DOE–LM/1592–2008

Present Landfill Monitoring and Maintenance Plan and Post-Closure Plan U.S. Department of Energy Rocky Flats Site

March 2008

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AM01–07LM00060
for the U.S. Department of Energy Office of Legacy Management.
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Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AM01–07LM00060
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Acronyms and Abbreviations

CAD/ROD	Corrective Action Decision/Record of Decision
CCR	*Code of Colorado Regulations*
CDPHE	Colorado Department of Public Health and Environment
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FML	flexible membrane liner
GCL	geosynthetic clay liner
GWIS	Groundwater Intercept System
IDW	investigation-derived waste
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
LM	Legacy Management
M&M Plan	Monitoring and Maintenance Plan and Post-Closure Plan
OU	Operable Unit
PLF	Present Landfill
PLFTS	Present Landfill Treatment System
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFLMA	Rocky Flats Legacy Management Agreement
RL	reporting limit
UHSU	upper hydrostratigraphic unit
VOC	volatile organic compound

End of current text

1.0 Introduction

This Monitoring and Maintenance Plan and Post-Closure Plan (M&M Plan) applies to the Present Landfill (PLF) (historical Individual Hazardous Substance Site [IHSS] 114) at the Rocky Flats Site (Rocky Flats). This PLF M&M Plan is a modification of the original PLF M&M Plan, approved in May 2006 as described further in this section, below.

The PLF M&M Plan fulfills the requirements for a post-closure plan in 6 *Code of Colorado Regulations* (CCR) 1007-3 §265.118 and the requirements of 6 CCR 1007-3 §265.121(a)(3).[1]

Under the Final Interim Measure/Interim Remedial Action (IM/IRA) for IHSS 114 and Resource Conservation and Recovery Act (RCRA) Closure for the Present Landfill (DOE 2004, DOE 2006a), a RCRA Subtitle C-compliant cover was selected to address closure of the PLF. The cover is a geosynthetic composite cover with a rock layer to deter burrowing animals and a 2-foot-thick topsoil layer, and includes installation of perimeter drainage channels to control surface water run-on and runoff around the PLF cover. The closure also included modification of the existing PLF Seep Treatment System (PLFTS). Construction of the PLF cover included removing sediments from the East Landfill Pond, drying the sediments, and placing the dried sediments under the PLF cover. Construction was completed in May 2005, with a minor drainage modification on the PLF east face completed in August 2005.

The original PLF M&M Plan was approved in May 2006, prior to the September 2006 Corrective Action Decision/Record of Decision (DOE, EPA and CDPHE 2006) (CAD/ROD) for Rocky Flats. Pursuant to the CAD/ROD Rocky Flats was configured into two Operable Units (OUs). The Central OU consolidates all areas of Rocky Flats that have remaining hazardous substance contamination and require additional remedial actions, including the PLF. The Peripheral OU surrounds the Central OU and includes the other generally unaffected portions of Rocky Flats that served as a buffer zone surrounding the former industrial area. Under the CAD/ROD, the final remedy is no action for the Peripheral OU, and institutional controls, physical controls, and continued monitoring for the Central OU.

The Rocky Flats Legacy Management Agreement (DOE, EPA, and CDPHE 2007) (RFLMA), signed by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE), to implement the CAD/ROD became effective March 14, 2007. The PLF M&M Plan is incorporated by reference as an enforceable requirement of RFLMA (See RFLMA Attachment 2, "Legacy Management Requirements," Section 5.3.1). RFLMA terminated and superseded the Rocky Flats Cleanup Agreement (RFCA).

The May 2006 PLF M&M Plan referenced RFCA in certain sections. This modified M&M Plan is based on the outcome of consultation in accordance with RFLMA consultative process as documented in Regulatory Contact Record 2007-08, which was approved December 21, 2007. Therefore, this modified PLF M&M Plan revises the original PLF M&M Plan text as appropriate to recognize the implementation of the remedy under RFLMA. It also incorporates changes in inspection frequencies, completion of certain monitoring requirements that now may be phased

[1] 6 CCR 1007-3 §265.121is identified as an Applicable or Relevant and Appropriate Requirement in the CAD/ROD. Subsection (a)(3) refers to requirements for monitoring programs in 6 CCR 1007-3 §264.91 - §264.100.

out, clarification of vegetation inspection schedules and completion criteria, as anticipated in the original PLF M&M Plan.

Modifications to the PLF M&M Plan and to RFLMA requirements pertaining to the PLF monitoring and maintenance are subject to CDPHE review and approval in accordance with RFLMA Part 10, Amendment of Agreement and Modification of Attachments.

1.1 Purpose

The PLF M&M Plan is designed to meet the following objectives:

1. Describe the procedures to maintain the integrity and effectiveness of the final cover, including making repairs as necessary (Section 3.0);
2. Describe the features to maintain and monitor the groundwater monitoring system (Section 4.0); and
3. Present the PLFTS and East Landfill Pond Environmental Monitoring Plan (Section 5.0).

For consistency and simplicity, when specific evaluations and follow-up actions related to these objectives are contained in RFLMA requirements, the PLF M&M Plan refers to the RFLMA requirements.

1.2 Facility Location and Units

Rocky Flats is a government-owned facility formerly used for the fabrication of miscellaneous weapons components for national defense. Rocky Flats is located in Jefferson County, Colorado, approximately 16 miles northwest of Denver (Figure 1−1). The Central OU comprises approximately 1,309 acres situated in the central portion of the former Rocky Flats Environmental Technology Site. The PLF is located within the northern portion of the Central OU, as shown on Figure 1−2.

1.3 Site Operations

The PLF is located in the No Name Gulch drainage, at the western limit of headward erosion and pediment dissection. Beginning in 1968, a portion of the natural drainage at the headwaters of the No Name Gulch drainage was filled with soil from an on-site borrow area to a thickness of approximately 5 feet to construct a surface on which to begin landfilling operations. The PLF does not have a bottom liner. Waste delivered to the PLF was spread across the work area, compacted, and covered with a daily soil cover, eventually filling the valley to the top of the pediment. The PLF eventually consumed the West Landfill Pond; the East Landfill Pond is still present.

The PLF remained in operation until March 1998, at which time it was placed in a contingent closure status and seeded to stabilize soil and control erosion. Final closure was completed in 2005, in accordance with the PLF IM/IRA. The PLF occupies an area of approximately 20 acres. Waste material is generally thinnest along the boundaries and thickest along the east-west axis of the PLF. Thicknesses range from less than 1 foot to approximately 40 feet near the eastern face of the PLF.

Additional information can be found in the PLF IM/IRA.

2.0 Site Physical Description

This section describes the physical conditions at the PLF site such as topography, hydrology, climate and precipitation, hydrogeology, and site features, which include the final cover, the stormwater management system, the RCRA groundwater monitoring network, the PLFTS, and the East Landfill Pond.

2.1 Topography

The final topography of the PLF is as shown on the post-construction survey (Figure 2−1). The slopes of the landfill cover are generally between 3 to 5 percent in accordance with EPA guidance for landfill covers (EPA 2002). The east face of the PLF has a maximum slope of 4 horizontal to 1 vertical (4H:1V). Perimeter drainage channels were built to control surface water run-on and runoff and are sloped to drain to the east of the PLF below the East Landfill Pond dam. A diversion berm was built at the top of the east face to direct surface water into the perimeter channels. Two additional stormwater drainage channels were built to direct surface water at the toe of the east face.

2.2 Hydrology

The PLF is located within the No Name Gulch drainage. Perimeter channels have been constructed around the PLF to route stormwater off the cover and prevent run-on from the surrounding watersheds. On the northern side of the PLF, the western portion of the perimeter channel runs under a perimeter road through a culvert and east into a natural drainage that eventually joins the No Name Gulch drainage below (east of) the East Landfill Pond dam. The northeastern portion of the channel empties into the same natural drainage that eventually joins No Name Gulch below the East Landfill Pond dam. On the southern side of the PLF, the perimeter channel runs eastward above the East Landfill Pond and drops into the No Name Gulch drainage below the dam (Figure 2−1).

The Groundwater Intercept System (GWIS) was installed around the north, east, and south PLF perimeter in 1974 to reduce groundwater inflow to the PLF from the surrounding area. Two 900 foot soil-bentonite slurry walls were also installed on the north and south PLF perimeter in 1984 and tied into the north and south arms of the GWIS. The flow of groundwater from within the PLF to the north and south is also limited by the GWIS. Groundwater collected by the GWIS flows to the PLFTS.

A diversion berm constructed at the top of the east slope directs surface water from the cover away from the east face and into the perimeter channels. These channels and diversion berms limit runoff into the East Landfill Pond.

The East Landfill Pond covers approximately 2.5 acres. Recharge to the pond occurs from direct precipitation, groundwater discharge, PLFTS effluent, and surface water runoff from the surrounding hillslopes, including surface water discharge from the two riprap channels constructed on the east face of the PLF. Groundwater discharge is likely limited because of the relatively low hydraulic conductivity of the underlying weathered bedrock. At the discretion of DOE, the outlet valve in the dam may be left in the open position to limit the Pond water level,

resulting in a maximum surface water area of approximately 0.8 acre; or the valve may be closed to increase the associated wetland vegetation. Pond discharge via the emergency overflow spillway will only occur if and when the operations are changed or there is an abnormal condition.

2.3 Climate and Precipitation

Rocky Flats is located in the southern Rocky Mountains and has a continental, semiarid climate. The region is noted for large seasonal temperature variations, occasional dramatic short-term temperature changes, and strong, gusty winds that can exceed 100 miles per hour. Mean annual precipitation is approximately 15.5 inches, with approximately one-half of that amount occurring as snow.

2.4 Hydrogeology

In the area of the PLF, groundwater flows predominantly within the upper hydrostratigraphic unit (UHSU). The UHSU is composed of materials that include the Rocky Flats Alluvium, colluvium, Valley Fill Alluvium, and weathered bedrock (predominantly claystone). Unweathered bedrock is part of the lower hydrostratigraphic unit. The thickness of the weathered bedrock material varies considerably in the vicinity of the PLF, ranging from approximately 4 to 35 feet. In the past, the average depth to groundwater ranged from 5 to 15 feet in unconsolidated surficial deposits around the PLF.

2.5 Site Features

Site features at the PLF include the final cover, the stormwater management system, the RCRA groundwater monitoring network, the PLFTS, and the East Landfill Pond. Each of the site features is discussed in this plan. Monitoring procedures are provided in subsequent sections.

2.5.1 Final Cover

The final cover of the PLF includes the following components, beginning with the top layer:

- A 2-foot-thick soil layer to facilitate vegetation, route surface water, and protect the cover system below;
- A 1-foot-thick rock layer with soil in the interstices to deter burrowing animals from impacting the underlying geosynthetics;
- A 10-inch-thick rock cushion soil layer to protect the underlying geosynthetics from rocks;
- Geocomposite drainage net to act as a drainage layer to route infiltrating water off of the cover;
- Flexible membrane liner (FML) to act as an impermeable layer and prevent water infiltration to the waste material below;
- Geosynthetic clay liner (GCL) to act as a secondary impermeable layer and also to “heal” punctures in the FML by the swelling of the GCL; and
- A 6-inch-thick GCL cushion soil layer to protect the geosynthetics above. This layer also includes a barometric vent system to equalize atmospheric pressure under the cover.

Inspection and monitoring procedures to maintain the integrity and effectiveness of the final cover are included in Section 3.0.

2.5.2 Stormwater Management System

2.5.2.1 Introduction

The stormwater management plan is presented in Appendix H of the Present Landfill Design Submittal (Earth Tech, Inc. 2004). This appendix presents the results of calculations used to determine the stormwater run-on and runoff volumes to adequately design the perimeter channels and culverts. The calculations use a 100-year, 24-hour storm event and check the capacity of this design to handle a 1,000-year, 24-hour storm event. The contributing area for storm events is approximately 54 acres.

2.5.2.2 Applications

Effective stormwater management is achieved in the system by applying the following principles:

- Protect the land surface from erosion;
- Manage run-on and runoff, keeping velocities low; and
- Inspect and maintain the erosion and stormwater management practices (discussed in Section 3.0).

2.5.2.3 Erosion Control

Stormwater management features at the PLF have been designed with erosion control features to limit both short-term and long-term erosion (Figure 2−1). Erosion control is any practice that protects soil surfaces and prevents the soil particles from being detached by rainfall or wind. The PLF cover is covered with a NAG C125 temporary erosion mat and the cover sideslopes, perimeter channel bottom, perimeter channel sideslopes, and diversion berms are all covered with a NAG SC150 temporary erosion control mat. These mats have a design life of approximately 3 years, depending on weather conditions. This will limit short-term erosion until vegetation is established. Portions of the perimeter channel with steeper slopes are lined with riprap, a more robust erosion control measure. The diversion berm outfalls to the perimeter channel are also lined with riprap to prevent scouring. The cover of the cap has been seeded, mulched, and covered with erosion matting to limit erosion until vegetation is established. The east face and portions of the diversion berms have a more permanent erosion control mat (NAG C350) because the slope is longer and is more susceptible to erosion. Vegetation will also reduce erosion on the east face.

2.5.2.4 Run-on and Runoff Control

The PLF stormwater management system has two purposes:

- To collect, route, and discharge stormwater run-on and runoff while minimizing unnecessary ponding and subsequent infiltration into the cover; and
- To control erosion and sediment transport.

Run-on stormwater is conveyed from west of the PLF as overland flow and in intermittent, grassed waterways, and then enters the perimeter channel. Other run-on is from overland flow from the contributing areas on the non-PLF sides of the perimeter channel.

Runoff enters the perimeter channel from overland flow on the cover as well as grassed waterway flow from the diversion berms constructed on the top of the slope at the east face.

2.5.3 RCRA Groundwater Monitoring Network

Six RCRA monitoring wells are used for groundwater monitoring at the PLF as discussed in Section 4.0. Three RCRA wells are upgradient and three RCRA wells are downgradient of the PLF.

2.5.4 PLF Seep

A seep, known as the PLF seep, exists at the eastern end of the PLF. As part of final closure, subsurface strip drains were placed below the east face cover to collect water under the east face cover including the seep and route the water to the PLFTS. The PLFTS replaced a similar seep treatment system installed in 1996. This new PLFTS also collects and treats groundwater (if any) from the GWIS and flow from the east face subsurface strip drains. As part of the construction supporting the PLF closure, the existing GWIS pipelines were routed to the PLFTS (See Figure 5−1). Concentrations of most contaminants in the PLF seep have been reported below the RFLMA surface water standards; however, a few constituents may exceed these levels. Monitoring is discussed in Section 5.0.

2.5.5 East Landfill Pond

The East Landfill Pond will remain and receive treated water from the PLFTS and surface water from the east face and surrounding hillsides, as well as precipitation falling directly into the Pond. Monitoring of the Pond is discussed in Section 5.0.

2.5.6 Access Controls

Access controls will be maintained in accordance with the RFLMA requirements for physical controls, including signs. RFLMA requirements meet the intent of warning signs in accordance with 6 CCR 1007-3 §265.14.

3.0 Final Cover and Stormwater Management System Inspection and Monitoring

This section outlines the inspection and monitoring program to be undertaken at the PLF to ensure that the integrity of the cover is not compromised and continues to function as designed. Inspection and monitoring tasks include surface water and groundwater monitoring, monitoring and inspection of subsidence/consolidation, slope stability, soil cover, vegetation, stormwater management structures, and erosion in surrounding features so that maintenance actions can be taken in a timely manner.

DOE will follow RFLMA requirements for informing the other RFLMA Parties of any RFLMA reportable conditions resulting from conducting the inspection and monitoring program described in this PLF M&M Plan. Final plans and schedules for mitigating actions, if any, will be developed and approved in accordance with RFLMA requirements.

3.1 Inspection Procedures

The frequency for each inspection and monitoring item will be conducted as specified in RFLMA. Modifications to the inspection program, including inspection frequency, will be evaluated using the RFLMA consultative process, and approved as specified by RFLMA modification requirements. More frequent inspection may occur any time conditions warrant.

In accordance with the IM/IRA (DOE 2006a), to maintain integrity and effectiveness of the final cover, site inspections of the area will be conducted on a regular, periodic basis following construction of the final cover. In addition to regularly scheduled inspections, weather-related inspections will be conducted as follows:

- The PLF will be inspected after a storm event of 1 inch or more of rain in a 24-hour period; and
- The PLF will be inspected after significant melt of an accumulation of snow greater than 10 inches (assuming 10 inches of snow is equivalent to 1 inch of water).

Inspections will be performed by qualified personnel and reviewed by a competent professional. Inspections will encompass the following subjects, as described in Sections 3.2 through 3.8: subsidence/consolidation, slope stability, soil cover, vegetation, stormwater management structures, run-on erosion controls, and institutional controls and related matters. Inspections will be performed using a prescribed form containing a checklist of items that documents the evaluation of site conditions. The inspection form is presented in Appendix A. The inspection form will be signed and dated by the inspector and the reviewer. The findings and observations of the site inspection will be entered on the form and presented in an annual PLF monitoring report, as described in Section 6.1. Minor repairs or maintenance may be performed in conjunction with the inspection and will be noted on the inspection form.

3.2 Subsidence/Consolidation

Subsidence and consolidation at the PLF largely depend on how well the waste, cover, and fill were compacted when placed, and the waste thickness, age, rate of degradation, and composition. Waste subsidence or continued consolidation may result in differential settlement which generally occurs when one area of waste settles more readily than another because of differences in waste composition, degradation, compaction, thickness, and moisture content. Differential settlement across the PLF may create cracks on the surface, which would allow precipitation to infiltrate more easily. Differential settlement can also change the topography of the PLF and create areas on the surface where ponding of water can occur. Localized waste subsidence can manifest itself in the form of cracks, depressions, and sinkholes. Construction of the final cover system included placement of engineered fills and repair of unsuitable areas. In addition, the waste was compacted when placed, and decomposition is nearly complete as

indicated by measurement of PLF gases. Therefore, cover subsidence or consolidation is of little concern. Nevertheless, differential settlement may occur.

3.2.1 Monitoring Locations and Procedures

Subsidence/consolidation monitoring will be conducted to evaluate actual settlement compared to the expected settlement calculated in the final design and to observe areas of water ponding on the PLF surface or other indicators of differential settlement. Subsidence/consolidation at the PLF will be monitored by visually inspecting the surface of the PLF cover for cracks, depressions, heaving, and sinkholes. Visual inspections will involve traversing the PLF to gain perspective on regions of the PLF (i.e., every square foot of the PLF will not be inspected). In addition, the settlement plates (monument locations) were installed as shown on Figure 2−1. For each monument location, the calculated settlement from the final design will be established to be compared to measured settlement. (There is no calculated settlement plate data for plates H and I; these locations will be monitored for settlement trends based on their initial survey coordinates.) Areas of observed differential settlement, including ponding, will be staked, photographed, measured, and located on the PLF site map prior to any maintenance action. Survey Control Point 1006 (shown on Figure 2−1) will be maintained as the control for surveying the PLF.

3.2.2 Maintenance Activities

The maintenance actions that will normally occur to correct the effect of adverse differential settlement are to place additional soil and regrade the affected area. This action will eliminate the potential for ponding and/or correct the slope of the surface. Maintenance that addresses differential settlement will be photographed, and the area will be measured and located on the PLF site map. Replacement soil will be Rocky Flats Alluvium meeting the specifications in the Accelerated Action Design. This requirement will be met by stockpiling appropriate soil, identifying appropriate borrow locations, or ensuring that a supplier meets the specifications.

Settlement plate data will be tabulated and the measured settlement will be compared to the anticipated settlement calculated in the final design. Should measured settlement exceed 30 percent of the calculated maximum settlement and be expressed as differential settlement, the area will be photographed, located on the PLF site map, as described above, repaired, and reported in the inspection reports. Should the measured settlement exceed 90 percent of the calculated maximum settlement and be expressed as differential settlement, a qualified geotechnical engineer will be consulted to determine a maintenance action and the results of the geotechnical engineer's evaluation will be reported by DOE to CDPHE. The area(s) where maintenance actions have taken place will be specifically inspected and reported during subsequent periodic inspections of the cover for as long as detailed follow-up evaluation is needed to monitor any continued subsidence. DOE will follow RFLMA requirements for reportable conditions if differential settlement or localized subsidence appears to be substantial and likely to influence the integrity, and thus the effectiveness, of the existing cover and surface water drainage over the PLF after taking these maintenance actions.

3.3 Slope Stability

Some areas of the PLF site may be susceptible to instability due to lateral movement. Slope failures can be caused by the weight of the wastes and cover material, steeply regraded slopes, and seepage forces resulting from water infiltration. Seismic forces can also cause slope failures. Steep slopes produce less stable conditions and are more susceptible to failure. Slope failures can also occur within the waste mass, resulting in downslope sliding of the cover components. The cover system has been designed and constructed with applicable safety factors to guard against slope failure. Nevertheless, slope stability will be monitored to verify that slope failure is not in progress. In addition, if areas of slope stability concerns are found outside the boundaries of the PLF footprint but within the general area of the PLF, the area of the inspection will be expanded to include these areas.

3.3.1 Monitoring Locations and Procedures

Slope stability at the PLF will be monitored by visually inspecting the cover system sideslopes, perimeter channel sideslopes, east face slope, and area above the GWIS pipeline that was rerouted to the PLFTS (outside the PLF closure boundary) for signs of cracks, evidence of block failure, and evidence of circular failure. The inspection will categorize the observed cracking. Visual inspection will involve traversing the slope to gain a perspective of the entire slope. Particular attention will be provided at the drainage divide where the east (central) area meets both the north and south areas of the east face. Any areas where a surface seep is identified will be photographed, marked, located on the PLF site map, and monitored for signs of slope instability. Areas identified during the inspections as potential slope stability concerns will be photographed, located on the PLF site map, and staked for further monitoring. If adverse surface water flow into cracks is likely, actions such as filling the cracks or controlling surface water flows will be taken to prevent surface water from entering the cracked area. DOE will follow RFLMA requirements for reportable conditions if further monitoring indicates a continued stability concern after taking these maintenance actions and will consult a qualified geotechnical engineer.

In addition to the visual inspections, several sideslope monitoring points were placed on the east face slope and will be monitored for vertical and horizontal movement. These will be visually inspected on each field inspection and surveyed at the same frequency as the settlement plates. Observations gathered will be combined with the other inspection data to evaluate the overall performance of the east face.

3.3.2 Maintenance Activities

Based on the site monitoring data and consultation with a qualified geotechnical engineer, maintenance actions will be taken to address any potential slope failure at the PLF that would likely compromise the remedy. The actions may include, but not be limited to, regrading affected areas, filling areas, maintaining positive drainage of surface water, creating slopes ranging from 2 to 5 percent on top of the waste, and regrading steep sections to achieve sideslopes no greater than 4:1. Areas where maintenance actions have taken place will be closely monitored and documented for further slope stability concerns. DOE will follow RFLMA requirements for reportable conditions if inspections show continued slope stability concerns in an area of the PLF closure after taking these maintenance actions.

3.4 Soil Cover

The cover system at the PLF was designed and installed to meet the minimum soil erosion requirements from both water and wind erosion. During the post-closure period, it is important to ensure that both temporary and permanent erosion controls are functioning properly. Regardless, the soil cover thickness may change over time due to wind and water erosion. Subsidence due to waste settlement and lateral movement of wastes or slopes may also contribute to changes in differential soil cover thickness. Monitoring of the soil cover is conducted to verify the cover is performing in accordance with the design and the PLF system as a whole continues to meet performance objectives.

3.4.1 Monitoring Locations and Procedures

Monitoring of the soil cover at the PLF includes the following:

- Visually inspecting the soil cover for erosion or deposition areas;
- Visually inspecting the soil cover for signs of burrowing animals; and
- Visually inspecting the diversion berm, diversion berm outfalls, and the east face for erosion rills or excessive deposition.

Visual inspection involves traversing the slope to gain perspective of the entire area. Particular attention will be provided at the drainage divide where the east (central) area meets both the north and south areas of the east face. Signs of rill and gully erosion will be photographed, marked with stakes, measured, located on the PLF site map, and reported on the inspection form. Additionally, areas of observed soil deposition will also be photographed, marked, measured, located on the PLF site map, and reported on the inspection form.

3.4.2 Maintenance Activities

If monitoring indicates significant loss of soil over time, maintenance actions will be taken. If a gully is measured at equal to or more than 6 inches deep, maintenance actions will be implemented. The actions may include, but not be limited to, soil replacement, regrading the affected areas to match adjacent grades, and removing and relocating any deposited eroded soils (if necessary). The regraded areas will be vegetated to prevent further erosion. Erosion control measures will be implemented to prevent further erosion of cover soils (e.g., erosion control mat and/or revegetation), if necessary. The amount of soil used to fill areas of erosion will be estimated, recorded, and reported in the quarterly monitoring report. DOE will follow RFLMA requirements for reportable conditions if soil erosion concerns persist after taking these maintenance actions. Areas of soil deposition that hinder the flow of surface water in a stormwater channel will be removed to maintain the designed channel configuration and flow capacity. Maintenance of these areas will also be documented and reported in the quarterly report.

3.5 Vegetation

Vegetation is important at the PLF to aid with short-term and long-term erosion control although the design calculations have shown that the materials used for construction are resilient to water

and wind erosion. The approved PLF IM/IRA (Section 5.1) states: “Additionally, surface vegetation will be established on this soil layer to enhance resistance to surface erosion, prevent intrusion of noxious weeds and burrowing animals, and to provide an aesthetic appearance to the cover, using appropriate native seed mixes.” Section 6.1.1 of the PLF IM/IRA also states: “Vegetation of a soil cover is planned to further reduce erosion, although vegetation and weed control measures will be employed to maintain a healthy stand of vegetation consistent with the wildlife refuge end-state.” Vegetation inspections will ensure that vegetation is established properly. Maintenance of the cover vegetation will be consistent with the Revegetation Plan (DOE 2005a) and the Vegetation Management Plan (DOE 2006b) for site-wide vegetation management.

3.5.1 Monitoring Locations and Procedures

Vegetation at the PLF will be monitored by visual inspection by traversing the cover and visually inspecting for the health of the vegetation and for unwanted vegetation such as weeds. In addition, the vegetation at the PLF will be monitored annually as described in the Revegetation Plan. Once the success criteria listed below (from the Revegetation Plan) have been met, quantitative vegetation monitoring will be discontinued. The major goals of the plan are:

Quantitative grassland success criteria:

1. A minimum of 30 percent relative foliar cover of live desired species (seeded native species and/or non-seeded native species).
2. A minimum of 60 percent total ground cover comprised of litter cover, current year live vegetation basal cover, and rock cover.
3. A minimum of 50 percent of the seeded native species will be present at the revegetation site.
4. No single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives).

Noxious weeds criteria:

1. Noxious weeds will be evaluated on a species-specific basis, and weed control will be employed as necessary using appropriate strategies in the Vegetation Management Plan to achieve the success criteria listed above.

3.5.2 Maintenance Activities

If visual inspections indicate vegetation concerns on the cover, maintenance action will be taken. Actions may include, but not be limited to, the following:

- Reseeding of the soil cover;
- Spot herbicide applications;
- Maintenance/repair of erosion controls; and
- Removal of deep-rooting trees or shrubs growing in the cap and repair of the area.

Maintenance of the cover vegetation will be consistent with the Revegetation Plan and the Vegetation Management Plan for site-wide vegetation management. DOE will notify and consult with CDPHE should an area consistently show vegetation concerns to determine if this condition could result in a RFLMA reportable condition.

3.6 Stormwater Management Structures

Stormwater management will be required at the PLF to ensure that existing stormwater control structures (man-made drainage features) are functioning adequately to achieve the following objectives:

- Prevent run-on and runoff from eroding or damaging the cover; and
- Limit transport of sediment from the disturbed areas to off-site drainage ways.

Existing stormwater controls at the PLF include the following (Figure 2−1):

- Diversion berm;
- Diversion berm outfall-north;
- Diversion berm outfall-south;
- Culvert 1;
- Culvert 2;
- Southwest culvert outfall;
- Vegetation-lined perimeter channel-north;
- Vegetation-lined perimeter channel-south;
- Riprap-lined perimeter channel;
- East face riprap channel-north;
- East face riprap channel-south; and
- NAG C350-lined east face (hillside).

Details of each type of structure are included on Figure 3−1.

3.6.1 Monitoring Locations and Procedures

Stormwater management structures will be monitored visually by walking the structures and examining all components. Problem areas will be noted on the inspection form, graphically depicted, and photographed. At a minimum, these structures will be inspected for signs of excessive erosion, settlement, bank failure, breaching of the diversion berms, subsidence, burrowing animals, and blockage. Signs of potential problems include, but are not limited to, gullying, sediment buildup, and depressions.

The perimeter channel lining will be inspected for evidence of damage, displacement, undermining, scour, or deterioration. Repairs will be made to restabilize the channel in accordance with the design specifications. Permanent (extended term) erosion control mat lining on the east face will also be inspected. The erosion control mat will be inspected for holes, rips,

and separation. In addition, any evidence of erosion rills or gullies will be monitored during the inspection.

3.6.2 Maintenance Activities

If the inspections indicate that the existing stormwater management structures are not adequately controlling surface water run-on and runoff, maintenance actions will be taken.

As necessary, routine maintenance of the surface water controls will include removing any blockages, filling eroded areas, replacing erosion control mat, or repairing other disturbances. Sediment will be removed from the stormwater management structures to restore the design characteristics of the structure. Areas that exhibit excessive erosion may require placement of erosion control material or strengthening of the existing erosion control measures. DOE will follow RFLMA requirements for reportable conditions if stormwater management structures continue to show evidence they are not adequately controlling surface water run-on and runoff after taking these maintenance actions.

3.7 Run-On Erosion Control

Erosion control inspections will take place in natural drainages around the PLF to prevent excess sediment load to the PLF system and to ensure erosion is not problematic. Natural drainages and slopes around the PLF to be inspected for excess erosion as shown on Figure 2−1 include the following:

- Natural drainage fed by Culvert 1;
- Natural drainage fed by the northeast portion of the perimeter channel;
- Natural drainage fed by the south perimeter channel; and
- Natural area sideslopes of the perimeter channel.

The inspection will include areas where flows from the channels discharge to the existing downstream land surface.

3.7.1 Monitoring Locations and Procedures

The natural drainages will be visually monitored to identify signs of soil erosion that could adversely impact the PLF or conditions that may cause an overload on existing stormwater management structures.

3.7.2 Maintenance Activities

If inspections indicate soil loss, excessive disturbance in the areas, the presence of erosion gullies, or other evidence of erosion, maintenance action will be taken. The slope areas are more susceptible to water erosion in the event of high-intensity rainfall and are of particular concern. Actions may include placing additional soil, regrading, and seeding of the affected areas. Other erosion control measures that may be implemented include, but are not limited to, placing erosion mat, riprap, straw bale barrier(s), and silt fencing. DOE will follow RFLMA requirements for reportable conditions if areas consistently show signs of erosion after taking these maintenance actions.

3.8 Institutional Controls and Other Inspections

In addition to the inspection and monitoring activities discussed above, the PLF site inspection will include assessment of other items related to institutional controls, the condition of established monitoring points, and site security. DOE will follow RFLMA requirements for informing the other RFLMA Parties of any RFLMA reportable conditions related to institutional controls and other inspections.

3.8.1 Institutional Controls

Institutional controls are specified in RFLMA Attachment 2, Table 4, "Institutional Controls for the Central Operable Unit." These institutional controls are used to control access and restrict activities at the PLF to ensure the effectiveness of the engineered controls and the monitoring systems. PLF inspections will monitor conditions that violate the institutional controls or damage the physical controls. Inspections will be conducted to look for evidence of the following activities:

- Excavation(s) of the cover and in the immediate vicinity of the cover;
- Construction of roads, trails, or buildings on the cover;
- Drilling of wells or use of groundwater except for remedy-related purposes;
- Disruption or damage of the seep treatment system;
- Damage or removal of any signage or groundwater monitoring wells at the PLF;
- Evidence of unauthorized entry, including damage from vehicular traffic; and
- Damage from burrowing animals.

A checklist of these items is included on the inspection form found in Appendix A.

3.8.2 Condition of Monitoring Points

All established monitoring locations, such as monitoring wells and the seep treatment system or other items placed to assist inspection efforts, will be evaluated for ongoing integrity. The inspection will include documentation of any damage to the monitoring points that would impact their usefulness for inspections.

3.8.3 Site Conditions

During site inspections, signs, markers, and the overall condition of the PLF site will be checked to determine continuing effectiveness of institutional and physical controls.

3.8.4 Reporting and Record Keeping

Inspection forms and findings will be included in the annual PLF monitoring reports discussed in Section 6.1, which will be included in the annual reports specified in RFLMA Attachment 2, Section 7.0, "Periodic Reporting Requirements."

4.0 Groundwater Monitoring Plan

This section presents the plan to maintain and monitor the groundwater monitoring system for the PLF during the post-closure period.

4.1 Purpose and Requirements

The constituents monitored, frequency of monitoring, and other requirements of §264.98 and the IM/IRA are specified in RFLMA Attachment 2, as outlined in this section. RFLMA Attachment 2 requirements replaced the RFCA Integrated Monitoring Plan (IMP) requirements (DOE 2005b). The PLF groundwater monitoring plan has been implemented to determine groundwater quality impacts of the PLF pursuant to the detection monitoring requirements of 6 CCR 1007-3, §264.91(d) and §264.98. The groundwater monitoring will be used to evaluate upgradient versus downgradient groundwater quality at the PLF as set forth in RFLMA, Attachment 2.

4.2 Data Quality Objectives

The PLF groundwater monitoring data quality objectives (DQOs) were generally developed using EPA guidance documents. Quality assurance/quality control (QA/QC) requirements are specified in RFLMA Attachment 2, Section 5.0, “Monitoring Requirements.” Groundwater monitoring wells at the PLF are categorized in RFLMA as RCRA monitoring wells and monitoring results will be evaluated in accordance with RFLMA Attachment 2, Figure 10, “RCRA Wells,” which incorporates the DQO process.

4.3 Well Locations

Well locations were selected and approved by CDPHE and EPA. Six RCRA groundwater monitoring wells, three downgradient and three upgradient (Figure 2−1), are employed.

Upgradient monitoring wells include wells 70193, 70393, and 70693. Downgradient monitoring wells include wells 73005, 73105, and 73205. Monitoring well details are summarized in Table 4−1. Boring logs are included in Appendix B.

4.4 Sampling Procedures Summary

Groundwater sampling will be conducted in accordance with Legacy Management (LM) operational documents related to monitoring as provided in RFLMA Attachment 2, Section 5.0, “Monitoring Requirements.” Groundwater monitoring will include water level measurements, conventional groundwater purging and sampling, QC field samples, and proper equipment decontamination. Investigation-derived waste (IDW) (e.g., for purge and decontamination waters) will also be managed in accordance with the LM operational documents.

.

4.5 Laboratory Procedures Summary

Analytical methodologies and reporting limits (RLs), data reporting procedures, laboratory QA/QC procedures, and laboratory data validation and contractor validation procedures are to be conducted in accordance with EPA-approved methods. Groundwater samples will be submitted to an EPA-approved analytical laboratory for the following analyses:

- SW-846 Method 8260B—Volatile organic compounds (VOCs);
- SW-846 Method 6010B—Metals; and
- SW-846 Method 7470A—Mercury.

The remedy performance standards for surface water are in RFLMA Attachment 2, Table 1, "Surface Water Standards." Sampling criteria for surface water are presented in RFLMA Attachment 2, Table 2, "Water Monitoring Locations and Sampling Criteria." The analytical results obtained by these methods will be reported as described in Section 4.6.

Sample results are reported according to laboratory analytical method Standard Operating Procedures or contract specifications. The laboratory will report any analyte of interest detected at or above the RL as a positive value. Any analyte of interest not detectable or detected below the RL will be reported as "not detected" at the RL or an estimated value between the RL and the instrument or method detection limit. Data are generally reported in a tabular format or posted on maps and figures. RLs are adjusted for dilution when necessary.

4.6 Reporting and Schedule

Groundwater monitoring results will be included in the quarterly and annual reports specified in RFLMA Attachment 2, Section 7.0, "Periodic Reporting Requirements." The annual PLF monitoring reports, discussed in Section 6.1, will be included in the RFLMA annual reports.

5.0 Present Landfill Seep and East Landfill Pond Environmental Monitoring Plan

As part of PLF closure, the PLFTS, a passive seep interception and treatment system, was installed to treat PLF seep water and GWIS water. Effluent from the PLFTS eventually flows to the East Landfill Pond. This section presents the monitoring plan for PLFTS influent and effluent as well as the East Landfill Pond, as required by the DQO process, if PLFTS effluent exceeds RFLMA Attachment 2, Table 1, "Surface Water Standards."

5.1 Purpose and Requirements

The PLF Seep and East Landfill Pond Monitoring Plan is implemented to determine surface water quality impacts of the PLF. Sampling parameters, sampling frequency and applicable surface water standards are listed in RFLMA, Attachment 2, Table 1, "Surface Water Standards," and Table 2, "Water Monitoring Locations and Sampling Criteria." The decision framework for this sampling is found in RFLMA Attachment 2, Figure 11.

5.2 Data Quality Objectives

The PLF surface water monitoring DQOs were generally developed using EPA guidance documents. QA/QC requirements are specified in RFLMA Attachment 2, Section 5.0, "Monitoring Requirements." PLFTS influent, effluent, and East Landfill Pond (when required) monitoring results will be evaluated in accordance with RFLMA Attachment 2, Figure 11, "Groundwater Treatment Systems," which incorporates the DQO process.

5.3 Sample Locations

Sampling will be conducted at both the influent and effluent of the PLFTS at the locations shown on Figure 5−1 in accordance with RFLMA Attachment 2 requirements. Flow at the seep influent (pipe from south manhole) to the PLFTS will be manually measured (calibrated bucket and stopwatch) when a sample is collected. GWIS north and south influent enters the north manhole at two locations. The north manhole is the designated sampling point for the GWIS. In accordance with RFLMA Attachment 2, Figure 11, and after consultation with CDPHE, sampling of the GWIS was discontinued for monitoring purposes. Any subsequent GWIS sampling will be as required in RFLMA Attachment 2. The PLFTS effluent sample will be collected from the base of the treatment unit or after the last step.

If East Landfill Pond sampling is required as discussed in Sections 5.1 and 5.2, a sample will be collected near the pond discharge location (Figure 5−1).

5.4 Sampling Procedures Summary

Surface water sampling will be conducted in accordance with LM operational documents related to monitoring as provided in RFLMA Attachment 2, Section 5.0, "Monitoring Requirements." Surface water monitoring will include QC field samples and proper equipment decontamination. IDW (e.g., for excess sample and decontamination waters) will also be managed in accordance with the LM operational documents.

5.5 Laboratory Procedures Summary

Analytical methodologies and RLs, data reporting procedures, laboratory QA/QC procedures, and laboratory data validation and contractor validation procedures are to be conducted in accordance with EPA-approved methods. Samples will be submitted to an EPA-approved analytical laboratory for the following analyses:

- SW-846 Method 8260B—VOCs;
- SW-846 Method 6010B—Metals;
- SW846 Method 8270C—Semivolatile organic compounds;
- Alpha Spectrometry—Isotopic uranium or SW-846 Method 6010B—Metals (uranium) as appropriate for the applicable standard in RFLMA; and
- EPA-600/4-79-020 Method 353.2—Nitrate/nitrite.

The surface water monitoring details are in RFLMA Attachment 2, Table 2, "Water Monitoring Locations and Sampling Criteria." The analytical results obtained by these methods will be reported as described in Section 5.6.

Sample results are reported according to laboratory analytical method Standard Operating Procedures or contract specifications. The laboratory will report any analyte of interest detected at or above the RL as a positive value. Any analyte of interest not detectable or detected below the RL will be reported as "not detected" at the RL or an estimated value between the RL and the instrument or method detection limit. Data are generally reported in a tabular format or posted on maps and figures. RLs are adjusted for dilution when necessary.

5.6 Reporting and Schedule

PLFTS and East Landfill Pond sampling results will be included in the quarterly and annual reports specified in RFLMA Attachment 2, Section 7.0, "Periodic Reporting Requirements." The annual PLF monitoring reports, discussed in Section 6.1, will be included in the RFLMA annual reports.

5.7 Seep Treatment System Inspections

During sampling of the PLFTS, the system components will be inspected to ensure proper operation. The PLFTS is shown on Figure 5−1 and includes the following components:

- Former seep treatment system influent pipe;
- East face strip drain influent pipe;
- Concrete manholes (two);
- GWIS influent pipes (two);
- Treatment unit influent pipes (two);
- Treatment unit, which includes 10 steps; and
- Treatment unit effluent pipe.

The concrete manholes and treatment unit will be inspected for signs of damage as will the piping contained within. The influent and effluent pipes within the manhole and the PLFTS effluent pipe will be inspected for signs of blockage.

6.0 Reporting and Contact Information

6.1 Reporting

The annual PLF monitoring report, including inspection results, repairs, groundwater monitoring data, PLFTS monitoring data, and East Landfill Pond monitoring data if applicable, will be submitted as part of the RFMLA annual report. Any maintenance actions during the year will be detailed in the report. DOE will follow RFLMA requirements for reportable conditions and potentially impacted communities will be notified immediately of conditions that occur at any

time that require immediate attention. The annual PLF monitoring report will include at a minimum:

- All inspection forms/reports for the year, including vegetation information;
- Notations of problems, actions taken, maintenance, or repairs as a result of the inspections;
- Any deviations from this M&M Plan and the rationale for such deviations;
- Summary of monitoring locations;
- Tables with depth to water, well elevations, and groundwater elevations;
- Table with groundwater results and associated qualifiers;
- Tables with PLFTS sampling results and associated qualifiers;
- Tables with GWIS sampling (if required by RFLMA) results;
- Tables with East Landfill Pond sampling results if applicable;
- Figures with groundwater monitoring points, East Landfill Pond monitoring points, and location(s) of problems and/or repairs; and
- Groundwater and seep/PLFTS/East Landfill Pond water sampling forms, as appropriate.

During the year, DOE will transmit completed inspection forms as they become available, but in no case later than 1 month after the field activity is completed.

6.2 Contact Information

The point of contact and contact information for the PLF during the monitoring and maintenance phase is as follows:

Scott Surovchak/U.S. Department of Energy
Rocky Flats Office of Legacy Management
11025 Dover St., Suite 1000
Westminster, CO 80021
Ph. (720) 377-9682

7.0 References

DOE (U.S. Department of Energy), 2004. *Final Interim Measure/Interim Remedial Action for IHSS 114 and RCRA Closure for the RFETS Present Landfill*, Rocky Flats Environmental Technology Site, Golden, Colorado, August.

DOE (U.S. Department of Energy), 2005a. *Rocky Flats, Colorado, Site Revegetation Plan*, Rocky Flats Office of Legacy Management, Broomfield, Colorado, December.

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Earth Tech, Inc, 2004. *Final Design Analysis and Design Calculations, Accelerated Action Design for the Present Landfill*, October.

EPA (U.S. Environmental Protection Agency), 2002. *Technical Guidance for RCRA/CERCLA Final Covers*, April.

Figures

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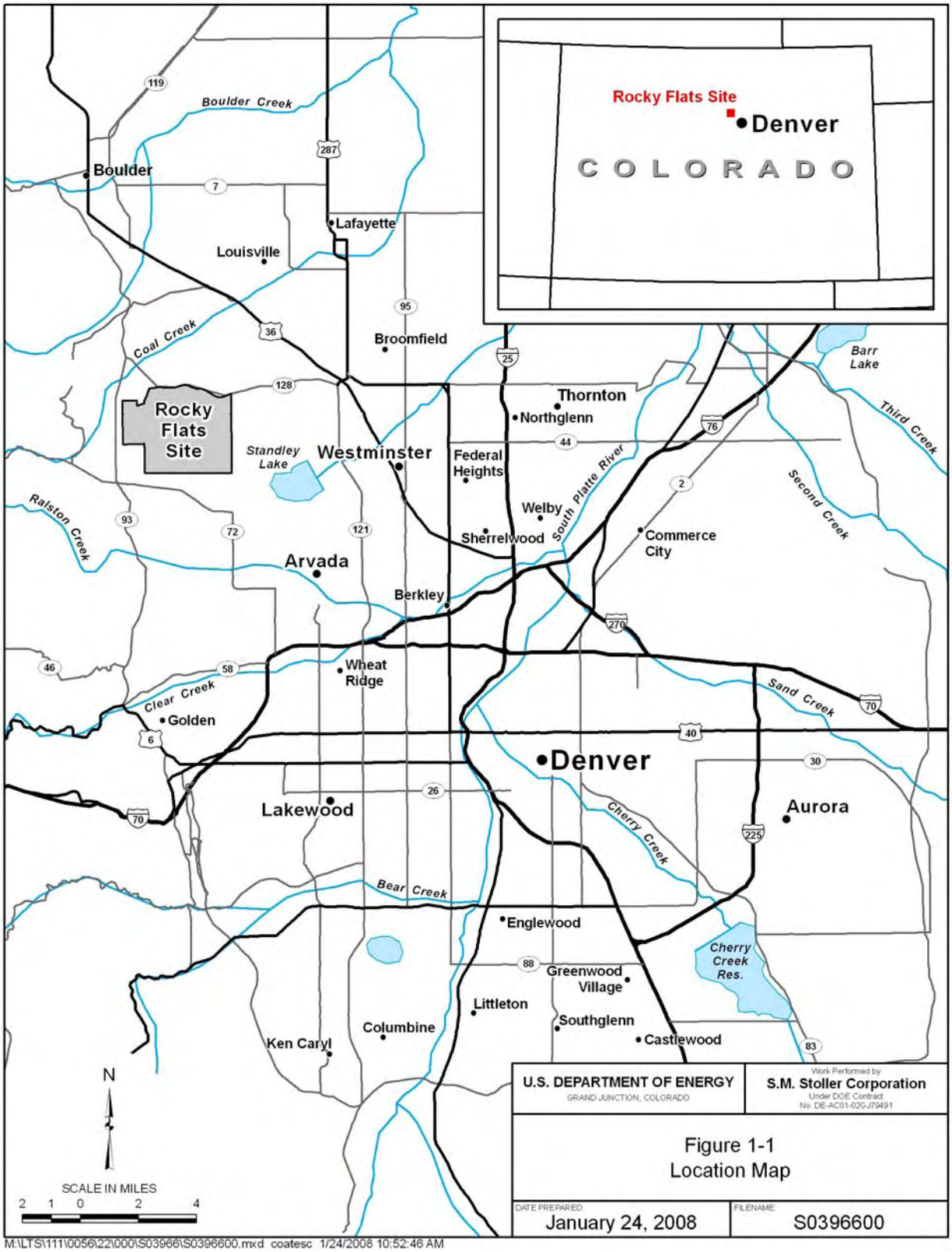
Rocky Flats Site
Denver
COLORADO
Boulder
Boulder Creek
Lafayette
Louisville
Coal Creek
Broomfield
Rocky Flats Site
Standley Lake
Westminster
Thornton
Northglenn
Federal Heights
South Platte River
Barr Lake
Third Creek
Second Creek
Ralston Creek
Welby
Sherrelwood
Commerce City
Arvada
Berkley
Wheat Ridge
Clear Creek
Golden
Sand Creek
Denver
Lakewood
Aurora
Cherry Creek
Bear Creek
Englewood
Cherry Creek Res.
Greenwood Village
Littleton
Southglenn
Columbine
Ken Caryl
Castlewood
N
SCALE IN MILES
2 1 0 2 4
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO
Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE-AC01-02G-J79491
Figure 1-1
Location Map
DATE PREPARED
January 24, 2008
FILENAME
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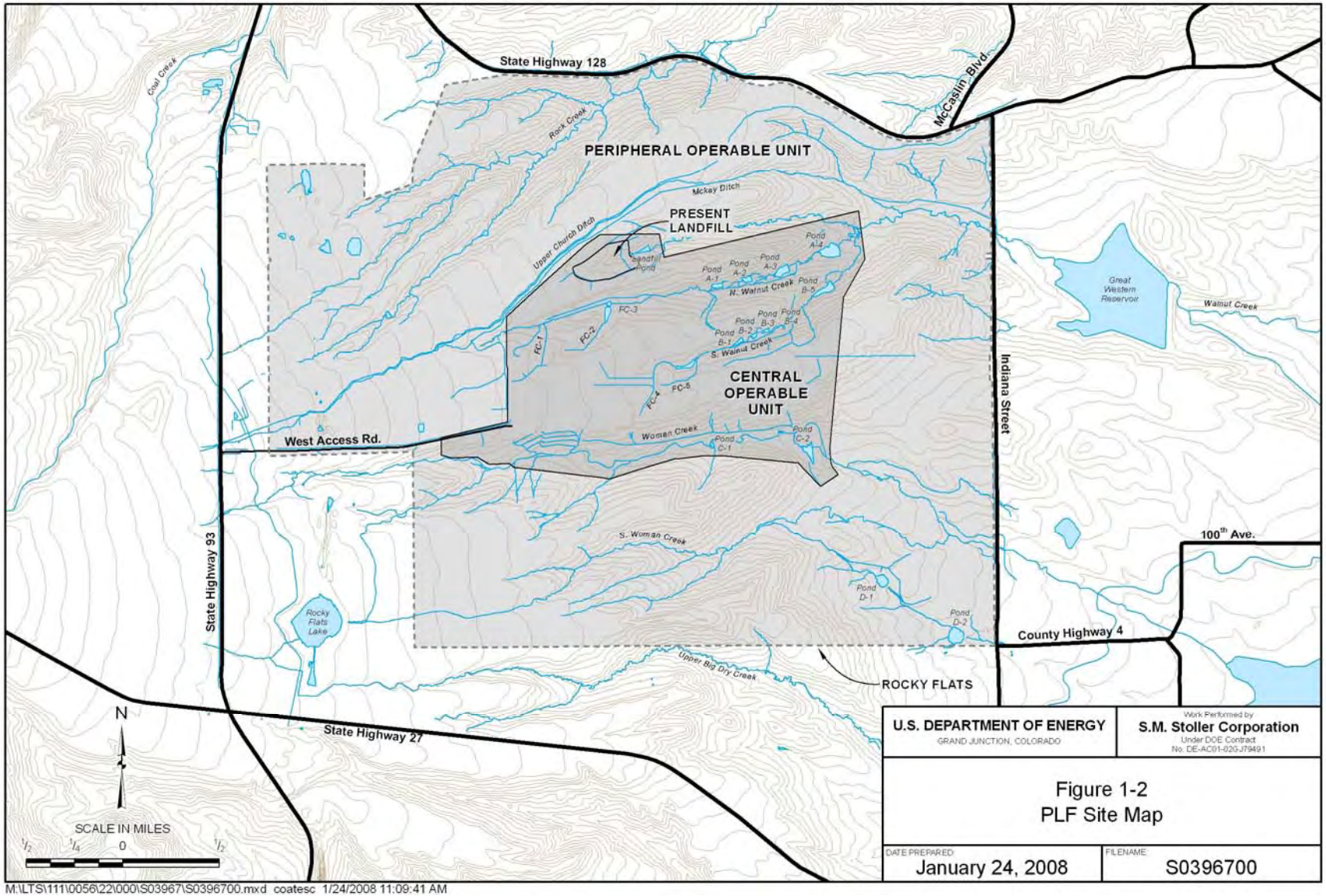
State Highway 128
McCaslin Blvd.
Coal Creek
Rock Creek
PERIPHERAL OPERABLE UNIT
Mckay Ditch
PRESENT LANDFILL
Upper Church Ditch
Landfill Pond
Pond A-1
Pond A-2
Pond A-3
Pond A-4
N. Walnut Creek
Pond B-5
Great Western Reservoir
Walnut Creek
FC-3
FC-2
FC-1
Pond B-3
Pond B-4
Pond B-2
Pond B-1
S. Walnut Creek
CENTRAL OPERABLE UNIT
FC-4
FC-5
Indiana Street
West Access Rd.
Woman Creek
Pond C-1
Pond C-2
100th Ave.
S. Woman Creek
Pond D-1
Pond D-2
State Highway 93
Rocky Flats Lake
County Highway 4
Upper Big Dry Creek
ROCKY FLATS
N
State Highway 27
SCALE IN MILES
1/2 1/4 0 1/2
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO
Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE-AC01-02GJ79491
Figure 1-2
PLF Site Map
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January 24, 2008
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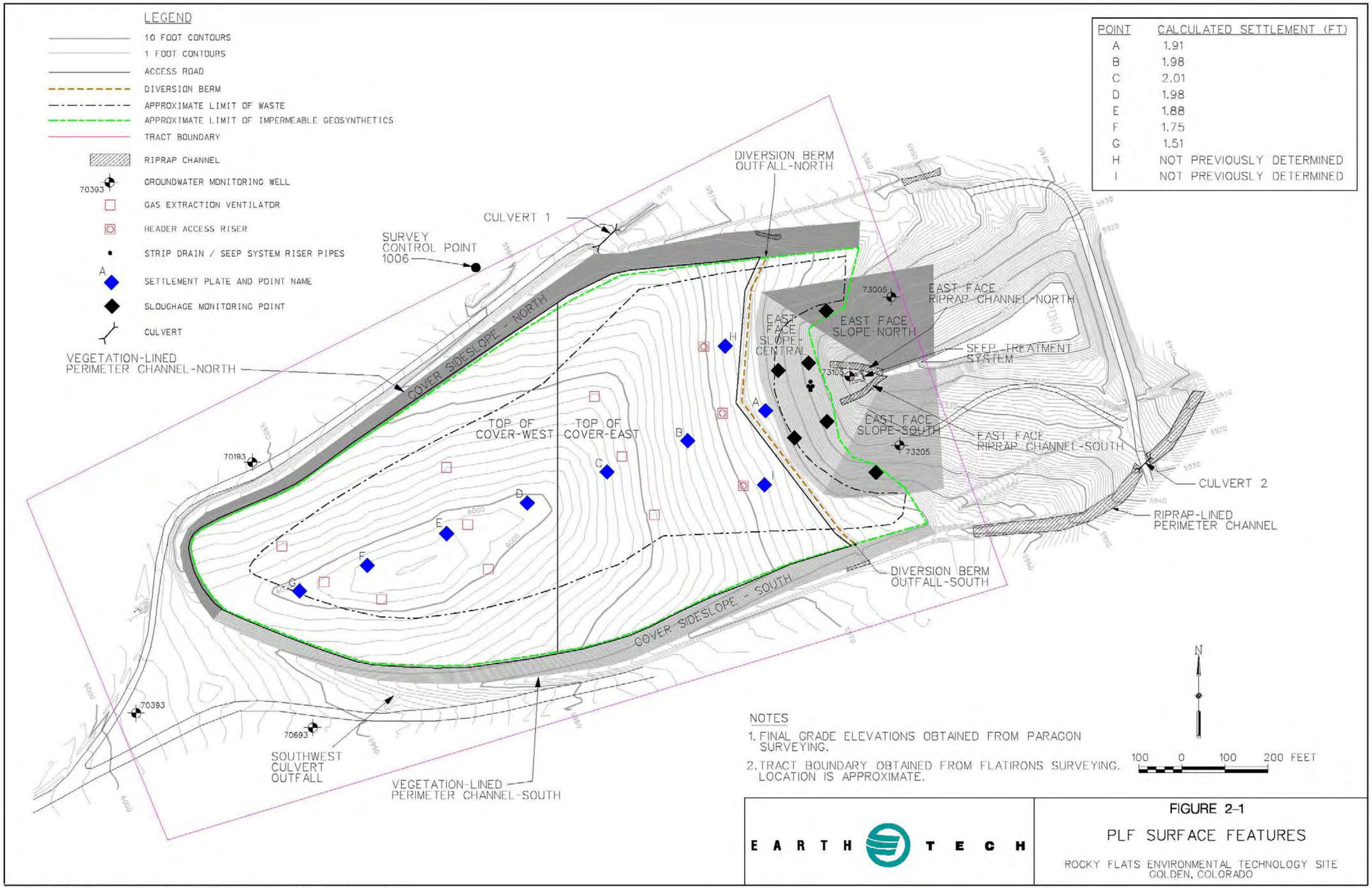


POINT	CALCULATED SETTLEMENT (FT)
A	1.91
B	1.98
C	2.01
D	1.98
E	1.88
F	1.75
G	1.51
H	NOT PREVIOUSLY DETERMINED
I	NOT PREVIOUSLY DETERMINED

NOTES

1. FINAL GRADE ELEVATIONS OBTAINED FROM PARAGON SURVEYING.
2. TRACT BOUNDARY OBTAINED FROM FLATIRONS SURVEYING. LOCATION IS APPROXIMATE.

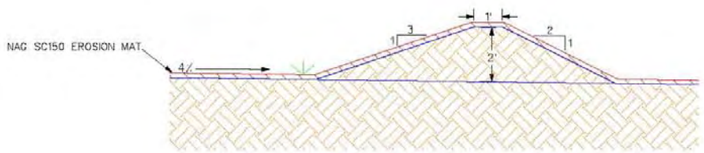
EARTH TECH

FIGURE 2-1

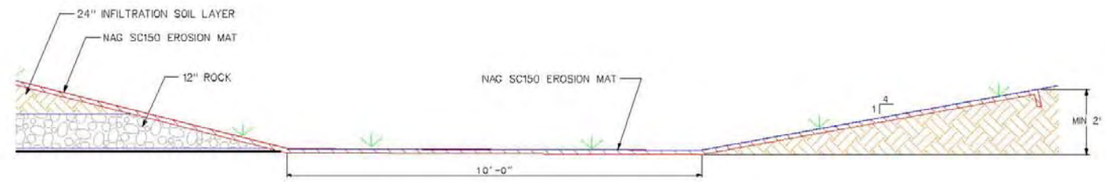
PLF SURFACE FEATURES

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

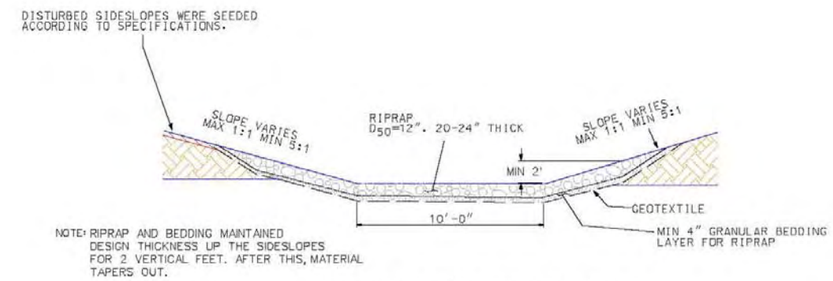
L:\GROUP\CAD\ROCKY_FLATS\New_Design2004\PLFM&M\PLFRev1.dgn DATE: 4/20/06



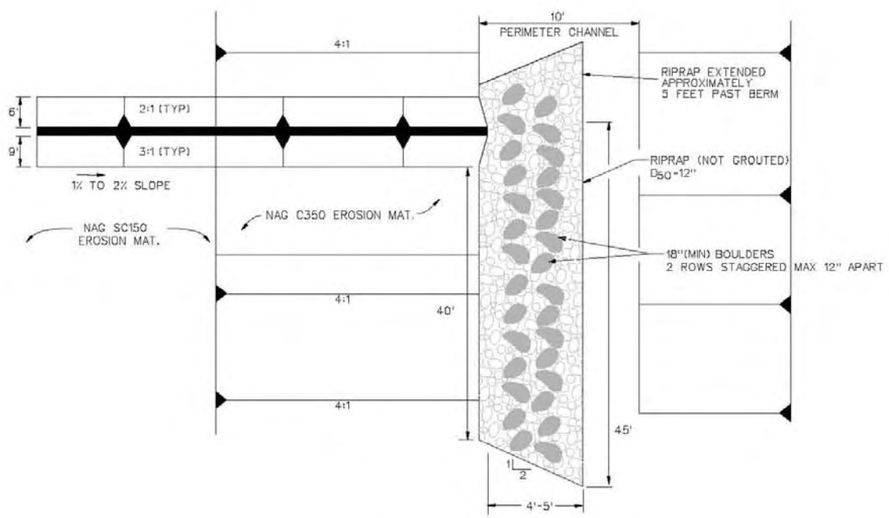
DIVERSION BERM
NTS



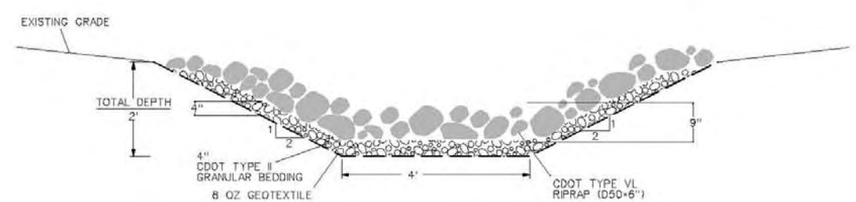
VEGETATION-LINED PERIMETER CHANNEL
NTS



RIPRAP-LINED PERIMETER CHANNEL
NTS



DIVERSION BERM OUTFALL
NTS



EAST FACE RIPRAP CHANNEL SECTION
NTS

E A R T H T E C H

FIGURE 3-1
PLF STORMWATER MANAGEMENT STRUCTURE DETAILS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

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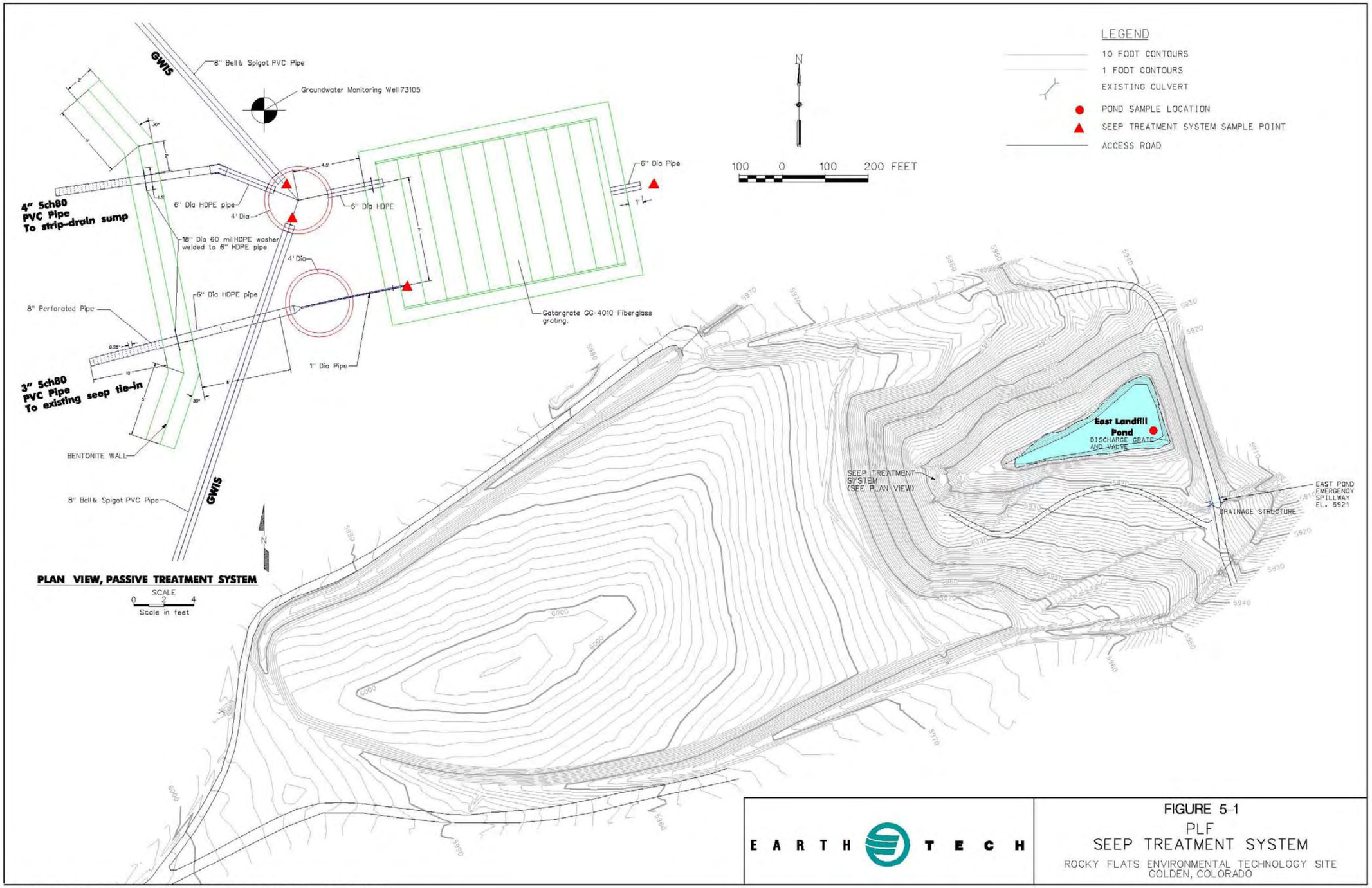
LEGEND
10 FOOT CONTOURS
1 FOOT CONTOURS
EXISTING CULVERT
POND SAMPLE LOCATION
SEEP TREATMENT SYSTEM SAMPLE POINT
ACCESS ROAD
N
100 0 100 200 FEET
GWIS
8" Bell & Spigot PVC Pipe
Groundwater Monitoring Well 73105
4" Sch80 PVC Pipe To strip-drain sump
6" Dia HDPE pipe
4' Dia
6" Dia HDPE
6" Dia Pipe
18" Dia 60 mil HDPE washer welded to 6" HDPE pipe
4' Dia
8" Perforated Pipe
6" Dia HDPE pipe
Gatorgrate GG-4010 Fiberglass grating.
1" Dia Pipe
3" Sch80 PVC Pipe To existing seep tie-in
BENTONITE WALL
8" Bell & Spigot PVC Pipe
GWIS
PLAN VIEW, PASSIVE TREATMENT SYSTEM
SCALE
0 2 4
Scale in feet
East Landfill Pond
DISCHARGE GRATE AND VALVE
SEEP TREATMENT SYSTEM (SEE PLAN VIEW)
EAST POND EMERGENCY SPILLWAY EL. 5921
DRAINAGE STRUCTURE
EARTH TECH
FIGURE 5-1
PLF
SEEP TREATMENT SYSTEM
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO
L:\GROUP\CAD\ROCKY_FLATS\New_Design2004\PLFM&M\SeepLoc1.dgn DATE: 8/23/05

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Table

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Table 4−1. Groundwater Monitoring Wells at the PLF

Well ID	Type	Installation Date	Screen Length (feet)	Borehole Depth (feet bgs)	Well Diameter (inches)	Depth to Top of Screen (feet bgs)	Depth to Bedrock (feet bgs)
70193	Upgradient	1/15/93	15	39.4	2	22.30	19.50
70393	Upgradient	2/2/93	15	26.0	2	7.80	22.80
70693	Upgradient	12/4/92	20	30.3	2	8.50	28.50
73005	Downgradient	6/27/05	20	28.0	2	4.60	0.00
73105	Downgradient	6/27/05	20	27.7	2	5.65	12.50
73205	Downgradient	6/27/05	25	32.0	2	4.55	4.20

Notes:
bgs below ground surface

End of current text

Appendix A

Present Landfill Inspection Form

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PRESENT LANDFILL – MONITORING AND MAINTENANCE PROGRAM

INSPECTION FORM

INSPECTOR: _____ DATE: _____TIME: _____ REVIEWED BY: _____

TEMPERATURE: _____ WEATHER CONDITIONS: _____REVIEW DATE: _____

METEOROLOGICAL STATION LOCATION: _____

SUBSIDENCE/CONSOLIDATION

REGION	EVIDENCE OF CRACKS?	EVIDENCE OF DEPRESSIONS?	EVIDENCE OF SINK HOLES?	EVIDENCE OF PONDING?	OTHER (DESCRIBE BELOW)
TOP OF COVER – WEST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
TOP OF COVER – EAST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SIDESLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SIDESLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – CENTRAL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – NORTH SEEP*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Settlement Plates and side-slope monitoring points to be inspected for integrity.
During Year 1, they will be surveyed quarterly, and annually thereafter

Integrity intact?
☐ Yes ☐ No

MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

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* AREA OF SEEP IS OUTSIDE OF LANDFILL COVER AND EAST OF THE COVER ANCHOR TRENCH

SLOPE STABILITY

REGION	EVIDENCE OF CRACKS?	EVIDENCE OF BLOCK OR CIRCULAR FAILURE?	EVIDENCE OF SEEPS?	OTHER (DESCRIBE BELOW)
COVER SIDESLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SIDESLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
PERIMETER CHANNEL OUTER SLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
PERIMETER CHANNEL OUTER SLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – CENTRAL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – NORTH SEEP*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

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* AREA OF SEEP IS OUTSIDE OF LANDFILL COVER AND EAST OF THE COVER ANCHOR TRENCH

SOIL COVER

REGION	EVIDENCE OF SOIL DEPOSITION OR EROSION?	EVIDENCE OF EROSION RILLS/GULLIES?	EVIDENCE OF BURROWING ANIMALS?	OTHER (DESCRIBE BELOW)
TOP OF COVER – WEST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
TOP OF COVER – EAST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SIDESLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SIDESLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
EAST FACE SLOPE –- CENTRAL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
AREA WHERE EAST SLOPE CENTRAL MEETS EAST SLOPE NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
AREA WHERE EAST SLOPE CENTRAL MEETS EAST SLOPE SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
	VENT CAPS IN PLACE & SECURE?	**STANDPIPES IN GOOD CONDITION?**	**BIRDS OR INSECTS IN VENT CAPS?**	
COVER – BAROMETRIC VENTS	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

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VEGETATION

REGION	CONDITION OF GRASS	UNWANTED VEGETATION PRESENT*?	OTHER (DESCRIBE BELOW)
TOP OF COVER – WEST		☐ Yes ☐ No	
TOP OF COVER – EAST		☐ Yes ☐ No	
EAST FACE SLOPE – NORTH		☐ Yes ☐ No	
EAST FACE SLOPE – SOUTH		☐ Yes ☐ No	
EAST FACE SLOPE – CENTRAL		☐ Yes ☐ No	
COVER SIDESLOPE – NORTH		☐ Yes ☐ No	
COVER SIDESLOPE – SOUTH		☐ Yes ☐ No	
VEGETATION-LINED PERIMETER CHANNEL – NORTH		☐ Yes ☐ No	
VEGETATION-LINED PERIMETER CHANNEL – SOUTH		☐ Yes ☐ No	

* Unwanted vegetation includes weeds and deep-rooting trees.

MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

SEEP TREATMENT SYSTEM

REGION	EVIDENCE OF PLUGGING, OBSTRUCTIONS, OR EXCESS DEBRIS?	EVIDENCE OF CRACKS OR DETERIORATION?	OTHER (DESCRIBE BELOW)
GWIS INLET PIPES	☐ Yes ☐ No	☐ Yes ☐ No	
STRIP DRAIN INLET PIPE	☐ Yes ☐ No	☐ Yes ☐ No	
NORTH MANHOLE OUTLET PIPE	☐ Yes ☐ No	☐ Yes ☐ No	
SOUTH MANHOLE OUTLET PIPE	☐ Yes ☐ No	☐ Yes ☐ No	
TREATMENT UNIT	☐ Yes ☐ No	☐ Yes ☐ No	
TREATMENT UNIT OUTLET PIPE	☐ Yes ☐ No	☐ Yes ☐ No	
NORTH MANHOLE	☐ Yes ☐ No	☐ Yes ☐ No	
SOUTH MANHOLE	☐ Yes ☐ No	☐ Yes ☐ No	
TREATMENT UNIT GRATING	NA	☐ Yes ☐ No	

MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

STORMWATER MANAGEMENT STRUCTURES

CHANNELS/LINING

STRUCTURE	EVIDENCE OF EXCESSIVE EROSION, GULLYING, SCOUR, OR UNDERMINING?	EVIDENCE OF SETTLEMENT/ SUBSIDENCE OR DEPRESSIONS?	EVIDENCE OF BREACHING OR BANK FAILURE?	EVIDENCE OF BURROWING ANIMALS?	EVIDENCE OF SEDIMENT BUILD-UP OR OTHER BLOCKAGE?	EVIDENCE OF LINING DETERIORATION, HOLES, RIPS, OR SEPARATION?	EVIDENCE OF LINING DISPLACEMENT?
DIVERSION BERM	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
VEGETATION-LINED PERIMETER CHANNEL – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
VEGETATION-LINED PERIMETER CHANNEL – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
RIPRAP-LINED PERIMETER CHANNEL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
C350-LINED EAST FACE	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
EAST FACE RIPRAP CHANNEL – NORTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
EAST FACE RIPRAP CHANNEL – SOUTH	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

OTHER DEFICIENCIES?

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MAINTENANCE REQUIRED/COMMENTS/PHOTO LOG

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STORMWATER MANAGEMENT STRUCTURES (CONTINUED)

OUTFALLS

CHECK EACH STRUCTURE FOR EXCESSIVE EROSION AND SEDIMENT DEPTH. IF SEDIMENT DEPTH IS COMPROMISING THE DESIGN CHARACTERISTICS, REMOVE SEDIMENT.

STRUCTURE	CONDITION/SEDIMENT DEPTH
DIVERSION BERM OUTFALL – NORTH	
DIVERSION BERM OUTFALL – SOUTH	
CULVERT 1 OUTFALL	
CULVERT 2 OUTFALL	
SOUTHWEST CULVERT OUTFALL	

CULVERTS

CHECK EACH STRUCTURE FOR BLOCKAGE, SURROUNDING CONDITIONS, BREACHING, SEDIMENT BUILD-UP, AND INLET/OUTLET CONDITIONS.

STRUCTURE	CONDITION
CULVERT 1	
CULVERT 2	
SOUTHWEST CULVERT	

MAINTENANCE REQUIRED/PHOTO LOG

"RUN-ON" EROSION CONTROL

AREA	ADVERSELY AFFECTING PLF?		
RUN-ON INTO PERIMETER CHANNEL – NORTH	☐ Yes	☐ No	COMMENT:
RUN-ON INTO PERIMETER CHANNEL – SOUTH	☐ Yes	☐ No	COMMENT:
NATURAL DRAINAGE FED BY CULVERT 1	☐ Yes	☐ No	COMMENT:
NATURAL DRAINAGE FED BY NORTHEAST PERIMETER CHANNEL	☐ Yes	☐ No	COMMENT:
NATURAL DRAINAGE FED BY RIPRAP	☐ Yes	☐ No	COMMENT:

MAINTENANCE REQUIRED/PHOTO LOG

INSTITUTIONAL CONTROLS

ITEM			
EVIDENCE OF EXCAVATION(S) OF COVER AND IMMEDIATE VICINITY OF COVER?	☐ Yes	☐ No	COMMENT:
EVIDENCE OF CONSTRUCTION OF ROADS OR TRAILS ON COVER OR BUILDINGS?	☐ Yes	☐ No	COMMENT:
EVIDENCE OF UNAUTHORIZED ENTRY?	☐ Yes	☐ No	COMMENT:
EVIDENCE OF DRILLING OF WELLS OR USE OF GROUNDWATER?	☐ Yes	☐ No	COMMENT:
DISRUPTION OR DAMAGE OF SEEP TREATMENT SYSTEM?	☐ Yes	☐ No	COMMENT:
DAMAGE OR REMOVAL OF ANY SIGNAGE OR GROUNDWATER MONITORING WELLS?	☐ Yes	☐ No	COMMENT:

OTHER DEFICIENCIES/PHOTO LOG

ACTION ITEMS

DEFICIENCY	DATE NOTED	ACTION	DATE COMPLETED	COMMENTS

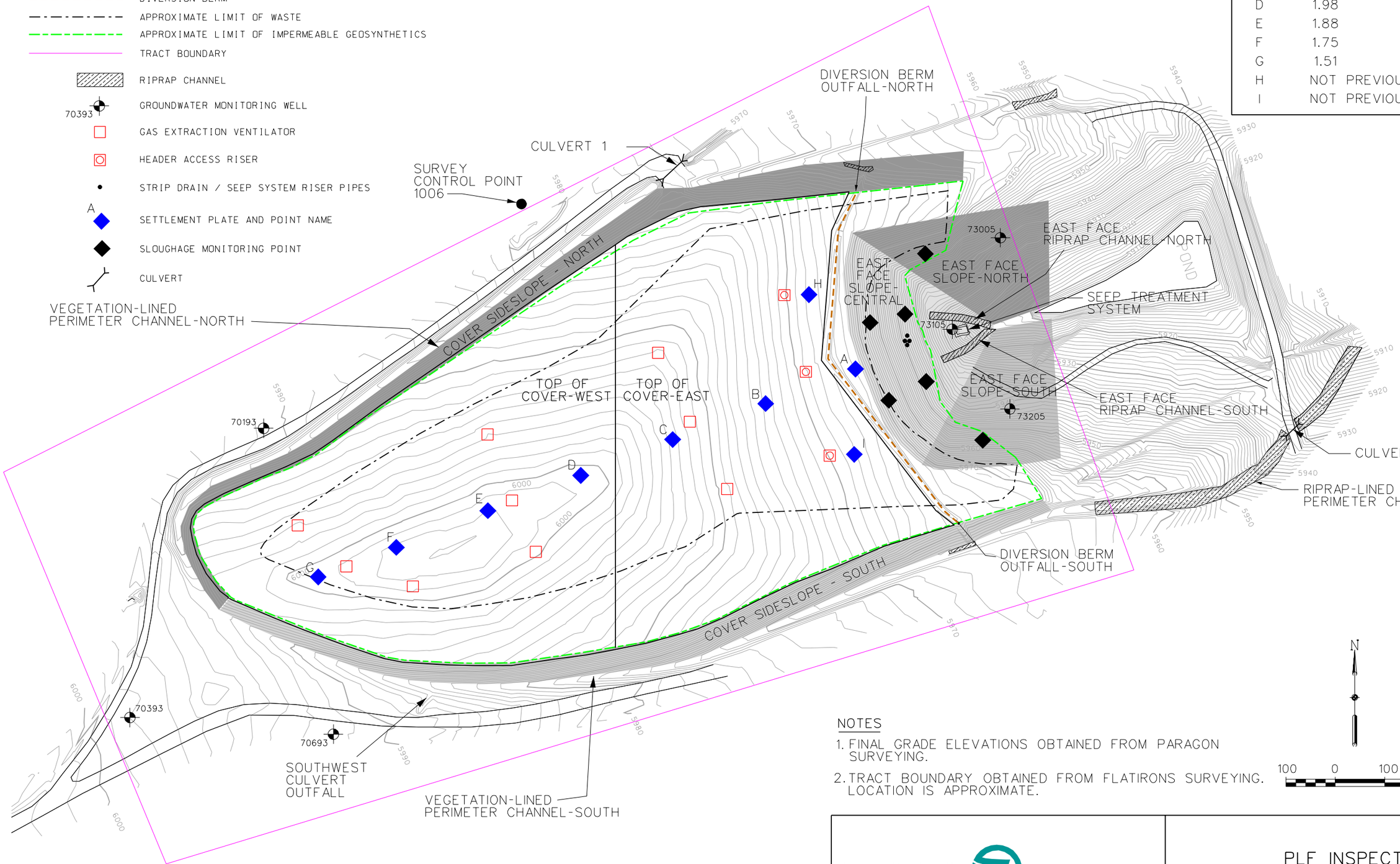
INSPECTOR SIGNATURE: _____ DATE: _____

REVIEWER SIGNATURE: _____ DATE: _____

LEGEND

- 10 FOOT CONTOURS
- 1 FOOT CONTOURS
- ACCESS ROAD
- DIVERSION BERM
- APPROXIMATE LIMIT OF WASTE
- APPROXIMATE LIMIT OF IMPERMEABLE GEOSYNTHETICS
- TRACT BOUNDARY
- RIPRAP CHANNEL
- 70393 GROUNDWATER MONITORING WELL
- GAS EXTRACTION VENTILATOR
- HEADER ACCESS RISER
- STRIP DRAIN / SEEP SYSTEM RISER PIPES
- A SETTLEMENT PLATE AND POINT NAME
- SLOUGHAGE MONITORING POINT
- CULVERT

POINT	CALCULATED SETTLEMENT (FT)
A	1.91
B	1.98
C	2.01
D	1.98
E	1.88
F	1.75
G	1.51
H	NOT PREVIOUSLY DETERMINED
I	NOT PREVIOUSLY DETERMINED



NOTES

1. FINAL GRADE ELEVATIONS OBTAINED FROM PARAGON SURVEYING.
2. TRACT BOUNDARY OBTAINED FROM FLATIRONS SURVEYING. LOCATION IS APPROXIMATE.

EARTH TECH

PLF INSPECTIONS

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

L\GROUP\CAD\ROCKY_FLATS\New_Design2004\PLFM&M\plfinsp3.dgn DATE: 4/25/06

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Appendix B

Groundwater Well Boring Logs/Construction Summaries

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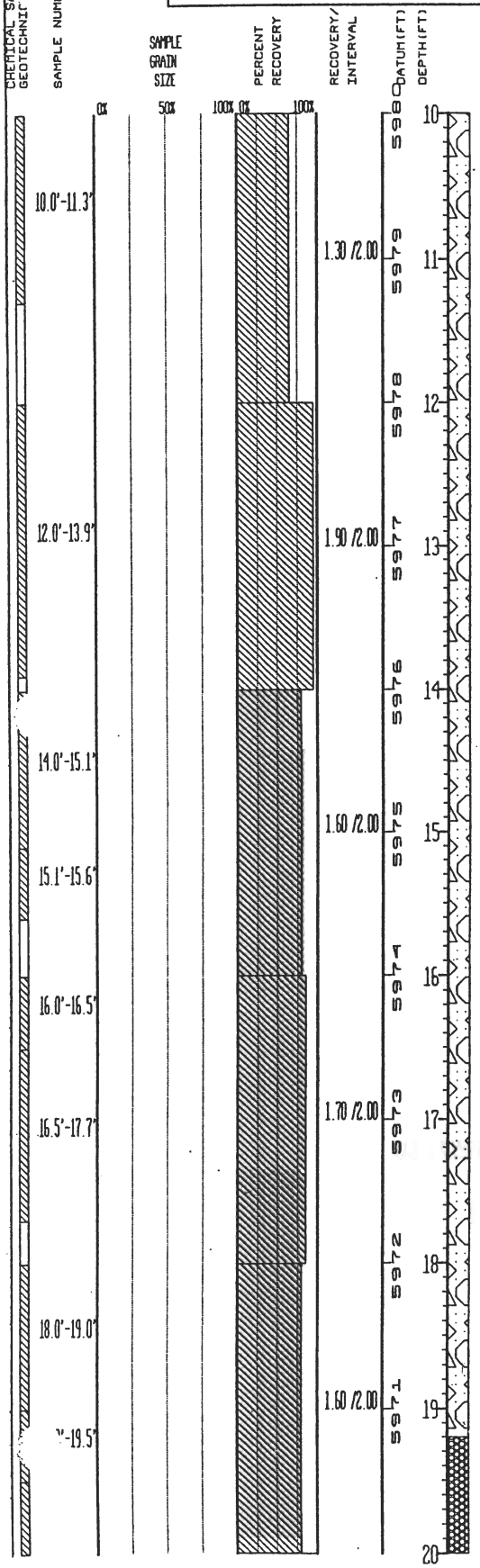
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 39.4	GROUND ELEVATION (FT)	5990.00	PROJECT NUMBER:	9890973	LOG OF BORING NUMBER:
NORTH:	752688	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	JAB/KJT	70193
EAST:	2082674	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN):	10.25	DATE DRILLED:	01/15/93	

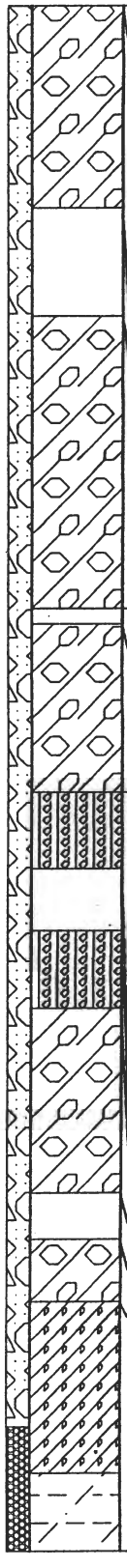
REMARKS: MOBIL DRILL B-57; HSA, CEMENT GROUT 0.0'-19.5', BENTONITE SEAL 19.5'-21.5', SAND 21.5'- 37.6', NATURAL BACK- FILL 37.6'-39.4'; CENTRALIZERS PLACED 18.5' AND 38.55'; HOLE DIAMETER 10.25" 0.0'- 37.5' AND 3.0" 37.5' - 39.4'; 2.0' SUMP 37.3'- 39.3' DEPTH TO BEDROCK 19.5'.

CHEMICAL SAMPLE DEPTH / GEOTECHNICAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% – 50%)	PERCENT RECOVERY (100% 0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0.0'-1.4'				1.40 /2.00	5990 5989	0–1			GM:	Sandy Gravel with some silt. Dark brown (7.5 YR 3/2). Coarse to fine gravel (max=2 1/2", mean=1 1/2"diam), very fine to coarse sand (mean=medium) in clayey silt matrix. Well graded subangular to subrounded gravel and sand composed mainly of quartzite and quartz with some granite, feldspar metamorphic frags. Not bedded, slightly moist. 65% Gravel, 20% sand, 10% silt, and 5% clay.
										No core recovery (1.4'-2.0')
2.0'-3.5'				1.90 /2.00	5988 5987	2–3			SM:	Gravelly sand with some silt and clay. Reddish brown (2.5 YR 4/4). Fine to medium gravel (max=2", mean=3/4"diam), very fine to coarse sand (mean=medium), in a silty clay matrix. Well graded. Angular to subangular gravel and sand comprised of granite, quartzite, schist, and quartz. Gravel strongly weathered and often ground to powder. Not bedded, moist. 39% Gravel, 43% sand, 13% silt, and 5% clay.
3.5'-3.9'					5986	4			GW:	Sandy Gravel. Light olive brown (2.5 Y 5/3). Fine to coarse gravel (max=2", mean=1 1/4"diam), angular to subrounded. Very fine to coarse sand (mean=coarse), subangular to subrounded. Gravel and sand mainly composed of rock frags, weathered granite, schist, and quartzite. Not bedded, slightly moist. 45% Gravel, 46% sand, 7% silt, 2% clay.
4.0'-6.0'				2.00 /2.00	5985	5				No core recovery (3.9'-4.0')
									GW:	Same as above
6.0'-7.1'				1.10 /2.00	5984 5983	6–7			SM:	Gravelly sand with some silt. Light olive brown (2.5 Y 5/6 to 2.5 Y 6/4). Coarse to fine gravel (max=2 1/2", mean=1" diam) and very fine to coarse (mean=coarse) sand, in clayey silt matrix. Well graded. Angular to subrounded gravel and sand composed of quartzite, quartz, granite, schist, with some sand of feldspar and mafic minerals. Not bedded, moist. 30% Gravel, 45% sand, 16% silt, 9% clay.
										No core recovery (7.1'-8.0')
8.0'-8.5'					5982	8			SM:	Same as above
8.5'-9.4'				1.60 /2.00	5981	9–10			SC:	Clayey Sand with Some silt and gravel. Light yellowish brown (2.5 Y 6/4). Coarse to fine gravel (max=2", mean=1/2"diam) and very fine to coarse sand (mean=fine) in silty clay matrix. Well graded. Angular to subangular sand and gravel composed of quartzite, quartz, granite, and feldspar. Not bedded, moist. 21% Gravel, 39% sand, 28% clay, and 12% silt.
										No core recovery (9.4'-10.0')

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 39.4	GROUND ELEVATION (FT):	5990.00	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752688	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	JAB/KJT	70193
EAST:	2082674	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN):	10.25	DATE DRILLED:	01/15/93	

REMARKS: MOBIL DRILL B-57; HSA, CEMENT GROUT 0.0'-19.5', BENTONITE SEAL 19.5'-21.5', SAND 21.5'- 37.6', NATURAL BACK- FILL 37.6'-39.4'; CENTRALIZERS PLACED 18.5' AND 38.55'; HOLE DIAMETER 10.25" 0.0'- 37.5' AND 3.0" 37.5' - 39.4'; 2.0' SUMP 37.3'- 39.3' DEPTH TO BEDROCK 19.5'.





UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	No core recovery (9.4'-10.0')
GC:	Sandy Gravel with some clay. Light yellowish brown (2.5 Y 6/4). Coarse to fine gravel (max=2 1/2", mean=1 1/4"diam) and very fine to coarse sand (mean=fine) in silty clay matrix. Well graded. Angular to rounded gravel, some broken by drilling, subangular to subrounded sand. Gravel composed of quartzite, granite, and some schist. Sand composed of quartz, rock fragments, feldspars and micas. Not bedded, moist. 44% Gravel, 39% sand, 12% clay, and 5% silt.
	No core recovery (11.3'-12.0')
GC:	Sandy Gravel with some clay. Strong brown (7.5 YR 5/6). Very coarse to fine gravel (max=3", mean=1"diam) and very fine to coarse sand (mean=coarse) in silty clay matrix. Well graded angular to subrounded gravel and subangular to subrounded sand. Gravel composed of quartzite, quartz, granite, schist; sand composed of quartz, feldspar, quartzite, granite, micas and mafic minerals. Moist to wet. 45% Gravel, 32% sand, 15% clay, and 8% silt
	No core recovery (13.9'-14.0')
GC:	Same as above
SM:	Silty Gravelly Sand. Light yellowish brown (2.5 Y 6/4) to light brown (7.5 YR 6/4). Coarse to fine gravel (max=2 1/2", mean=3/4"diam) and very fine to coarse sand (mean=coarse) in clayey silt matrix. Well graded. Angular to subrounded gravel and sand composed of quartzite, quartz, granite, and schist with some sand of feldspar, micas, mafic minerals. Not bedded, saturated. 18.5% Gravel, 55.5% sand, 20% silt, and 6% clay.
	No core recovery (15.6'-16.0')
SM:	Same as above
GC:	Sandy Gravel with some clay. Same as interval from 12.0' to 15.1'.
	No core recovery (17.7'-18.0')
GC:	Same as above. Saturated.
SC:	Clayey Gravelly Sand. Light brownish gray (2.5 Y 6/2) to dark brown (7.5 YR 4/4) Fine gravel and very fine to coarse sand (mean=medium) composed of same composition as above. Decreasing sand and gravel with depth - transition to bedrock clay. Clay is of low plasticity. Crudely bedded at boundary with reworked bedrock. Moist. 10% Gravel, 45% sand, 35% clay, and 10% silt.

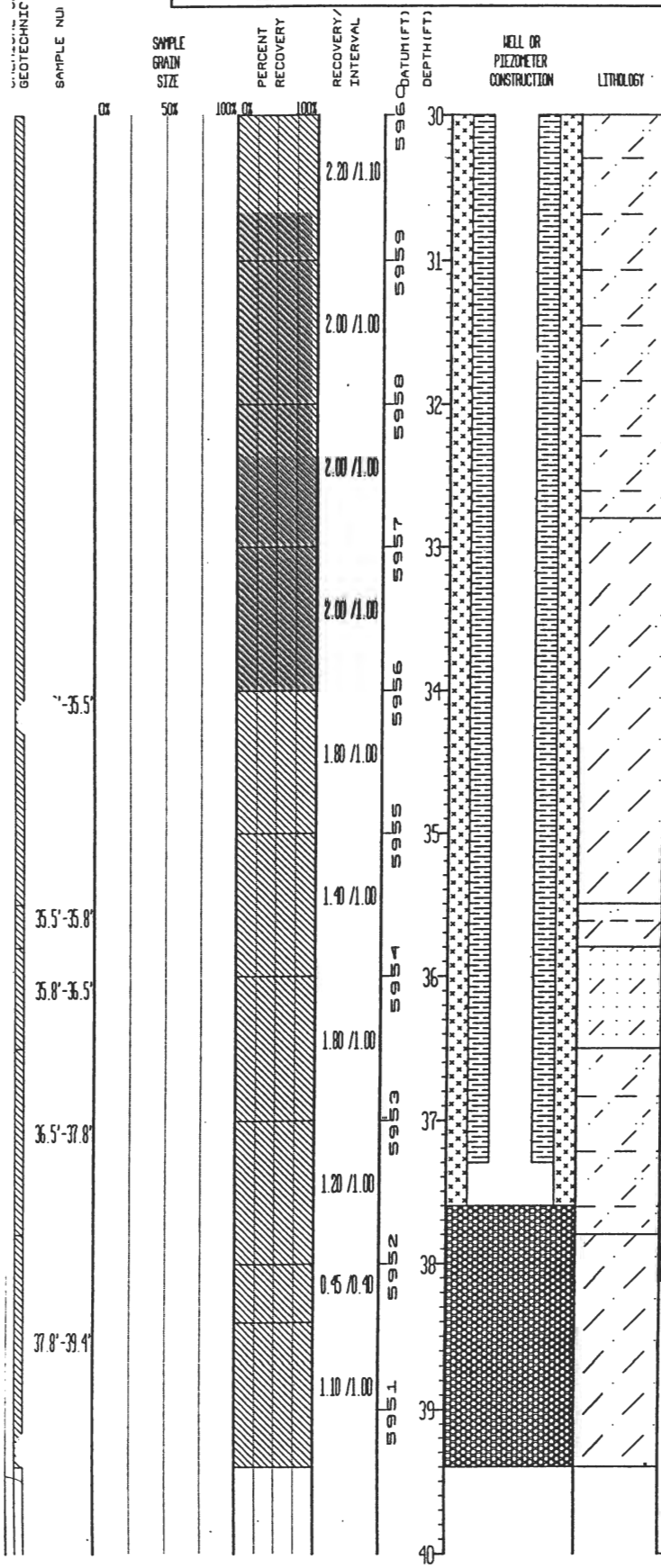
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 39.4	GROUND ELEVATION (FT):	5990.00	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752688	AREA: 007 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	JAB/KJT	70193
EAST:	2082674	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN):	10.25	DATE DRILLED:	01/15/93	

REMARKS: MOBIL DRILL B-57; HSA, CEMENT GROUT 0.0'-19.5', BENTONITE SEAL 19.5'-21.5', SAND 21.5'- 37.6', NATURAL BACK- FILL 37.6'-39.4'; CENTRALIZERS PLACED 19.5' AND 38.55'; HOLE DIAMETER 10.25" 0.0'- 37.5' AND 3.0" 37.5' - 39.4'; 2.0' SUMP 37.3'- 39.3' DEPTH TO BEDROCK 19.5'.

GEOTECHNICAL SAMPLE DEPTH	SAMPLE NO.	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5970	20	01/15/93 ▽		SILTY CLAYSTONE	Silty Claystone with trace of very fine sand. Light olive gray (5 Y 6/2) to olive yellow (2.5 Y 6/8) where stained by Fe-oxides, moderately sorted, porosity=18%, no cement, moderately to highly friable, massive claystone with mottled coloring due to weathering, increasing silt content with depth. Moist. 20% Silt and 80% clay.
19.5'-22.0'				2.00 /2.00	5969	21				
					5968	22			CLAYEY SILTSTONE	Clayey Siltstone with some very fine sand. Gray (5 Y 6/1) to light yellowish brown (2.5 Y 6/4) and olive yellow (2.5 Y 6/8), moderately sorted, porosity=20%-25%, no cement, highly to moderately friable, composed of varying proportions of clay and silt, siltstone often contains up to 10% of very fine sand, mottled coloring due to weathering, thin and irregular subparallel bedding to disturbed bedding, not fractured, moist to wet. 5% Sand, 65% silt, and 30% clay.
				2.20 /2.00	5967	23				
					5966	24				
22.0'-26.8'				1.00 /1.00	5965	25				
				1.00 /1.00	5964	26				
				1.40 /0.90	5963	27			CLAYEY SILTSTONE	Clayey Siltstone. Light olive brown (2.5 Y 5/6) to olive yellow (2.5 Y 6/8), variable porosity 10%-25%, no cement, highly friable, silt and clay vary throughout interval but bedding is not apparent, much of core heavily damaged during drilling, mottled due to Fe-oxide staining, weathered not fractured (except where damaged), moist to wet (saturated) bottom 0.5' of interval stained bright olive yellow (Fe-hydroxide stain). Carbonaceous fragments present, especially from 30.0'-31.0'. 60% Silt and 40% clay.
				1.70 /1.00	5962	28				
				1.10 /1.00	5961	29				
				1.70 /1.00		30				
26.8'-32.8'										

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 39.4	GROUND ELEVATION (FT): 5990.00	PROJECT NUMBER: 989073	LOG OF BORING NUMBER:
NORTH: 752688	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN): 2	GEOLOGIST: JAB/KJT	70193
EAST: 2082674	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN): 10.25	DATE DRILLED: 01/15/93	

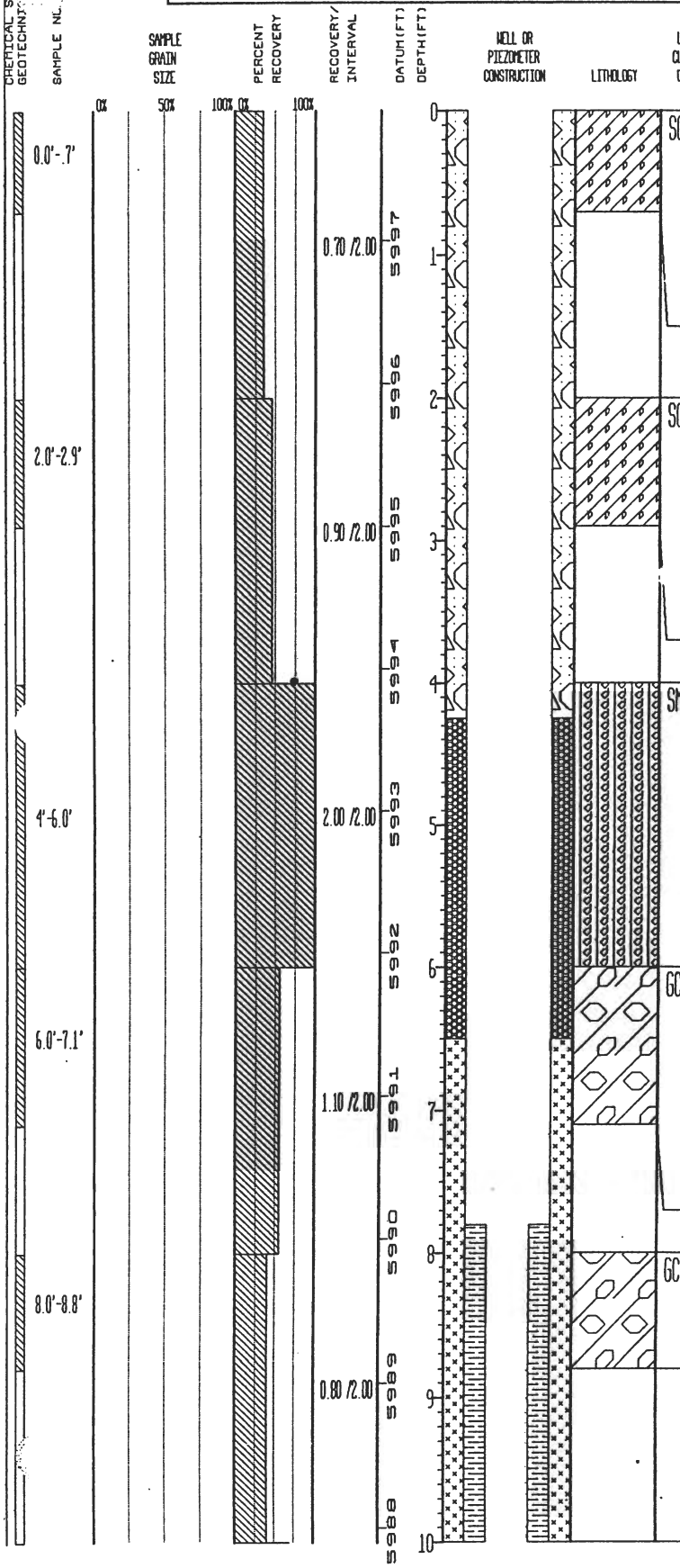
REMARKS: MOBIL DRILL B-57; HSA, CEMENT GROUT 0.0'-19.5', BENTONITE SEAL 19.5'-21.5', SAND 21.5'-37.6', NATURAL BACK-FILL 37.6'-39.4'; CENTRALIZERS PLACED 18.5' AND 38.55'; HOLE DIAMETER 10.25" 0.0'-37.5' AND 3.0" 37.5' - 39.4'; 2.0' SUMP 37.3'-39.3' DEPTH TO BEDROCK 19.5'



	DESCRIPTION
CLAYEY SILTSTONE:	Clayey Siltstone. Light olive brown (2.5 Y 5/6) to olive yellow (2.5 Y 6/8), variable porosity 10%-25%, no cement, highly friable, silt and clay vary throughout interval but bedding is not apparent, much of core heavily damaged during drilling, mottled due to Fe-oxide staining, weathered not fractured (except where damaged), moist to wet (saturated) bottom 0.5" of interval stained bright olive yellow (Fe-hydroxide stain). Carbonaceous fragments present, especially from 30.0'-31.0'. 60% Silt and 40% clay.
SILTSTONE:	Siltstone with some clay. Light olive brown (2.5 Y 5/4) to olive yellow (2.5 Y 6/8), porosity = 20%-25%, no cement, highly to moderately friable, clay content varies, sub-horizontal bedding occurs in siltiest intervals, not fractured but damaged during drilling, moist. 85% Silt and 15% clay.
SILTY CLAYSTONE:	Silty Claystone. Dark grayish brown (2.5 Y 4/2), porosity = 10%-15%, no cement, slightly to moderately friable, grades into overlying siltstone, not bedded, not fractured but broken during drilling, slightly moist. 70% Clay and 30% sand.
SILTY SANDSTONE:	Silty Sandstone. Light gray (5 Y 6/1) to olive yellow (2.5 Y 6/6), very fine sand, moderately sorted, porosity = 25%, no cement, highly friable, intermixed with claystone and siltstone but not bedded. 70% Sand, 25% silt, and 5% clay.
CLAYEY SILTSTONE:	Clayey Siltstone. Dark gray (5 Y 4/1) to dark grayish brown (2.5 Y 4/2), porosity varies from 10% to 25%, no cement, slightly to moderately friable, Fe-oxide stains present but limited, thin irregular planar bedding. 60% Silt and 40% clay.
SILTSTONE:	Siltstone with some clay. Light olive brown (2.5 Y 5/4) to gray (5 Y 5/1), porosity=20%-25%, no cement, moderately friable, clay content varies (max=25%) in thin 1" intervals within siltstone, irregular bedding, subhorizontal, not fractured, moist. 85% Silt and 15% clay. Total Depth 39.4'.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.00	GROUND ELEVATION (FT):	5997.90	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752090	AREA: 007 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	J. BOYLAN	70393
EAST:	2082389	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN):	7	DATE DRILLED:	02/02/93	

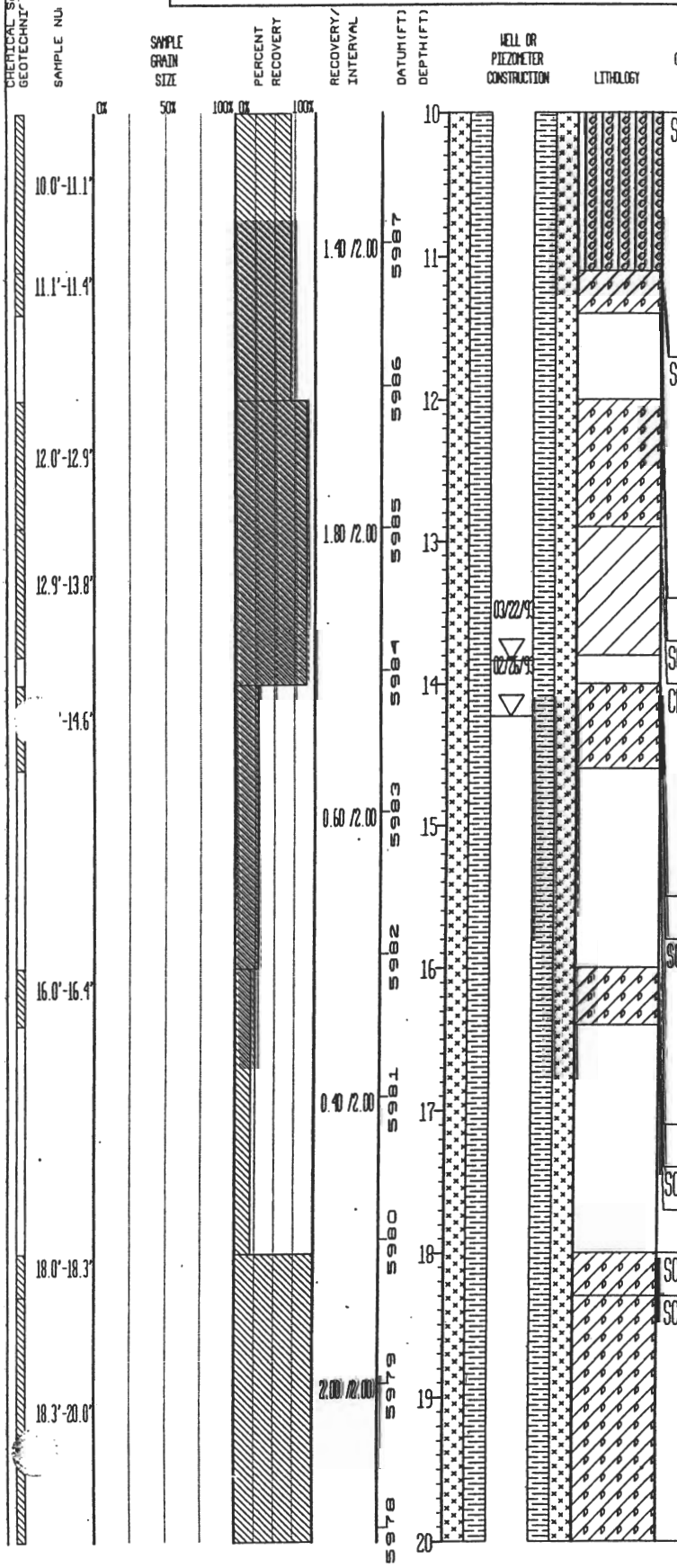
REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.25', BENTONITE SEAL 4.25'-6.5', SAND 6.5'-24.5', NATURAL BACKFILL 24.5'-26'; CENTRALIZERS PLACED AT 3.8' AND 24.2'; 2' SUMP 22.8'-24.8'; DEPTH TOBEDROCK 22.8'.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SC:	Gravelly Sand with silt and clay. Very dark grayish brown (10 YR 3/2). Coarse to fine sand (mean=fine) with coarse to fine gravel (max=3", mean=0.5"diam). Sand subangular to subrounded comprised of quartz, trace of dark minerals. Gravel subangular to subrounded, comprised of quartzite and igneous rock frags. Not bedded, well graded. Slightly moist. 19% Gravel, 67% sand, 7% clay, and 7% silt.
	No core recovery (0.7'-2.0').
SC:	Gravelly Clayey Sand. Grayish brown (2.5 Y 5/2), dark grayish brown (2 Y 4/3) and dark reddish gray (2.5 YR 4/6) staining. Coarse to fine sand (mean=fine) with coarse to fine gravel. Sand subangular to subrounded, comprised of quartz and a trace of dark minerals and rock frags. Gravel subangular to subrounded, comprised of igneous rock frags and quartzite. Not bedded, poorly sorted. Slightly moist. 15% Gravel, 63% sand, 14% clay, and 8% silt.
	No core recovery (2.9'-4.0').
SM:	Gravelly Sand. Light olive brown (5 Y 5/3) to olive brown (5 Y 5/3), becoming dark yellowish brown (10 YR 4/6) at base. Sand coarse to fine (mean=fine). Gravel coarse to fine (max=3", mean=1" diam). Sand subangular to subrounded, comprised of quartz with a trace of dark minerals and rock frags. Gravel subangular to subrounded comprised of quartzite and igneous rock frags. Not bedded, poorly sorted. Slightly moist. 32% Gravel, 50% sand, 7% clay, and 11% silt.
GC:	Sandy Gravel. Dark yellowish brown (10 YR 4/4) with very dark gray (2.5 YR N3) cobbles. Coarse to fine gravel (max=3", mean=2"diam), fractured; subangular to subrounded; comprised of igneous frags with some smaller granite and quartzite frags. Sand coarse to fine; subangular to subrounded; comprised of quartz, trace of dark minerals, and rock frags. Fines upward, possibly two graded (fining up) sequences. Slightly moist. 50% Gravel, 35% sand, and 15% fines.
	No core recovery (7.1'-8.0').
GC:	Same as above. See description 6.0'-7.1'.
	No core recovery (8.8'-10.0').

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.00	GROUND ELEVATION (FT): 5997.90	PROJECT NUMBER: 989073	LOG OF BORING NUMBER:
NORTH:	752090	AREA: 007 PRESENT LANDFILL	CASING DIAMETER (IN): 2	GEOLOGIST: J. BOYLAN	70393
EAST:	2082389	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN): 7	DATE DRILLED: 02/02/93	

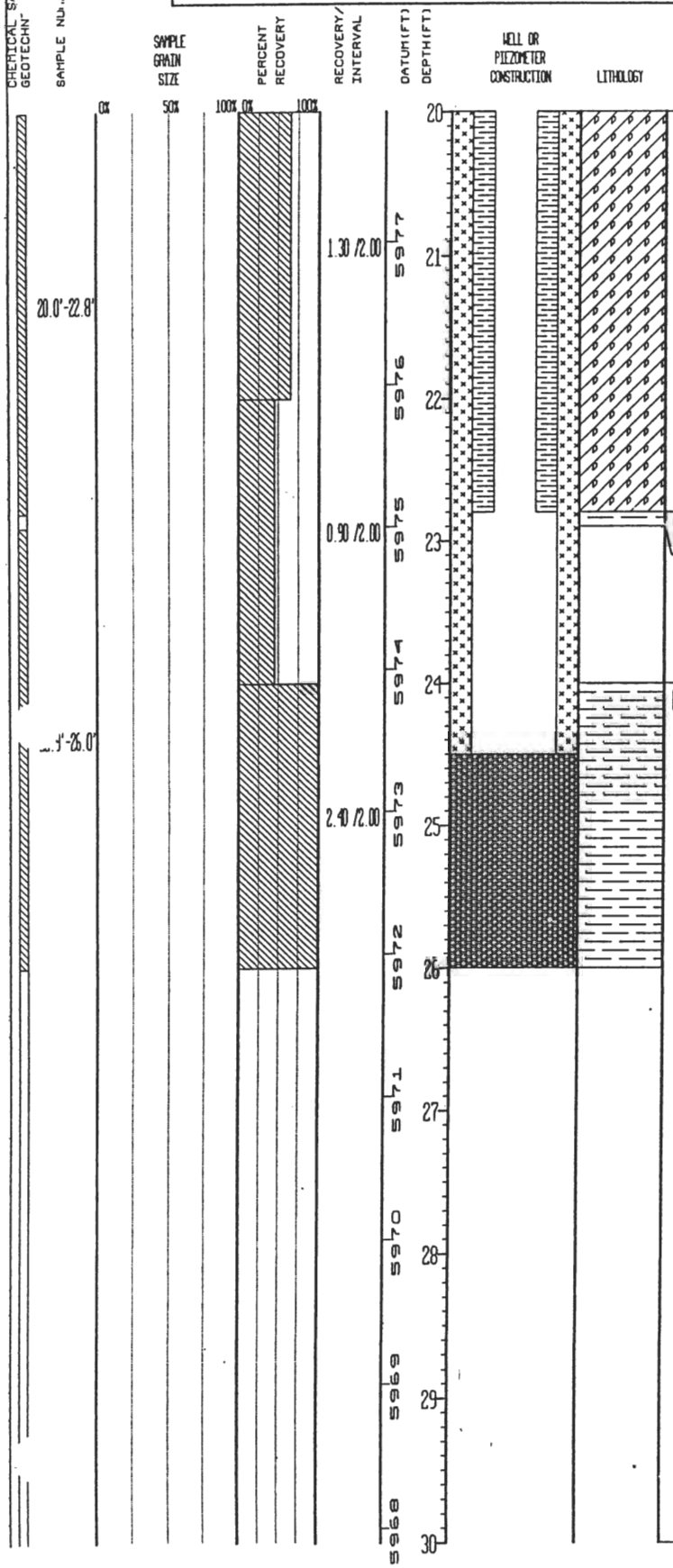
REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.25', BENTONITE SEAL 4.25'-6.5', SAND 6.5'-24.5', NATURAL BACKFILL 24.5'-26'; CENTRALIZERS PLACED AT 3.8' AND 24.2'; 2' SUMP 22.8'-24.8'; DEPTH TO BEDROCK 22.8'.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SM:	Gravelly Sand. Dark yellowish brown (10 YR 4/4) to olive gray (5 Y 5/2) with reddish brown (5 YR 4/4) staining. Fine to coarse sand (mean=fine) and coarse to fine gravel (max=2", mean=0.5" diam). Sand subangular to subrounded, comprised of quartz with a trace of mica and dark minerals. Gravel subangular to subrounded, comprised of igneous rock frags and pegmatitic quartzite. No bedding. Slightly moist. 30% Gravel, 50% sand, and 20% fines.
SC:	Sand with some gravel and clay. Light olive brown (5 Y 5/4) to brown (10 YR 5/3). Coarse to fine (mean=fine) sand and coarse to fine gravel (max=2", mean=0.5" diam). Sand subangular to subrounded, comprised of quartz with a trace of mica and dark minerals. Gravel subangular to subrounded, comprised of granitic, mafic, igneous, arkosic, and quatzite rock frags. No bedding. Slightly moist. 14% Gravel, 71% sand, and 10% clay, and 5% silt.
	No core recovery (11.4'-12.0').
SC:	Same as above. See description 11.0'-11.4'.
CL:	Sandy Clay with some gravel and silt. Mottled dark yellowish brown (10 YR 4/6) and light olive gray (5 Y 6/2). Coarse to fine gravel (max=2.5", mean=0.5" diam) and coarse to fine (mean=medium) sand. Gravel and sand angular to subrounded, comprised mainly of quartzite and schist. Low to moderate plasticity. Moderately well graded. No bedding. Slightly moist. 15% Gravel, 35% sand, 35% clay, and 15% silt.
	No core recovery (13.8'-14.0').
SC:	Gravel, sand, clay mixture. Strong brown (7.5 YR 5/6) to yellowish brown (10 YR 5/4). Gravels broken during drillling (>3" diam) and very coarse to very fine sand (mean=medium). Sand angular to subrounded. Poorly to moderately graded. Igneous and metamorphic gravels; sand is predominantly quartz. No bedding. Slightlly moist. 20% Gravel, 50% sand, and 30% fines.
	No core recovery (14.6'-16.0').
SC:	Same as above See description 14.0'-14.6'.
	No core recovery (16.4'-18.0').
SC:	Same as above See description 14.0'-14.6'.
SC:	Sand with gravel and clay. Light yellowish brown (2.5 Y 6/3) dominates to 20.0'. Fine to coarse gravel (max=2", mean= .25"-.5") and very fine to very coarse sand (mean=fine to medium) Grains subangular to subrounded, comprised of quartz and quarztitic metamorphic rock frags with abundant fe-oxide grains below 20.0'. Moderately well graded, no bedding. Coarser below 21.0'. Slightlly moist. 7% Gravel, 82% sand, 4% silt, and 7% clay.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 26.00	GROUND ELEVATION (FT): 5997.90	PROJECT NUMBER: 989073	LOG OF BORING NUMBER:
NORTH: 752090	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN): 2	GEOLOGIST: J. BOYLAN	70393
EAST: 2082389	LOCATOR NUMBER: 12J	BOREHOLE DIAMETER (IN): 7	DATE DRILLED: 02/02/93	

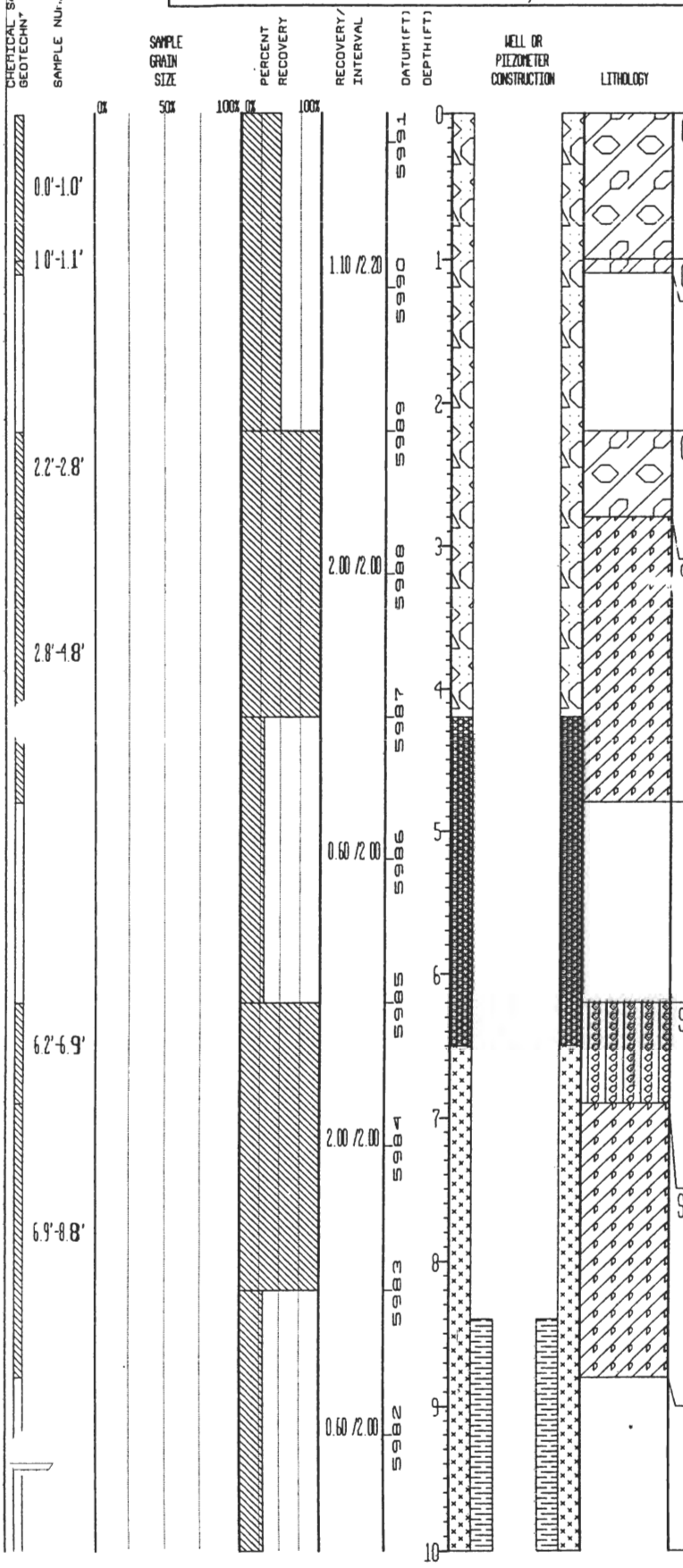
REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.25', BENTONITE SEAL 4.25'-6.5', SAND 6.5'-24.5', NATURAL BACKFILL 24.5'-26'; CENTRALIZERS PLACED AT 3.8' AND 24.2'; 2' SUMP 22.8'-24.8'; DEPTH TO BEDROCK 22.8'.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SC:	Same as above. See description 18.3'-20.0', with a color change to strong brown (7.5 YR 5/6, 4/6) to reddish yellow (7.5 YR 6/6). Coarsens below 21.0'.
CLAYSTONE:	Claystone. Top of bedrock 22.8'. See description below
	No core recovery (22.9'-24.0').
CLAYSTONE:	Claystone. Light brownish gray (2.5 Y 6/2) above 25.0' to light olive brown (2.5 Y 5/3), yellowish brown (10 YR 5/6, 5/8) and dark yellowish brown (10 YR 4/6, 3/6). Core is thin, extruded due to gravel clast pushed by auger. Trace to some silt. Porosity=5%-10%. Argilloceous cement plus Fe-oxide in yellowed areas. Non- to slightly- friable. No apparent bedding. Slightly moist. 95% Clay and 5% silt. Total Depth 26.0'.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.3	GROUND ELEVATION (FT):	5991.20	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752070	AREA: 007 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	JAB/KJT	70693
EAST:	2082799	LOCATOR NUMBER: 11J	BOREHOLE DIAMETER (IN)	10.25	DATE DRILLED:	12/04/92	

REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0 0'-4.2', BENTONITE SEAL 4.2'-6.5', SAND 6.5'-30.5', NO BACKFILL, NO CENTRALIZERS PLACED; BOREHOLE DIAMETER 10.25" 0'-28.5' AND 3" 28.5'-30', 2.1' SUMP 28.4'- 30.5'; DEPTH TO BEDROCK 28.5'



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Clayey Gravel with some Silt and Sand. Dark brown (7.5 YR 3/2) well graded coarse to fine gravel (max=1.5" diam) and fine to coarse sand in silty clay matrix. Subangular to angular sand and gravel composed of quartz and feldspar frags. Moist 70% Gravel, 10% clay, 10% sand, and 5% silt
GC	See description below. Same as 2.2'-2.8'
	No core recovery (1.1'-2.2')
GC:	Sandy Clayey Gravel. Dark red (2.5 YR 3/6) well graded fine to coarse gravel and sand in silty clay matrix. Subangular sand and gravel, slightly moist. 45% Gravel, 30% sand, 25% clay, and 5% silt
SC:	Gravelly Clayey Sand with some silt. Dark brown (7.5 YR 4/4) fine to coarse gravel (max=3" diam) and fine to coarse sand in silty clay matrix. Well graded, angular to subangular gravel composed of weathered rock frags (igneous and metamorphic), quartz, and feldspar. Sand composed of quartz and feldspar. Gravel and sand strongly weathered with some secondary clay. Slightly moist. 30% Gravel, 35% sand, 20% clay, and 15% silt
	No core recovery (4.8'-6.2')
SM:	Sandy Gravel with some silt. Light olive brown (2.5 Y 5/6) to black (N2). Poorly graded medium to fine gravel in fine to coarse sand and silt matrix with a trace of clay. Gravel and sand subangular to subrounded. Matrix contains tarry substance (creosote?). Moist. 40% Gravel, 50% sand, 8% silt, and 2% clay
SC:	Gravelly Sand with trace of clay. Brown (7.5 YR 5/4) to strong brown (7.5 YR 5/6). Well graded, coarse to fine gravel (max=2" diam) and sand (mean=coarse) in silty clay matrix. Angular to subangular gravel (broken) and subangular sand. Gravel composed of rock frags and quartz. Sand composed of rock frags, quartz, feldspar, and micas. Moist. 27% Gravel, 65% sand, 5% clay, and 3% silt
	No core recovery (8.8'-10.2')

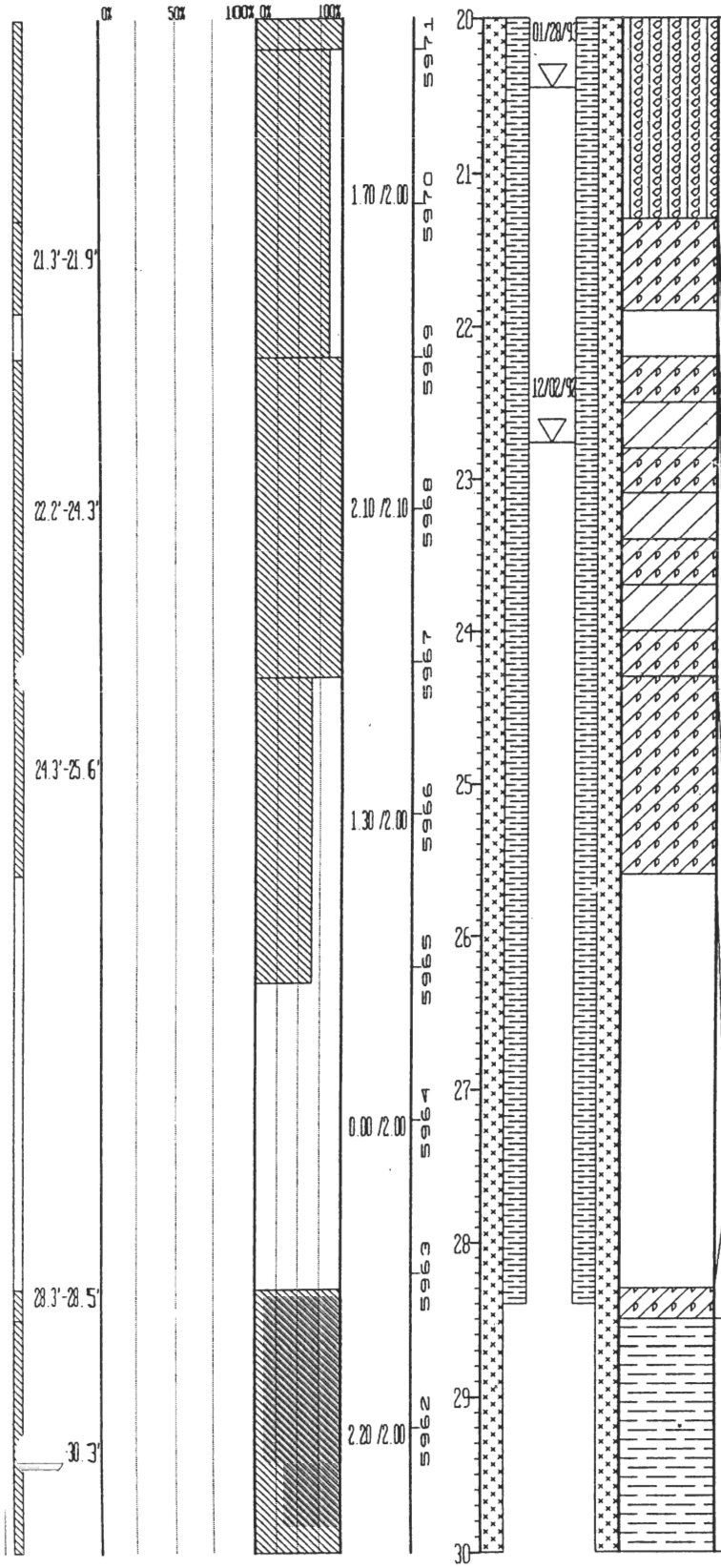
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.3	GROUND ELEVATION (FT)	5991.20	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752070	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN)	2	GEOLOGIST:	JAB/KJT	70693
EAST:	2082799	LOCATOR NUMBER: 11J	BOREHOLE DIAMETER (IN)	10.25	DATE DRILLED:	12/04/92	

REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.2', BENTONITE SEAL 4.2'-6.5', SAND 6.5'-30.5', NO BACKFILL; NO CENTRALIZERS PLACED; BOREHOLE DIAMETER 10.25" 0'-28.5' AND 3" 28.5'-30', 2.1' SUMP 28.4'- 30.5'; DEPTH TO BEDROCK 28.5'

GEOTECHNICAL SAMPLE DEPTH	SAMPLE No.	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						10				No core recovery (8.8'-10.2')
10.2'-12.6'				2.00 /2.00	5981 5980 5979	11 12			SC:	Same as above
12.6'-14.3'				2.00 /2.00	5978 5977	13 14			ML:	Sandy Silt with some clay Reddish yellow (7.5 YR 6/8) Very fine to fine sand in clayey silt matrix. Low plasticity Poorly graded. Subangular to subrounded sand, composed of quartz, micas - including biotite, rock frags, trace of black stained material throughout (not identified) Moist 50% Silt, 30% sand, and 15% clay
14.3'-15.4'				1.40 /2.00	5976 5975	15 16			SC:	Gravelly Sand. Reddish yellow (7.5 YR 6/6) fine to medium gravel and very fine to coarse sand (mean=coarse) in clay and silt matrix. Well graded. Subangular to angular sand and gravel composed of rock frags and quartz. Moist 23% Gravel, 56% sand, 11% clay, and 10% silt.
										No core recovery (15.4'-16.2')
16.2'-16.5'									SC:	Same as above.
16.5'-17.6'				2.00 /2.00	5974 5973	17 18			SC	Clayey Sand with some silt Light brownish gray (2.5 Y 6/2) to reddish yellow (7.5 YR 6/8) Very fine to fine sand in silty clay matrix. Subangular to subrounded sand composed of quartz, micas, rock frags, and feldspar Moist 50% Sand, 40% clay, and 10% silt
21.3'				2.00 /2.00	5972	19 20			SM:	Silty Sand with some gravel and trace of clay Light brownish gray (2.5 Y 6/2) to reddish yellow (7.5 Y 6/8) Heterogeneous mix of gravelly clayey sand, silty sand, and clayey silty sand. Gravel concentrated between 18.0'-18.5' (damaged core) Fine to medium gravel (max=0.5" diam) and very fine to fine sand in silty clay matrix Well graded, sub-angular to subrounded gravel and sand composed of rock frags and quartz with some feldspar, micas, and clays Moist to wet Grades into underlying clay 7% Gravel, 50% Sand, 30% silt, and 13% clay

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.3	GROUND ELEVATION (FT)	5991.20	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752070	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN):	2	GEOLOGIST:	JAB/KJT	70693
EAST:	2082799	LOCATOR NUMBER: 11J	BOREHOLE DIAMETER (IN):	10.25	DATE DRILLED:	12/04/92	

REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.2', BENTONITE SEAL 4.2'-6.5', SAND 6.5'-30.5', NO BACKFILL, NO CENTRALIZERS PLACED; BOREHOLE DIAMETER 10.25" 0'-28.5' AND 3" 28.5'-30', 2.1' SUMP 28.4'- 30.5', DEPTH TO BEDROCK 28.5'



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SM:	Silty Sand with some gravel and trace of clay. Light brownish gray (2.5 Y 6/2) to reddish yellow (7.5 Y 6/8) Heterogeneous mix of gravelly clayey sand, silty sand, and clayey silty sand. Gravel concentrated between 18.0'-18.5' (damaged core) Fine to medium gravel (max=0.5" diam) and very fine to fine sand in silty clay matrix. Well graded, sub-angular to subrounded gravel and sand composed of rock frags and quartz with some feldspar, micas, and clays. Moist to wet. Grades into underlying clay. 7% Gravel, 50% Sand, 30% silt, and 13% clay
SM:	Same as above
SC:	Clayey Sand with some gravel Strong brown (7.5 Y 5/8) Fine gravel and fine to coarse sand in silty clay matrix. Sub-rounded sand and gravel Moist to wet 5% Gravel, 60% sand, 20% clay, and 15% silt.
	No core recovery (21.9'-22.2')
SC	Clayey Sand to Sandy Clay. Light olive brown (2.5 Y 5/3) to light brownish gray (2.5 Y 6/2) Interbedded sand and clay layers (thick) Very fine to medium sand in clay and silt matrix. Subangular to subrounded sand composed of quartz, felspar, micas, rock frags, and trace of carbonaceous material Some Fe-oxide stains within clay and sand. Wet 50% Sand, 38% clay, and 12% silt, to 72% clay, 10% silt, and 18% sand.
SC	Gravelly Silty Sand. Strong brown (7.5 Y 5/6) Coarse to fine gravel (max=1 3/4" diam) and fine to coarse sand in clayey silt matrix. Subangular gravel but angular where broken with angular to subrounded sand Well graded Gravel composed mainly of quartz, quartzite, and rock frags with some meta-morphic rocks. Sand composed of quartz, rock frags, mafic minerals, and feldspar Wet/saturated. 25% Gravel, 59% sand, 10% silt, and 6% clay
	No core recovery (25.6'-28.3')
SC:	Same as above Top of bedrock 28.5'
CLAYSTONE:	Claystone with trace of silt Grayish brown (2.5 Y 5/2) to light olive brown (2.5 Y 5/6) Clay with trace of silt (4%) Well sorted, porosity=10%, no cement, slightly friable, slightly weathered, mottled gray appearance with some ir-regular patches of Fe-oxide stains, massive, not fractured Moist 96% Clay and 4% silt

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.3	GROUND ELEVATION (FT)	5991.20	PROJECT NUMBER:	989073	LOG OF BORING NUMBER:
NORTH:	752070	AREA: OU7 PRESENT LANDFILL	CASING DIAMETER (IN)	2	GEOLOGIST	JAB/KJT	70693
EAST:	2082799	LOCATOR NUMBER: 11J	BOREHOLE DIAMETER (IN):	10.25	DATE DRILLED:	12/04/92	

REMARKS: MOBIL DRILL B-57; HSA; CEMENT GROUT 0.0'-4.2', BENTONITE SEAL 4.2'-6.5', SAND 6.5'-30.5', NO BACKFILL; NO CENTRALIZERS PLACED; BOREHOLE DIAMETER 10.25" 0'-28.5' AND 3" 28.5'-30', 2.1' SUMP 28.4'- 30.5'; DEPTH TO BEDROCK 28.5'

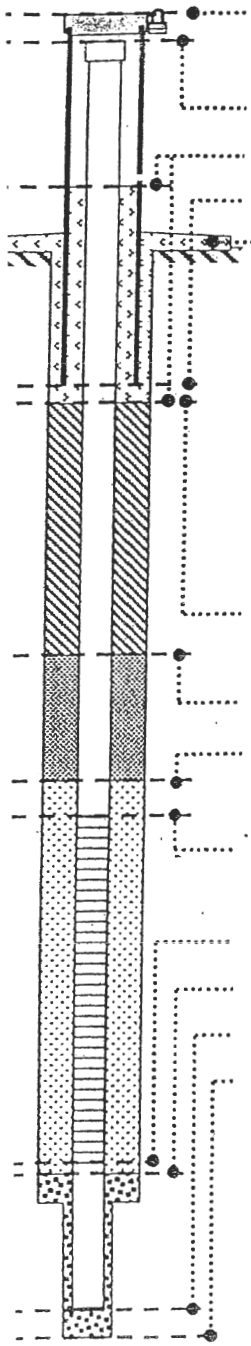
GEOTECHNICAL SAMPLE DEPTH	SAMPLE NO.	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%		5961	30			CLAYSTONE	Same as above. Total Depth 30.3'
					5960	31				
					5959	32				
					5958	33				
					5957	34				
					5956	35				
					5955	36				
					5954	37				
					5953	38				
					5952	39				
						40				

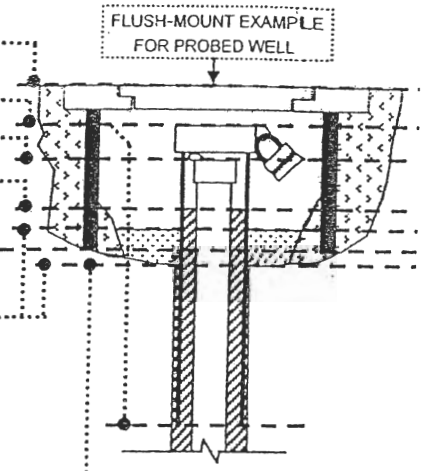
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 73005 PROJECT NAME: CY05 WELL INSTALLATION PROGRAM: PRESENT LANDFILL
SCREENED FORMATION: Bdrk. DRILLING CONTRACTOR: Layne BORING METHOD: Hollow Stem Auger
DATE DRILLED: 6/22/05 DATE COMPLETED: 6/27/05 TOTAL DEPTH: 28.0' COMPLETED DEPTH: 25.0'
ESTIMATED DEPTH TO BEDROCK: 0.0' RIG GEOLOGIST: E. WARP LOGGING GEOLOGIST: E. WARP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry, 6/22/05 COMPLETED WATER LEVEL (FT, DATE): Dry, 6/27/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2" PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): ABOVE GROUND STEEL PROTECTIVE CASING

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE





PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.1' a.g.s.
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.7' ags ID (IN): 2.0
SURFACE SEAL TOP: 1.35' ags BOTTOM: 0.2' bgs TYPE: CONCRETE
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.9', 5"x5" SQUARE STEEL
*WELL PAD DIMENSIONS, TYPE: 3'x3' square, Concrete
*ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: N/A TYPE: N/A
*BENTONITE SEAL TOP: 0.2' TYPE: 1/4" Bentonite pellets - BARROID AND Pel-Plug } HYDRATED W/ 5 gall. of Distilled H_2O
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0'
FILTER PACK TYPE: 16/40 Silica Sand BRAND: C.S.S.I.
SURFACE CASING BOTTOM (=SCREEN TOP): 4.6' TYPE: Sch. 40-PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01 TYPE: Sch. 40-PVC
SCREEN BOTTOM (= SUMP, TOP): 24.65' SUMP TYPE: Threaded End Cap - Sch. 40 PVC
FILTER PACK BOTTOM (= *BACKFILL TOP): 25.0' *BACKFILL TYPE: 1/4" bentonite pellets - Pel-plug
SUMP BOTTOM (= WELL COMPLETED DEPTH): 25.0' *PILOT HOLE TOP, DIAMETER: 26.0', 2.5"
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 28.0'

REMARKS: Routine well installation on 6/22/05. Top 2' of bentonite seal and protective casing installed on 6/23/05. Concrete well pad installed on 6/27/05

COMPLETED BY: Ellen S. Warp Ellen S. Warp DATE: 6/27/05
CHECKED BY: J. Boylan DATE: 6/30/05

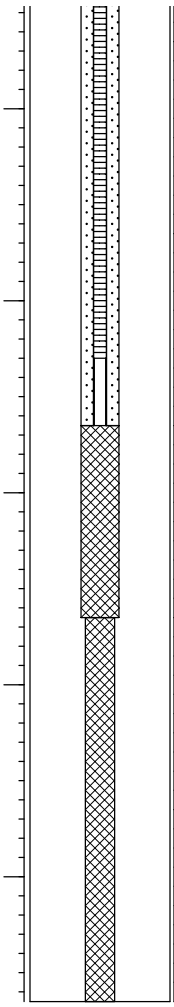
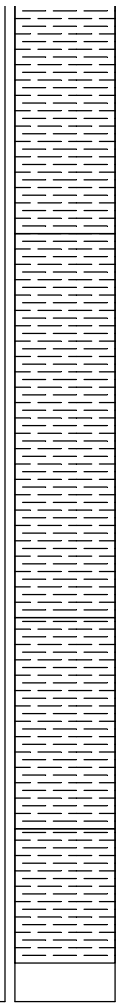
STATE PLANE COORDINATES AREA: GRND ELEV. (FT): 5937.35 CASING DIA (IN): 2
NORTH: 753006.65 TOTAL DEPTH (FT): 28.0 BH DIA. (IN): 8
EAST: 2084095.22 COMPLETION DATE: 6/22/05 GRID LOCATOR:
PROJECT: Present Landfill GEOLOGIST: E. Warp
REMARKS:

LOG OF BORING NUMBER: 73005

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5940	Protective Casing, 5 in. square, Steel; Casing, Sch 40-PVC, 2 in. ID.	3			
5939	Concrete Seal	2			
5938	Concrete Pad	1			
5937		0			SILTSTONE: Clayey Siltstone, light yellowish brown (10YR6/4). Massive texture, trace roots, dry.
					SILTSTONE: Clayey Siltstone with trace to some sand in pockets (rip-up?), brownish yellow (10YR6/6) with some light gray (10YR7/1) mottling. Weak to moderate pervasive iron oxidation with some un-oxidized mottling. Massive texture. Weak to moderately friable, trace roots. Slightly moist. Trace to some, very fine grained, sand.
5936		1			CLAYSTONE: Silty Claystone, light brownish gray (10YR6/2). Decreased iron oxidation to trace. Strongly friable, crumbly, trace roots, slightly moist.
5935	Hydrated Bentonite Pellets	2			No recovery.
					SILTSTONE: Clayey Siltstone, light yellowish brown (10YR6/4) to light brownish gray (10YR6/2). Weak pervasive iron oxidation from 2.0' to 2.1'. Massive texture, slightly moist. Increasing clay at base of interval. Moderately friable.
5934		3			CLAYSTONE: Claystone with some silt, light brownish gray (10YR6/2). Trace weak iron oxidation, predominately along bedding planes (subhorizontal) and fracture surfaces. Trace white caliche stringers and blebs. Massive texture, moderately friable, slightly moist.
5933	Filter Pack, 16/40 Silica Sand	4			No recovery.
					CLAYSTONE: Claystone with some silt, pale brown (10YR6/3) with some gray (10YR5/1) mottling. Weak pervasive iron oxidation from

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
					4.0' to 4.4'. Gray mottling from 4.4' to 4.8', with iron oxidation on internal fracture surfaces. Massive texture. Slightly moist from 4.0' to 4.4', increase to moist from 4.4' to 4.8'. Friable.
5932	Screen, Sch 40-PVC, 2 in. ID., 0.010 in. slots	5			CLAYSTONE: Claystone with some silt, gray (10YR5/1) to grayish brown (10YR5/2). Weak iron oxidation along bedding planes. Massive texture, weak to moderately friable, slightly moist.
		6			No recovery.
5931					CLAYSTONE: Claystone with trace silt, same as interval from 4.8' to 5.9'. Slightly moist.
5930		7			CLAYSTONE: Claystone, gray (10YR6/1), predominately un-oxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable. Slightly moist.
		8			No recovery.
5929					CLAYSTONE: Claystone, gray (10YR6/1), predominately un-oxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable, slightly moist.
5928		9			
		10			No recovery.
5927					CLAYSTONE: Claystone, gray (10YR6/1), predominately un-oxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable, slightly moist. Trace iron oxidation stringers from 10.3' - 10.5'.
		11			CLAYSTONE: Claystone, brown (10YR5/3), slight color change. Faint laminations (bedding planes) visible with trace to some black organic stringers on planes. Trace to some iron oxidation stringers along bedding planes and fracture surfaces. Weak to moderately friable, slightly moist.
5926					
		12			CLAYSTONE: Claystone, gray (10YR5/1 to 10YR6/1). Weak iron oxidation along bedding planes at 11.6' and from 12.2' to 13.0'. Fissile and moderately friable, slightly moist. Iron oxidation along fracture surfaces, especially from 11.6' to 11.8' and 12.2' to 13.0'.
5925					
		13			
5924					

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
		14			SILTSTONE: Clayey Siltstone to silty claystone, pale brown (10YR6/3) to light brownish gray (10YR6/2). Weak iron oxidation on sub-horizontal bedding planes (approximately 4 to 6 iron-oxidized bedding planes per foot) and fracture surfaces. Trace black organic stringers. Notable iron oxidation coating 80 deg fracture from 18.9' to 19.2'. Color of iron oxidation is strong brown (7.5YR5/6). Iron oxidation on 20 deg fracture from 19.5' to 19.6'. Moisture decreasing to trace. Occasional iron oxidation-replaced organic debris fragments. Some intervals to silty claystone, but predominately clayey siltstone.
5923					
		15			
5922					
		16			
5921					
		17			
5920					
		18			
5919					
		19			
5918					
		20			
5917					
		21			
5916					
		22			SILTSTONE: Clayey Siltstone to silty claystone, gray (10YR5/1). Notable color change. Decrease iron oxidation to trace as minor fracture coating. Massive texture, moderately friable. Increase moisture to slightly moist.
5915					

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5914		23			CLAYSTONE: Claystone with some silt, yellowish brown (10YR5/6) and gray (10YR5/1). Weak iron oxidation mottled throughout. Iron oxide coating ~80 deg fracture at 22.9'. Moderate pervasive iron oxidation from 23.7' to 23.8'. Moderately friable from 23.1' to 24.0', corresponding with increased moisture zone. Slightly moist from 22.7' to 23.1', moist from 23.1' to 24.0'.
		24			CLAYSTONE: Claystone with trace silt, gray (10YR5/1) to light brownish gray (10YR6/2). Decreased iron oxidation to trace along bedding planes and fracture surfaces. Massive textured, moderately friable. Clay-rich (no silt) from 24.0' to 24.2' and slightly darker color (dark gray: 10YR4/1). Moist, decreasing to very slightly moist from 24.2' to 26.0'. Fissile between 24.5' and 25.7'. Trace black organic material.
5913					
		25	Threaded End Cap - Sump, Sch 40-PVC		
5912			Bentonite Pellet Backfill		
		26			CLAYSTONE: Claystone, grayish brown (10YR5/2). Massive texture, weakly friable. Iron oxidation along internal fractures at 26.3' and 27.0'. Very slightly moist.
5911			Bentonite Pellet Backfill in Pilot Hole		
		27			CLAYSTONE: Claystone, dark gray (10YR4/1). Notable color change. Fissile and friable, trace moisture.
5910					
		28			No recovery.

STATE PLANE COORDINATES AREA: GRND ELEV. (FT): 5925.8 CASING DIA (IN): 2

NORTH: 752878.53 TOTAL DEPTH (FT): 27.7 BH DIA. (IN): 8

EAST: 2084050.53 COMPLETION DATE: 6/27/05 GRID LOCATOR:

PROJECT: Present Landfill GEOLOGIST: E. Warp

REMARKS:

LOG OF BORING NUMBER: 73105

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5929	Protective Casing, 5 in. square, Steel; Casing, Sch 40-PVC, 2 in. ID.	3			
5928		2			
5927		1			
5926	Concrete Seal; Concrete Pad	0			GP: Gravel (fill), pea gravel (1/4" diameter, subrounded to subangular), composed of granite and quartzite. Poorly graded, dry.
5925		1			CL: Clay with trace sand and gravel, grayish brown (10YR5/2) to gray (10YR5/1). Re-worked claystone. Thin black organic stringers common, moist.
5924		2			SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR5/6). Imported fill (Qalrf). 60% clay, medium plasticity, 30% sand (medium grained to coarse grained, subrounded to subangular), 10% gravel (1/4" diameter, subrounded to subangular), very moist.
5923	Hydrated Bentonite Pellets	3			No recovery.
5922		4			SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR4/6). Imported fill (Qalrf). Very similar to interval from 0.4' to 0.8'. 65% clay, medium plasticity, 20 - 25% sand (medium grained to coarse grained, subangular to subrounded), 10 - 15% gravel (1/8" - 1/4" diameter, subrounded, predominately granite and quartzite), saturated, but not flowing.
					No recovery.
					SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR4/6). Imported fill (Qalrf). Very similar to interval from 2.0' to

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5921	Filter Pack, 16/40 Silica Sand	5			2.9'. 60% clay, medium plasticity, 25% sand (medium grained to coarse grained, subangular to subrounded), 15% gravel (1/4" - 1/2" diameter, subangular, composed of granite, quartzite, and schist), saturated.
5920	Screen, Sch 40-PVC, 2 in. ID., 0.010 in. slots	6			No recovery.
5919		7			GP: Gravel with trace sandy clay, strong brown (7.5YR4/6) clay. Appears to be pea-gravel (possible slough). Gravel (1/4" - 3/4" diameter, subrounded to subangular), poorly graded. Moisture decreases from saturated to moist.
5918		8			GC/CL: Gravelly, Sandy Clay and shattered quartzite cobble mixture. 45% gravelly, sandy clay, light brown (7.5YR6/4) with 55% shattered cobbles (1/2" to 1-1/2" diameter, angular), moist.
5917		9			No recovery.
5916		10			GC/CL: Sandy Clay/Gravel mixture, strong brown (7.5YR5/6) clay. 60 - 70% gravel and cobbles, 20 - 30% clay (medium plasticity), 5 - 10% sand (coarse grained, subangular). Shattered quartzite cobbles from 8.4' to 8.6' (2" diameter) and from 9.2' to 9.5' (2" - 3" diameter). Moist.
5915		11			No recovery.
5914		12			GC/CL: Sandy Clay/Gravel mixture, strong brown (7.5YR5/6). 50% clay (medium plasticity), 30% gravel (1/8" - 3/4" diameter, subangular), ~20% sand (coarse grained), moist. Quartzite cobbles (1" - 2" diameter) at 11.2' and 11.7'.
5913		13			No recovery.
					GC/CL: Sandy Clay/Gravel mixture, same as interval from 10.0' to 11.9'.
					CL: Silty Clay, gray (10YR6/1). Re-worked silty claystone. Poor recovery due to clogged split spoon sampler producing "ribbons" of claystone. Probable cobble lodged in sampler. Moist.
					No recovery.

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5912					
		14			CLAYSTONE: TOP OF BEDROCK. Silty Claystone (weathered bedrock), grayish brown (10YR5/2) with some yellowish brown (10YR5/6) mottling. Massive texture, firm and cohesive. Weak to moderately friable. Weak iron oxidation mottled throughout. Trace black organic material. Moist. Bedrock contact estimated at 12.5'. Estimated by drilling conditions and changes in penetration.
5911		15			No recovery.
5910		16			CLAYSTONE: Silty Claystone, iron oxidized, yellowish brown (10YR5/4), grading to gray (10YR5/1) at base of interval. Moderate pervasive iron oxidation from 16.0' to 16.3', then decreasing at base. Massive texture, weak to moderately friable. Saturated from 16.0' to 16.2', decreasing to moist from 16.2' to 16.3'.
5909		17			CLAYSTONE: Claystone with silt, iron oxidized, yellowish brown (10YR5/8). Strong pervasive iron oxidation. Firm and dense, moist. Black organic material common as stringers and along undulating bedding planes.
5908		18			CLAYSTONE: Claystone with silt, grayish brown (10YR5/2) with some yellowish brown (10YR5/6) mottling. Decreasing overall iron oxidation to weak, mottled. Firm, weakly friable, moist. Black organic stringers common. Faint bedding visible.
					No recovery.
5907		19			CLAYSTONE: Claystone with trace to some silt, gray (10YR5/1) with yellowish brown (10YR5/4) mottling. Weak iron oxidation mottled throughout. Firm/dense. Weakly friable. Black organic stringers common. Black carbonaceous material coating bedding planes at 18.9' and 19.0'. Moist.
5906					No recovery.
		20			CLAYSTONE: Claystone, light brownish gray (10YR6/2) to gray (10YR6/1). Massive texture, firm/dense. Trace overall iron oxidation. Weak iron oxidation from 21.7' to 22.0'. Trace black organic stringers. Moisture decreases to slightly moist.
5905		21			
5904		22			
					CLAYSTONE: Claystone, gray (10YR5/1) to dark gray (10YR4/1).

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5903		23			Un-oxidized bedrock. Notable color change. Massive texture, firm/dense. Trace black organic material. Moisture decreases to very slightly moist. Abrupt color change at base.
5902		24			CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Un-oxidized, un-weathered bedrock. Fissile/friable. Black carbonaceous material common. Decreasing moisture.
5901		25			
5900	Threaded End Cap - Sump, Sch 40-PVC	26			No recovery.
	Bentonite Pellet Backfill in Pilot Hole				CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Un-oxidized, un-weathered bedrock. Fissile/friable. Black carbonaceous material common. Abundant black carbonaceous material from 27.0' to 27.7'. Moisture decreases to trace. Refusal at 27.7'.
5899		27			

STATE PLANE COORDINATES AREA: GRND ELEV. (FT): 5937.12 CASING DIA (IN): 2
NORTH: 752767.53 TOTAL DEPTH (FT): 32.0 BH DIA. (IN): 8
EAST: 2084218.33 COMPLETION DATE: 6/27/05 GRID LOCATOR:
PROJECT: Present Landfill GEOLOGIST: E. Warp
REMARKS:

LOG OF BORING NUMBER: 73205

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5940	Protective Casing, 5 in. square, Steel	3			
	Casing, Sch 40-PVC, 2 in. ID.				
5939		2			
5938		1			
	Concrete Seal				
5937	Concrete Pad	0			CL: Clay with silt, trace gravel, and trace sand, brown (7.5YR4/3). Medium plasticity and firm. Trace to 3% disseminated caliche. Trace roots. Schist cobble (3/4" diameter, subangular) at 0.3'. Slightly moist to moist.
5936		1			
					No recovery.
5935	Hydrated Bentonite Chips	2			CL: Clay with silt, trace gravel, and trace sand, brown (7.5YR4/4 to 7.5YR4/2). Medium plasticity and firm. Same as interval from 0.0' to 1.5'. Slightly moist.
5934		3			GC/CL: Sandy Gravel/Clay mixture, brown (7.5YR4/4). ~75% sandy gravel and ~25% clay. Gravel (1/4" - 1" diameter, subangular to subrounded, predominately quartzite). Sand (coarse grained, subangular). Weak iron oxidation disseminated throughout clay and as coating on 1/4" gravel clasts. Trace disseminated caliche. 2" diameter quartzite cobble at 2.4'. Shattered quartzite cobble from 3.0' to 3.2'. Poor recovery due to cobbles. Slightly moist.
					No recovery.
5933	Filter Pack, 16/40 Silica Sand	4			CL: Sandy, Gravelly Clay, brown (7.5YR4/4). 5 - 10% gravel (1/4" - 1/2" diameter, subrounded to subangular, predominately quartzite). 5 - 7% sand (coarse grained, subangular). Clay has medium
	Screen, Sch 40-PVC, 2 in. ID., 0.010 in.				

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
					plasticity. Moisture increases from slightly moist to moist.
5932		5			CLAYSTONE: TOP OF BEDROCK. Claystone, grayish brown (10YR5/2) to gray (10YR5/1). Firm/dense. Black organic stringers common on undulating bedding planes. 1/4" caliche lense at base of interval. Sharp basal contact, color change. Moist.
5931		6			CLAYSTONE: Claystone, iron-oxidized/weathered, yellowish brown (10YR4/6). Moderate to strong pervasive iron oxidation. Moderately friable. 1/4" caliche lense at top of interval and as blebs throughout. Moist.
					CLAYSTONE: Silty Claystone, gray (10YR6/1). Dinstinct color change. Massive texture. Caliche mottled throughout. Friable. Moisture decreases to very slightly moist.
5930		7			No recovery.
					CLAYSTONE: Claystone, iron oxidized/weathered, yellowish brown (10YR5/6 to 10YR5/4). Weak pervasive iron oxidation. Weak to moderately friable. Trace white caliche stringers. Thin caliche lense at 6.8'. Slightly moist.
5929		8			CLAYSTONE: Claystone, grayish brown (10YR5/2). Decreased iron oxidation to trace as stringers. Moderately friable. Massive texture. Slightly moist.
					No recovery.
5928		9			CLAYSTONE: Silty Claystone, iron oxidized, yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Massive texture. Weak to moderately friable. Black manganese oxide (possible organics) bleb at 8.2'. Slightly moist.
5927		10			CLAYSTONE: Claystone, gray (10YR5/1). Decreased iron oxidation to trace. Massive texture, firm yet weakly friable. Trace black organic stringers throughout. Black organic lense (1/8" thick) at 11.2'. Trace iron oxidation stringers from 11.2' to 12.0'. Moisture decreases to very slightly moist. Hard, cryptocrystalline calcareous clast (~3/8") at 9.9'.
5926		11			
5925		12			CLAYSTONE: Claystone, gray (10YR6/1). Massive texture, dense/firm, weakly friable. Trace to some iron oxidation. Abundant black organic material from 12.8' to 13.0'. Very slightly moist.
5924		13			CLAYSTONE: Claystone with silt, gray (10YR6/1). Massive texture as above interval from 12.0' to 13.3'. Un-oxidized bedrock. Trace black organic stringers. Firm/dense. Thin caliche lense along

slots

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
					internal bedding plane at 13.7'. Very slightly moist.
5923		14			
5922		15			CLAYSTONE: Silty Claystone, gray (10YR6/1). Weak iron oxidation along horizontal bedding planes. Predominately massive texture, firm/dense. Trace black organic stringers and blebs. Weak to moderate pervasive iron oxidation from 17.3' to 17.7'. Near-vertical fracture (~80 deg) from 18.9' to 19.5' with iron oxide coating. 1/4" horizontal lense of carbonate (druse) at 19.7'. Interval slightly moist. Occasional sandy intervals at 17.1', and from 17.6' to 17.7'. Claystone interval from 18.8' to 19.1'. Rip-up clasts, iron oxide-replaced organic debris present. Sand is very fine grained to fine grained.
5921		16			
5920		17			
5919		18			
5918		19			
5917		20			
5916		21			CLAYSTONE: Claystone, grayish brown (10YR5/2). Weak iron oxidation as stringers and along bedding planes. Black organic material along bedding planes. Possible manganese oxide associated with iron oxidation along bedding and fracture surfaces. Dense/firm. Slightly moist.
5915		22			CLAYSTONE: Claystone, gray (10YR6/1 to 10YR5/1). Trace weak iron oxidation as stringers and along bedding/fracture surfaces. Iron oxidation as fracture (~50 deg) coating at 22.6'. Interval weak to moderately friable. Massive texture. Slightly moist.

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
5914		23			CLAYSTONE: Claystone, dark gray (10YR4/1). Firm/dense. Trace iron oxidation along bedding planes/fracture surfaces. Bedding planes are faintly visible. Trace black organic material along bedding and as clasts (to 1/2" diameter). Slightly moist from 23.1' to 24.2', decreases to trace moisture from 24.2' to 30.4'. Weak pervasive iron oxidation from 29.1' to 29.3'.
5913		24			
5912		25			
5911		26			
5910		27			
5909		28			
5908		29			
5907	Threaded End Cap - Sump, Sch 40-PVC	30			
5906	Bentonite Pellet Backfill in Pilot Hole	31			CLAYSTONE: Claystone, un- (iron) oxidized/un-weathered, very dark gray (10YR3/1). Distinct color change. Firm and dense. Trace iron oxidation stringers from 31.8' to 31.9'. Sub-horizontal, undulating bedding faintly visible. Black organic material common along bedding planes and as clasts (to 1/2" diameter). Trace moisture.
		32			