER BLACKFOOT-PAYMASTER REPOSITORY

Legal Description:

Descriptive Location: NEAR WEST SIDE OF PROPOSED REPOSITORY

Recorded By: MIKE R. WIGNOT

Drilling Company: SMITHS BACKHOE

Driller: MARK SMITH

Drilling Method: BACKHOE

Drilling Fluids Used: NA

Pilot Hole Dia:

Total Depth Drilled: 10.00

Purpose of Hole: Backhoe pit for Geotechnical samples.

Purpose of Well:

Target Aquifer: NA

	Y/N	TYPE-DESCRIPTION
Well Installed?	Y	2" Schedule 40 PVC
Surface Casing Used?	N	
Casing Perforated?	Y	Saw Cut in Lower 2 ft
Screen Used?	N	
Well Developed?	N	
Well Yield Tested?	N	
Water Samples Taken?	N	
Boring Samples Taken?	Y	

Static Water Level: No Water Encountered Date: 10/25/94

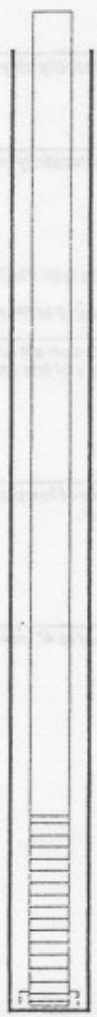
MP Description: Top of PVC Measuring Point (MP) Elevation:

MP Height Above or Below Ground? (+ / -) :

Remarks: Pushed shelby tube approx. 26" at 5 ft. Two-inch peizometer placed in backhoe pit and pit backfilled. Excavation was backfilled with native soils.

Well Construction

Riser Type: 2" Schedule 40 PVC



Ground Surface 0.00

Saw Cut Slots 8.00

Bottom of Hole 10.00

10.00

GRAPHICS

Geological Description and Notes

0.00 — Topsoil (ML) Clayey silt with angular gravel to 4" and trace amounts of low plasitcity clay.

1.00 — Clayey gravel (GC), coarse angular gravel to 6" with brown silty, clay, low to medium plasticity with small amounts of sand.

Pocket Penetrometer at 1' = 1.5 tsf
Pocket Pentrometer at 2' = >4.5 tsf.

Sample UBGT - 9410 -100 @ 0-12" (Geotech, composite with PMTP-2 and PMTP-3)
Sample UBGT-9410-107 @ 0-12" (Metals composite with PMTP-2 and PMTP-3)

4.00 — Gravelly sand (SC), well graded sand with small amounts of low plasticity clay and angular gravel to 4', less gravel at 5-7'.
Pocket Penetrometer at 4' = 3.0 tsf.
Pocket Penetrometer at 5' = 4.0 tsf.
Pocket Penetrometer at 6' = 2.0 tsf.
No penetrometer readings below 6'.
Sample UBGT-9410-101 @ 5' (Geotech, 5 gallon bucket).
Sample UBGT - 9410-103 @ 5' (Geotech, shelby tube).

7.00 — Sandy gravel (GW), well graded gravel, angular with significant amounts fo sand. Oxidized from 7 to 8'. Some medium plasticity clay.

8.00 — Gravelly sand (SW), well graded sand with trace amounts of clay and silt. Some gravel to 2".

9.00 — Sandy gravel (GW), angular, well graded gravel to 6" with coarse to fine sand and trace amounts of clay.

Sample UBGT - 9410 - 106 @ 10' (Geotech, 5 gallon bucket)

10.00

HYDROMETRICS INC.

Consulting Scientists and Engineers
2727 Airport Rd. Helena Mt, 59601

TEST PIT AND PIEZOMETER CONSTRUCTION

Hole Name: PMTP-2

State: MONTANA County: LEWIS AND CLARK Date Hole Started: 10/25/94 Date Hole Finished: 10/25/95

Project: UPPER BLACKFOOT-PAYMASTER REPOSITORY

Legal Description:

Descriptive Location: NEAR CENTER OF PROPOSED REPOSITORY

Recorded By: MIKE R. WIGNOT

Drilling Company: SMITHS BACKHOE

Driller: MARK SMITH

Drilling Method: BACKHOE

Drilling Fluids Used: None

Pilot Hole Dia: NA

Total Depth Drilled: 10.00

Purpose of Hole: Backhoe pit for Geotechnical samples.

Purpose of Well: NA

Target Aquifer: NA

	Y/N	TYPE-DESCRIPTION
Well Installed?	Y	2 inch schedule 40 PVC casing
Surface Casing Used?	N	
Casing Perforated?	Y	Saw cuts in lower 2 ft.
Screen Used?	N	
Well Developed?	N	
Well Yield Tested?	N	
Water Samples Taken?	N	
Boring Samples Taken?	Y	

Static Water Level: No Water Encountered Date: 10/25/94

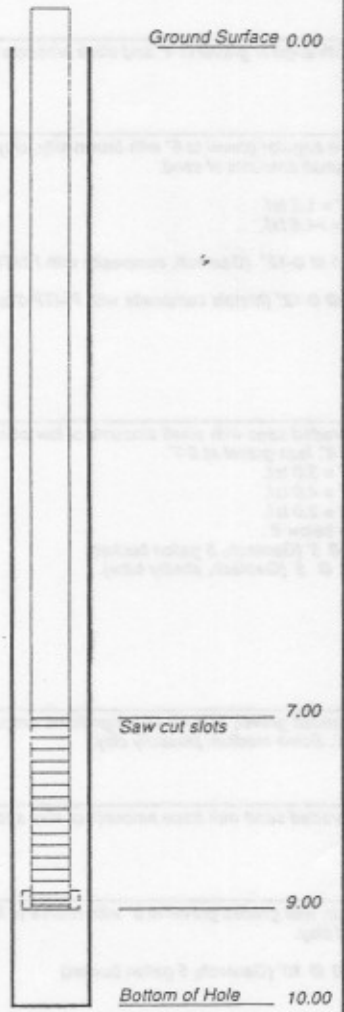
MP Description: Top of PVC Measuring Point (MP) Elevation:

MP Height Above or Below Ground? (+ / -) :

Remarks: Pushed 30" shelby tube to depth approx 26" at 5 ft. Two inch PVC piezometer placed in backhoe pit and pit backfilled. Excavation backfilled with native soils.

Well Construction

Riser Type: 2 inch schedule 40 PVC casing



GRAPHICS

Geological Description and Notes

0.00 — Topsoil (ML) clayey silt with angular gravel to 4". Low plasticity clay

1.00 — Clayey gravel (GC) Course angular gravel to 8" with low plasticity clay and some silt.

Pocket Penetrometer at 1' = 2.0 tsf.
Pocket Penetrometer at 2' = 3.0 tsf.

Sample UBGT - 9410 - 100 at 0-12" (Geotech, composite with PMTP-1and PMTP-3).
Sample UBGT - 9410 - 107 at 0-12 (Metals composite with PMTP-1 and PMTP-3).

3.00 — Silty Gravel (GW) well graded angular gravel to 6" with brown silt and trace amounts of low plasticity clay. Some small amounts of fine grained sand at 4-5'.

Pocket Pentrometer at 4' = 3.0 tsf.

4.50 — Gravelly sand (SC), well graded sand with small amounts of low plasticity clay, and angular gravel to 2" oxidized at appx. 4.5 to 5.0'.

Pocket Pentrometer at 5' = 2.0 tsf.

Sample UBGT-9410 - 104 at 5' (Geotech, shelby tube).

6.00 — Gravelly sand (SW), well graded sand with angular gravel to 4" with little clay or silt. Larger gravel at depth.

Pocket Penetrometer at 6' = 2.5 tsf.
No penetrometer readings below 6"

10.00

HYDROMETRICS INC.

Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

TEST PIT AND PIEZOMETER CONSTRUCTION

Hole Name: PMTP-3

State: MONTANA County: LEWIS AND CLARK

Date Hole Started: 10/25/94 Date Hole Finished: 10/25/94

Project: UPPER BLACKFOOT PAYMASTER REPOSITORY

Legal Description:

Descriptive Location: Near North Side of Proposed Repository

Recorded By: MIKE R. WIGNOT

Drilling Company: SMITHS BACKHOE

Driller: MARK SMITH

Drilling Method: BACKHOE

Drilling Fluids Used:

Pilot Hole Dia:

Total Depth Drilled: 10.00

Purpose of Hole: Backhoe pit for Geotechnical samples

Purpose of Well:

Target Aquifer: NA

	Y/N	TYPE-DESCRIPTION
Well Installed?	Y	2-inch Schedule 40 PVC
Surface Casing Used?	N	
Casing Perforated?	Y	Saw slots in lower 2 ft
Screen Used?	N	
Well Developed?	N	
Well Yield Tested?	N	
Water Samples Taken?	N	
Boring Samples Taken?	Y	

Static Water Level: No Water Encountered Date: 10/25/94

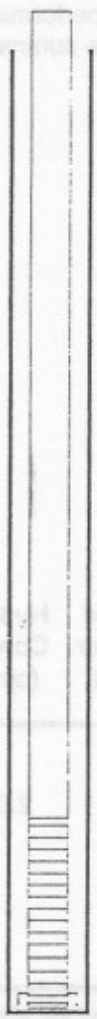
MP Description: Top of PVC Measuring Point (MP) Elevation:

MP Height Above or Below Ground? (+ / -) :

Remarks: Could only push 30" shelby tube 12" at 5 ft. Refusal at 6 ft. Two inch piezometer placed in backhoe pit and pit backfilled. Excavation backfilled with native soils.

Well Construction

Riser Type: 2-inch Schedule 40 PVC



GRAPHICS

Geological Description and Notes

0.00 — Topsoil (ML), predominantly silt with some clay and angular gravel to 1"

0.75 — Silty gravel (GW), well graded angular gravel to 4" with tan silt, trace amounts of low plasticity clay. Larger gravel at 3-4'.
Pocket Penetrometer at 1' = 1.0 tsf.
Pocket Penetrometer at 2' = 3.5 tsf.
Pocket Penetrometer at 4' = 2.0 tsf.
Sample UBGT - 9410 - 100 at 0-12" (Geotech, composite with PMTP-1 and PMTP-2). Sample UBGT - 9410 -107 at 0-12" (Metals composite with PMTP-1 and PMTP-2)

4.00 — Clayey gravel (GC), coarse angular gravel to 6" with low to medium plasticity clay, oxidized at 4' to 5'. Some sand at 5 to 5.5'.
Pocket Penetrometer at 5' = 1.5 tsf.
Sample UBGT - 9410 - 102 at 5' (Geotech, 5 gallon bucket)
Sample UBGT - 9410 - 105 at 5' (Geotech, shelby tube).

5.50 — Sandy gravel (GW), well graded gravel angular to 12" with coarse grained sand. Larger gravel and boulders near the bottom of pit.

No penetrometer readings below 6'.

10.00

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Upper Blackfoot Mining Complex

Hole Name: PRMW-1

Date Hole Started: 8/9/06 Date Hole Finished: 8/9/06

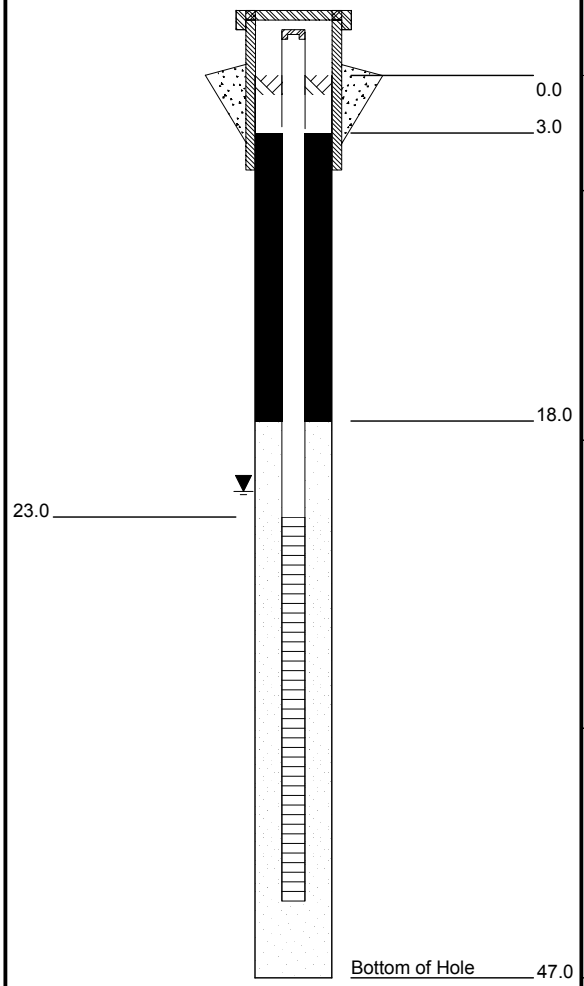
Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: Asarco, LLC
Legal Description:
Location Description: Downgradient (east) of Paymaster Repository
Recorded By: Larry Johnson
Drilling Company: Boland Drilling
Driller: James
Drilling Method: Air Rotary
Drilling Fluids Used: None
Purpose of Hole: Monitoring Well
Target Aquifer: First Water
Hole Diameter (in): 6"
Total Depth Drilled (ft): 47

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+3 to 43
Surface Casing Used?	Y	6" Steel	+3 to 2
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	23' to 43'
Sand Pack?	Y	10/20 Colorado Sand	18' to 47'
Annular Seal?	Y	Bentonite Chips	4' to 18'
Surface Seal?	Y	Cement	0 to 1'
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Yes	
Water Samples Taken?	N		
Boring Samples Taken?	Y	Yes	

Northing: 47.03955 Easting: 112.38757
Static Water Level Below MP: 24.17
Date: 8/15/06
MP Description: Top of PVC
MP Height Above or Below Ground (ft): +2.5
Surface Casing Height (ft): TBD
Riser Height (ft): TBD
Ground Surface Elevation (ft): TBD
MP Elevation (ft):

Remarks: Hard competent bedrock from 6 ft. to total depth. Drilled open hole from 6 to 47 ft. First water at 31 ft. bgs; very dusty drilling above 31 ft. Driller poured sand down hole prior to setting casing to bottom. so well completed to 43 ft. only.

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 6.0' **Colluvium/Weathered Bedrock**
Light tan sandy soil with rock fragments, both sedimentary and intrusive rock. Dry (very dusty drilling).

6.0 - 47.0' **Diorite Intrusive**
Dark gray to black, medium to fine-grained.

18.0 - 19.0'
Fractures at 18 to 19 feet.

30.0 - 34.0'
Fractures at 30 feet, iron staining.

First water at 31 feet, 1 to 2 gpm.

STANDARD_REV3 1290.GPJ HYDHLN1.GDT 9/21/06

Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Upper Blackfoot Mining Complex

Hole Name: PRMW-2

Date Hole Started: 8/9/06 Date Hole Finished: 8/9/06

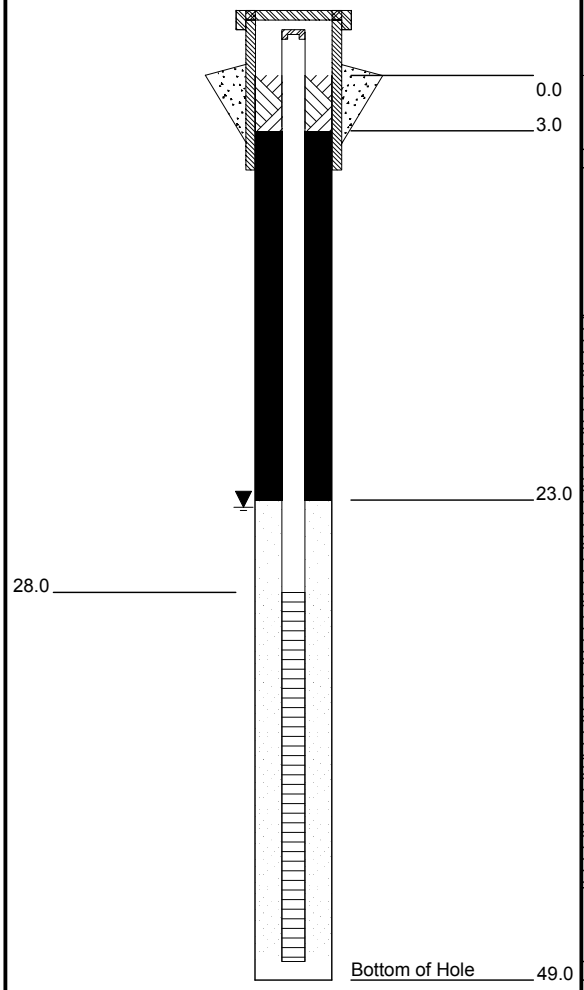
Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: Asarco, LLC
Legal Description:
Location Description: Downgradient (west) of Paymaster Repository
Recorded By: Larry Johnson
Drilling Company: Boland Drilling
Driller: James
Drilling Method: Air Rotary
Drilling Fluids Used: None
Purpose of Hole: GW Monitoring
Target Aquifer: First Water
Hole Diameter (in): 6"
Total Depth Drilled (ft): 49

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+3 to 49'
Surface Casing Used?	Y	6" Steel	+3 to 2'
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	28' to 49'
Sand Pack?	Y	10/20 Colorado Sand	24' to 49'
Annular Seal?	Y	Bentonite Chips	3' to 24'
Surface Seal?	Y	Cement	0 to 1'
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Yes	
Water Samples Taken?	N		
Boring Samples Taken?	Y	Yes	

Northing: 47.03955 Easting: 112.38863
Static Water Level Below MP: 25.89
Date: 8/15/06
MP Description: Top of PVC
MP Height Above or Below Ground (ft): +2.5
Surface Casing Height (ft): TBD
Riser Height (ft): TBD
Ground Surface Elevation (ft): TBD
MP Elevation (ft):

Remarks:

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 4.0' **Colluvium**
0 to 4 feet, dry, sandy colluvium, diorite float.

4.0 - 5.0' **Clayey Colluvium**
Dry, colluvium with moderate clay.

5.0 - 13.0' **Colluvium**
Dry, sandy colluvium with diorite float.

13.0 - 44.0' **Bedrock** [Bedrock]
Dry to damp, gray to green gray diorite.

34.0 - 37.0'
Iron stained fractures 34 to 37 feet.

First water at 35 feet, 1 to 2 gpm.

44.0 - 48.0' **Quartz Sulfide Vein**
2 - 4% pyrite with galena and moly.

48.0 - 49.0' **Clay**
Clay. Buff colored clay (gouge?).

STANDARD_REV3 1290.GPJ HYDHLN1.GDT 9/21/06

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Upper Blackfoot Mining Complex

Hole Name: PRMW-3

Date Hole Started: 8/9/06 Date Hole Finished: 8/10/06

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: Asarco, LLC

Legal Description:

Location Description: Upgradient of Paymaster Repository

Recorded By: Larry Johnson

Drilling Company: Boland Drilling

Driller: James

Drilling Method: Air Rotary

Drilling Fluids Used: None

Purpose of Hole: Monitoring Well

Target Aquifer: First Water

Hole Diameter (in): 6'

Total Depth Drilled (ft): 65

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+3 to 65'
Surface Casing Used?	Y	6" Steel	+3 to 2'
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	40' to 60'
Sand Pack?	Y	10/20 Colorado Sand	35' to 65'
Annular Seal?	Y	Bentonite Chips	3' to 35'
Surface Seal?	Y	Cement	0 to 1'
DEVELOPMENT/SAMPLING			
Well Developed?	Y	Yes	
Water Samples Taken?	N		
Boring Samples Taken?	Y	Yes	

Northing: 47.03862 Easting: 112.38767

Static Water Level Below MP: 43.28

Date: 8/15/06

MP Description: Top of PVC

MP Height Above or Below Ground (ft): +2.5

Surface Casing Height (ft): TBD

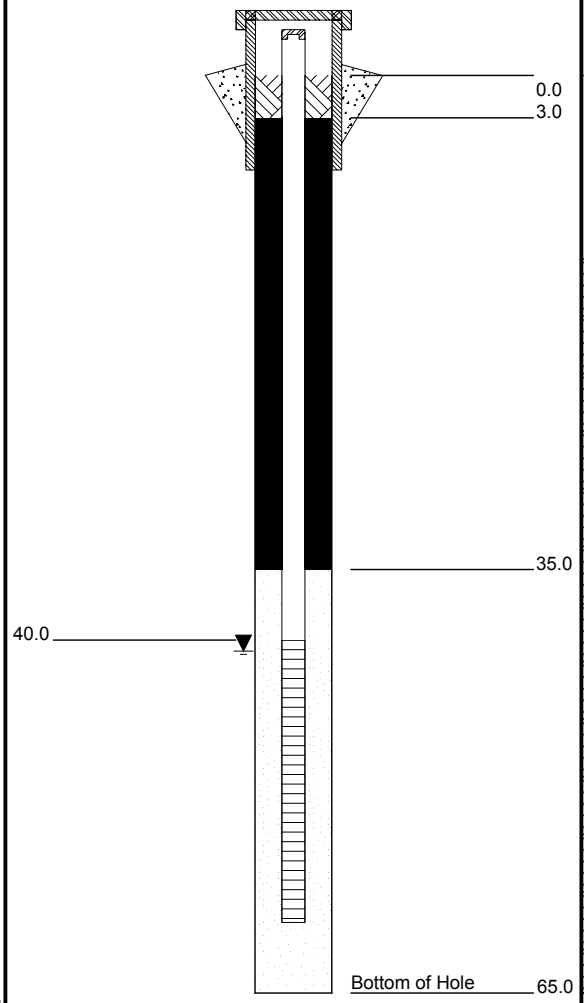
Riser Height (ft): TBD

Ground Surface Elevation (ft): TBD

MP Elevation (ft):

Remarks: Backfilled bottom 5 feet of hole with silica sand.

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 13.0' **Colluvium/Weathered Bedrock**
Dry, light tan, sandy colluvium grading to weathered broken diorite bedrock.

13.1 - 65.0' **Bedrock**
Dark gray diorite with argillized feldspar. Highly fractured to 17 feet.

35.0 - 65.0' **Diorite**
Very fine-grained diorite from 35 to 65 feet.

Easier drilling at 43 feet.

First water at 44.5 feet.

STANDARD_REV3 1290.GPJ HYDHLN1.GDT 9/21/06

Huntingdon
(Formerly Chen-Northern, Inc.)
600 South 25th Street
P O Box 30615
Billings, MT 59107
(406) 248-9161
FAX (406) 248-9282

TECHNICAL REPORT

REPORT TO: ATTN: MR. MICHAEL WIGNOT
HYDROMETICS, INC.
2727 AIRPORT ROAD
HELENA, MT 59601

DATE: December 12, 1994
JOB NUMBER: 84-601
SHEET: 1 of 2
INVOICE NO.: 6830-BI

REPORT OF: Laboratory Testing - UBMC-Paymaster Repository

SAMPLE IDENTIFICATION:

On November 4, 1994 we received seven soil samples from the subject site with instructions to perform four sieve analysis, one hydrometer analysis, three density and moisture contents, three direct shear tests, one moisture-density determination, one remolded hydraulic conductivity test, and one organic matter content. The hydraulic conductivity test specimen was remolded to 95% of the maximum dry density and optimum moisture content as indicated on the moisture-density determination. The tests were performed in general accordance with applicable ASTM or other specified procedures. The procedures are summarized in the table below.

TEST	STANDARD
Sieve and Hydrometer Analysis	ASTM D451
Density & Moisture Content	ASTM D2937
Direct Shear Test	ASTM D3080
Mositure-Density Determination	ASTM D698-78
Hydraulic Conductivity Test	ASTM D5084
Organic Matter	USDA-24

TEST RESULTS:

HYDRAULIC CONDUCTIVITY TEST

Sample Number	Dry Density (pcf)	Moisture Content (%)	Hydraulic Gradient	Head Water (feet)	Hydraulic Conductivity (cm/sec)
From Pit PMTP-1 @ 5 ft					
UBGT-9410-101 (Paymaster Repository Subgrade-Remolded to 95% MDD)	118.8	15.2	18.5	4.6	2.0×10^{-7}

(Note: Hand Notations by MFG, Inc.)

TEST RESULTS Continued:

DENSITY & MOISTURE CONTENT
(In-Place)

Sample Number	Dry Density (pcf)	Moisture Content %
UBGT-9410-103	103.8	15.6
UBGT-9410-104	102.4	21.0
UBGT-9410-105	98.2	20.9

The test results for the sieve and hydrometer analysis, moisture-density determination, received moisture contents, and organic matter are included on the attached plates. If you have any questions regarding this report or if we can be of further service, please contact us.

Reviewed by David M Hummel

cc: Attn: John Rahe
McCulley, Frick and Gilman, Inc.
4848 Pearl East Circle, Suite 200 W
Boulder, Colorado 80301

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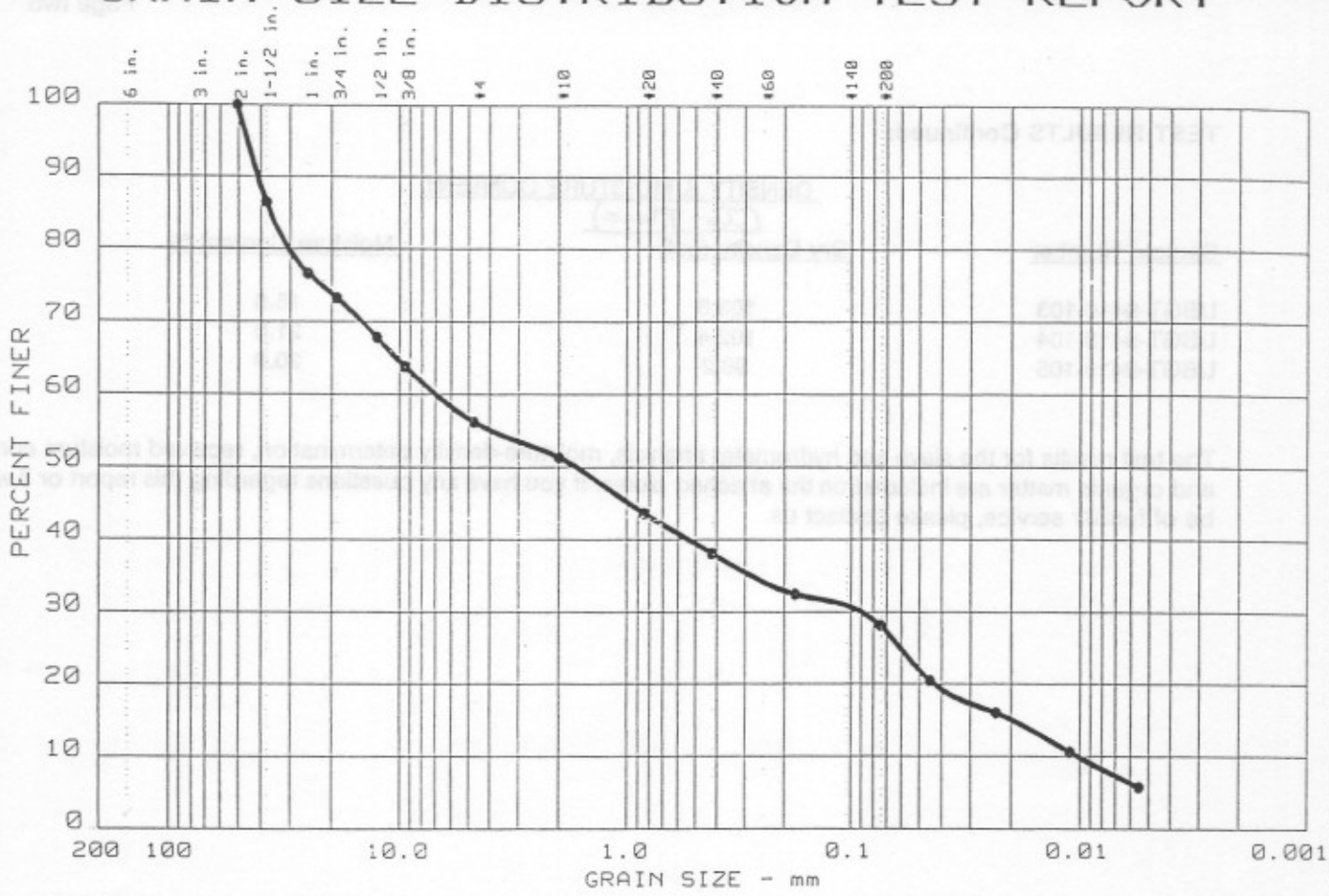
GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
•	0.0	43.8	28.0	28.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
•	0	0	36.60	6.97	1.67	0.090	0.0197	0.0102	0.11	683.9

MATERIAL DESCRIPTION	USCS	AASHTO
• Silty GRAVEL with Sand	GM	

Project No.: ASHP09
Project: UBMC-9410-100
• Location: UMGT-9410-100

Date: 12-2-94

GRAIN SIZE DISTRIBUTION TEST REPORT

HUNTINGDON ENGINEERING & ENVIRONMENTAL

Remarks:

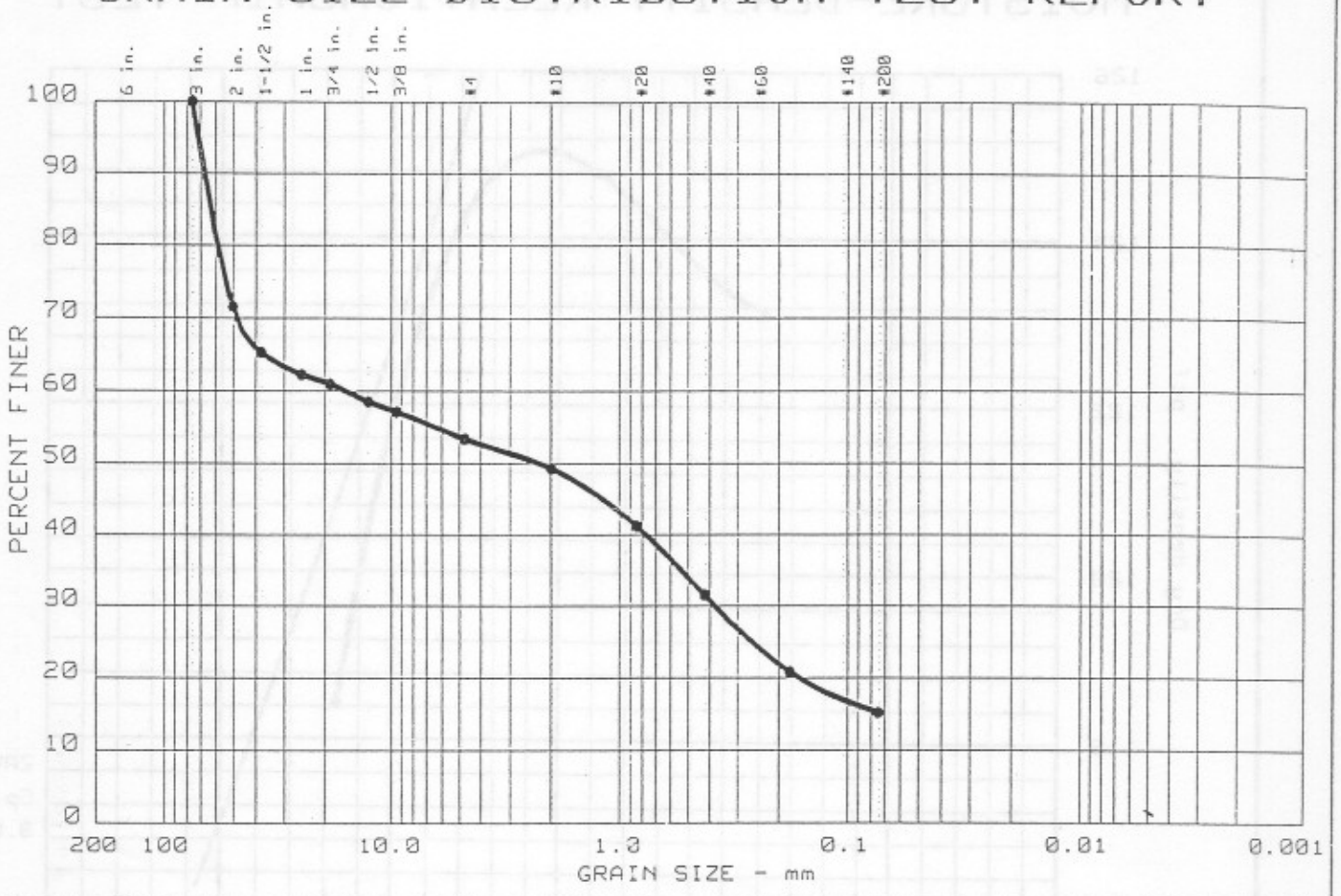
Received moisture 14.3%

Organic matter 1.01%

Paymaster Repository (0-12" Composite)

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
•	0.0	46.6	38.2	15.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
•	0	0	63.31	15.90	2.25	0.377				

MATERIAL DESCRIPTION	USCS	AASHTO
• Silty GRAVEL with Sand	GM	

Project No.: ASHP09
Project: UBMC-PAYMASTER REPOSITORY
• Location: UBGT-9410-101

Date: 12-2-94

Remarks:

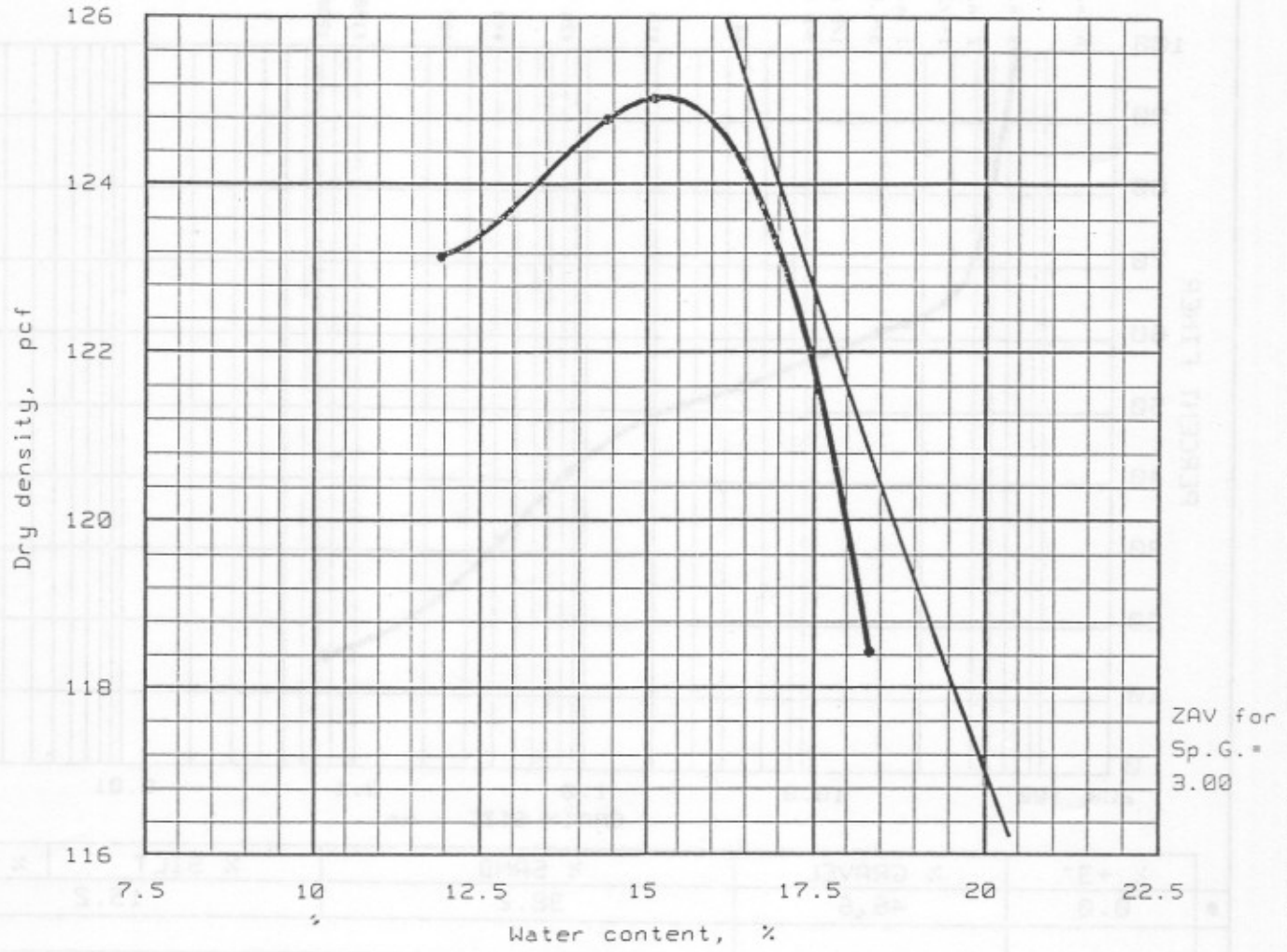
Received moisture 7.2%
(Bulk sample @ 5')
PMTP-1

GRAIN SIZE DISTRIBUTION TEST REPORT

HUNTINGDON ENGINEERING & ENVIRONMENTAL

Figure No. _____

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-78 Method D, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
			7.2 %	3.00	0	0	39 %	15.2 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 125.1 pcf Optimum moisture = 15.2 %	Silty GRAVEL with Sand

Project No.: 84-601
Project: UBMC-PAYMASTER REPOSITORY
Location: UBGT-9410-101

Date: 11-11-1994

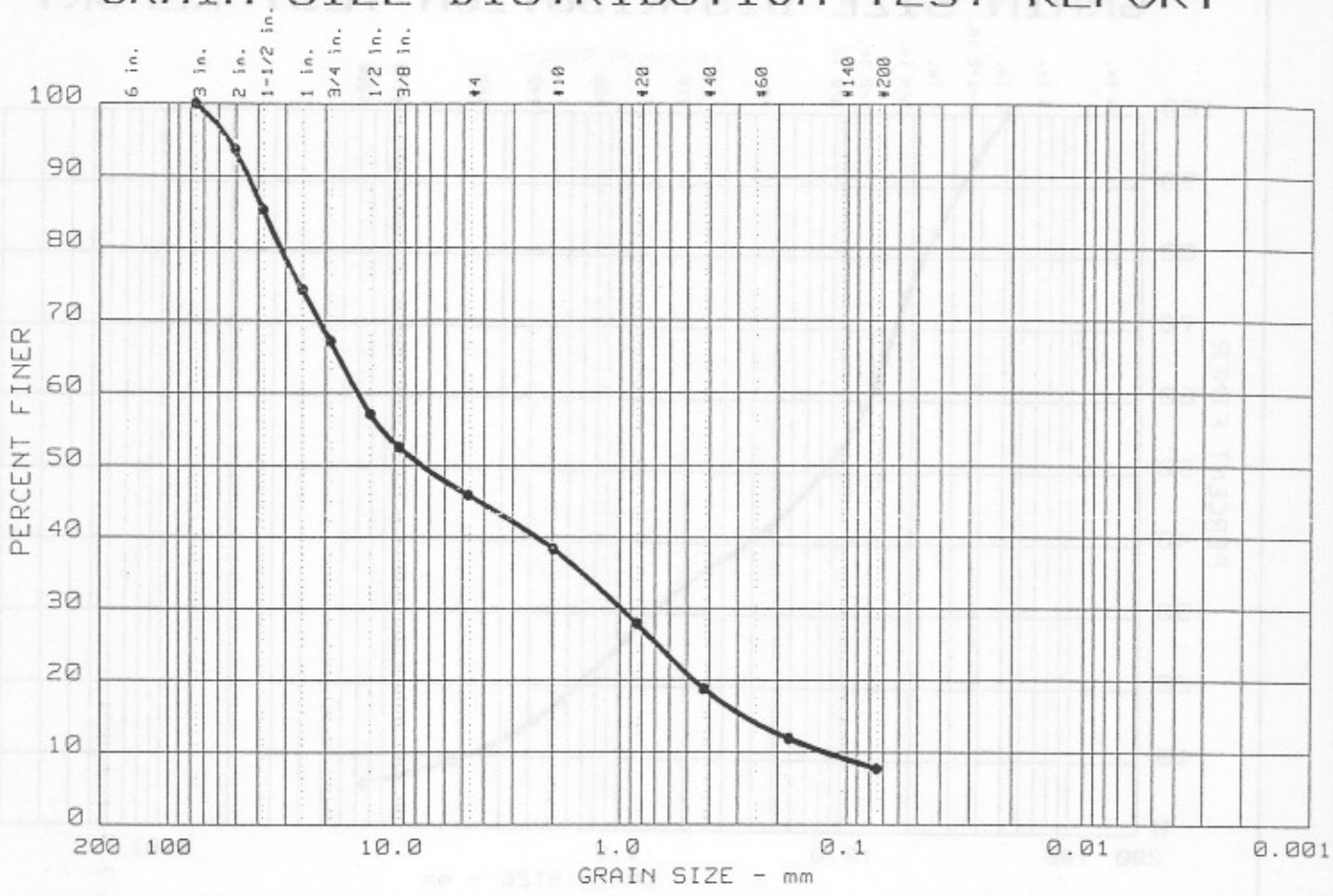
Remarks:
(Bulk Sample @ 5'
PMTP-1)

MOISTURE-DENSITY RELATIONSHIP TEST

HUNTINGDON ENGINEERING & ENVIRONMENTAL

Fig. No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
•	0.0	54.2	38.0	7.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
•	0	0	37.58	14.42	7.57	0.986	0.2812	0.1242	0.54	116.1

MATERIAL DESCRIPTION	USCS	AASHTO
• Poorly Graded GRAVEL with Silt & Sand	GP-GM	

Project No.: ASHP09
Project: UBMC-PAYMASTER REPOSITORY
• Location: UBGT-9410-102

Date: 12-2-94

Remarks:

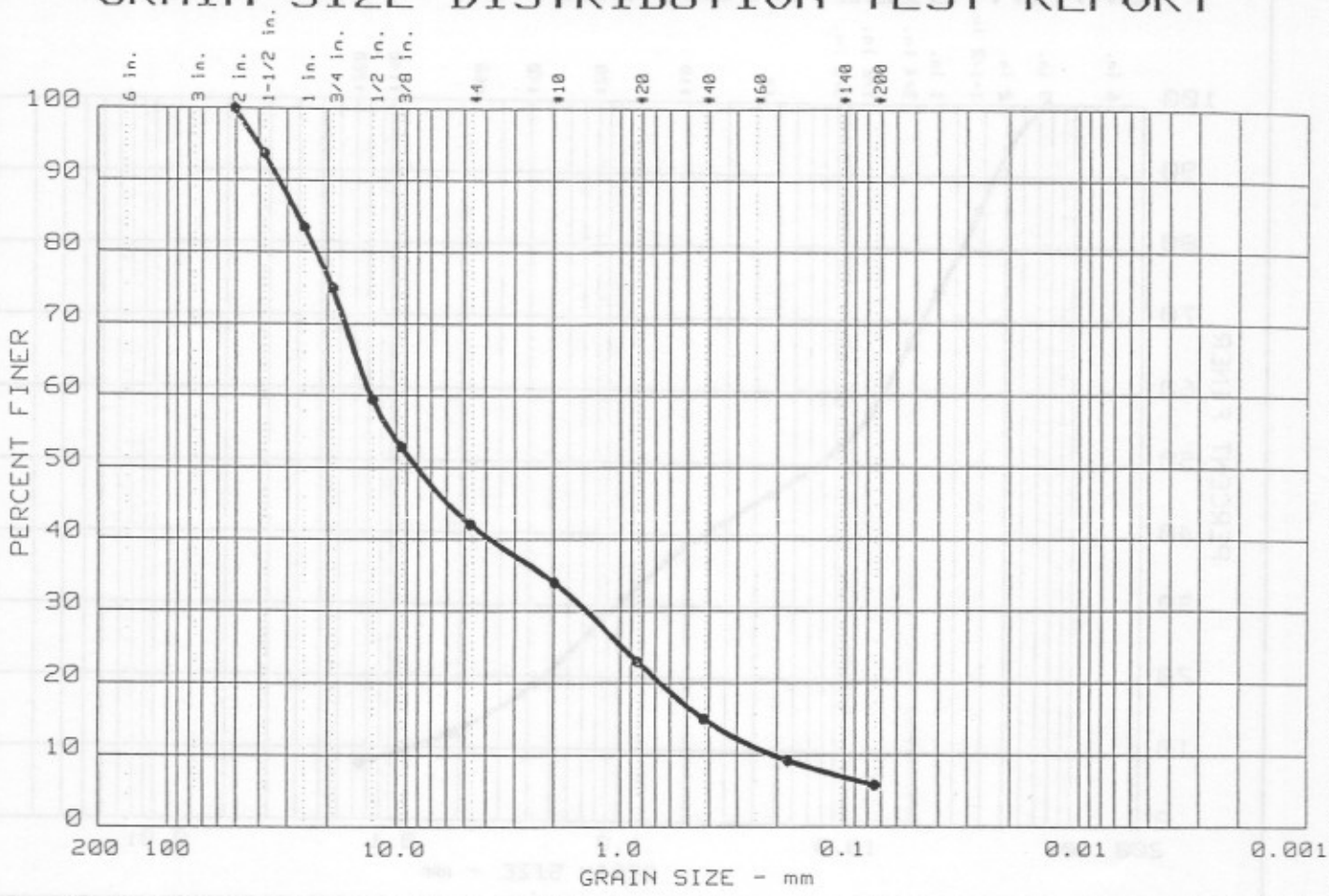
Received moisture 11.0%
(Bulk Sample @ 5'
PMTP-3

GRAIN SIZE DISTRIBUTION TEST REPORT

HUNTINGDON ENGINEERING & ENVIRONMENTAL

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
•	0.0	57.9	36.2	5.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
•	0	0	26.92	12.88	8.04	1.413	0.4217	0.2065	0.75	62.4

MATERIAL DESCRIPTION	USCS	AASHTO
• Poorly Graded GRAVEL with Silt & Sand	GP-GM	

Project No.: ASHP09
Project: UBMC-PAYMASTER REPOSITORY
• Location: UMGT-9401-106

Date: 12-2-94

Remarks:
Received Moisture 16.1%
(Bulk Sample @ 10')
PMTP-1

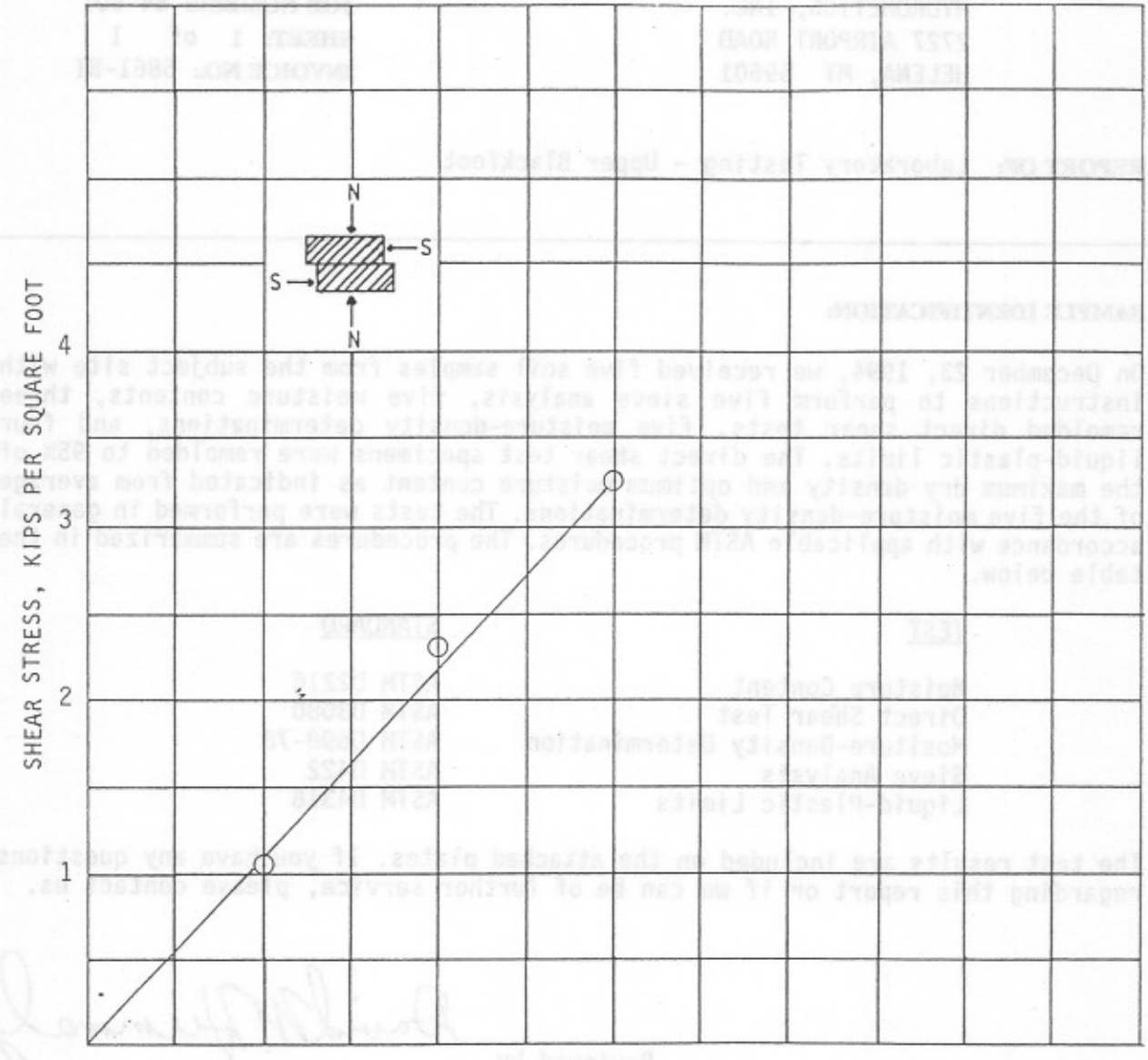
GRAIN SIZE DISTRIBUTION TEST REPORT
HUNTINGDON ENGINEERING & ENVIRONMENTAL

Figure No. _____

DIRECT SHEAR TEST

DRILL HOLE:
DEPTH:
SAMPLE NO.: UBGT-9410-104
(Paymaster Repository Subgrade; Shelby Tube @ 5'; PMTP-2)

MOIST UNIT WEIGHT	:	122 pcf
DRY UNIT WEIGHT	:	101 pcf
MOISTURE CONTENT	:	21 %
CLASSIFICATION	:	
FRICTION ANGLE	:	47°
COHESION INTERCEPT	:	0.0 ksf
SHEAR RATE	:	0.048 inch/minute



● SATURATED
○ FIELD MOISTURE CONTENT

UBMC - PAYMASTER REPOSITORY
(Subgrade; Intact Sample)

HYDROMETRICS - HELENA, MT

Huntingdon
Engineering & Environmental, Inc.

JOB NO. 84-601 PLATE NO.

Huntingdon

(Formerly Chen-Northern, Inc.)
600 South 25th Street
P O Box 30615
Billings, MT 59107
(406) 248-9161
FAX (406) 248-9282

TECHNICAL REPORT

REPORT TO: ATTN: MR. ROBERT ANDERSON
HYDROMETICS, INC.
2727 AIRPORT ROAD
HELENA, MT 59601

DATE: January 16, 1995
JOB NUMBER: 84-601
SHEET: 1 of 1
INVOICE NO.: 6861-BI

REPORT OF: Laboratory Testing - Upper Blackfoot

SAMPLE IDENTIFICATION:

On December 23, 1994, we received five soil samples from the subject site with instructions to perform five sieve analysis, five moisture contents, three remolded direct shear tests, five moisture-density determinations, and four liquid-plastic limits. The direct shear test specimens were remolded to 95% of the maximum dry density and optimum moisture content as indicated from average of the five moisture-density determinations. The tests were performed in general accordance with applicable ASTM procedures. The procedures are summarized in the table below.

TEST	STANDARD
Moisture Content	ASTM D2216
Direct Shear Test	ASTM D3080
Mositure-Density Determination	ASTM D698-78
Sieve Analysis	ASTM D422
Liquid-Plastic Limits	ASTM D4318

The test results are included on the attached plates. If you have any questions regarding this report or if we can be of further service, please contact us.

Reviewed by _____

cc: Attn: John Rahe
McCulley, Frick and Gilman, Inc.
4848 Pearl East Circle, Suite 200 W
Boulder, Colorado 80301

n:\typing\geotech\84-601\blackft

rmr

FIRST GULCH REPOSITORY SITE INFORMATION

(See Drawing 14, Appendix F for First Gulch Test Pit and Monitoring Well Locations)

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Test Pit Log

Hole Name: FG-TP-1

Date Hole Started: 11/22/06 Date Hole Finished: 11/22/06

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: ASARCO LLC

Legal Description:

Descriptive Location:

Recorded By: Rhodes/Anderson

Equipment Owner:

Equipment Operator:

Excavation Method:

Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
						0.0 - 0.5' **TOPSOIL** Brown-black topsoil, highly organic - roots, bark.
						0.5 - 1.0' **SM/SC** Reddish brown, moist, slight plasticity, 10-20% angular rocks to 4" in size.
						1.0 - 4.0' **GM** Reddish brown, dry, 40-60% angular bedrock pieces to 10" in diameter.
5					5	4.0 - 6.0' **BEDROCK** Weathered bedrock, little to no fines, solid bedrock at 6 feet.

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Test Pit Logs

Hole Name: FG-TP-2

Date Hole Started: 11/22/07 Date Hole Finished: 11/22/07

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: ASARCO LLC

Legal Description:

Descriptive Location:

Recorded By: Rhodes/Anderson

Equipment Owner:

Equipment Operator:

Excavation Method:

Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
		GRAB		0.0 - 0.5' Topsoil		0.0 - 0.5' **TOPSOIL** Brown to black topsoil, highly organic - roots, bark.
						0.5 - 1.3' **SM** Reddish brown, moist, slight plasticity - 20-30% angular rock to 3" in diameter.
		GRAB		0.8 - 1.5' Subsoil		
						1.3 - 4.0' **GM/BEDROCK** Orange-yellowish, large flat shale rock, bedrock at 4 feet, weathered section from 24" to 48".
5					5	

TEST PIT LOG K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 7/18/07

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Test Pit Log

Hole Name: FG-TP-3

Date Hole Started: 11/22/06 Date Hole Finished: 11/22/06

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: ASARCO LLC

Legal Description:

Descriptive Location:

Recorded By: Poell/Anderson

Equipment Owner:

Equipment Operator:

Excavation Method:

Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
						0.0 - 0.5' **TOPSOIL** Brown black topsoil, organic material, moist, slightly plastic.
						0.5 - 1.5' **GC-SC** Brown, moist, mild plasticity, small angular gravels to 3" in diameter.
						1.5 - 4.0' **GM** Reddish brown, dry, large plasticity angular rock, weathered bedrock.
5					5	4.0 - 6.0' **BEDROCK** Yellow-orange, weathered bedrock, high solid bedrock at 6 feet, red shaley rock.

TEST PIT LOG K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 7/18/07

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Test Pit Log

Hole Name: FG-TP-4

Date Hole Started: 11/22/06 Date Hole Finished: 11/22/06

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: ASARCO LLC

Legal Description:

Descriptive Location:

Recorded By: Rhodes/Anderson

Equipment Owner:

Equipment Operator:

Excavation Method:

Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
						0.0 - 0.5' **TOPSOIL** Brown, black topsoil, organic, wood bark, small pea gravels, many roots.
						0.5 - 2.0' **SM** Brown, reddish, moist, silty gravelly subsoil, slightly plastic, some roots.
						2.0 - 5.0' **GM** Reddish, 20% angular gravels, dry, non-plastic, lower portion weathered bedrock.
5					5	
						5.0 - 6.0' **BEDROCK** Fractured bedrock, fairly solid rock at 6 feet.

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Test Pit Log

Hole Name: FG-TP-5

Date Hole Started: 11/22/06 Date Hole Finished: 11/22/06

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: ASARCO LLC

Legal Description:

Descriptive Location:

Recorded By: Rhodes/Anderson

Equipment Owner:

Equipment Operator:

Excavation Method:

Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
						0.0 - 1.0' **TOPSOIL** Brown black topsoil, organic, wood bark, small pea gravels, many roots.
		GRAB		1.0 - 2.5' Subsoil		1.0 - 2.5' **GM/SM** Reddish brown, dry silty sandy, 20% angular gravels - some cobbles to 8 inches.
						2.5 - 4.0' **BEDROCK** Weathered bedrock, hit hard bedrock at 4 feet.
5					5	

TEST PIT LOG K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 7/18/07

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Test Pit Log

Hole Name: FG-TP-8

Date Hole Started: Date Hole Finished:

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: ASARCO LLC
Legal Description:
Descriptive Location:

Recorded By: Rhodes/Johnson

Equipment Owner:
Equipment Operator:
Excavation Method:
Excavation Dimensions:

Remarks:

DEPTH / SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
			0.0 - 10.0' Installed piezometer - 5 feet of screen.		0.0 - 0.3' **Topsoil** Black, moist, mostly organics, roots.
					0.3 - 8.0' **GW-GM** Reddish brown, moist, angular and subrounded gravels, very loose, well graded, cobbles to 8 inches - appears to be glacial till deposit.
5				5	
					8.0 - 10.0' **GW** Same material as above with an increase in large angular cobbles and much lower percentage of fine material.
10				10	

TEST PIT LOG K:\GINT\PROJECTS\11290.GPJ HYDHLN2.GDT 6/6/07

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Test Pit Log

Hole Name: FG-TP-9

Date Hole Started: Date Hole Finished:

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: ASARCO LLC
Legal Description:
Descriptive Location:

Recorded By: Rhodes/Johnson

Equipment Owner:
Equipment Operator:
Excavation Method:
Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
				0.0 - 10.0' Installed piezometer - 5 feet of screen.		0.0 - 0.3' **Topsoil** Black, highly organic. 0.3 - 2.0' **GW-GM** Moist, brown, slighty plastic, angular gravels, a few cobbles from 6 inches to 8 inches - glacial till. 2.0 - 10.0' **GW** Yellow brown, moist, angular flat platy cobbles, very little fine matrix, rock appears highly altered - may be top of weathered bedrock outcrop.
5					5	
10					10	

TEST PIT LOG K:\GINT\PROJECTS\11290.GPJ HYDHLN2.GDT 6/8/07

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Test Pit Log

Hole Name: FG-TP-10

Date Hole Started: Date Hole Finished:

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: ASARCO LLC
Legal Description:
Descriptive Location:

Recorded By: Rhodes/Johnson

Equipment Owner:
Equipment Operator:
Excavation Method:
Excavation Dimensions:

Remarks:

DEPTH / SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
			0.0 - 10.0' Installed piezometer - 5 feet of screen.		0.0 - 0.7' **Topsoil** Black, moist, lightly organic.
					0.7 - 5.0' **GW-GM** Reddish brown, moist, stickly, plastic, gravels are angular to subrounded, some cobbles to 8 inches - glacial till.
5				5	
					5.0 - 10.0' **GW** Yellow brown, some large flat platy cobbles, large clumps of ash tuft, tuft is friable and very weathered.
10				10	

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Helena, Montana

Test Pit Log

Hole Name: FG-TP-11

Date Hole Started: Date Hole Finished:

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: ASARCO LLC
Legal Description:
Descriptive Location:

Recorded By: Rhodes/Johnson

Equipment Owner:
Equipment Operator:
Excavation Method:
Excavation Dimensions:

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
				0.0 - 10.0' Installed piezometer - 5 feet of screen.		0.0 - 0.3' **Topsoil** Black, moist, highly organic.
						0.3 - 2.0' **GW-GM** Brown, moist, sticky, well graded, flat platy angular cobbles to 6 inches, plastic - glacial till.
						2.0 - 3.0' **GW** Reddish brown, flat platy belt rock cobbles to 6 inches, very moist.
						3.0 - 10.0' **GW** Red/yellow cobbles to 8 inches, moist, angular, some fine material with little to no plasticity, some water present in cobble fractures at 9 to 10 feet.
5					5	
10					10	

TEST PIT LOG K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 6/8/07

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Test Pit Log

Hole Name: FG-TP-12

Date Hole Started: Date Hole Finished:

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: ASARCO LLC
Legal Description:
Descriptive Location:

Recorded By: Rhodes/Johnson

Equipment Owner:
Equipment Operator:
Excavation Method:
Excavation Dimensions:

Remarks:

DEPTH / SAMPLE NUMBER	SAMPLE TYPE	SAMPLE TIME	NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
			0.0 - 10.0' Installed piezometer - 5 feet of screen.		0.0 - 0.5' **Topsoil** Black, moist, highly organic.
					0.5 - 5.0' **GC** Reddish brown, moist, sticky, plastic subangular to subrounded gravel, a few cobbles from 6 to 8 inches - glacial till.
5				5	5.0 - 10.0' **GW-GM** Red brown, moist, slightly plastic, large yellow cobbles, very angular, pockets of yellow/orange clay at 7.5 feet, some water in rock features at 10 feet.
10				10	

TEST PIT LOG K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 6/8/07

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	PROJECT NO.: 1290
ADDRESS:	DATE OF REPORT: 6/5/2007
ATTN:	
PROJECT: First Gulch Test Pits	SAMPLE NO.: TP-8 3-5'
	SAMPLE DEPTH/DESCRIPTION:
LOCATION: East Helena	
	TESTED BY:
SAMPLED BY: DATE:	UNIFIED SOIL CLASSIFICATION: GW-GM
SUBMITTED BY: Hydrometrics, Inc. DATE:	SOURCE OF MATERIAL: GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		40.87		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		2.53		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	96.4%			LIQUID LIMIT / PLASTICITY INDEX		18.5 / 1.5		D 4318
3/4	82.3%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	73.4%			DENSITY	OPTIMUM MOISTURE, %			
3/8	65.5%			RELATIONSHIP	METHOD			
#4	50.1%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	30.5%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	18.7%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	13.4%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	9.4%			HYDROMETER				D 422
#200	5.8%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	**PROJECT NO.:** 1290
ADDRESS:	**DATE OF REPORT:** 9/20/2006
ATTN:	
PROJECT: First Gulch Test Pits	**SAMPLE NO.:** TP-8 9-10'
	SAMPLE DEPTH/DESCRIPTION:
LOCATION:	
	TESTED BY:
SAMPLED BY: **DATE:**	**UNIFIED SOIL CLASSIFICATION:** SP
SUBMITTED BY: Hydrometrics, Inc. **DATE:**	**SOURCE OF MATERIAL:** GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		14.58		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		1.62		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	78.2%			LIQUID LIMIT / PLASTICITY INDEX		21 / 2.5		D 4318
3/4	67.0%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	50.8%			DENSITY	OPTIMUM MOISTURE, %			
3/8	43.7%			RELATIONSHIP	METHOD			
#4	27.7%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	13.9%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	8.8%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	5.8%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	3.8%			HYDROMETER				D 422
#200	2.4%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	**PROJECT NO.:** 1290
ADDRESS:	**DATE OF REPORT:** 9/20/2006
ATTN:	
PROJECT: First Gulch Test Pits	**SAMPLE NO.:** TP-9 5-7'
	SAMPLE DEPTH/DESCRIPTION:
LOCATION:	**TESTED BY:**
SAMPLED BY: **DATE:**	**UNIFIED SOIL CLASSIFICATION:** GP-GM
SUBMITTED BY: Hydrometrics, Inc. **DATE:**	**SOURCE OF MATERIAL:** GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		ND		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		ND		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	92.9%			LIQUID LIMIT / PLASTICITY INDEX		19 / 1.0		D 4318
3/4	90.9%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	75.6%			DENSITY	OPTIMUM MOISTURE, %			
3/8	65.9%			RELATIONSHIP	METHOD			
#4	48.5%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	31.9%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	21.7%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	17.2%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	13.0%			HYDROMETER				D 422
#200	8.9%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	PROJECT NO.: 6043
ADDRESS:	DATE OF REPORT: 9/20/2006
ATTN:	
PROJECT: First Gulch Test Pits	SAMPLE NO.: TP-10 3-5'
	SAMPLE DEPTH/DESCRIPTION:
LOCATION:	
	TESTED BY:
SAMPLED BY: DATE:	UNIFIED SOIL CLASSIFICATION: GW
SUBMITTED BY: Hydrometrics, Inc. DATE:	SOURCE OF MATERIAL: GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		19.28		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		2.04		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	90.2%			LIQUID LIMIT / PLASTICITY INDEX		19 / 6.0		D 4318
3/4	75.0%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	64.4%			DENSITY	OPTIMUM MOISTURE, %			
3/8	57.7%			RELATIONSHIP	METHOD			
#4	38.0%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	21.1%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	12.5%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	8.9%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	5.3%			HYDROMETER				D 422
#200	2.8%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	PROJECT NO.: 1290
ADDRESS:	DATE OF REPORT:
ATTN:	
PROJECT: First Gulch Test Pits	SAMPLE NO.: TP-10 8-10'
LOCATION:	SAMPLE DEPTH/DESCRIPTION:
	TESTED BY:
SAMPLED BY: DATE:	UNIFIED SOIL CLASSIFICATION: GW
SUBMITTED BY: Hydrometrics, Inc. DATE:	SOURCE OF MATERIAL: GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		22.50		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		0.00		
1 1/2	94.0%			SAND EQUIVALENT VALUE				D 2419
1	91.0%			LIQUID LIMIT / PLASTICITY INDEX		20.5 / 2.0		D 4318
3/4	85.8%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	81.6%			DENSITY	OPTIMUM MOISTURE, %			
3/8	77.4%			RELATIONSHIP	METHOD			
#4	59.0%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	36.2%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	20.7%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	13.6%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	8.7%			HYDROMETER				D 422
#200	4.3%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	PROJECT NO.: 1290
ADDRESS:	DATE OF REPORT:
ATTN:	
PROJECT: First Gulch Test Pits	SAMPLE NO.: TP-12 2-3'
LOCATION:	SAMPLE DEPTH/DESCRIPTION:
	TESTED BY:
SAMPLED BY: DATE:	UNIFIED SOIL CLASSIFICATION: GP-GM
SUBMITTED BY: Hydrometrics, Inc. DATE:	SOURCE OF MATERIAL: GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		52.02		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		4.63		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	100.0%			LIQUID LIMIT / PLASTICITY INDEX		18.5 / 0.5		D 4318
3/4	97.7%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	87.9%			DENSITY	OPTIMUM MOISTURE, %			
3/8	77.2%			RELATIONSHIP	METHOD			
#4	52.0%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	31.1%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	21.0%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	17.0%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	12.8%			HYDROMETER				D 422
#200	5.3%			AS RECEIVED MOISTURE CONTENT, %				C 566

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PHYSICAL PROPERTIES OF AGGREGATES/SOILS

CLIENT NAME: USFS	PROJECT NO.: 1290
ADDRESS:	DATE OF REPORT:
ATTN:	
PROJECT: First Gulch Test Pits	SAMPLE NO.: TP-12 9.5-10'
LOCATION:	SAMPLE DEPTH/DESCRIPTION:
	TESTED BY:
SAMPLED BY: DATE:	UNIFIED SOIL CLASSIFICATION: SW
SUBMITTED BY: Hydrometrics, Inc. DATE:	SOURCE OF MATERIAL: GEOTECHNICAL TESTPIT
	LAB NO.

SIEVE ANALYSIS

TEST STANDARDS ARE ASTM UNLESS OTHERWISE NOTED

SIEVE SIZE	CUMULATIVE % PASSING	CONTROL BAND	DESIGN RANGE	TESTS		RESULTS	SPECIFICATIONS	TEST STANDARD
6				FLAT AND ELONGATED PARTICLES,%				D 4791
5				FRACTURED	AT LEAST 1 FACE, %			D 5821
4				FACES	2 OR MORE FACES, %			D 5821
3	100.0%			COEFFICIENT of UNIFORMITY (C_u)		14.29		
2	100.0%			COEFFICIENT of CURVATURE (C_c)		1.60		
1 1/2	100.0%			SAND EQUIVALENT VALUE				D 2419
1	100.0%			LIQUID LIMIT / PLASTICITY INDEX		69 / 35.0		D 4318
3/4	98.8%			MOISTURE /	MAX. DRY DENSITY, pcf		STANDARD & PROCEDURE	
1/2	94.0%			DENSITY	OPTIMUM MOISTURE, %			
3/8	89.3%			RELATIONSHIP	METHOD			
#4	60.7%			FINENESS MODULUS				C 125
#8				LIGHTWEIGHT PIECES, %				C 123
#10	36.0%			CLAY LUMPS & FRIABLE PARTICLES, %				C 142
#20	19.8%			ORGANIC IMPURITIES				C 40
#30					BULK			C 127/128
#40	12.1%			SPECIFIC	BULK SSD			C 127/128
#60	-			GRAVITY	APPARENT			C 127/128
#80					ABSORPTION, %			C 127/128
#100	6.0%			HYDROMETER				D 422
#200	3.5%			AS RECEIVED MOISTURE CONTENT, %				C 566

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Helena, Montana

FGMW-1

Hole Name: FGMW-1

Date Hole Started: 5/31/07 Date Hole Finished: 5/31/07

Client: ASARCO, LLC

Project: Upper Blackfoot Mining Complex

County: Lewis & Clark State: Montana

Property Owner: U.S. Forest Service

Legal Description: SW 1/4 Sec 14 T15N R7W

Location Description: First Gulch

Recorded By: Larry Johnson

Drilling Company: Boland Drilling

Driller: James

Drilling Method: Rotary

Drilling Fluids Used: Air

Purpose of Hole: Determine depth to water

Target Aquifer: Bedrock

Hole Diameter (in): 6 1/2"

Total Depth Drilled (ft): 80

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2 to 78.5'
Surface Casing Used?	Y	6" Steel	-3 to +2.5'
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	58.5 to 78.5
Sand Pack?	Y	10/20 Colorado Sand	53 to 78.5'
Annular Seal?	Y	Bentonite Chips	3' to 53'
Surface Seal?	Y	Cement	0' to 3'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Cuttings	

Northing: 5211710 Easting: 389816

Static Water Level Below MP: 66.4

Date: 6/1/07

MP Description: Top of PVC Casing

MP Height Above or Below Ground (ft): +2.0

Surface Casing Height (ft): 2.5

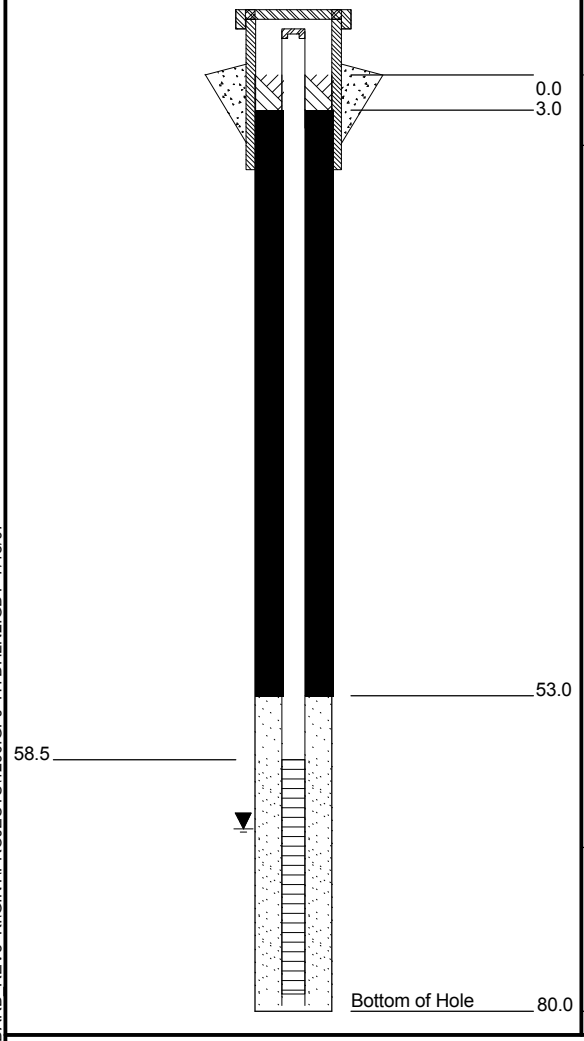
Riser Height (ft): 2.0

Ground Surface Elevation (ft): NA

MP Elevation (ft):

Remarks:

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 6.0' **Colluvium**
Reddish brown, silty clay, starting to see approximately 5% subrounded pebbles at 5 feet.

6.0 - 66.0' **Volcanic Tuff**
Limonite strained volcanic tuff: occassional belt chips, fracture zone at 57 feet, trace of water at 57 feet.

66.0 - 80.0' **Siltstone/Mudstone**
Maroon siltstone to mudstone, Spokane Formation, TD = 80 feet.

STANDARD_REV3 K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 7/18/07

Hydrometrics, Inc.
Consulting Scientists and Engineers
Helena, Montana

FGMW-2

Hole Name: FGMW-2

Date Hole Started: 6/1/07 Date Hole Finished: 6/1/07

Client: ASARCO, LLC
Project: Upper Blackfoot Mining Complex
County: Lewis & Clark State: Montana
Property Owner: U.S. Forest Service
Legal Description: SW 1/4, SEC 14, T15N, R7W
Location Description: First Gulch

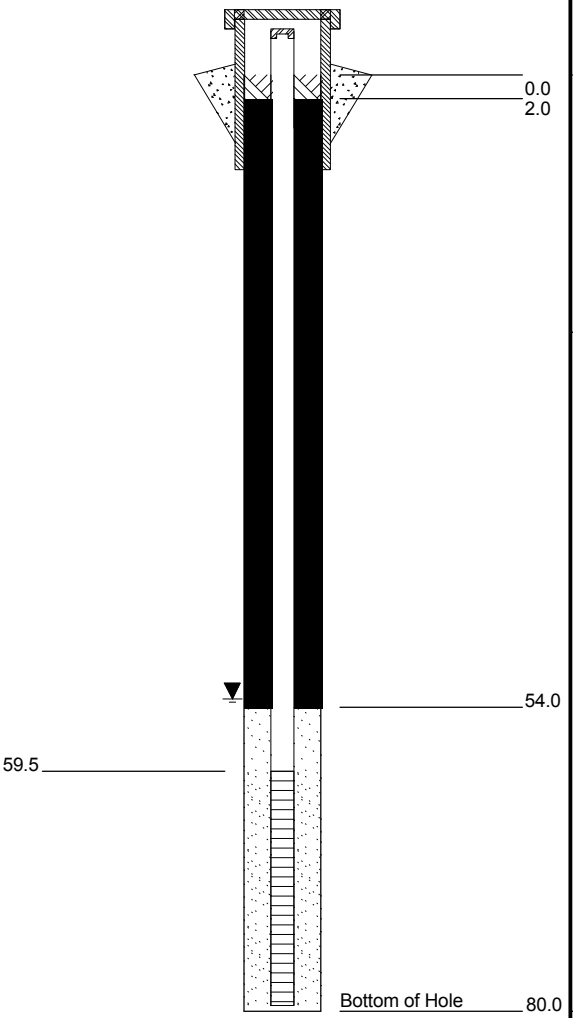
Recorded By: Larry Johnson
Drilling Company: Boland Drilling
Driller: James
Drilling Method: Air Rotary
Drilling Fluids Used: Air
Purpose of Hole: Determine depth to water
Target Aquifer: Bedrock
Hole Diameter (in): 7 1/8"
Total Depth Drilled (ft): 80

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.0 to 79.5'
Surface Casing Used?	Y	6" Steel	-3 to +2.5'
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	59.5' to 79.5'
Sand Pack?	Y	10/20 Colorado Sand	54' to 79.5'
Annular Seal?	Y	Bentonite Chips	2' to 54'
Surface Seal?	Y	Cement	0' to 2'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Cuttings	

Northing: 389826 Easting: 5211535
Static Water Level Below MP: 55.28
Date: 6/1/07
MP Description: Top of PVC
MP Height Above or Below Ground (ft): +2.0
Surface Casing Height (ft): +2.5
Riser Height (ft): 2.0
Ground Surface Elevation (ft): NA
MP Elevation (ft):

Remarks:

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 22.0' **Colluvium**
Reddish brown, plastic clay, damp, 10 feet - mudstone and limestone chips in clayey silt (less clay).

22.0 - 80.0' **Siltstone/Mudstone**
Maroon, siltstone to mudstone, Spokane Formation, trace of water at 60 - 65 feet, TD = 80 feet.

STANDARD_REV3 K:\GINT\PROJECTS\1290.GPJ HYDHLN2.GDT 7/18/07

HORSEFLY CREEK REPOSITORY SITE INFORMATION

TETRA TECH

December 26, 2006

Mr. Dave Bowers
Department of Environmental Quality
1100 North Last Chance Gulch
P.O. Box 20091
Helena, MT 59620-0901

Re: Repository Test Pit Investigation Report – Horsefly Creek Site, Lincoln, Montana

Dear Dave:

On December 7, 2006 Blaine Hardy and Bill Bucher from Tetra Tech, Inc. (Tetra Tech) and Mark Smith of Smith's Backhoe Service, Inc. traveled to the Horsefly Creek potential mine waste repository site for a Phase 3 investigation to excavate and log up to six test pits. This work was accomplished in partial fulfillment of Task Order No. 50 of Contract No. 1176. The Horsefly Creek site is being considered by the State of Montana as a potential repository site capable of safely holding all mine wastes expected to be excavated from the Upper Blackfoot Mining Complex (UBMC) in Option 5 of the Engineering Evaluation/Cost Analysis (EE/CA) for the UBMC. The Horsefly Creek site is located in Section 3, Township 14 North, Range 7 West, PMM, Lewis and Clark County, Montana, on property owned by Stimson Lumber Company (see Figure 1, Attachment A). The site was identified under a Repository Screening Evaluation Tetra Tech performed for the Montana Department of Environmental Quality (MDEQ) in September 2006 as a potential site for mine waste from the UBMC (Tetra Tech, 2006a). Only sites within 10 air miles of the Mike Horse Mine and containing areas 20 acres or greater with slopes less than or equal to 10% were considered under the screening evaluation. The Horsefly Creek site met these criteria and contains about 74 acres meeting the slope criteria. Under the screening evaluation, we also determined from references that the site is probably covered with sedimentary alluvium and possibly terrace deposits and glacial drift. The soils are probably very well drained, very gravelly clay loam approximately five feet deep (NRCS 2004).

A Phase 2 investigation was conducted by Tetra Tech personnel on November 22, 2006. The purpose of the Phase 2 investigation was to determine visually if the Horsefly Creek site was suitable for further investigation. The Phase 2 investigation consisted of a site visit by qualified personnel to assess the following site characteristics:

- Site development feasibility,
- Site soils and geology,
- Accessibility from major roads,
- Site hydrology,
- Potential impacts to neighboring properties, and
- Aesthetic considerations.

The Phase 2 investigation results are documented in a letter report dated November 29, 2006 (Tetra Tech, 2006b). The results of the Phase 2 investigation indicated the site has promising characteristics for further investigation based on the criteria listed above. Due to the positive

Tetra Tech, Inc.
303 Irene Street (P.O. Box 4699), Helena, Montana, USA 59601 (59604)
Tel 406.443.5210 Fax 406.449.3729 www.tetratech.com

results of the Phase 2 investigation, the Phase 3 investigation was conducted at the request of the MDEQ. The remainder of this letter discusses the results of the Phase 3 investigation.

Geologic Investigation Methods

This portion of the Phase 3 investigation included the collection of information on geological and hydrogeological conditions at the site. Smith's Backhoe Service, Inc. was subcontracted by Tetra Tech to excavate up to six test pits to a maximum depth of ten feet using a rubber tired backhoe (Attachments A & B). The test pits were excavated in locations determined by Tetra Tech personnel to provide a continuous repository to contain all of the UBMC mine wastes without disturbing the natural drainage patterns of the area. The test pits were logged and photographed by qualified Tetra Tech personnel to evaluate the native soil profile for soil texture, rock content, color and other significant conditions (Attachment C). Samples of soil were obtained of typical observed materials from the six test pits. The test pits were then backfilled and each test pit was located using a hand-held GPS unit.

Three of the samples were submitted to the Tetra Tech materials laboratory in Helena, Montana for analysis. The three samples were chosen based on differential lithologies and test pit location. The three samples analyzed included the zero to five foot and five to ten foot intervals of test pit HFC-TP-1 and the one to ten foot interval of test pit HFC-TP-5. Analysis for the three submitted samples consisted of gradation (ASTM D422 and D1140) and Atterberg limits (ASTM D4318). The three samples were then composited, and the composite sample was analyzed for remolded permeability (ASTM D2434). The laboratory results are contained in Attachment D.

Geologic Investigation Results

Based on visual observations made in the field, the Horsefly Creek site has the capacity to contain the volume of mine wastes present at the UBMC in each of two areas. As described in the Phase 2 investigation report, the two areas are the western area and central area (Tetra Tech, 2006b).

Based on visual observations made in the field and laboratory analyses, the soils in each of the two areas consist predominately of light brown clayey gravel and sand with some silt, cobbles, and boulders. The soil fraction is soft with medium plasticity and approximately equal parts sand and fines. The fine fraction (i.e., less than 200 mesh) consistently classifies as a lean clay according to the Atterberg tests. The soil was generally moist and neither groundwater nor bedrock were encountered in any of the six test pits. The remolded permeability was determined to be 2.5×10^{-5} centimeters per second (cm/sec) at 90% of the maximum dry density.

Conclusions

The UBMC mine wastes could be deposited at the Horsefly Creek site and covered with a cap or cover system that could be readily designed for stable slopes. If the UBMC mine wastes are moved to the Horsefly Creek site, the design for the repository should address protection of water quality in Horsefly Creek, as the distance from the southern edge of the proposed site to the active stream channel is approximately 200 feet.

The field observations and laboratory analyses of samples collected from the test pits indicate the presence of materials suitable for a repository base as well as cover soil, and; due to the apparent depth of bedrock in the area, the surficial material is thick enough to potentially serve as a base liner. However, the permeability of the base material, although not very high, is too high to meet Subtitle D requirements for a landfill liner.

Since the initial Phase 3 evaluation of the soils at the site indicates suitable characteristics for repository construction, a monitoring well should be installed to determine depth to groundwater at the site and subsurface conditions below the test pit depths.

Once the drilling is complete, the parameters collected during Phase 3 activities should be input into the Hydrologic Evaluation of Landfill Performance (HELP) model to determine if the subsurface materials at the Horsefly Creek site will control potential leachate migration from the repository, or if a geosynthetic bottom liner is required to protect the water quality.

If you have any questions about this letter report, please give one of us a call.

Sincerely,

Bill Bucher, P.E.
Senior Project Manager

Blaine Hardy, P.E.
Project Engineer

References:

National Resource Conservation Service, 2004. Tabular Data Version: 2, NRCS Website, http://websoilsurvey.nrcs.usda.gov/appl, October 6.

Tetra Tech, 2006a. Repository Screening Evaluation for the Upper Blackfoot Mining Complex. Montana Department of Environmental Quality, Helena, Montana. Tetra Tech, Inc., Helena, Montana, September 6.

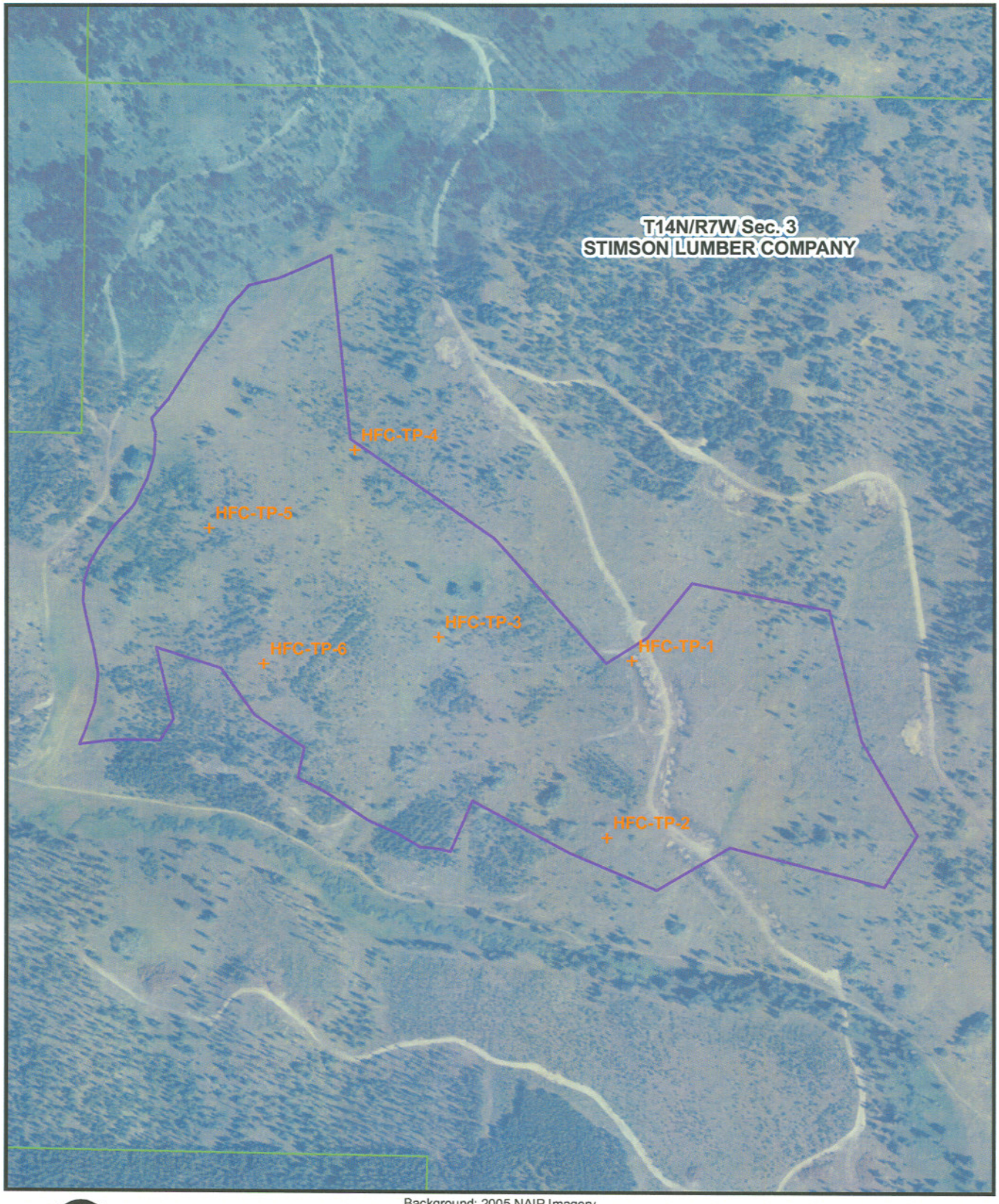
Tetra Tech, 2006b. Phase 2 Repository Investigation Report – Horsefly Creek Site, Lincoln, Montana. Montana Department of Environmental Quality, Helena, Montana. Tetra Tech, Inc., Helena, Montana, November 29.

Attachment A: Figures
Attachment B: Photos
Attachment C: Test Pit Logs
Attachment D: Laboratory Reports

TETRA TECH

ATTACHMENT A
FIGURES

G:\Mike_Horse\ArcMap\Fig1_20061218.mxd



Background: 2005 NAIP Imagery

0 250 500 Feet

+ Phase 3 Test Pit Approximate Location

Horse Fly Creek Evaluation Area

MT Dept. of Revenue Parcels

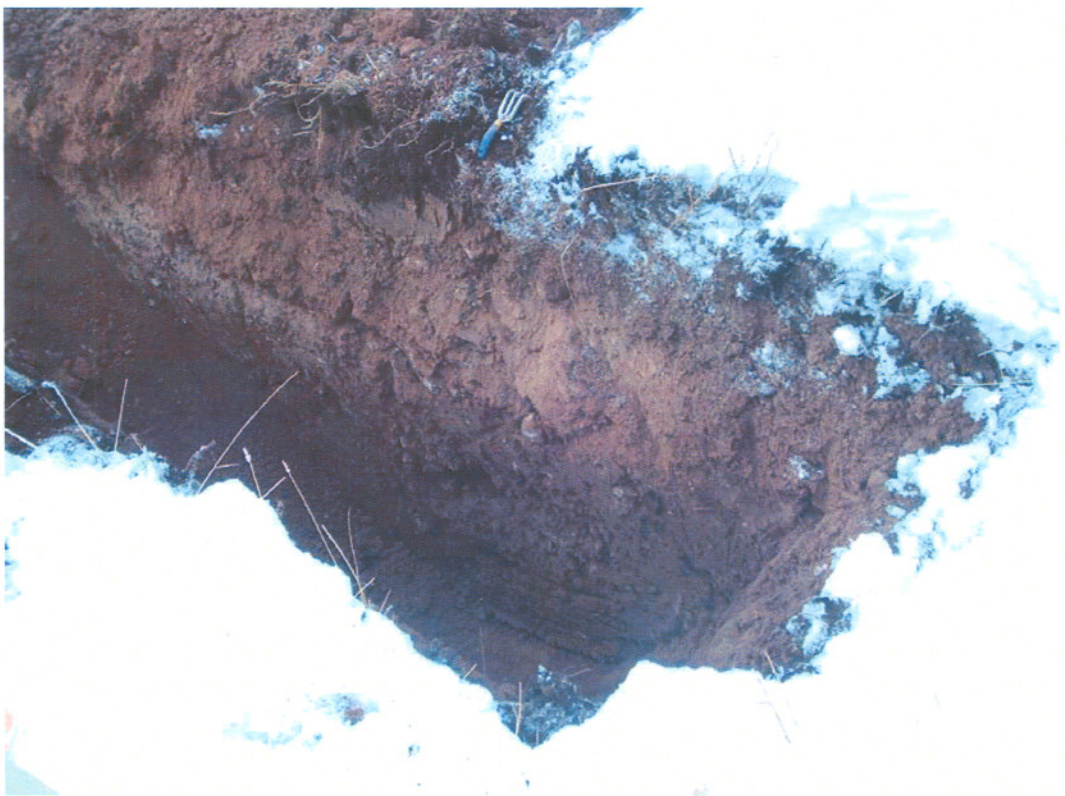
TETRA TECH
7561465-300

Figure 1
Phase 3 Test Pit Locations
Upper Blackfoot Mining Complex
Horse Fly Creek
MT Dept. of Environmental Quality

TETRA TECH

ATTACHMENT B
PHOTOS

Test Pit HFC-TP-1



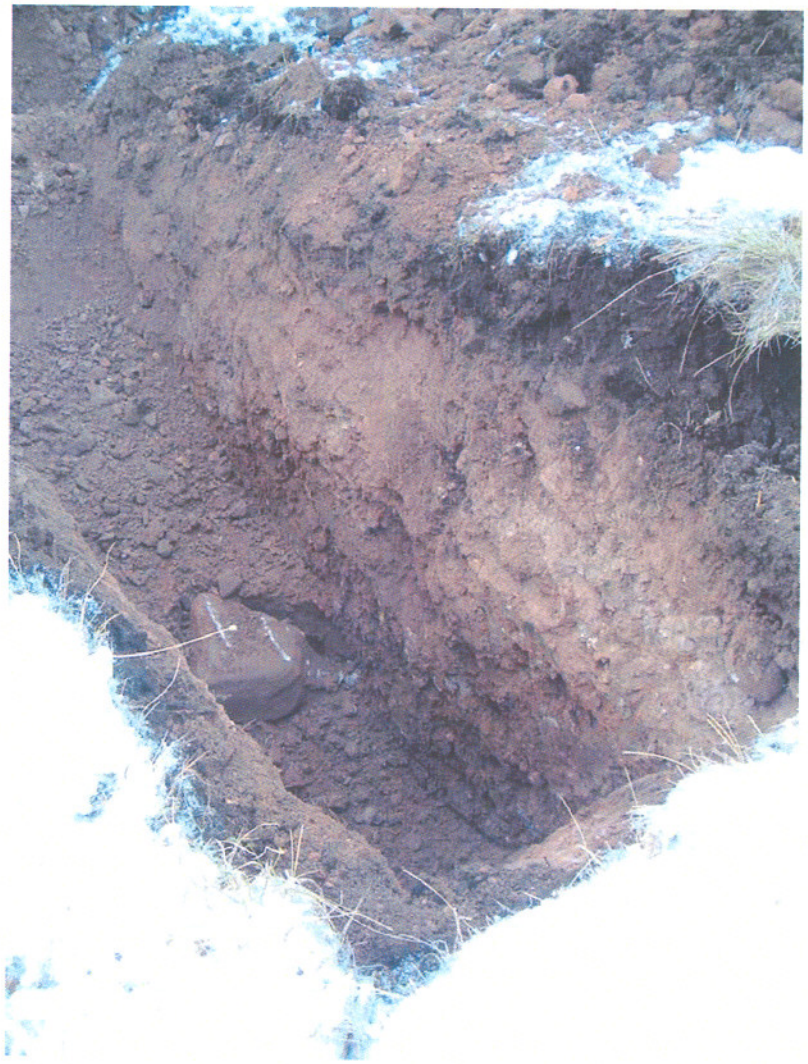
Test Pit HFC-TP-2

Soil from Test Pit HFC-TP-2

Test Pit HFC-TP-3

Soil from Test Pit HFC-TP-4

Test Pit HFC-TP-5



Test Pit HFC-TP-6

TETRA TECH

ATTACHMENT C
TEST PIT LOGS

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-1

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY Smith's Backhoe Service, Inc.

TOTAL DEPTH 12 Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 4"	Topsoil with some gravel (<5%). Charcoal from burning of		
	logged area.		
4" – 5'	Flat, subrounded cobbles with maximum size of 6" (<5%).	4" – 5'	
	Subangular gravel up to 2" (30%). Coarse to fine sand (20%).		
	Fines (50%). Clayey GRAVEL with sand. Light brown to		
	yellowish brown with gray mottling at four feet. Moist		
	throughout with no free water. Two seeps presented at 4' with		
	free water in two areas of sidewall. Soft, medium plasticity.		
5' – 10'	Subangular cobbles up to 8" (15%). Gravel (35%). Medium to	5' – 10'	
	fine sand (20%). Fines (45%). Silty, clayey GRAVEL with sand.		
	Light brown. Moist, but substantially drier than upper sample.		
	Soft, medium plasticity.		

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-2

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY: Smith's Backhoe Service, Inc.

TOTAL DEPTH: Ten Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 1'	Topsoil, primarily clay with some silt. Root penetration		
	throughout. Black and moist.		
1' – 10'	Semiangular cobbles up to 8" (5%). Semiangular coarse	1' – 10'	
	gravel (40%). Coarse to medium sand (20%). Fines (40%).		
	Clayey GRAVEL with sand. Light reddish brown. Medium		
	plasticity, medium stiff, weak toughness.		

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-3

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY: Smith's Backhoe Service, Inc.

TOTAL DEPTH: Ten Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 9"	Topsoil. Root penetrations throughout with earthworms present. Black with organics.		
9" – 2'	Subangular gravel up to 2" (30%). Medium sand (25%). Fines (45%). Silty clayey GRAVEL with sand. Light brown with dark brown mottling. Some root material. Moist. Medium plasticity.		
2' – 3'	Very angular gravel up to 3" (50%). Fine to medium sand (25%). Fines (25%). Silty, clayey GRAVEL with sand. Red and yellow gravel. Moist.		
3' – 8'	Gravel up to 2" (20%). Fine sand (35%). Fines (45%). Clayey, SAND with gravel. Light brown with gray and tan mottling. Moist, no free water. Medium plasticity.	3' – 8'	
8' – 10'	Similar to 3' – 8' horizon but with subangular cobbles up to 11" (10%). No groundwater.		

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-4

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY Smith's Backhoe Service, Inc.

TOTAL DEPTH Ten Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 1'	Topsoil. Root penetration throughout. Primarily clay and silt,		
	some sand. Black. Moist.		
1' – 10'	Subangular boulders and cobbles up to 13" (5%). Subangular	1' – 10'	
	gravel up to 3" (35%). Fine sand (30%). Fines (35%). Clayey		
	GRAVEL with sand. Light brown with tan and gray mottling		
	throughout. Slightly moist. Medium plasticity.		

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-5

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY: Smith's Backhoe Service, Inc.

TOTAL DEPTH: Ten Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 1'	Topsoil. Root penetrations throughout. Primarily clay with		
	organics.		
1' – 10'	Subangular cobbles up to 12" (5%). Coarse gravel (30%).	1' – 10'	
	Medium to fine sand (40%). Fines (30%). Clayey SAND with		
	gravel. Reddish brown with dark brown mottling throughout.		
	Hard, weak medium plasticity. Slightly moist.		

TETRA TECH

TETRA TECH, INC
LOG OF EXPLORATION TEST PIT

JOB NO: 1157561465 PROJECT NAME: Horsefly Creek Repository Site Investigation

STATE: MT COUNTY: Lewis & Clark LOGGED BY: Blaine Hardy, P.E. TEST PIT NO.: HFC-TP-6

DESCRIPTIVE LOCATION:

DATE: December 7, 2006 EXCAVATION COMPANY Smith's Backhoe Service, Inc.

TOTAL DEPTH Ten Feet

REMARKS: Used GPS unit Garmin GPS V to locate test pit locations

Depth Interval (feet)	Classification and Description	Sample Depth (feet)	Headspace (ppm)
0 – 1'	Topsoil. Root penetration throughout. Mostly clay with silt.		
	Black. Moist.		
1' – 10'	Semiangular cobbles up to 12" (10%). Coarse, semiangular	1' – 10'	
	gravel (40%). Medium to fine sand (25%). Fines (35%).		
	Silty, clayey GRAVEL with sand. Light brown with tan mottling.		
	Medium stiff, medium plasticity, low strength, medium		
	toughness. Slightly moist.		
	Boulders up to 2' near bottom of hole (5%).		

TETRA TECH

ATTACHMENT D
LABORATORY REPORTS

TETRA TECH, INC.

Tetra Tech, Inc.
303 Irene Street, P.O. Box 4699
Helena, MT 59604
Telephone: (406) 443-5210
FAX: (406) 449-3729

REPORT OF MOISTURE-DENSITY RELATIONS

CLIENT: TETRA TECH
P.O. BOX 4699
HELENA, MT 59604

PROJECT NO.: 7561465
REPORT NO.: 18171
PROJECT: HORSE FLY CREEK REPOSITORY
DATE OF SERVICE: 12/14/2006
AUTHORIZATION: BLAINE HARDY
REPORT DATE: 12/14/2006

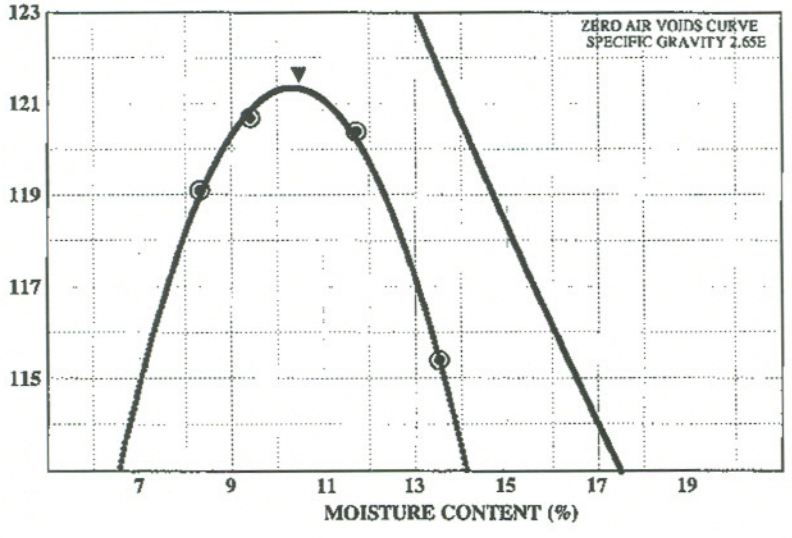
SERVICES: Obtain sample of material used for construction, prepare samples and perform moisture-density relations test to establish the maximum density and optimum moisture of the material.

PROJECT DATA

CONTRACTOR: TETRA TECH
DATE SAMPLED: 12/07/2006
SAMPLED BY: TETRA TECH
TEST FOR: FILL
SAMPLE LOCATION: COMPOSITE: TP-1, 0'-5'
TP-1, 5'-10' AND TP-5, 1'-10'

TEST DATE: 12/14/2006
MATERIAL: FILL
CLASSIFICATION: Silty Clayey Sand W/Gravel
MATERIAL PREPARATION METHOD: Moist
RAMMER TYPE: Manual
METHOD OF TEST: AASHTO T99-C

REPORT OF TESTS



MAXIMUM DENSITY, PCF: 121.5

OPTIMUM MOISTURE (%): 10.5

E = Estimated Value

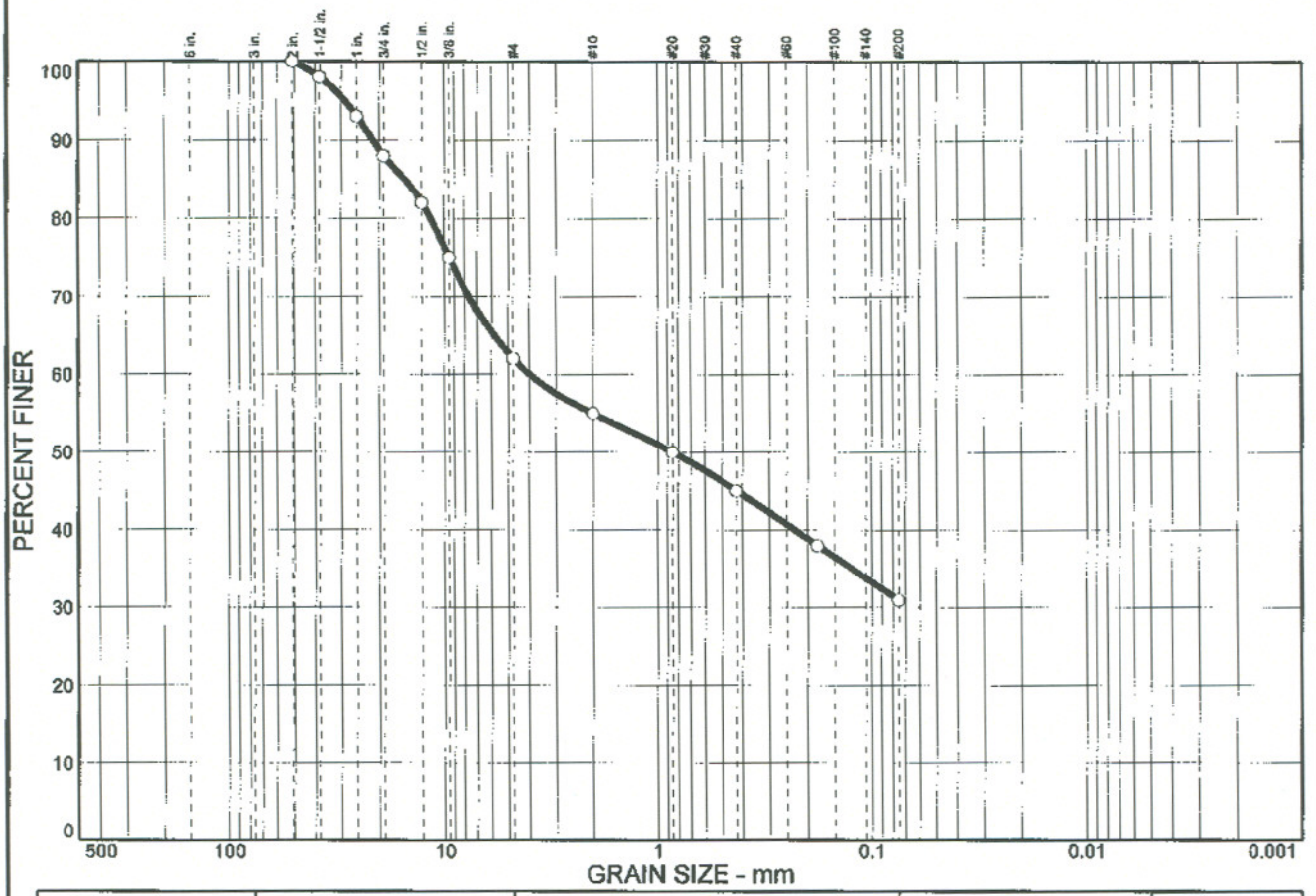
Technician: Jesse Whitford, CET, CWI
Engineering Technician IV

Report Distribution:
(1) TETRA TECH

TETRA TECH, INC.

EDWARD JOHNSON, CET
LABORATORY MANAGER

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	38.0	31.0	31.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1-1/2 in.	98.0		
1 in.	93.0		
3/4 in.	88.0		
1/2 in.	82.0		
3/8 in.	75.0		
#4	62.0		
#10	55.0		
#20	50.0		
#40	45.0		
#80	38.0		
#200	31.0		

* (no specification provided)

Material Description

SILTY CLAYEY GRAVEL WITH SAND

Atterberg Limits

PL= 16 LL= 27 PI= 11

Coefficients

D_{85}= 15.3 D_{60}= 3.99 D_{50}= 0.850
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC-GM AASHTO=

Remarks

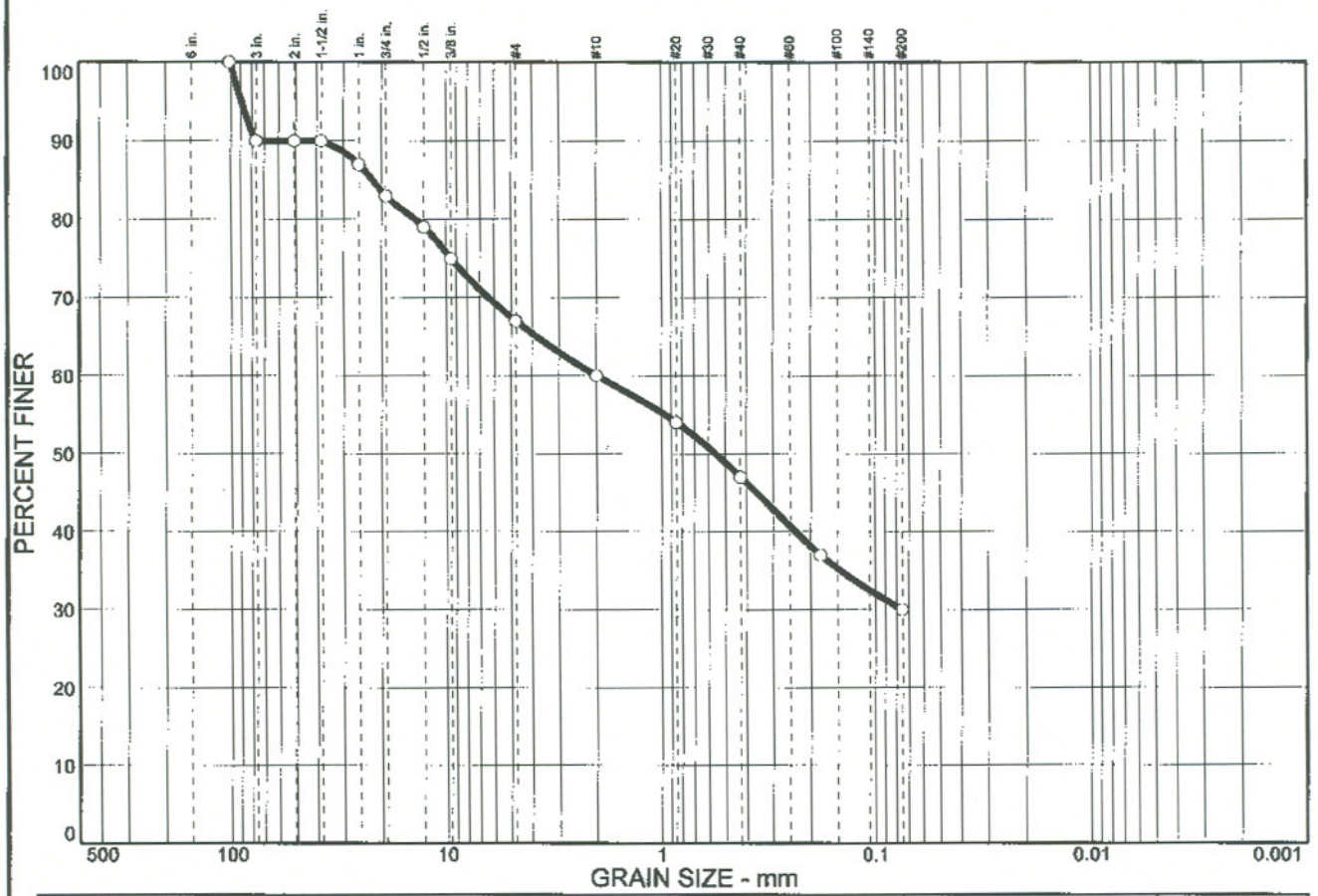
Sample No.: 18171-1 **Source of Sample:** **Date:** 12/7/2006
Location: TP-1 **Elev./Depth:** 0'-5'

Maxim Technologies, Inc.

Client: TETRA TECH INC.
Project: HORSE FLY CREEK REPOSITORY

Project No: 7561465.200 **Figure** 18171-1

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
10.0	23.0	37.0	30.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4 in.	100.0		
3 in.	90.0		
2 in.	90.0		
1-1/2 in.	90.0		
1 in.	87.0		
3/4 in.	83.0		
1/2 in.	79.0		
3/8 in.	75.0		
#4	67.0		
#10	60.0		
#20	54.0		
#40	47.0		
#80	37.0		
#200	30.0		

* (no specification provided)

Material Description

CLAYEY SAND WITH GRAVEL

Atterberg Limits

PL= 16 LL= 25 PI= 9

Coefficients

D_{85}= 22.0 D_{60}= 2.00 D_{50}= 0.557
D_{30}= 0.0750 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

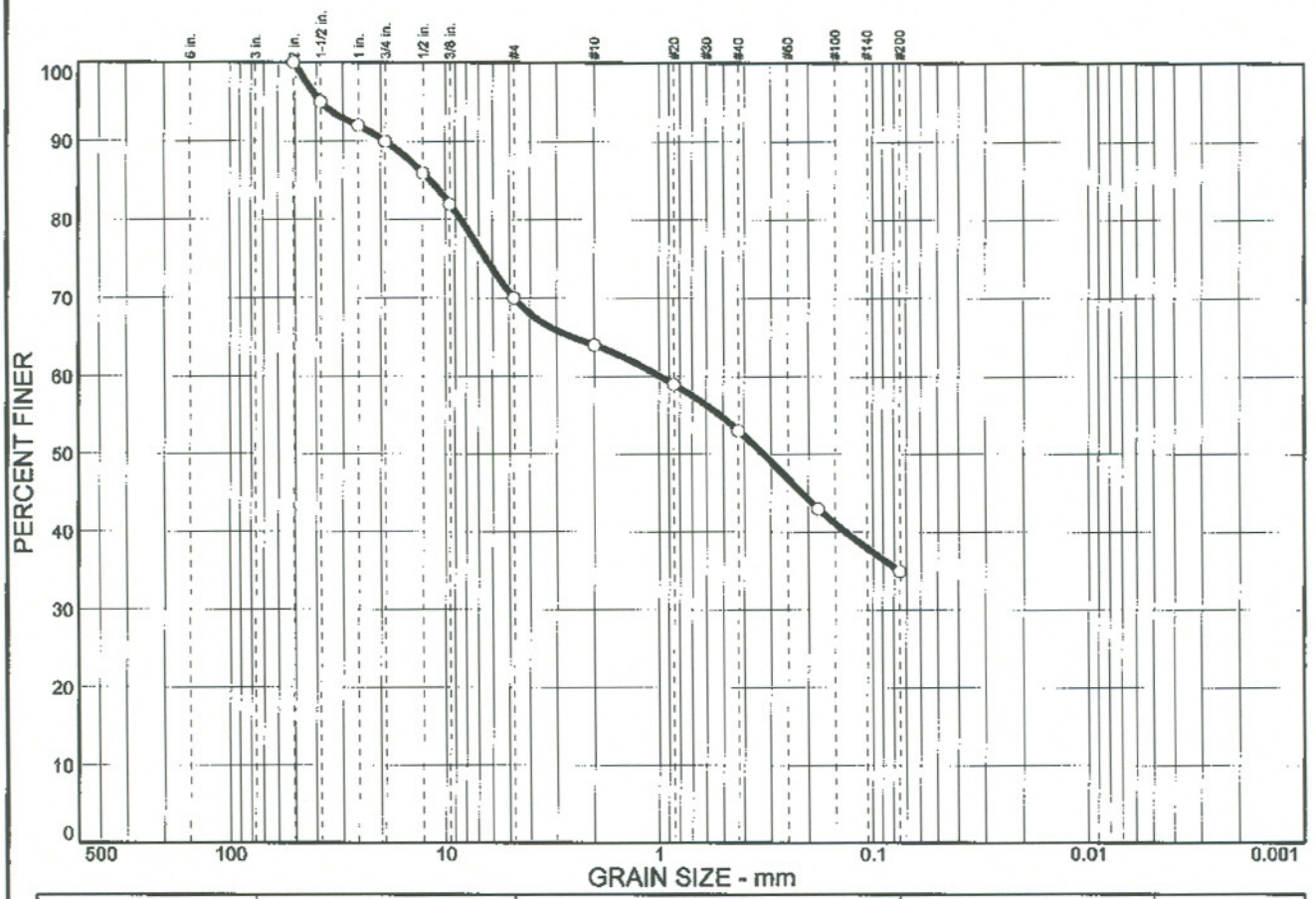
Remarks

Sample No.: 18171-2 **Source of Sample:** **Date:** 12-7-2006
Location: TP-1 **Elev./Depth:** 5'-10'

Maxim Technologies, Inc.

Client: TETRA TECH INC.
Project: HORSE FLY CREEK REPOSITORY
Project No: 7561465.200 **Figure** 18171-2

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	30.0	35.0	35.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1-1/2 in.	95.0		
1 in.	92.0		
3/4 in.	90.0		
1/2 in.	86.0		
3/8 in.	82.0		
#4	70.0		
#10	64.0		
#20	59.0		
#40	53.0		
#80	43.0		
#200	35.0		

* (no specification provided)

Material Description

CLAYEY SAND WITH GRAVEL

Atterberg Limits

PL= 16 LL= 29 PI= 13

Coefficients

D_{85}= 11.7 D_{60}= 0.981 D_{50}= 0.326
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Sample No.: 18171-3 **Source of Sample:** **Date:** 12/7/2006
Location: TP-5 **Elev./Depth:** 1'-10'

Maxim Technologies, Inc.

Client: TETRA TECH INC.
Project: HORSE FLY CREEK REPOSITORY
Project No: 7561465.200 **Figure** 18171-3

TETRA TECH, INC.

Tetra Tech, Inc.
303 Irene Street, P.O. Box 4699
Helena, MT 59604
Telephone: (406) 443-5210
FAX: (406) 449-3729

REPORT OF MOISTURE-DENSITY RELATIONS

CLIENT: TETRA TECH
P.O. BOX 4699
HELENA, MT 59604

PROJECT NO.: 7561465
REPORT NO.: 18171
PROJECT: HORSE FLY CREEK REPOSITORY
DATE OF SERVICE: 12/14/2006
AUTHORIZATION: BLAINE HARDY
REPORT DATE: 12/14/2006

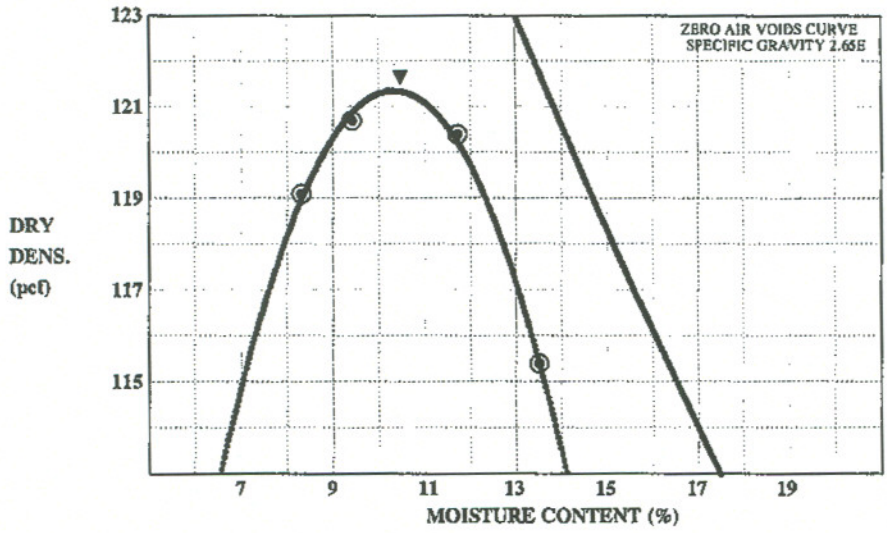
SERVICES: Obtain sample of material used for construction, prepare samples and perform moisture-density relations test to establish the maximum density and optimum moisture of the material.

PROJECT DATA

CONTRACTOR: TETRA TECH
DATE SAMPLED: 12/07/2006
SAMPLED BY: TETRA TECH
TEST FOR: FILL
SAMPLE LOCATION: COMPOSITE: TP-1, 0'-5'
TP-1, 5'-10' AND TP-5, 1'-10'

TEST DATE: 12/14/2006
MATERIAL: FILL
CLASSIFICATION: Silty Clayey Sand W/Gravel
MATERIAL PREPARATION METHOD Moist
RAMMER TYPE: Manual
METHOD OF TEST: AASHTO T99-C

REPORT OF TESTS



MAXIMUM DENSITY, PCF: 121.5

OPTIMUM MOISTURE (%): 10.5

E = Estimated Value

Report Of Tests Continued On Page 2

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REPORT OF TESTS

ADDITIONAL COMMENTS:

REMOLDED PERMEABILITY

Remolded Dry Density,pcf (90.0% of Max. Dry Density)	109.4
Moisture Content, %	10.5
Hydraulic Gradient	9.23
Hydraulic Conductivity (cm/sec)	2.5x10-5

Technician: Jesse Whitford, CET, CWI
Engineering Technician IV

Report Distribution:
(1) TETRA TECH

TETRA TECH, INC.

EDWARD JOHNSON, CET
LABORATORY MANAGER