REFUSE DISPOSAL PERMIT APPLICATION
PHASE II REPORT

HAWKINS POINT LANDFILL

3801 Fort Armistead Road
Baltimore, Maryland

July 28, 2022

Prepared for:

HAWKINS MANAGEMENT, LLC
2519 Wilkens Avenue
Baltimore, Maryland 21223

Submitted to:

SOLID WASTE PROGRAM
Maryland Department of the Environment
1800 Washington Boulevard, Suite 605
Baltimore, MD 21230-1719

Attn: Mr. Ed Dexter and Andrew Grenzer

Prepared by:

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GTA Project No. 200476

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GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing GBA Member Firm

July 28, 2022

Solid Waste Program
Maryland Department of the Environment
1800 Washington Boulevard, Suite 605
Baltimore, MD 21230-1719

Attn: Mr. Ed Dexter and Mr. Andrew Grenzer

Re: Refuse Disposal Permit Application – Phase II Report
Hawkins Point Landfill
3801 Fort Armistead Road
Baltimore, Maryland
(Existing Permit: No. 2019-WIF-0527A)

Dear Mr. Dexter:

Geo-Technology Associates, Inc. (GTA) has prepared this Phase II Report for a Refuse Disposal Permit for the remaining capacity of the above-referenced landfill ("Site"). This Phase II Report has been prepared as part of an application for a refuse disposal permit for the existing Hawkins Point Landfill at 3801 Fort Armistead Road in the Curtis Bay area of Baltimore, Maryland (Existing Refuse Disposal Permit No. 2019-WIF-0527A).

This report transmits GTA's findings. Should you have any questions regarding this report, or should you require additional information, please contact our office at (410) 792-9446.

Sincerely,
GEO-TECHNOLOGY ASSOCIATES, INC.

Kristen Daly
Associate

for

Paul H. Hayden, P.G., L.R.S., R.S.M.
Vice President

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REVISED REFUSE DISPOSAL PERMIT PHASE II REPORT

HAWKINS POINT LANDFILL
BALTIMORE, MARYLAND
JULY 28, 2022

1.0 INTRODUCTION

1.1 Overview and Purpose

At the request of Hawkins Management LLC, Geo-Technology Associates, Inc. (GTA) has prepared this Phase II Report as part of an application for a refuse disposal permit for the existing Hawkins Point Landfill (HPL) at 3801 Fort Armistead Road in the Curtis Bay area of Baltimore, Maryland (the "Site", *Figure 1 – Site Location Map*). The Site was a landfill previously used to support the operations of the now-closed Cristal USA, Inc. manufacturing plant. The landfill previously accepted industrial waste and has remaining capacity to accept additional waste. The landfill recently began operating under the existing permit until a new permit is issued per a written agreement between the applicant and prior owner.

The Site is currently permitted through the Maryland Department of the Environment's (MDE) Solid Waste Program (SWP) permit no. 2019-WIF-0527A issued to the prior owner, Hawkins Point LLC, and originally operated by Cristal USA, Inc. The Site recently changed ownership and operation under the current permit has been transferred to the current owner, Hawkins Management LLC. This report represents the permit application for Hawkins Management LLC to accept waste for the remaining capacity of the landfill.

1.2 Limitations

This report was prepared by GTA for Hawkins Management LLC, under the terms and conditions of GTA's contract(s) with Hawkins Management LLC. This report was prepared by GTA for the sole and exclusive use of Hawkins Management LLC. GTA acknowledges that this document is being submitted to the MDE and will be part of the public record, and that MDE is expected to use this report as part of its review process. However, use of this report by any third party is at their sole risk. GTA is not responsible for any claims, damages, or liabilities associated with third-party use.

1.3 Statement of Professional Qualifications

This report was prepared by GTA on behalf of Hawkins Management LLC. As required by COMAR 26.04.07.07(B), this report was prepared by an individual who "*shall possess at least a bachelor's degree from an accredited college or university in the field of geology or a related field of earth science*", Ms. Kristen Daly, and reviewed by a geotechnical engineer who "*shall possess at least a bachelor's degree in civil or environmental engineering from an accredited college or university with the major course of study in geotechnical engineering or related earth sciences, and shall be registered in Maryland as a professional engineer*", Mr. Benjamin Myers, PE.

1.4 Report Organization

This report represents a submission of the application for an industrial waste refuse disposal permit as outlined in MDE's solid waste regulation COMAR 26.04.07.19, and describes the soils, geology, meteorology, and hydrology of the Site. The design of the landfill exceeds the requirements of COMAR 26.04.07.19 and has been sited and constructed under the more stringent regulation for a Subtitle D Landfill under 40 Code of Federal Regulations (CFR) 258.10-15 and COMAR 26.04.07.07. Pursuant to the portion of Federal statute CFR Title 40 – Protection of the Environment, Part 258 – Solid Waste Disposal Facility Criteria, , this report addresses the siting of the industrial waste landfill. A summary of the compliance of the HPL with MDE's solid waste regulations is outlined in *Sections 3.0* and *4.0*.

2.0 BACKGROUND

2.1 Site Description

The Site consists of approximately 30 acres located southeast of Fort Armistead Road in Baltimore, Maryland. The majority of the Site is a landfill that occupies approximately 23 acres of the parcel, with an access road around the perimeter of the landfill and several small outbuildings including a main operations office in the northern portion of the property near an entrance gate. A stormwater retention pond is located at the southwestern corner of the property between the landfill and the perimeter access road. The property is accessed by a gated entry that extends south from Fort Armistead Road. The Site is bounded to the northwest and southwest by

CSX railroad tracks followed by Fort Armistead Road and a 65-acre landfill owned by Constellation Energy, respectively; to the southeast by the Anne Arundel County-Baltimore City boundary followed by industrial land operated by the Maryland Port Authority; and, to the northeast by industrial land formerly part of the Cristal USA, Inc. facility followed by the Patapsco River. A *Site Location Map* for the subject property is presented as *Figure 1*.

2.2 Site History and Operations

The Site was historically associated with the adjacent Cristal USA, Inc. facility that comprised approximately 148 acres and included a chemical manufacturing facility that produced titanium oxide since approximately 1954. Operations of the Cristal USA, Inc. manufacturing plant ceased in 2011. The landfill was approved to accept waste from the manufacturing process that included gypsum-sulfate process waste, dredged material from the wastewater treatment lagoons associated with the manufacturing plant, brick and refractory brick, soil excavated from the plant property for construction/maintenance purposes, rubble, ore residues, sand, lime, and road asphalt. Third party waste was acceptable in the event that it fit into one of the permitted categories of non-hazardous industrial waste and was properly characterized prior to acceptance. When manufacturing operations ceased, the landfill was used to stage clay excavated from the neighboring 65-acre landfill which began in 2009. The landfill was inactive between 2009 and 2020 aside from the operations and maintenance, groundwater monitoring, and reporting required by the permit. In 2020, during the current application process, the landfill began accepting third-party waste with the approval of MDE.

The landfill is estimated to have a capacity of approximately 3 million cubic yards (cy), of which approximately 2 million cy is estimated to still be available upon removal of the stockpiled clay. The maximum height of the waste pile as currently permitted is 218 feet above mean sea level (amsl). The landfill consists of Cells 1 and 2, both of which have been constructed. As-built plans show that the cells were excavated to approximately 11 feet amsl in the northwest corner of the landfill and gently slope down to approximately 8 feet amsl in the southwest corner. A bottom liner was constructed across the entire base of the landfill footprint consisting of a 12-inch-thick compacted clay layer that conforms to the required maximum hydraulic permeability of 1×10^{-7}

centimeters per second (cm/sec). A leachate collection system drains leachate and rainwater into a network of pipes and a sump. Leachate is currently pumped to a settling basin on the adjacent former Cristal USA, Inc. property that is scheduled to be abandoned. Leachate is planned to be redirected to discharge to the Patapsco River by way of an easement on the adjacently southeastern property, through a treatment system if needed based on leachate sampling results and discharge requirements.

Based on capacity and operations producing waste during the design of the landfill, the HPL was anticipated to have a disposal lifespan of approximately 9.4 years. The closure of the former Tronox/Cristal USA facility and cessation of previous waste stream reduced the amount of fill being placed in the landfill for a period of time, and waste stream volume is currently variable. The most recent projection of remaining landfill capacity was submitted to MDE on March 1, 2021, with the remaining capacity calculated to be 939,021 cy as of January 30, 2021. The letter states that because the waste stream into the landfill is variable and inconsistent, a revised projection of lifetime in years is not able to be made at this time.

The MDE received the Refuse Disposal Permit Application and Phase I Report for the Site on January 12, 2022 for a change in the permittee from Hawkins Point LLC to Hawkins Management LLC. MDE distributed the Permit Application and Phase I Report to interested agencies in accordance with COMAR 26.04.07.20B and requested any comments be submitted within 20 days. Following the agency comment period, a public comment period of 30 days was held that included a public meeting on March 1, 2022.

3.0 STATE OF MARYLAND STATUTE

The design of the landfill exceeds the requirements of COMAR 26.04.07.19 and has been sited and constructed under the more stringent regulation for a Subtitle D Landfill under 40 CFR 258 similar to a municipal solid waste landfill. Pursuant to State of Maryland regulation, this report describes the soils, geology, meteorology, and hydrology of the location of the HPL. The entire disposal footprint of the landfill has been constructed, covering approximately 23 acres of

the 30-acre site, and includes a bottom liner and leachate collection system. No expansion of the existing landfill cells is proposed at this time.

3.1 Site Topography

An up-to-date site-specific topographic map using a contour interval which is practical for that Site. The following items shall be shown on the map: (a) Surface waters and natural drainage features; (b) 100-year flood plain; (c) Property lines; (d) On-site buildings and structures;(e) Forested and other vegetated areas; and (f) The location of any buried or overhead power transmission lines, utility pipelines, or storage tanks on the property.

The existing topographic site plan indicates that the landfill has been partially filled and the majority of the previously placed fill consists of clayey soils. Topographically, the vicinity of the Site can be characterized as gently sloping to the east towards the Patapsco River, which is located approximately 2,000 feet to the east (*Figure 4, Vicinity Topographic Map*). Elevations on the Site range from 50 feet amsl around the perimeter of the property to approximately 140 feet amsl at the peak of the landfill mound. The USGS Curtis Bay, MD 1957 map does not show surface water features or wetland areas on the Site; however, the landfill had not yet been developed and the Site is shown as mostly flat and at approximate elevation of 50 feet amsl. A flyover topography survey from January 2021 depicts the current topography on the Site, including the existing sediment basin in the southwestern portion of the Site (*Figure 5*). Based on the available topographic maps and site observations, no sinkholes, seeps, springs, recently active faults, or rocky outcrops were identified in or near the Site. According to FEMA, the Site is not in the bounds of the 100-year flood plain, as shown on the attached flood map in *Figure 4*. Additionally, the HPL is not within the 1,000-foot buffer zone of tidal waters.

3.2 Site Geology

A discussion of the geologic formations directly underlying and in close proximity to the site, the present and projected use of these formations as a source of ground water and minerals, and the hydrogeologic relationship between the formations.

According to the *Geologic Map of Maryland* (1968) and the *Geologic Map of the Baltimore East Quadrangle* (1979), published by the Maryland Geologic Survey, the Site is within the Coastal Plain Physiographic Province. The Coastal Plain is characterized by undifferentiated and interlayered sedimentary deposits derived from eroded and transported rock formations to the north and west. Coastal Plain sediments were deposited in a marine and alluvial environment during periods of fluctuating sea levels over the crystalline rocks of the Piedmont Province. More specifically, the Site is shown to be underlain by the silt-clay facies of the Potomac Group (Kpc), which includes the Patapsco, Arundel, and Patuxent Formations. A regional hydrogeologic cross-section is presented in *Figure 6*. The total thickness of these units is estimated to be 3,000 feet.

The Patapsco Formation is the shallowest unit of the three within the Potomac Group and is estimated to be over 200 feet thick below the Site, overlying crystalline bedrock that dips to the southeast. The Patapsco Formation silt-clay facies is described as massive and thick-bedded variously colored clay with interbedded sand or silt lenses, and well-sorted fine- to medium-grained sand with thin clay beds. Within the site vicinity, the sand-gravel facies includes interbedded quartz sand, pebbly sand and gravel, and subordinate silt and clay.

Below the Patapsco Formation, the Arundel Formation is described as variously colored clay with interbedded sand or silt lenses, and well-sorted fine- to medium-grained sand with thin clay beds. Within the site vicinity, the sand facies of the Potomac Group (Kps), the Patuxent Formation, underlies the Arundel Formation at greater depths. Patuxent Formation soils consist of interbedded quartz sand, pebbly sand and gravel, and subordinate silt and clay.

Numerous soil borings have been performed at the Site as part of the development of the landfill or installation of the groundwater monitoring network on both the Site and the adjacent Lot 15 landfill between 1988 and 2009.

- In 1988, O'Brien and Gere, Inc. advanced 18 soil borings and installed 12 piezometers, most of which were located on the adjacent Lot 15 property. Five of the soil borings were located on the Site. Boring depth ranged from 10 to 180 feet below ground surface (bgs). The results of the investigation are included in a 1991 Phase II Report by Oosterbaan and are provided in *Appendix B*.
- In 1991, Hillis-Carnes, Inc. advanced four borings (G-3D, G-16D, G-18D, and G-22) and installed one groundwater monitoring well (G-18D) on the HPL site, and additional borings and wells on the adjacent Lot 15 property. The explorations generally encountered stiff clay. Laboratory analysis of the physical properties of the soil including water content, Atterberg Limits, and hydrometer analysis and field tests of falling head hydraulic conductivity were also performed. The boring logs and results of the laboratory tests are included in *Appendix B*.
- In October 1992, Haley and Aldrich (H&A) installed 10 monitoring wells (M-1 to M-7 and M-9 to M-11), two of which are located on the Site. The boring logs are included in *Appendix B*. Monitoring wells M-1 through M-5 are the wells that are located on the HPL property.
- In May 2009, Geosyntec performed shallow soil sampling at the adjacent Lot 15 Landfill site to conduct laboratory tests for geotechnical properties. Additionally, samples were collected from the clay stockpiled at the Lot 15 Landfill. The results of the field exploration and laboratory are included in *Appendix B*.
- In 2011, Geosyntec collected 25 soil samples, 19 from the bottom of Cell 1 (approximately El 10 to 16 feet amsl) and six from the bottom of the leachate pond (approximately El 38 feet amsl) during construction of those features. The sample locations and the results of the laboratory tests are also included in *Appendix B*.

According to a *Phase II Environmental Site Assessment Report* by EA Engineering dated November 2015, explorations encountered a subsurface profile consisting of interbedded sands and clays consistent with the Patapsco Formation. The Patapsco Formation includes

three distinct units, all of which were encountered during the soil boring investigations of the Site:

- *Upper Patapsco Unit:* The surficial exposure of the uppermost unit is typically a relatively thin layer of sand. Most of this sandy material was removed from the Site for use as part of the construction of the nearby Key Bridge. This sand unit is underlain by a thick clay confining unit.
- *Confining Clay Unit:* The explorations at the Site identified the clay confining unit as ranging in thickness from approximately 40 to 150 feet, and up to 105 feet thick below the existing landfill base. There are discontinuous beds of clayey and silty sands within the clay unit.
- *Lower Patapsco Unit:* The lower Patapsco unit was the deepest unit penetrated by borings drilled at the Site, encountered at a depth of 162 feet bgs. The unit was characterized by sand and gravel materials.

3.3 Groundwater Production Well Survey

A survey of all production wells within ½ mile of the site boundary. Each well shall be located on the topographic map and a table shall be developed which specifies all the available pertinent information such as well depth, screen type, productivity, materials encountered, and water level.

A request was submitted to MDE for a search of the groundwater production wells within a half-mile of the site boundary. The locations of the wells were obtained from the well location database provided by Kathy Mohan, PIA Liaison of the Water and Sciences Administration of MDE. The groundwater production wells within a half-mile of the Site are used as testing or monitoring wells, and not as drinking water wells. A listing of wells is provided in *Table 1* and locations are shown on *Figure 7*.

3.4 Groundwater Elevations

Ground water contour maps to show the occurrence and direction of ground water flow beneath the Site superimposed on the current topographic map. Three separate ground water contour maps as specified below shall be constructed for each distinct water-bearing formation occurring within 50 ft of the anticipated lowest elevation of the refuse cell floor, using monthly ground water elevation data collected from piezometers on the Site over a period of not less than 12 months, or derived using a hydrologic simulation or prediction technique approved by the Department. Three ground water contour maps shall be constructed from a set of: (a) Water elevations measured or predicted during the month that represents the most: (i) Elevated ground water condition, (ii) Depressed ground water condition; and (b) The highest observed or predicted ground water elevations.

The groundwater monitoring wells at the Site were installed in 1993 to depths ranging between approximately 137 to 192 feet bgs (80 and 120 feet below the base of the landfill), likely within a confined aquifer in the sandy unit of the Patapsco Formation. Groundwater

is stored in the sands of the Patapsco Formation and the sand and gravels of the Patuxent Formation. During the most recent monitoring event, groundwater elevation ranged between 2.40 and 5.30 feet amsl with a flow direction towards the southeast.

The most recent groundwater sampling report (TM Engineering, Inc., May 2021) stated that "…all wells appear to fluctuate in unison indicating hydraulic communication between the strata the wells penetrate." High groundwater elevations ranged from 5.31 feet amsl to 4.30 feet amsl, and low elevations ranged from 3.32 feet amsl to 2.12 feet amsl. Details are included in the Analysis of Groundwater Data report dated May 25, 2021 in *Appendix C*.

Contours of elevated and depressed groundwater conditions, and highest observed groundwater elevations for the hydrostratigraphic unit encountered at the Site, are presented in *Figure 8*. Historic groundwater elevation data are tabulated in the most recent available groundwater monitoring report attached as *Appendix C*.

3.5 Geologic Cross-Sections

Geologic cross sections in sufficient detail, orientation, and number to clearly identify subsurface conditions at the Site.

A site geologic cross-section key map is shown in *Figure 9*, and geologic cross-sections are provided in *Figures 10* through *14*.

3.6 Site Bedrock Profile

A bedrock map, except in the coastal plain outside the fall zone, to show the contours of the bedrock surface beneath the Site.

As described further in *Section 4.2*, according to the *Geologic Map of Maryland* (1968) and the *Geologic Map of the Baltimore East Quadrangle* (1979), published by the Maryland Geologic Survey, the Site is within the Coastal Plain Physiographic Province. Because the Site is located in the coastal plain, a bedrock map is not required.

3.7 Shallow Soil Profile

An isopachous map to show the minimum thickness of soil and other unconsolidated sediments above the elevation of ground water as determined in § C(4), or bedrock as determined in § C(6), whichever is the higher.

As discussed in *Section 4.2*, prior investigations of the Site and the adjacent Lot 15 landfill provided data regarding the unconsolidated sediments located at the Site. Based on the interpreted Site geology from the subsurface investigation and highest groundwater elevations, an isopachous map showing the distance between highest groundwater table and the base of the landfill liner is included as *Figure 15*.

Based on the most recent groundwater monitoring report for the property dated May 25, 2021: "*Groundwater in the Patapsco formation occurs primarily within upper and lower sand facies which are separated by a clay confining layer. Locally, the sand layers can be discreet and discontinuous, but when extensive, form the upper regional aquifer. Groundwater within the clay facies rarely occurs as free moisture in occasional sand pockets and this portion of the formation is generally impervious with a thickness of approaching and exceeding one hundred feet in the vicinity of the landfill site*." The bottom of the landfill liner is separated from the aquifer in the lower sand unit by a clay confining layer. A generalized regional hydrogeologic cross-section of the Coastal Plain sediments overlying Piedmont bedrock in the vicinity of the Site is presented in *Figure 5*.

3.8 Groundwater Quality

A discussion of the chemical quality of ground water in the aquifers beneath the Site as determined in § C(2). The list of chemical parameters shall include pH, alkalinity, hardness, chloride, specific conductance, nitrate, chemical oxygen demand, arsenic, barium, cadmium, chromium, zinc, lead, mercury, the volatile priority pollutants, and any other pollutants specified by the Department.

Groundwater quality for the Site was characterized in 1991 as part of a site investigation conducted to support the preparation of the previous Hawkins Point Plant (HPP) Landfill (Oosterbaan, 1991). Groundwater quality test results demonstrated that groundwater collected at the Site met maximum contaminant levels (MCL) for the analysis performed. Groundwater is monitored semi-annually, generally in January and July, according to the requirements of the refuse permit and a Groundwater Monitoring Plan (*Appendix D*) prepared by TM Engineering, Inc. dated April 27, 1992/revised August 2019.

The groundwater monitoring wells at the Site were installed in 1993 to depths ranging between approximately 137 and 192 feet bgs (80 and 120 feet below the base of the landfill, respectively), likely within a confined aquifer in the sandy unit of the Patapsco Formation. Based on the most recent available monitoring event data, groundwater elevation ranged between 2.40 and 5.30 feet amsl with a flow direction towards the southeast. A summary of analytical results for the semi-annual groundwater monitoring events conducted at the HPL for the five onsite monitoring wells through February 2021 is included in *Appendix C*.

The groundwater samples are analyzed for chemical oxygen demand, dissolved metals, total alkalinity, ammonia, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, hardness, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, sulfate and chloride, nitrates, thallium, vanadium, and zinc. Characteristics measured during sampling include pH, turbidity, and electrical conductivity. The most recent groundwater sampling report states that: "*Nearly all groundwater samples from the monitoring wells for the HPP Landfill exhibited analytical test values below limits established U.S. Environmental Protection Agency for parameters of the primary Drinking Water Regulations (DWR). Exceptions are pH values which are routinely below the lower DWR limit of 6.5. All of these pH values are within the natural range of concentrations for the geologic formation as reported in Reference 1. Overall, analytical data from monitoring*

wells are reasonably consistent and reflect natural groundwater conditions."

3.9 Potential Migration of Pollutants

A discussion of the potential for the vertical and horizontal movement of pollutants into the waters of this State.

The Patapsco River is located approximately 2,000 feet to the east of the Site. There is exchange of groundwater between the river and the aquifers underlying the Site, but there is no communication between the landfill and the underlying aquifer unit. Subsurface explorations at the Site identified a clay confining unit ranging from approximately 40 to 150 feet thick, and up to 105 feet thick below the existing landfill base (*Figure 15*). There are discontinuous beds of clayey and silty sands within the clay unit, which are not connected to the underlying lower aquifer sand units.

Additionally, there is a 12-inch-thick compacted clay layer underneath the landfill created to limit the vertical movement of groundwater into the aquifer below. Permeability testing has been completed on the clay layer, which demonstrates a maximum hydraulic permeability of 1×10^{-7} cm/sec. A leachate collection system is in place to contain pollutants produced by the landfill within the limits of the landfill. The leachate system is constructed of perforated pipes, coarse sand, and coarse aggregate.

The surface water on site is discharged through a leachate collection system into Swan Creek, which leads into the Patapsco River, through a National Pollutant Discharge Elimination System permitted Outfall 003. GTA is currently in the process of designing an updated leachate treatment system for use if concentrations warrant treatment prior to the discharge. This system will contain and treat the leachate, limiting the ability for pollutants to spread to the surrounding waters. All of these factors combined make any contamination of surrounding state waters unlikely.

3.10 Fracture Trace

The results of a fracture trace or aerial photographic lineament analysis (except in the coastal plain) which identifies the relationship between these features and the local ground water hydrology.

As described further in *Section 3.2*, according to the *Geologic Map of Maryland* (1968) and the *Geologic Map of the Baltimore East Quadrangle* (1979), published by the Maryland Geologic Survey, the Site is within the Coastal Plain Physiographic Province. Because the Site is located in the coastal plain, a fracture trace or aerial photographic lineament analysis is not required.

3.11 Geotechnical Properties

Test boring logs, well completion reports, piezometric measurements, chemical and physical soil/sediment analyses, and all accompanying geotechnical analyses. All laboratory and field methodologies and procedures shall be included.

As discussed in *Section 4.2* and provided in *Appendix B*, prior investigations of the Site and the adjacent Lot 15 landfill provided data regarding the unconsolidated sediments located at the Site. In 1988 and 1991, O'Brien & Gere and Hillis-Carnes conducted various geotechnical laboratory tests and in 1992, H&A conducted hydraulic conductivity tests on soil collected in the locations of installed groundwater wells. The average permeability for the soil tested was approximately 6.1×10^{-6} cm/s, which was is a somewhat elevated permeability for clay that may have resulted from scattered interbeds of sand within the screened wells. In 1999, GTA conducted additional geotechnical analysis on the clay at the base of the landfill cells. The average clay permeability from the samples collected by GTA was calculated to be 4.8×10^{-8} cm/s. In 2011, Geosyntec performed 25 permeability tests and moisture content tests during the construction of Cell 1 at the adjacent Lot 15 Landfill. The resulting averaged measured permeability of the samples was 3.2×10^{-8} cm/s. Results from prior investigations are summarized in *Appendix E* as compiled by Geosyntec as part of their 2019 permit application.

Methods utilized in the various investigations are summarized below:

- O'Brien and Gere, Inc. (1988): water content, Atterberg Limits, and grain size distribution.
- Hillis-Carnes, Inc. (1991): water content, Atterberg Limits, and grain size distribution; seven field falling-head hydraulic conductivity tests
- H&A (1992): two constant-head hydraulic conductivity tests on remolded samples of the cohesive material that were compacted to 95% of maximum dry density using the modified Proctor compaction effort
- GTA (1999): index tests, grain size distribution, Proctor tests, and laboratory falling-head permeability test
- Geosyntec (2009): Shelby tube samples, bulk samples for stockpiled clay from adjacent Lot 15 landfill
- Geosyntec (2011): permeability tests and moisture content tests for HPL Cell 1 and the adjacent Lot 15 landfill

The average permeability of the samples from the soil stockpile for the adjacent Lot 15 Landfill was 8.9×10^{-7} cm/s. The stockpile material appears to have been contained more granular, sandy materials which resulted in high permeability values in the laboratory analysis. As part of the construction of the adjacent Lot 15 Landfill, approximately 1,000,000 cy of clay was stockpiled on the HPL on top of the Phase I cell waste and unfilled Phase II cell. Currently, that clay and sandy clay material is being removed as overburden to expose

the available landfill capacity, and is being used as cover. The stockpiled clay is also being removed for offsite uses, or reserved for future closure-capping material.

3.12 Conceptual Landfill Design

A preliminary conceptual design of the proposed municipal landfill based on the geotechnical information gathered in § C(1) - § C(11)…

As described in *Section 2.2*, as-built plans show that the cells were excavated to approximately 11 feet amsl in the northwest corner of the landfill and gently slope down to approximately 8 feet amsl in the southwest corner. A bottom liner was constructed across the entire base of the landfill footprint consisting of a 12-inch-thick compacted clay layer that conforms to the required maximum hydraulic permeability of 1×10^{-7} cm/sec. Refer to *Figure 16, Liner Schematic*.

A leachate collection system drains leachate and rainwater into a network of pipes and a sump. An 18-inch-thick leachate collection system consisting of coarse sand with a network of 4-inch or 6-inch diameter perforated pipes surrounded by coarse aggregate encased in a filter fabric was installed to collect leachate generated and to prevent migration of pollutants outside the limits of the landfill. The liner floor was graded at approximately 0.25% slope to facilitate leachate conveyance to the sump and collection pipes. The pipe network drains to the leachate sump within the landfill and then gets pumped to a sump which consists of a manhole that removes leachate by gravity to the middle settling basin onsite. Refer to *Figure 17, Leachate System Layout*.

Leachate is currently pumped to a settling basin on the adjacent former Cristal USA, Inc. property that is scheduled to be abandoned. Leachate is planned to be redirected to discharge to the Patapsco River by way of an easement on the adjacently southeastern property, through a treatment system if needed based on leachate sampling results and discharge requirements. No modifications or expansions of the liner are proposed as part of the operations.

4.0 PROPOSED USE

4.1 Area Served

The landfill is intended to service third-party customers for disposal of acceptable wastes with MDE approval. The service area is not restricted to any particular county or city, but rather is focused on a specific waste stream for sites in the surrounding area.

4.2 Types of Waste Accepted

Wastes accepted would be the same wastes that the landfill is currently permitted to accept and similar materials. Some prior materials were process-specific for the now-closed Cristal USA,

Inc. plant such as gypsum-sulfate process waste, lagoon dredging/chloride process solids, and batch attack by-products such as mud and ore residues that are no longer applicable. Under the current permit, brick (including refractory), excavated soil/clay/rubble, and road asphalt are accepted and will continue to be disposed at the landfill. Additionally, the facility will accept third-party waste including non-friable asbestos-containing materials (ACM). Friable ACM will be accepted in a GPS-marked and dedicated area and subject to special handling and management requirements. The landfill will not accept household refuse, landscape debris, liquid waste, liquid paint, tar, paint thinner, other solvents, or hazardous waste. Third-party waste may be accepted at the landfill, excluding hazardous waste or waste that is included under RCRA Subtitle C regulation 40 CFR 261.4(b)(7). In such case, wastes shall be sampled and analyzed in accordance with USEPA approved Toxicity Characteristics Leaching Procedure and USEPA publication SW-846 prior to disposal. Should the landfill consider accepting third-party waste, the permittee will submit a written request to the MDE for authorization to dispose of the waste, including waste characterization as required by the MDE.

4.3 Site Receiving

The landfill is currently accessed via a locked gate along a driveway that extends south from Fort Armistead Road. Chain-link fences with barbed wire at the top have been installed around the facility perimeter to restrict access by unauthorized personnel and vehicles. The entrance is controlled via chain-link lockable gates. The landfill operations and visitor reception are managed out of the trailer building on the interior of the gate. Loads will be directed to the active portion of the landfill for disposal, except for friable ACM which will be directed to the asbestos disposal area. The facility will operate during daylight hours and access will be controlled at all times through a monitored gate.

5.0 ADMINISTRATIVE

Any modifications to the operating plan or requests to accept different types of waste will be submitted to MDE prior to implementation. The permittee will maintain records of waste characterization prior to acceptance, a logbook documenting loads received, and provide records

upon request to MDE. The facility will perform inspection of incoming waste and dust and litter control, and maintain an approved stormwater management plan for the entire site.

6.0 REFERENCES

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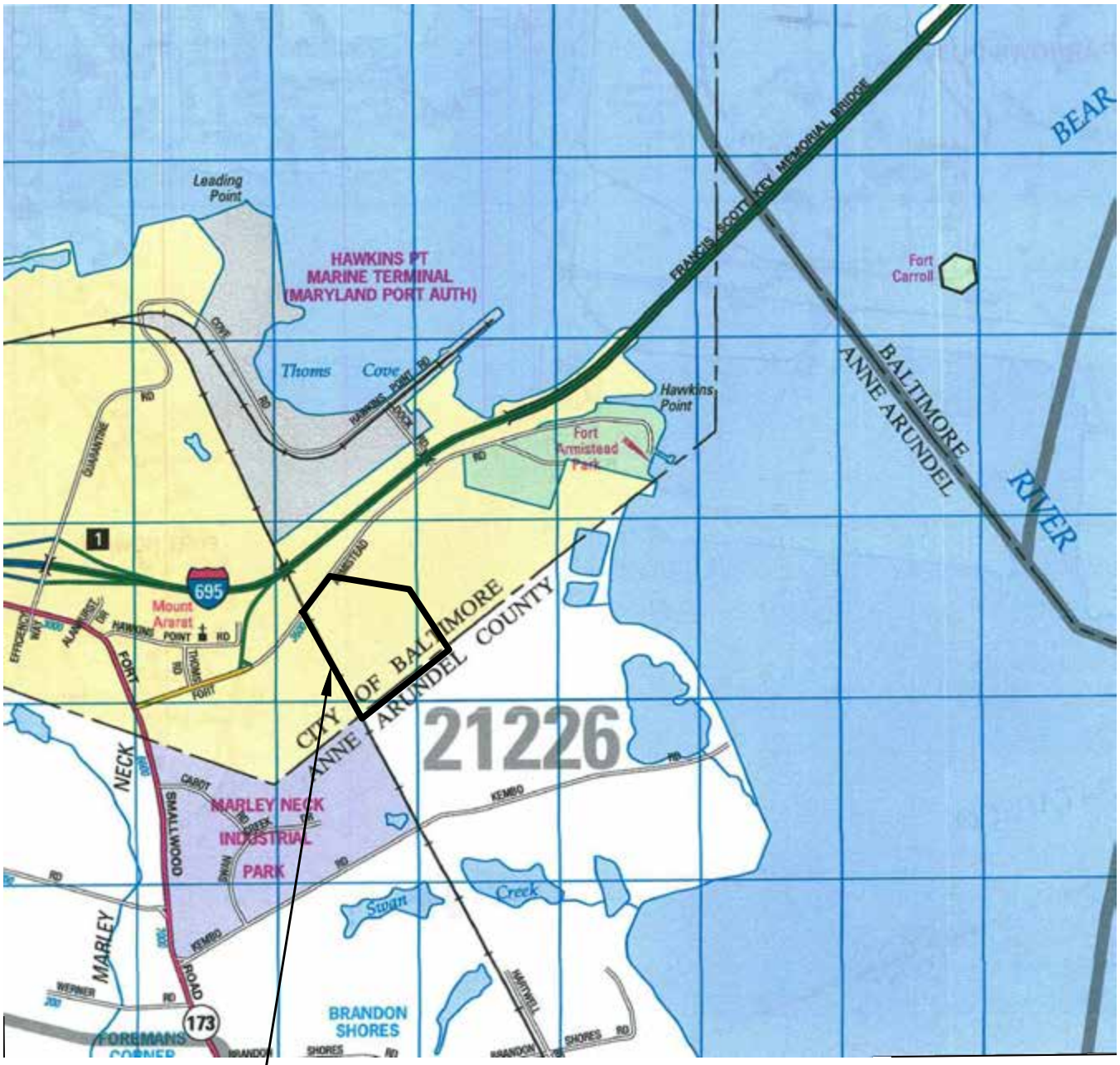
United States Environmental Protection Agency (1991b) Solid Waste Disposal Facility Criteria; Final Rule, Federal Register, 40 CFR Part 258.

******* END OF REPORT *******

FIGURES



Notes

1. Map Copyright © ADC The Map People, (800) 829-6277
2. Permitted Use Number 21006238

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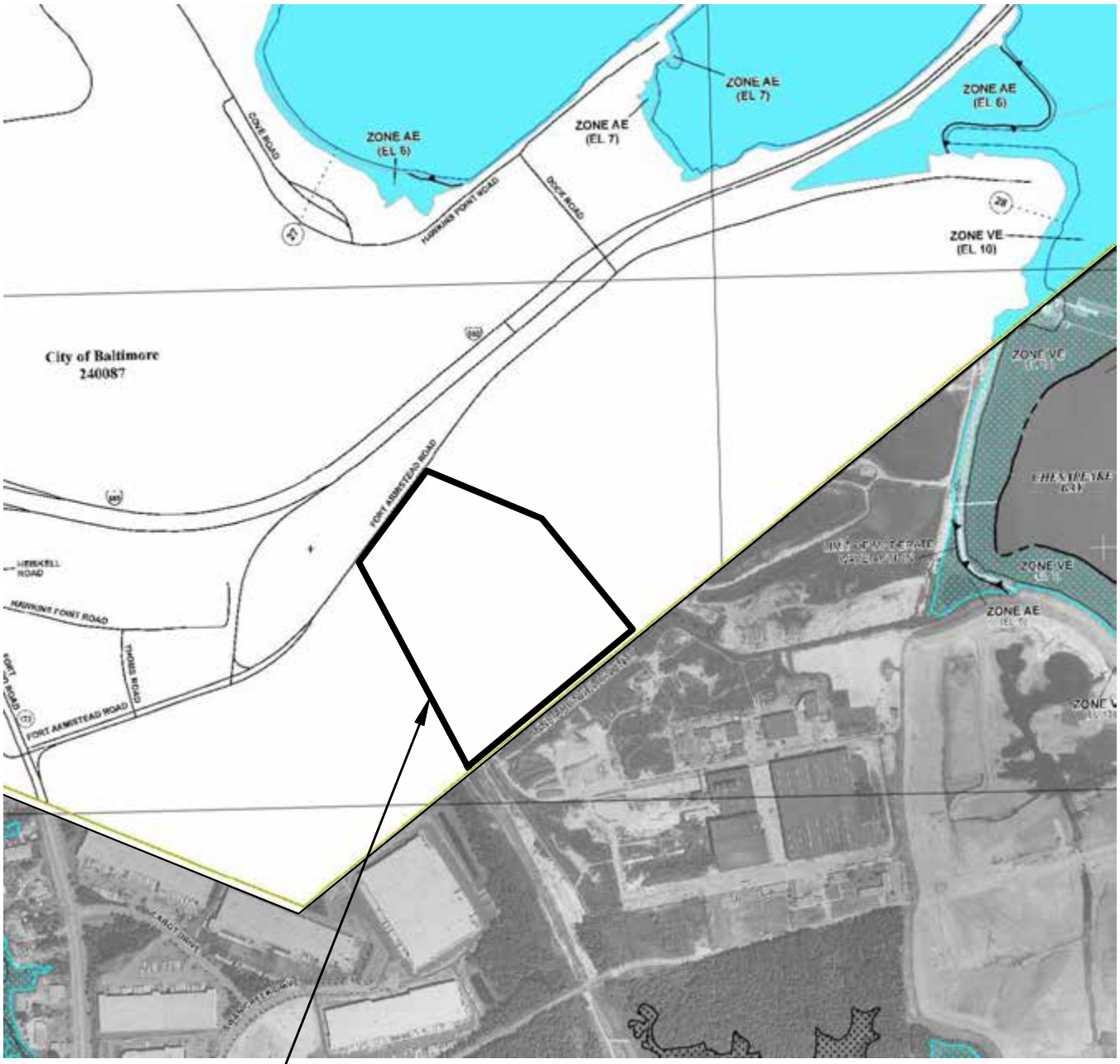
HAWKINS POINT LANDFILL

BALTIMORE CITY, MARYLAND

SITE LOCATION MAP

PROJECT: 200476	DATE: DECEMBER 2021	SCALE: 1" = 2000'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 1



Approximate Site Boundary

Notes

1. Base map image obtained from FEMA National Flood Insurance Program
2. Map #s: Baltimore-2400870036G, Anne Arundel County- 24003C0058F

0 500 1,000

Approximate Scale
1 inch = 1,000 feet

NORTH

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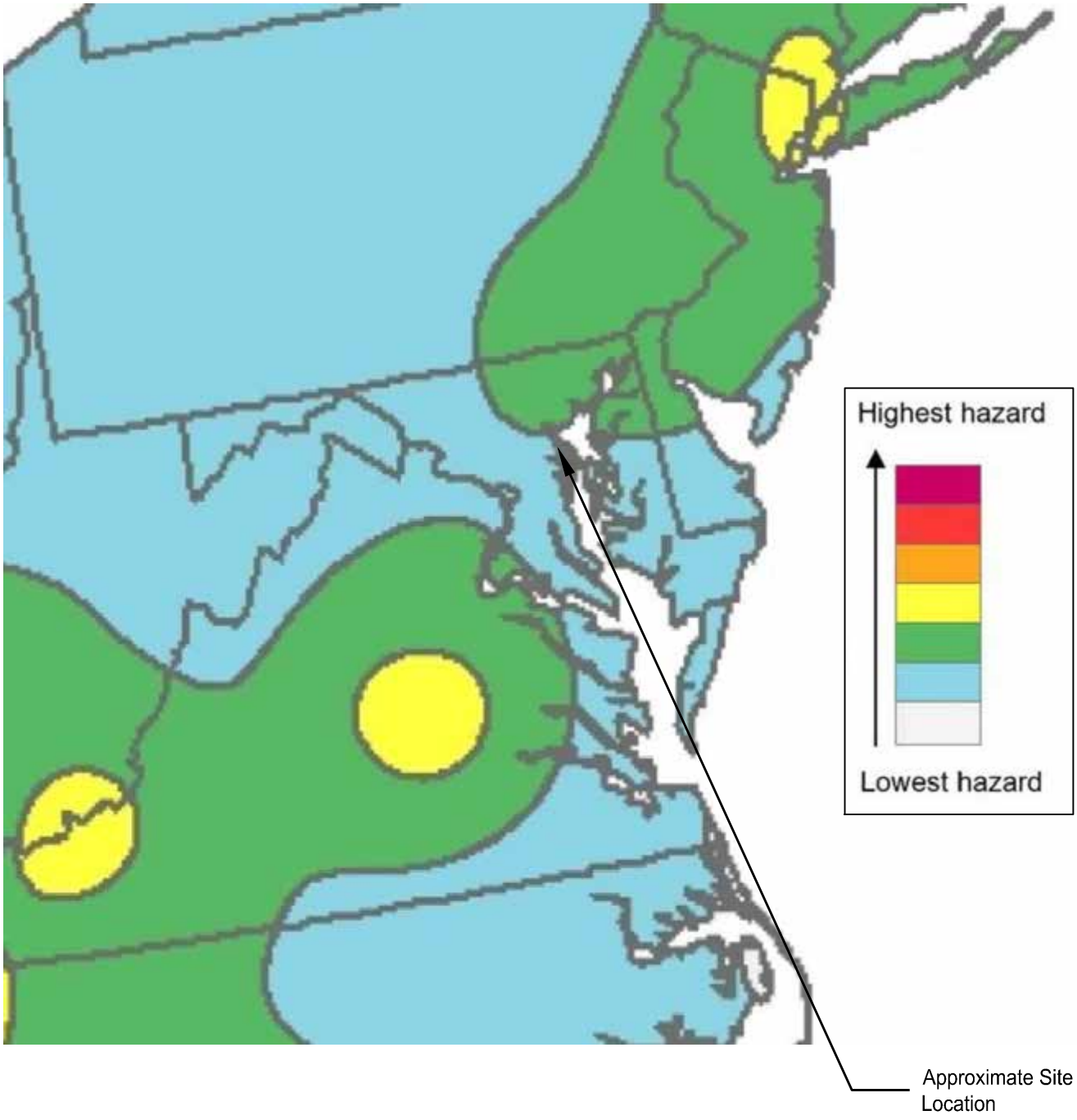
HAWKINS POINT LANDFILL
BALTIMORE CITY, MARYLAND

FEMA FLOODPLAIN MAPS

PROJECT: 31200476	DATE: October 2021	SCALE: 1" = 1,000'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 2



Notes

1. Base map image obtained from USGS, *2018 United States (Lower 48) Seismic Hazard Long-term Model* Map

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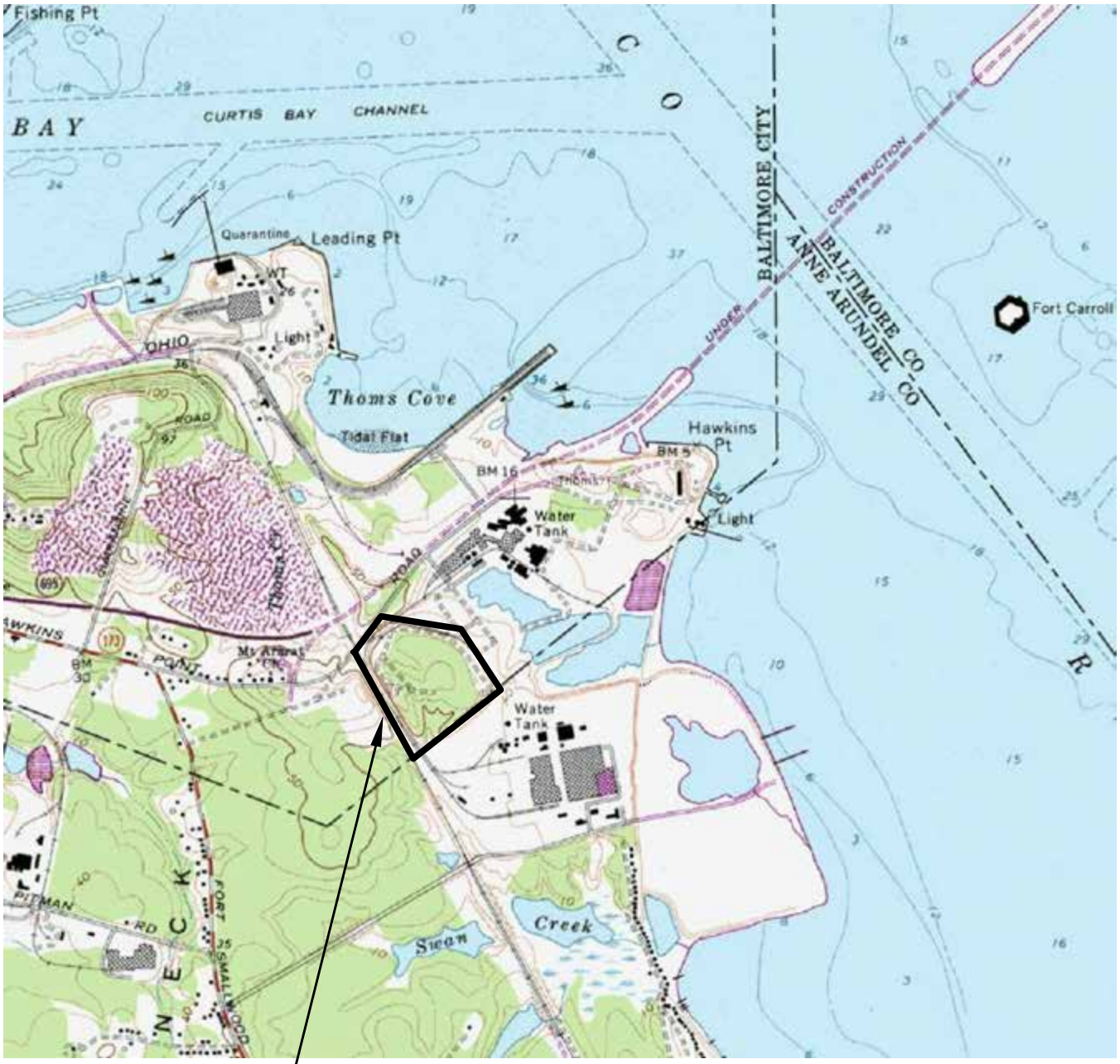
HAWKINS POINT LANDFILL
BALTIMORE CITY, MARYLAND

SEISMIC HAZARD MAP

PROJECT: 31200476	DATE: December 2021	SCALE: Not To Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 3



Notes

1. Based on the USGS Curtis Bay, MD 7.5 Minute Quadrangle Map.
2. Copyright 2013 MyTopo, Inc.

0 1,000 2,000

Approximate Scale
1 inch = 2,000 feet

NORTH

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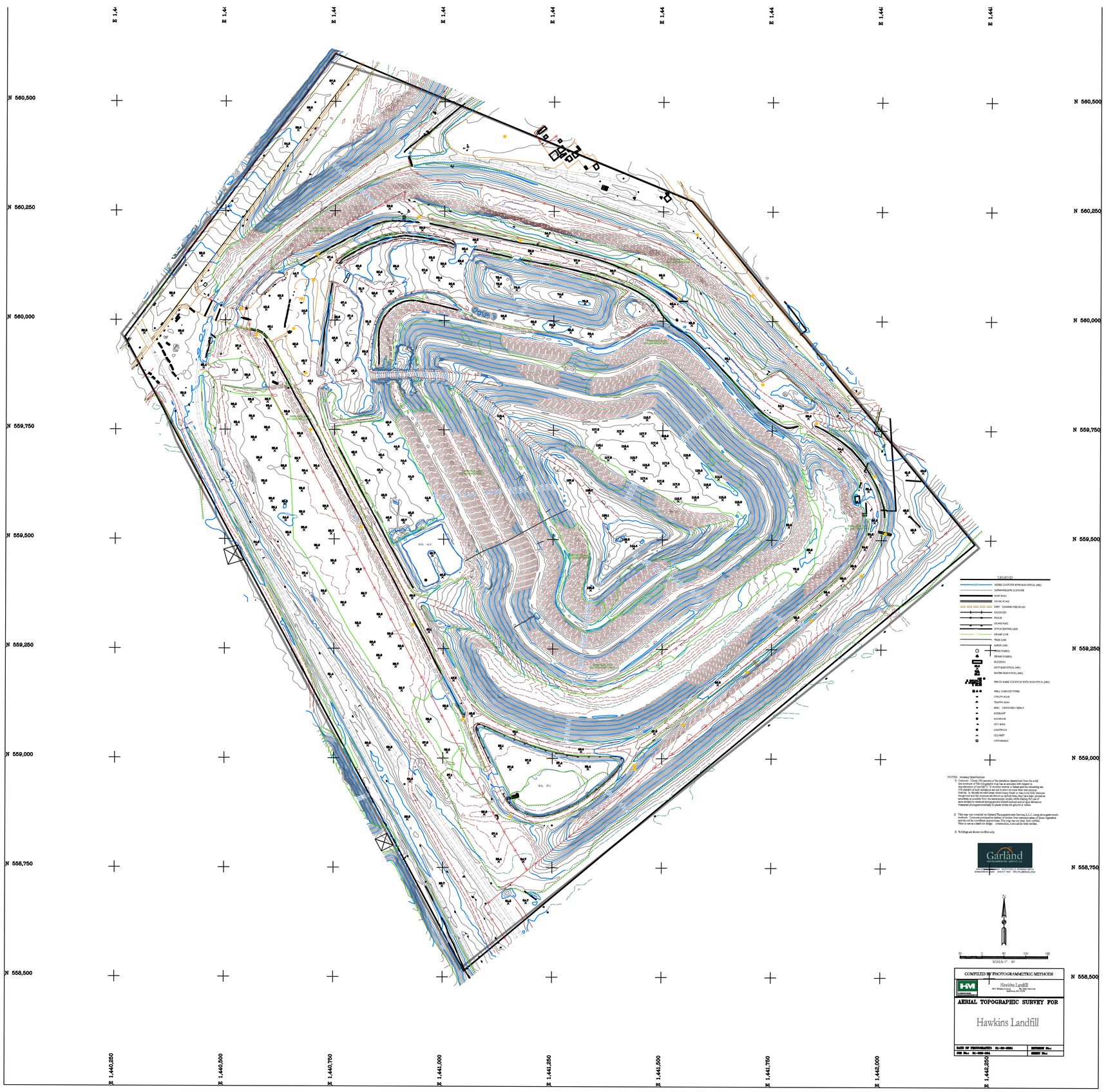
HAWKINS POINT LANDFILL
BALTIMORE CITY, MARYLAND

VICINITY TOPOGRAPHIC MAP

PROJECT: 200476	DATE: DECEMBER 2021	SCALE: 1" = 2000'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 4



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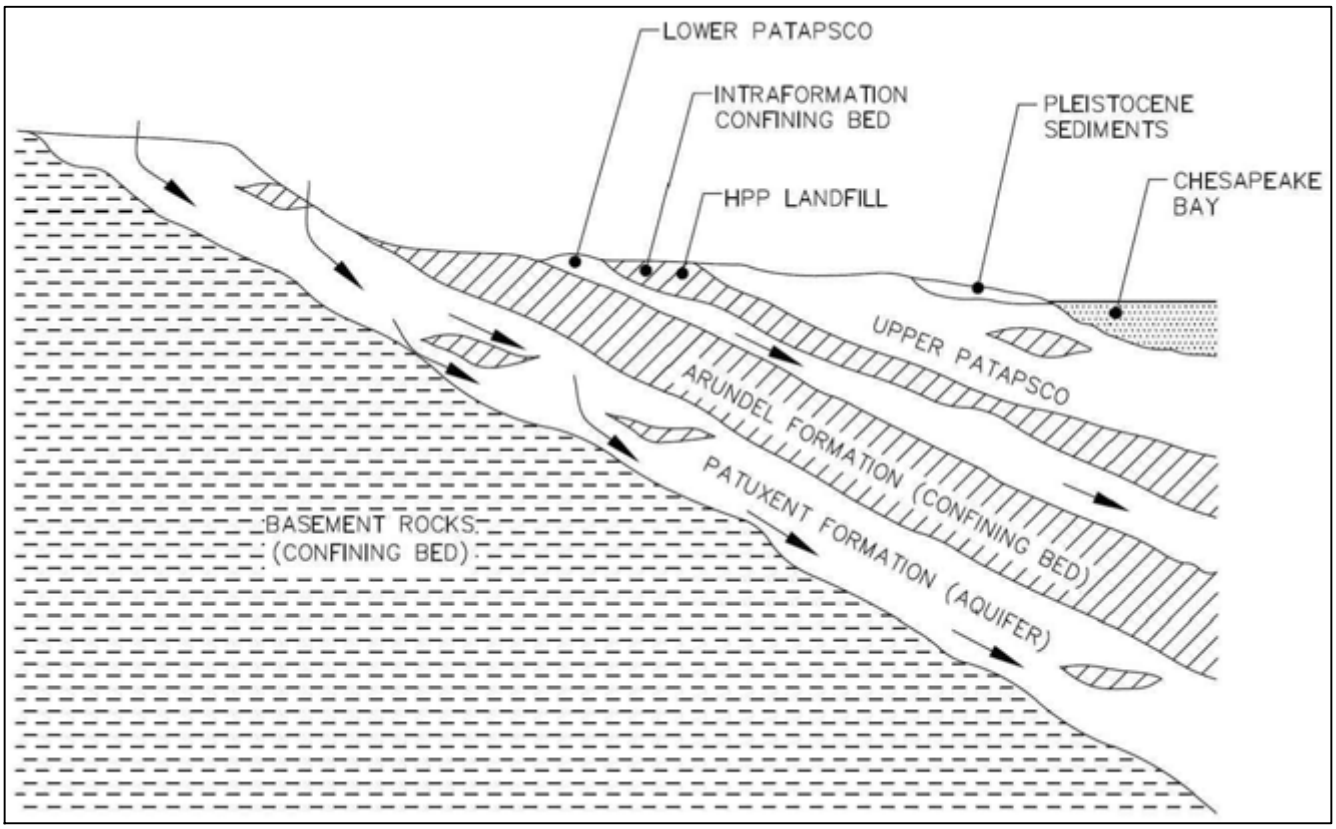
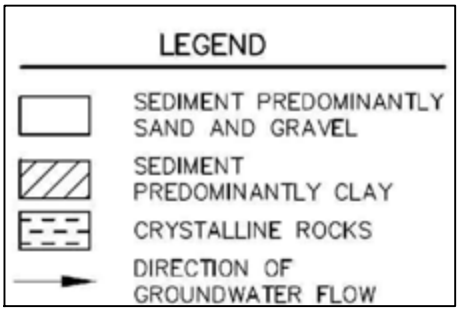
HAWKINS POINT LANDFILL

BALTIMORE COUNTY, MARYLAND

SITE TOPOGRAPHIC MAP

PROJECT: 200476	DATE: December 2021	SCALE: 1" = 80'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 5





Notes

1. Actual slope of sediments is ~60 feet per mile
2. Figure referenced from *Figure 4 Idealized Geologic Profile* by Haley & Aldrich, Inc., 1992.

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HAWKINS POINT LANDFILL
BALTIMORE CITY, MARYLAND

REGIONAL GEOLOGIC CROSS-SECTION

PROJECT: 31200476	DATE: December 2021	SCALE: Not To Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 6

Notes

1. Well locations within $\frac{1}{2}$ mile of the Site obtained from Maryland Department of the Environment
2. Base map image obtained from Google Earth (©2021 Google)

0 500 1,000

Approximate Scale
1 inch = 1,000 feet

NORTH

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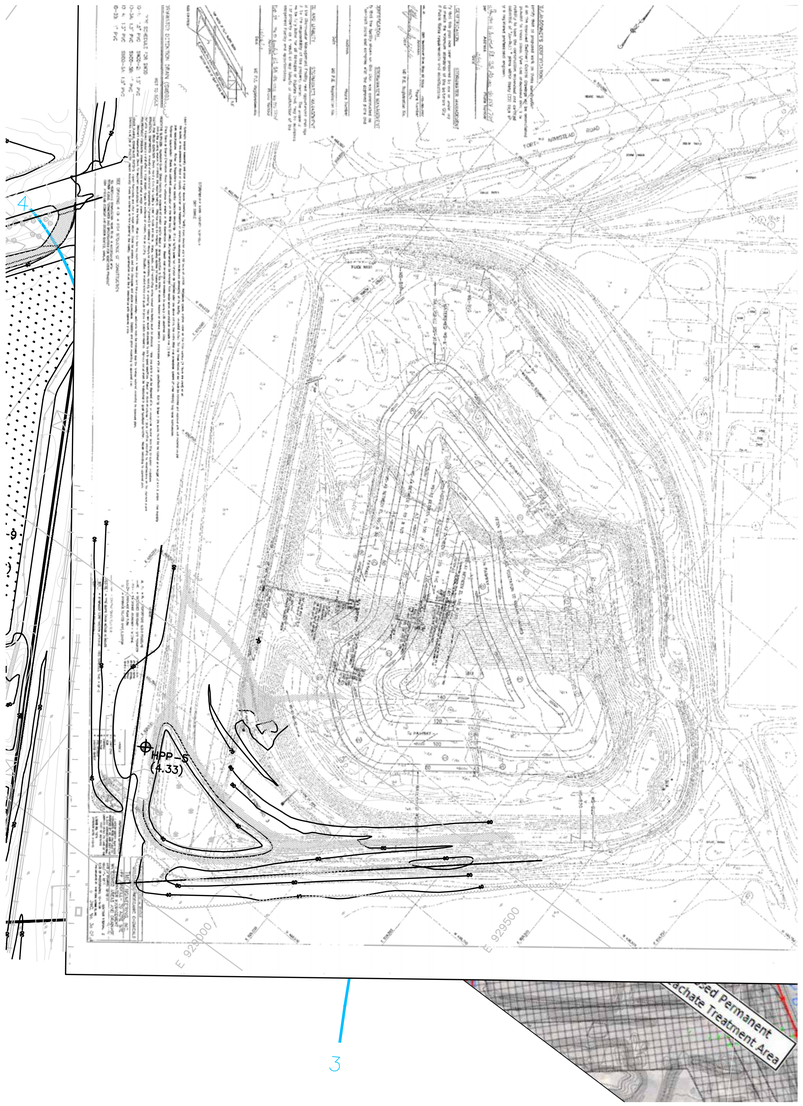
HAWKINS POINT LANDFILL

BALTIMORE CITY, MARYLAND

GROUNDWATER WELL DISTRIBUTION

PROJECT: 31200476	DATE: December 2021	SCALE: 1" = 250'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 7

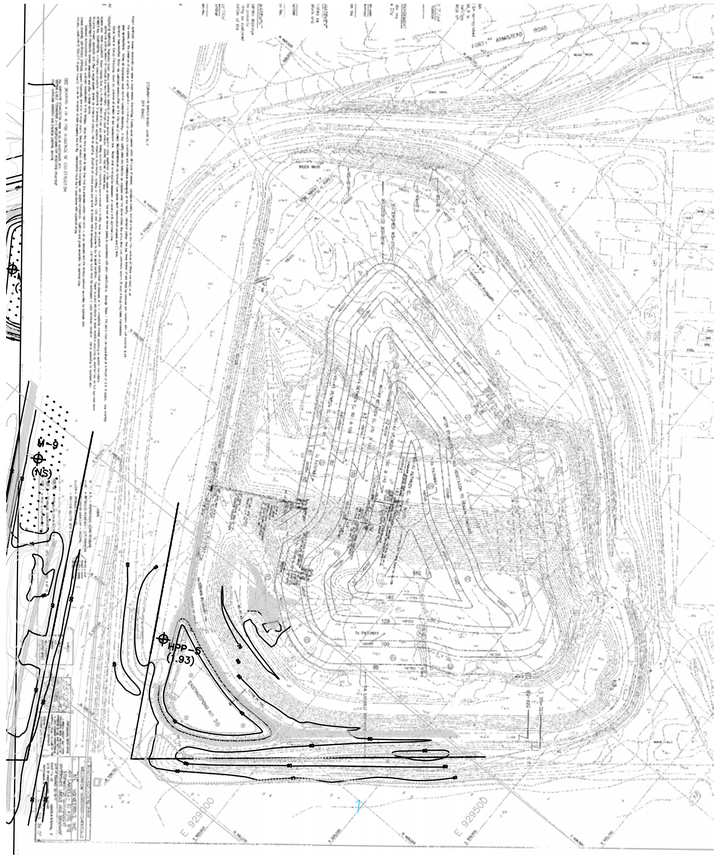


ELEVATED GROUNDWATER CONDITION

NOTES:

1. MAXIMUM GROUNDWATER ELEVATION AT EACH MONITORING WELL WAS SELECTED FROM DATA OBTAINED FROM JANUARY 2018 TO JANUARY 2019 AND REPRESENTS GROUNDWATER ELEVATED OBSERVED IN SEPTEMBER 2018

2. GROUNDWATER ELEVATION DATA COLLECTED FROM MONITORING WELLS LOCATED AT THE LOT 15 LANDFILL (M–6 THROUGH M–11) WERE USED AS A SUPPLEMENT TO DATA COLLECTED AT THE HAWKINS POINT PLANT LANDFILL. PUBLICLY AVAILABLE DATA WAS USED FOR THE LOT 15 LANDFILL GROUNDWATER ELEVATIONS.



DEPRESSED GROUNDWATER CONDITION

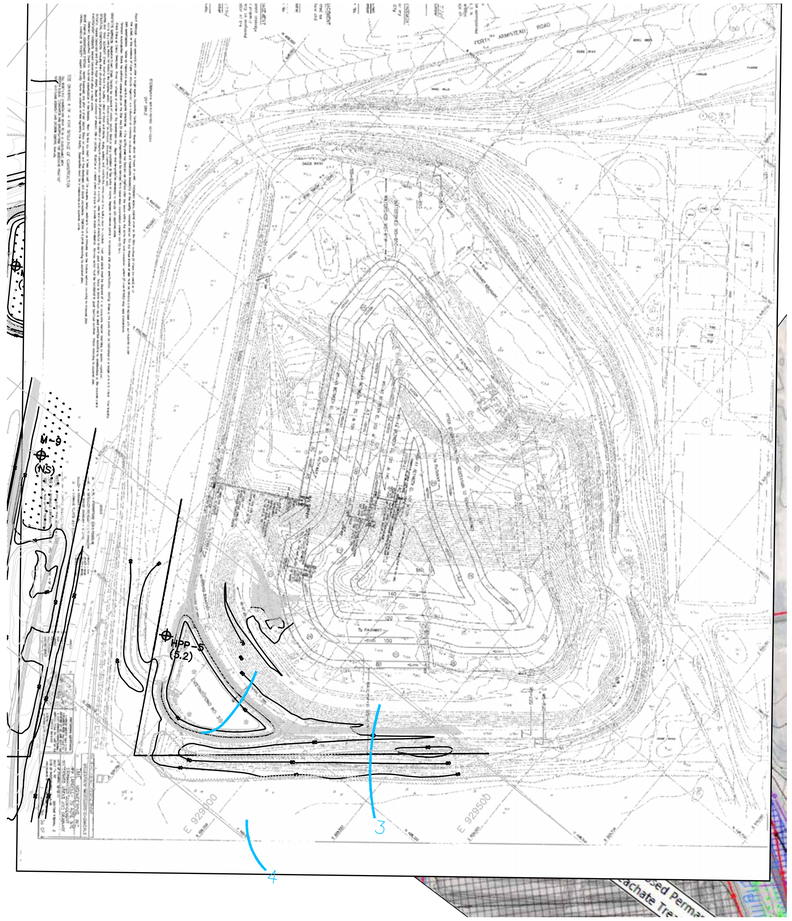
NOTES:

1. MINIMUM GROUNDWATER ELEVATION AT EACH MONITORING WELL WAS SELECTED FROM DATA OBTAINED FROM JANUARY 2018 TO JANUARY 2019 AND REPRESENTS GROUNDWATER ELEVATED OBSERVED IN JANUARY 2018.

2. GROUNDWATER ELEVATION DATA COLLECTED FROM MONITORING WELLS LOCATED AT THE LOT 15 LANDFILL (M–6 THROUGH M–11) WERE USED AS A SUPPLEMENT TO DATA COLLECTED AT THE HAWKINS POINT PLANT LANDFILL. PUBLICLY AVAILABLE DATA WAS USED FOR THE LOT 15 LANDFILL GROUNDWATER ELEVATIONS.

LEGEND

- LOT 15 LANDFILL PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 — MAJOR CONTOUR GRADE (FEET, MSL)
- (0.9) GROUNDWATER ELEVATION IN FEET–MSL OBSERVED IN JUNE 2008 (SEE NOTE 1)
- 4 — ELEVATED GROUNDWATER CONTOUR (FEET–MSL) (DASHED WHERE INTERRED)
- M–1 MONITORING WELL
- LIMIT OF WETLAND MITIGATION AREA



HIGHEST OBSERVED GROUNDWATER CONDITION

NOTES:

1. MINIMUM GROUNDWATER ELEVATION AT EACH MONITORING WELL WAS SELECTED FROM DATA OBTAINED FROM JANUARY 2018 TO JANUARY 2019 AND REPRESENTS GROUNDWATER ELEVATED OBSERVED IN JANUARY 2018.

2. GROUNDWATER ELEVATION DATA COLLECTED FROM MONITORING WELLS LOCATED AT THE LOT 15 LANDFILL (M–6 THROUGH M–11) WERE USED AS A SUPPLEMENT TO DATA COLLECTED AT THE HAWKINS POINT PLANT LANDFILL. PUBLICLY AVAILABLE DATA WAS USED FOR THE LOT 15 LANDFILL GROUNDWATER ELEVATIONS.

1. Base maps obtained from Geosyntec Consultants *Phase II Report Permit Application for Hawkins Point Plant Industrial Waste Landfill* dated September 2019

0 50 100
Approximate Scale
1 inch = 100 feet

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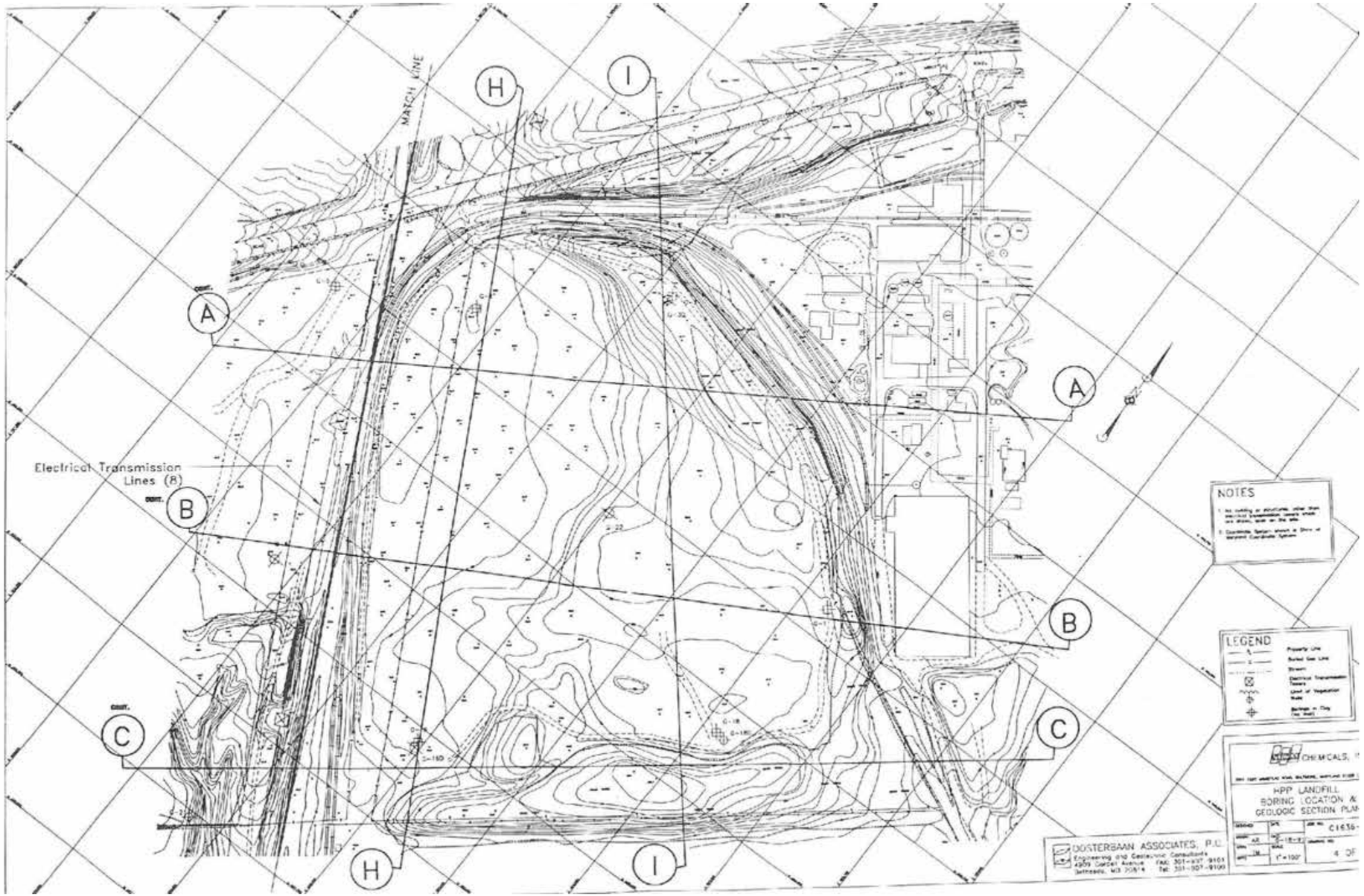
HAWKINS POINT LANDFILL

BALTIMORE COUNTY, MARYLAND

GROUNDWATER CONTOUR MAPS

PROJECT: 200476	DATE: December 2021	SCALE: 1" = 150'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 8



Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

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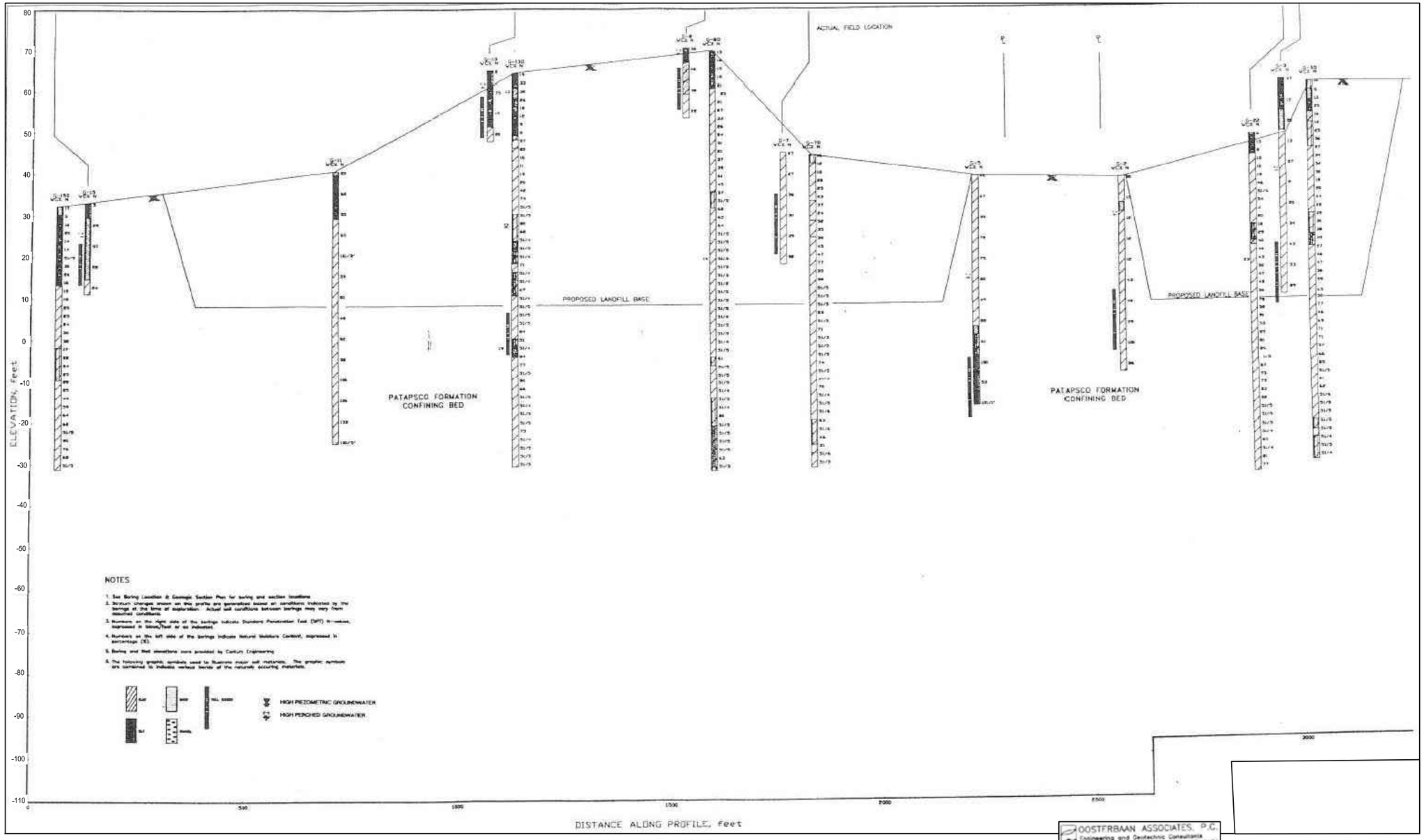
HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND

SITE GEOLOGIC CROSS-SECTION MAP

PROJECT: 31200476	DATE: December 2021	SCALE: 1" = 250'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 9



Section A - A'

Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

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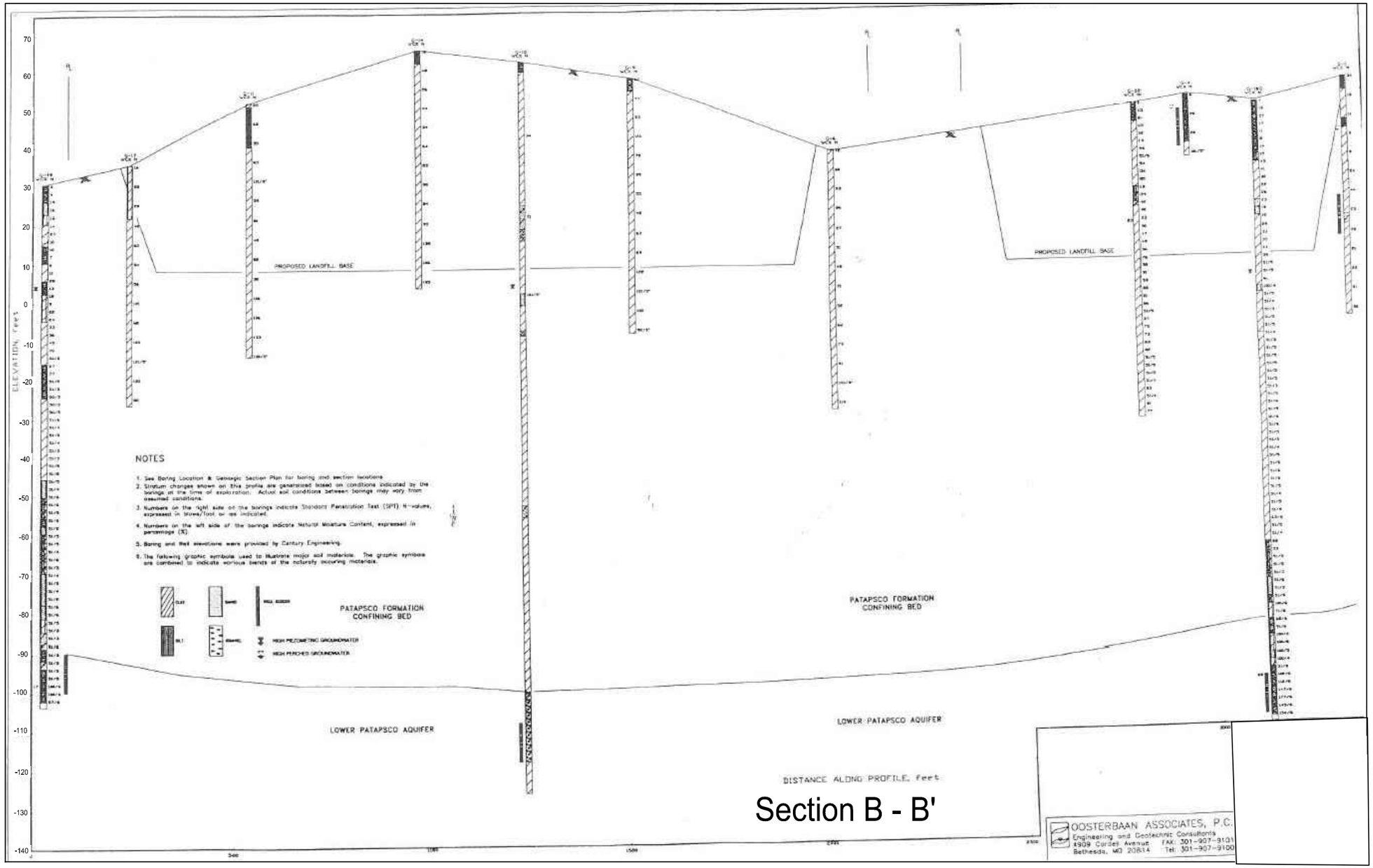
HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND
SITE GEOLOGIC CROSS SECTION A-A'

PROJECT: 31200476	DATE: December 2021	SCALE: Not to Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 10



Section B - B'

Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

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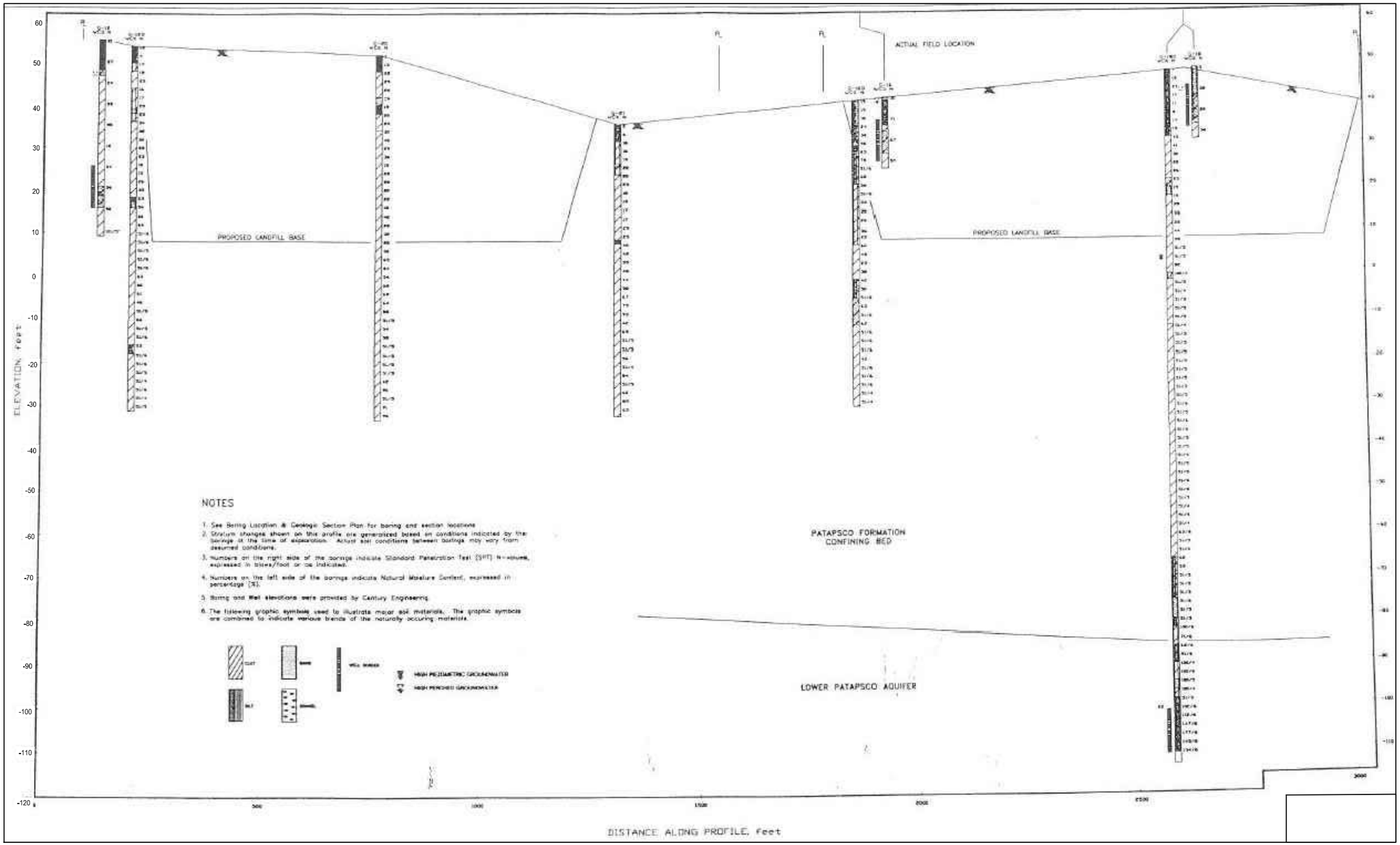
HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND

SITE GEOLOGIC CROSS SECTION B-B'

PROJECT: 31200476	DATE: December 2021	SCALE: Not to Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 11



Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

Section C - C'

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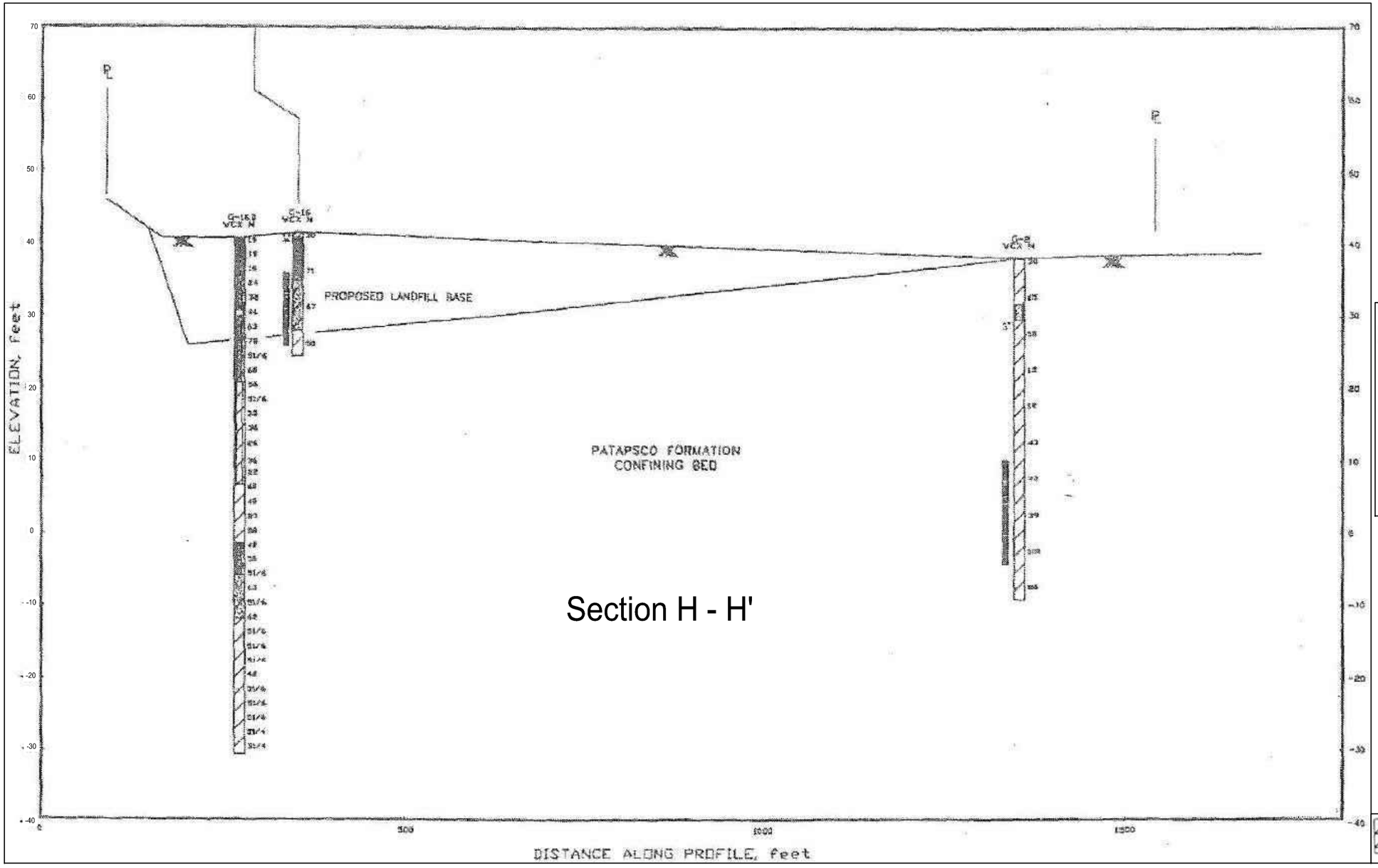
HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND

SITE GEOLOGIC CROSS SECTION
C-C'

PROJECT: 31200476	DATE: December 2021	SCALE: Not to Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 12



NOTES

1. See Boring Location & Geologic Section Plan for boring and section locations.
2. Stratum changes shown on this profile are generalized based on conditions indicated by the borings at the time of exploration. Actual and conditions between borings may vary from encountered conditions.
3. Numbers on the right side of the borings indicate Standard Penetration Test (SPT) N-values, expressed in blows/foot or as indicated.
4. Numbers on the left side of the borings indicate Natural Moisture Content, expressed in percentage (%).
5. Boring and Well elevations were provided by Century Engineering.
6. The following graphic symbols used to illustrate major soil materials. The graphic symbols are combined to indicate various blends of the naturally occurring materials.

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Engineering and Geotechnic Consultants
4909 Cordell Avenue FAX: 301-907-9101
Bethesda, MD 20814 Tel: 301-907-9100

Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

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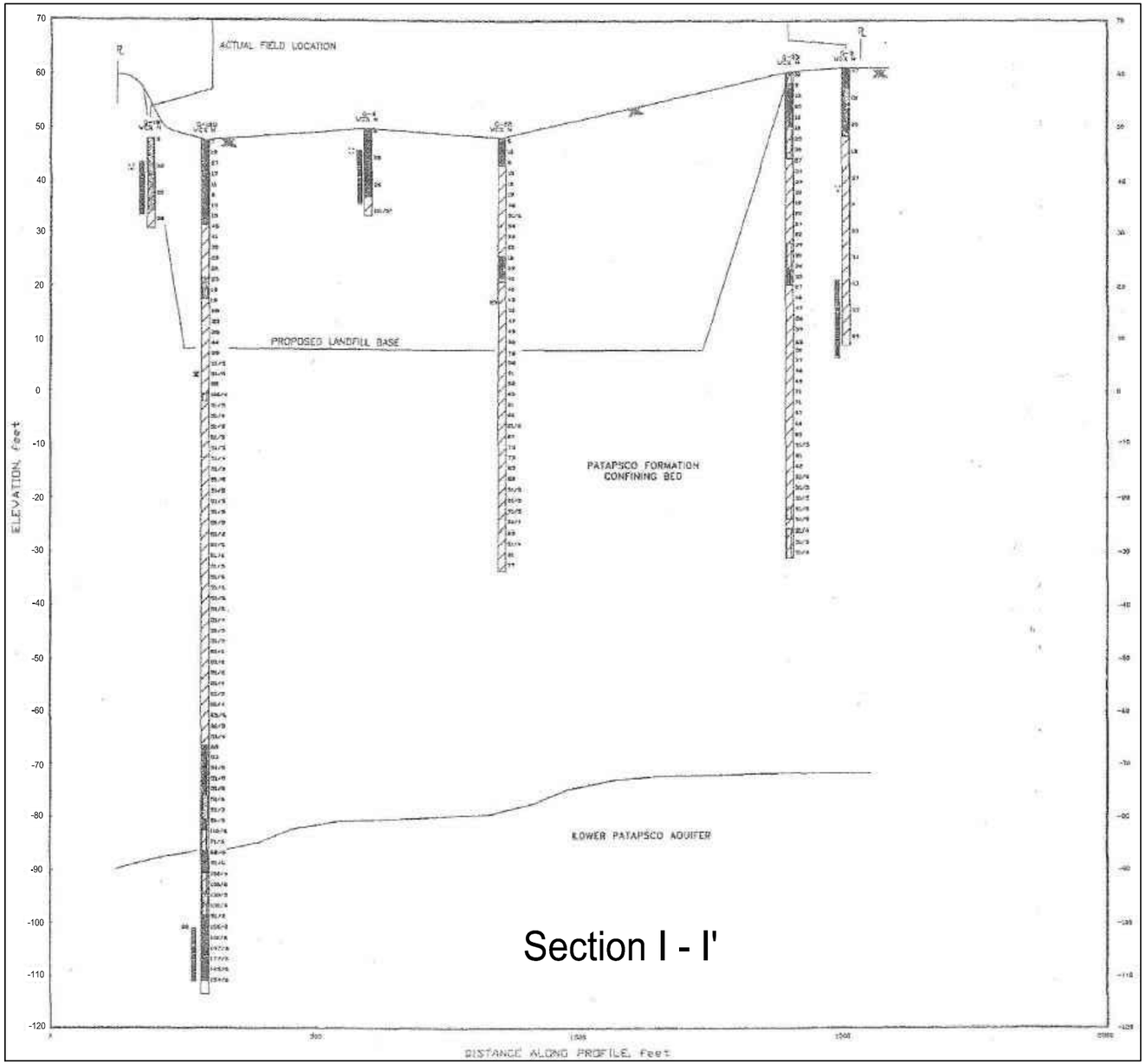
HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND
SITE GEOLOGIC CROSS SECTION H-H'

PROJECT: 31200476	DATE: December 2021	SCALE: Not to Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 13



Section I - I'

NOTES

1. See Boring Location & Geologic Section Plan for boring and section locations.
2. Stratum changes shown on this profile are generalized based on conditions indicated by the borings at the time of exploration. Actual soil conditions between borings may vary from assumed conditions.
3. Numbers on the right side of the borings indicate Standard Penetration Test (SPT) N-values, expressed in blows/foot or as indicated.
4. Numbers on the left side of the borings indicate Natural Moisture Content, expressed in percentage (%).
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Notes

1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

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HAWKINS POINT LANDFILL
BALTIMORE COUNTY, MARYLAND
SITE GEOLOGIC CROSS SECTION I-I'

PROJECT: 31200476	DATE: December 2021	SCALE: Not to Scale	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 14

Notes

1. Base map obtained from Geosyntec Consultants, *Phase II Report Permit Application for Hawkins Point Plan Industrial Waste Landfill* dated September 2019

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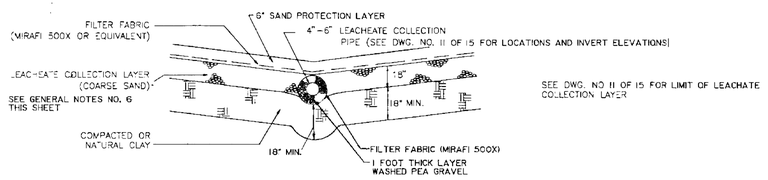
HAWKINS POINT LANDFILL

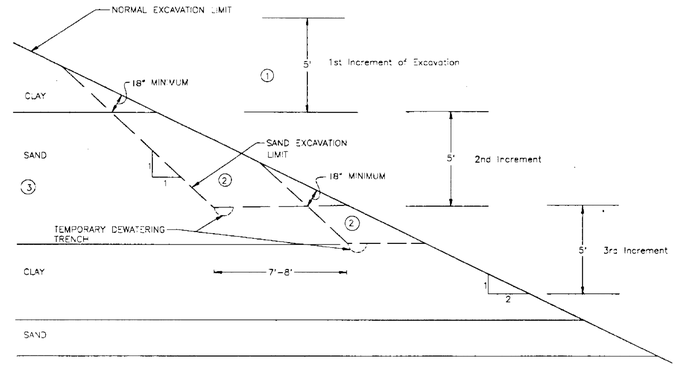
BALTIMORE CITY, MARYLAND

ISOPACHOUS MAP

PROJECT: 31200476	DATE: December 2021	SCALE: 1" = 250'	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 15



DETAIL 'A' - TYPICAL LINER/LEACHEATE COLLECTION LAYERS

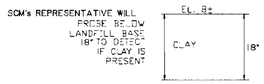


DETAIL C: NORMAL SLOPE CONSTRUCTION

NOT TO SCALE

NOTES FOR DETAIL C: NORMAL SLOPE CONSTRUCTION

1. EXCAVATION TO PROCEED IN FIVE (5) FOOT INCREMENTS. SLOPES WILL BE OBSERVED AND TESTED BY SCM'S REPRESENTATIVE AT EACH INCREMENT TO DEMONSTRATE CONTINUOUS CLAY, AT LEAST 18 INCHES THICK.
2. EXCAVATE SAND LAYERS/LENSES TO THE APPROXIMATE LIMITS SHOWN. REPLACE SAND WITH COMPACTED CLAY MEETING CLAY LINER SPECIFICATIONS.
3. TEMPORARY DEWATERING TRENCHES LEADING TO TEMPORARY SUMP AND PUMP WILL REMAIN IN OPERATION WHILE COMPACTED CLAY IS BEING PLACED.
4. IF INITIAL EXCAVATION ON SLOPE UNCOVERS A ZONE OF SEEPAGE OF A NOTICEABLE VOLUME ON A POTENTIALLY PERSISTENT BASIS, THE CONTRACTOR WILL BE DIRECTED TO IMPLEMENT DETAIL 'D'.

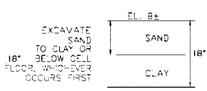


SCM's REPRESENTATIVE WILL TEST CLAY FOR

$k \leq 1 \times 10^{-7}$ cm/sec

IF CLAY FAILS TO MEET TEST FOR HYDRAULIC CONDUCTIVITY, FOLLOW CASE 3 FOR SAND

CASE 1 - CLAY AT LANDFILL BASE

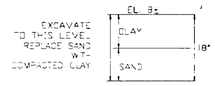


REPLACE SAND WITH COMPACTED CLAY

TEST COMPACTED CLAY FOR

$k \leq 1 \times 10^{-7}$ cm/sec

CASE 2 - SAND AT LANDFILL BASE

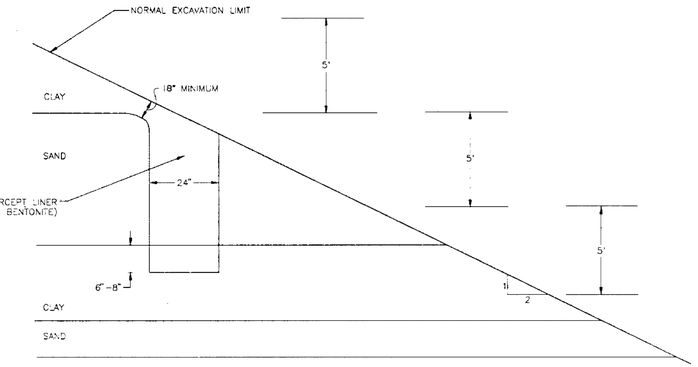


SCM's REPRESENTATIVE WILL TEST COMPACTED CLAY FOR

$k \leq 1 \times 10^{-7}$ cm/sec

CASE 3 - SAND WITHIN 18" OF LANDFILL BASE

DETAIL B: LANDFILL BASE PREPARATION



DETAIL D: CONTINGENT SLOPE CONSTRUCTION

NOT TO SCALE

NOTES FOR DETAIL D: CONTINGENT SLOPE CONSTRUCTION

1. EXCAVATE INTERCEPT LINER TWO (2) FEET IN WIDTH THROUGH SAND LAYER TO CLAY.
2. BACKFILL INTERCEPT LINER WITH CEMENTATIOUS BENTONITE WITH HYDRAULIC CONDUCTIVITY OF 1×10^{-6} cm/sec OR LESS. CEMENTATIOUS BENTONITES TO CONSIST OF SLURRY MIXTURE AT A RATIO OF 2 LBS. OF PORTLAND CEMENT TYPE II WITH 1 LB. OF BENTONITE WITH 1 GAL. OF WATER.
3. ALLOW CEMENTATIOUS BENTONITE TO CURE UNTIL INITIAL SET.
4. CONTINUE NEXT INCREMENT OF GENERAL EXCAVATION.

GENERAL NOTES

1. EXCAVATION FOR LANDFILL AT FINAL CUT SLOPES WILL PROCEED IN VERTICAL INCREMENTS NOT EXCEEDING FIVE (5) FEET.
2. FINAL CUT SLOPES WILL BE OBSERVED AND TESTED AT EACH INCREMENT BY A QUALIFIED FIELD TECHNICIAN UNDER THE SUPERVISION OF A REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER TO DEMONSTRATE CONTINUOUS CLAY, AT LEAST 18 INCHES THICK, MEASURED PERPENDICULAR TO THE SLOPE FACE AS SHOWN IN DETAILS 'C' AND 'D' ON THIS DRAWING SHEET.
3. CLAY TESTS WILL CONSIST OF IN-PLACE DENSITY TESTS, MOISTURE CONTENT, LIQUID AND PLASTIC LIMITS (LL AND PL), MECHANICAL ANALYSES TO DETERMINE THE PERCENT PASSING U.S. NO. 200 SIEVE AND FIELD OR LABORATORY HYDRAULIC CONDUCTIVITY TESTS PERFORMED ON FIELD SAMPLES OF COMPACTED CLAY.
4. ACCEPTABLE TESTS WILL BE AS FOLLOWS.
   A. IN-PLACE DENSITY, $\gamma_d \geq 95\%$ ASTM D-698
   B. PLASTIC INDEX, (PI=LL-PL) > 7
   C. PERCENT PASSING NO. 200 SIEVE > 40%
   D. HYDRAULIC CONDUCTIVITY, $k \leq 1 \times 10^{-7}$ cm/sec
5. FREQUENCY OF TESTS* (BY OTHERS)
   A. IN-PLACE DENSITY: 10 PER ACRE
   B. PLASTIC INDEX: 10 PER ACRE
   C. PERCENT PASSING NO. 200 SIEVE: 10 PER ACRE
   D. HYDRAULIC CONDUCTIVITY: 1 OR MORE PER ACRE
   E. CLAY THICKNESS PROBES: 10 PER ACRE

   * IN-PLACE DENSITY, P.I., AND PERCENTAGE PASSING NO. 200 SIEVE WILL BE USED AS INDICATOR TESTS AFTER CORRELATION WITH HYDRAULIC CONDUCTIVITY TESTS.
6. SAND USED FOR LEACHATE COLLECTION LAYER SHALL BE CLEAN SILICA SAND WITH LESS THAN 5% OF THE MATERIAL PASSING THE U.S. NO. 200 SIEVE AND WITH A HYDRAULIC CONDUCTIVITY, $k \geq 5 \times 10^{-3}$ cm/sec.
7. IN CIRCUMSTANCE WHERE SEEPAGE OF NOTICEABLE VOLUME ON A POTENTIALLY PERSISTANCE BASIS IS ENCOUNTERED IN SURFICIAL SAND, AN EXCAVATION TWO (2) FEET IN WIDTH, WILL BE CONSTRUCTED ON THE STORMWATER CONVEYANCE CHANNEL SIDE OF THE ACCESS ROAD. THE EXCAVATION WILL PROCEED VERTICALLY TO CLAY AND BE FILLED WITH SAND MEETING THE REQUIREMENTS OF THE LEACHATE COLLECTION LAYER SAND IN GENERAL NOTE NO.6, ABOVE. THE EXCAVATION WILL BE GRADED TO DRAIN BY GRAVITY TO A DOWN-GRADIENT LOCATION IN THE STORMWATER CONVEYANCE CHANNEL AND/OR A STORMWATER MANAGEMENT BASIN.

NOTE
SEE INDEX
ON 7533

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists
FORMERLY
OOSTERBAAN ASSOCIATES, P.C.
Engineering and Geotechnic Consultants
4909 Cordell Avenue FAX: 301-907-9101
Bethesda, MD 20814 Tel: 301-907-9100

BCM-ENVICAL, INC.
3901 FORT ARMISTEAD ROAD, BALTIMORE, MARYLAND 21226 (301) 355-3600

HPP LANDFILL
CLAY LINER DETAILS, SECTIONS & SPECIFICATIONS

DESIGNED TM	DATE 2-14-92	JOB NO: 65358-48
DRAWN AR	DATE 2-14-92	
APPD TM	SCALE AS SHOWN	DRAWING NO: 10 OF 15
APPD		

7543

1. Base plans obtained from Oosterbaan Associates P.C. Phase II Permit Application

GEO-TECHNOLOGY ASSOCIATES, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
14280 PARK CENTER DRIVE, SUITE A
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www.gtaeng.com

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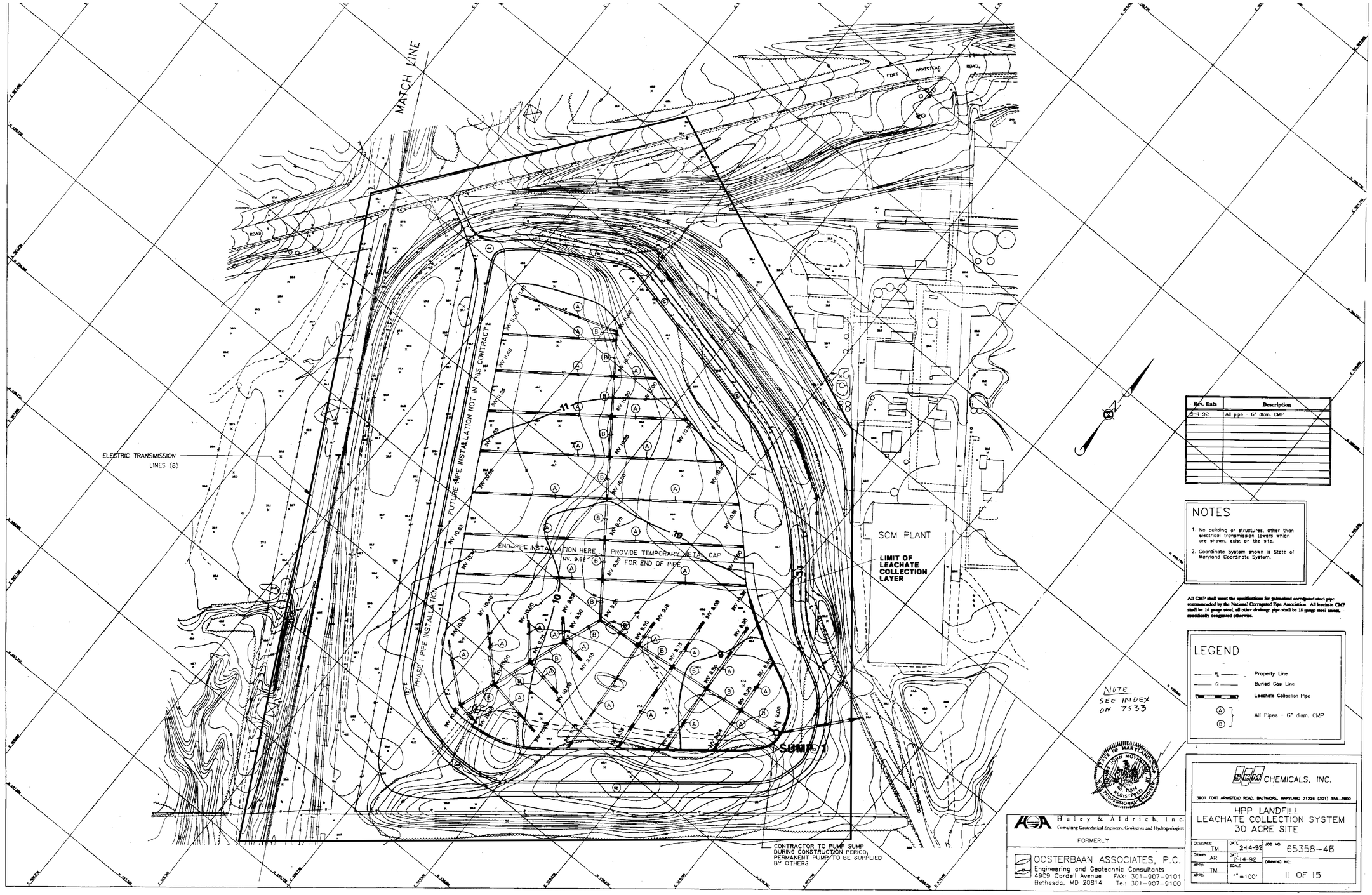
HAWKINS POINT LANDFILL

BALTIMORE COUNTY, MARYLAND

LINER SCHEMATIC

PROJECT: 200476	DATE: December 2021	NOT TO SCALE	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 16



1. Base map obtained from Oosterbaan Associates P.C. Phase II Permit Application

0 50 100
Approximate Scale
1 inch = 100 feet

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HAWKINS POINT LANDFILL

BALTIMORE COUNTY, MARYLAND

LEACHATE SYSTEM LAYOUT

PROJECT: 200476	DATE: December 2021	NOT TO SCALE	DESIGN BY: BRS	REVIEW BY: KBD	FIGURE: 17

TABLES

Table 1
Groundwater Wells Within 0.5 Mile

Permit Number	Location / Road	Total Depth (ft)	Screen Type	Screened Interval		Usage	Completion Date
				Top (ft)	Bottom (ft)		
AA817531	Kembo Road	52	PL	42	52	T	11/6/1986
BC810517	Quarantine Road	92	PL	82	92	T	6/5/1986
BC810519	Quarantine Road	--	--	--	--	T	--
BC810520	Quarantine Road	124	PL	114	124	T	8/12/1986
BC810526	Quarantine Road	97	PL	87	97	T	6/9/1986
BC810207	Glidden	30	PL	20	30	T	9/4/1984
BC810933	Dock Road	--	--	--	--	T	--
BC810271	RT 695	29	PL	20	29	T	12/18/1984
BC730031	RT 695	--	--	--	--	T	--
BC810040	Glidden	40	PL	33	40	T	9/23/1981
BC810043	Glidden	40	PL	33	40	T	9/23/1981
AA941340	Tanyard Cove Rd	15	ST	5	15	T	4/1/1997
BC100112	Cove Rd	50	PL	20	50	I	12/15/2011
BC100113	Cove Rd	45	PL	15	45	I	12/16/2011
BC100114	Cove Rd	45	PL	15	45	I	12/17/2011
BC100115	Cove Rd	36	PL	26	36	T	12/20/2011
BC130065	Quarantine Road	52	PL	22	52	T	12/7/2012
BC130066	Quarantine Road	54	PL	24	54	T	12/4/2012
AA150253	Kembo Road	15	PL	5	15	T	4/20/2017
AA150254	Kembo Road	50	PL	30	50	T	4/19/2017
AA150255	Kembo Road	15	PL	5	15	T	4/20/2017
BC150084	Fort Armistead Rd	22	--	--	--	T	6/10/2015
AA150470	Kembo Road	50	PL	30	50	T	11/13/2017
AA150464	Kembo Road	50	PL	30	50	T	11/14/2017
AA150465	Kembo Road	55	PL	35	55	T	11/20/2017
AA150467	Kembo Road	50	PL	30	50	T	10/31/2017
AA150468	Kembo Road	45	PL	25	45	T	11/9/2017

APPENDIX A
Wetland Delineation Report

Geosyntec consultants

10211 Wincopin Circle, 4th Floor
Columbia, Maryland 20144
PH 410-381-4333
www.geosyntec.com

Memorandum

Date:	9 October 2019
To:	Project File
From:	Alexander Mathes Thom Bristol
Subject:	Wetland Delineation Results Hawkins Point Landfill Hawkins Point, Baltimore, Maryland

Geosyntec Consultants (Geosyntec) has prepared this memorandum for Hawkins Point, LLC (Client) to present the findings of a wetland delineation of the Hawkins Point Landfill property (Survey Area) located on approximately 30-acres at 3901 Fort Armistead Rd., Baltimore, Maryland (the "Subject Property" or "Site"). The Site is currently an active landfill providing support to the Hawkins Point Plant located on an adjacent parcel. The following is a summary of Geosyntec's field investigation of the property.

Project Description

The Project site is located in southeastern Baltimore City boundary, immediately adjacent to the Anne Arundel County Line (**Figure 1**). The property is located on the southeast corner of the intersection of a northbound CSX rail line and Fort Armistead Road consisting of developed and undeveloped lands. The landfill, support offices, asphalt parking lots/roadways are located within the central portion of the Site, while railroad tracks occurring outside of the perimeter fence are present along the peripheral of the approximately 30-acre parcel. The remaining area is largely undeveloped, unmaintained woodland with the exception of a maintained electrical power line right-of-way (ROW) (**Figure 2**). A gravel two-track road circles the landfill and an active sediment basin occurs on the southwest corner of the landfill. Land use in the Project vicinity generally includes undeveloped woodlands, public utilities ROW, transportation corridors, and developed industrial land, including a nearby landfill used for the storage of coal combustion byproducts.

Geosyntec biologists, Alexander Mathes and Carter Black, conducted the wetlands delineations within the property boundary on 30 September and 1 October 2019. The primary goal of delineation was to positively identify, to the extent present, wetlands and other waters (streams, open waters, etc.) within the Survey Area and provide a general characterization of their condition (forested/scrub-shrub/herbaceous).

Wetlands Delineation Methodology

In general, wetlands and other waters of the U.S. are federally protected under Section 404 of the Clean Water Act. The definition of wetlands (at 40 Code of Federal Regulations §230.3(t)) is "*those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas*."

Geosyntec performed a wetlands/waters delineation of the Survey Area in accordance with the three-parameter methodology outlined in the *1987 USACE Wetlands Delineation Manual* [1] (Manual), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coast Region*[2], and per recent guidance issued jointly by the U.S. Environmental Protection Agency (EPA) and the USACE that resulted from the *Rapanos vs. U.S.* and *Carabell vs. U.S.* Supreme Court decisions[3].

The three parameters required for identifying a jurisdictional wetland are as follows:

- The presence of hydrology - At each data point, the delineator evaluates the area for evidence of hydrology. The Manual identifies both primary and secondary hydrologic indicators, where one primary indicator or two secondary indicators must be evident. Some examples of wetland hydrology indicators include saturation in the upper 12 inches of the soil profile, inundation, water marks on vegetation, drift lines, sediment deposits, drainage patterns, oxidized root channels, and waters stained leaves.

- The presence of hydrophytic vegetation - Plant species are assigned a regionally-based facultative status, by the U.S. Department of Agriculture (USDA), which describes a particular species' tolerance of water. A plant's facultative status suggests habitat preference(s) in a given region with respect to its aptitude to grow in low-oxygen (anaerobic) conditions. Hydrophytic, or "water loving", vegetation are those plants which have adapted to growing in the anaerobic conditions associated with prolonged saturation or flooding. Hydrophytic species can have a facultative status of "facultative" (FAC), "facultative wet" (FACW), or "obligate" (OBL). If, after defining a study plot that contains

[1] Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Department of the Army, Waterways Experiment Station. Vicksburg, Mississippi. 117 pages.

[2] Environmental Laboratory. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region(Version 2.0)*. Department of the Army. U.S. Army Corps of Engineer Research and Development Center. Vicksburg, Mississippi. 182 pages.

[3] Rapanos, John, et al. v. United States. 2006. 6th Circuit Court of Appeals. Docket Number 04-1034 and Carabell, June, et al. v. United States. 2005. 6th Circuit Court of Appeals. Docket Number No. 04-1384

vegetation representative of the larger area being described and identifying all species within it, 50 percent or greater of all identified species have an assigned facultative status of FAC, FACW or OBL, wetland vegetation criteria is met.

- The presence of hydric soils - Evaluating the presence of hydric soils requires that the delineator sample the upper 12 inches of soil to obtain a profile description and identify hydric soil indicators, such as histosols, histic epipedons, sulfidic odor, aquic moisture regime, reducing conditions, gleyed or low-chroma colors, concretions, etc. In most cases, hydric soils are most efficiently identified by the profile description, where the soil coloration is compared to the Munsell Color chart system to determine if the material meets hydric conditions.

An area is classified as a wetland only in instances where all three parameters exist (under normal circumstances). If one or more criteria are absent, then the area is deemed an upland. To sufficiently justify the wetland boundary line, a wetland data point and an upland data point are obtained at each respective location (a minimum of one pair of data points per wetland). As the delineator reviews the area and obtains data points, visible indicators (e.g., abrupt changes in vegetation, elevation, surface water, etc.) often become apparent, allowing the delineator to more efficiently establish the wetland boundary.

Geosyntec conducted on-site wetland assessments in accordance with the methodologies prescribed by the USACE and EPA pursuant to Sections 401 and 404 of the Clean Water Act (CWA). During the on-site wetland assessments, Geosyntec located and delineated the boundaries of features within the property boundary as depicted in **Figure 3**. Geosyntec flagged the boundaries of all delineated features with sequentially-numbered, high-visibility flagging and recorded the flag locations with a Global Positioning System (GPS) with submeter capabilities (Manufacturer/Model: Trimble R-1).

It should be noted that the surveys were conducted during an unseasonably dry period of the year in which much of Maryland was experiencing a D01 Moderate Drought conditions according to the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. See the Hydrology Section of the Wetland Data Forms for a more detail discussion on climatic conditions.

Findings

Nineteen herbaceous wetlands (designated as contained within areas W1, W2, and W3), one forested wetland (W2-For), and four Other Waters features (Sediment Basin, Washdown/Sump Pit, Impoundments-1 and -2) were delineated. These features are identified in **Table 1**, below and depicted on **Figure 3**.

Wetlands W1, W2, and W3 consist of heavily infested herbaceous wetlands that are/have been impacted by anthropogenic disturbances. Fourteen (14) W1 features are all associated with

manmade ditches constructed along railroad or vehicular roadways to drain water away from these features. W2 consists of two herbaceous wetlands that occur along the southern boundary of the property, outside of the perimeter fence. No access to the areas outside the fence was available. Based on current/historical aerial imagery, the primary hydrology of these features is associated with unregulated ponding from development within the adjacent landowner property. A small 0.11-acre forested wetland (W2-For) dominated by mature black willow (*Salix nigra*) occurs within the undeveloped portion of the W2. The area designated W3 consists of the dense stand of Phragmites that has infested a discharge area for the Sediment Basin. A constructed access road along the north/west perimeter of the wetland serves as an impoundment to the area. A mosaic of frequently saturated/inundated areas can be observed within this area on aerial imagery.

Impoundments 1 and 2 are located within the perimeter roadway around the landfill. They are manmade features created during the operation of the landfill. Impoundment-1 was inundated with approximately three feet of water and multiple turtles and other aquatic fauna were observed using the feature. A riser along the southwestern corner regulates flow into the interior ditch system around the landfill. Impoundment-2 was currently dry will large deep surface soil cracks present.

The primary Sediment Basin exists along the southwest corner of the landfill. Drainage from the interior and perimeter ditch system flows into the basin which has a riser pipe and discharge point along the western fenceline. The area of discharge makes up the W1 feature. Similar to Impoundment-2, the basin was dry during the survey with large surface soils cracks present.

A concrete-lined Washdown/Sump Pit was observed along the fenceline at the entrance of the property. The pit was inundated with approximately 2.5 feet of water and a culverted drainage pipe flows into a W1 ditch across the access gate.

Geosyntec completed Wetland Determination Data Forms, where appropriate, and photographs of the general site features and delineated features have been compiled into a photographic log, provided as an attachment.

Table 1. Delineated Features Identified Within the Survey Area

Resource	Acres
W1	1.21
W2	0.78
W3	2.55
Impoundment-1	0.22
Impoundment-2	0.01
Sediment Basin	0.60
Washdown/Sump Pit	0.02
Total	5.39

Summary

Geosyntec identified nineteen (19) features that total 5.39 acres within the Survey Area. These findings were demarcated in the field utilizing approved wetland delineation methods implemented by the USACE, it should be noted that formal consultation would be required with the USACE and appropriate state agency for official designation of jurisdictional wetland boundaries pursuant to Sections 404 and 401 of the CWA if the proposed Project will impact these features.

Attachments

Figures 1-4

Photographic Log

Routine Wetland Data Forms

* * * * *

FIGURES

Perimeter Boundary

0 1,800 3,600

SCALE IN FEET

Datasource:
U.S. Geological Survey 1:24,000 Topographical Quadrangles for Curtis Bay and Sparrow Point.

Tronox
Baltimore City, MD

Hawkins Point Plant Landfill - Wetland Delineation

Vicinity Map

Geosyntec consultants

FIGURE **1**

DB:AMATHES LD: PIC: PM: TM:
PROJECT: PATH: D:\MD Landfill Wetland Surveys\M - GIS\Projects_MXD\Reporting\TronoxLandfill_11x17_Figure 1_Overview.mxd

Edge of Road

Railraod Line

Fence

Perimeter Boundary

0 230 460

SCALE IN FEET

Datasource:
3-inch resolution imagery provided by MD iMAP hosted service.

Tronox
Baltimore City, MD

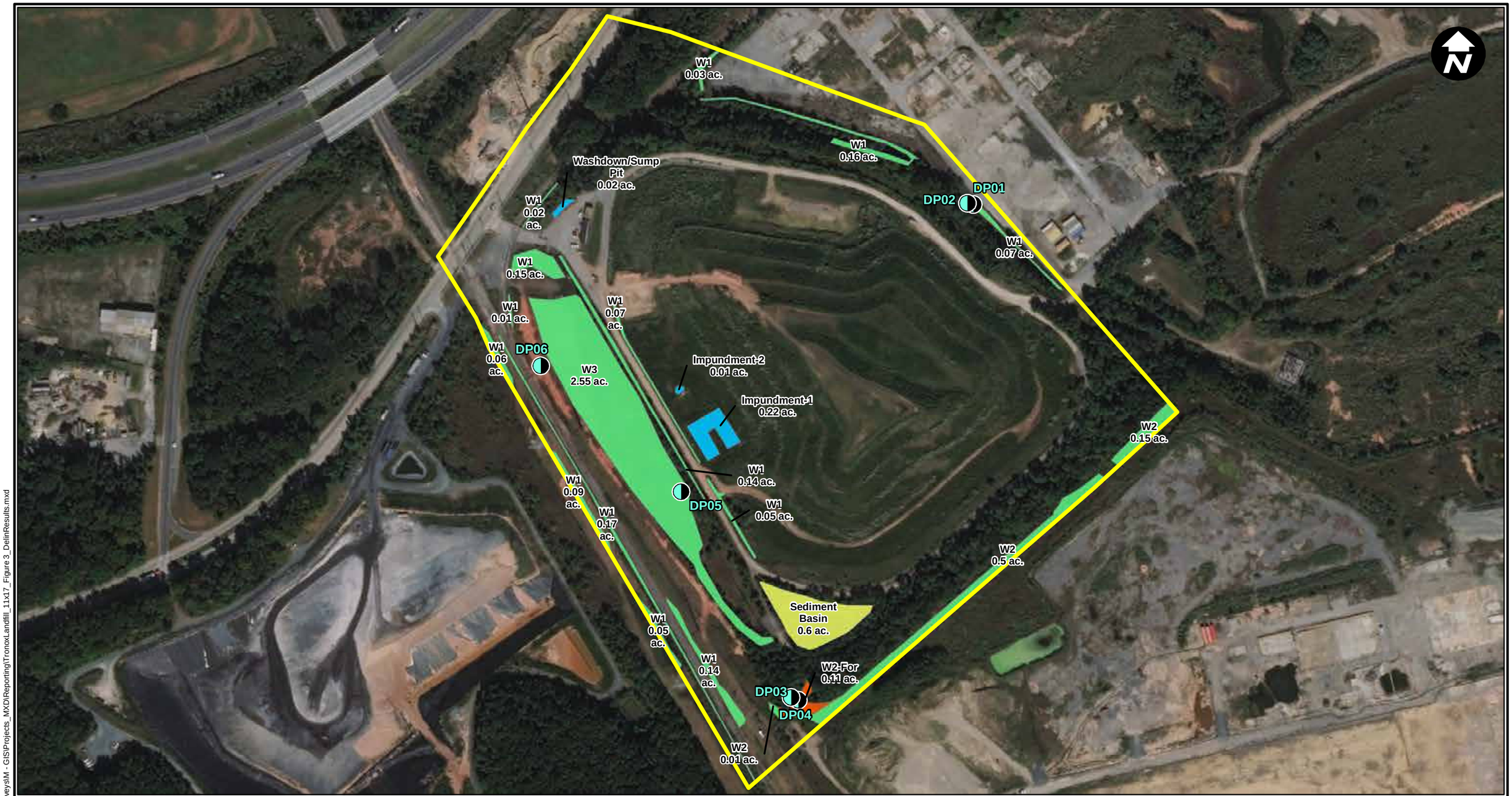
Hawkins Point Plant Landfill - Wetland Delineation

Site Location Map

Geosyntec consultants

FIGURE
2

DB: AMATHES LD: PIC: PM: TM:
PROJECT PATH: D:\MD Landfill Wetland Surveys\tM - GIS\Projects_MXD\ReportingTronoxLandfill_11x17_Figure 2_SiteLoc.mxd



Data Point

Perimeter Boundary

Delineated Feature

Sediment Basin

Impoundment

Forested Wetland

Herbaceous Wetland

0 230 460

SCALE IN FEET

Datasource:
3-inch resolution imagery provided by MD iMAP hosted service.

Tronox
Baltimore City, MD

Hawkins Point Plant Landfill - Wetland Delineation

Site Location Map

Geosyntec consultants

FIGURE
3

DB: AMATHES LD: PIC: PM: TM:
PROJECT: PATH: D:\MD Landfill Wetland Surveys\M - GIS\Projects_MXD\Reporting\TronoxLandfill_11x17_Figure 3_DelinResults.mxd

Photograph Location

Perimeter Boundary

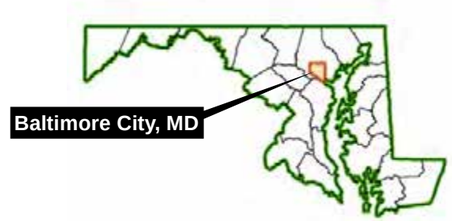
Delineated Feature

Sediment Basin

Impoundment

Forested Wetland

Herbaceous Wetland



0 230 460

SCALE IN FEET

Datasource:
3-inch resolution imagery provided by MD iMAP hosted service.

Tronox
Baltimore City, MD
Hawkins Point Plant Landfill - Wetland Delineation

Photo Location Map

Geosyntec consultants

FIGURE
4

DB: AMATHES LD: PIC: PM: TM:
PROJECT: PATH: D:\MD Landfill Wetland Surveys\M - GIS\Projects_MXD\Reporting\TronoxLandfill_11x17_Figure 4_PhotoLocation.mxd

PHOTOLOG

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 1

Date: 10/1/2019

Direction: South

Comments:
Photo of the unpaved powerline access road that serves as an impoundment to the sediment basin discharge.

Photograph 2

Date: 10/1/2019

Direction: North

Comments:
Photo of the sediment basin located on the southwest corner of the facility.

GEOSYNTEC CONSULTANTS Photographic Record	Geosyntec consultants
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 3 **Date:** 10/1/2019 **Direction:** Southwest **Comments:** Photo of a typical Phragmites-dominated railroad ditch located on the western boundary of the facility.	
Photograph 4 **Date:** 10/1/2019 **Direction:** Southwest **Comments:** Photo of the upland wooded habitat conditions along the southeast perimeter of the facility.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 5 **Date:** 10/1/2019 **Direction:** Northwest **Comments:** Photo of the eastern perimeter road of the landfill.	
Photograph 6 **Date:** 10/1/2019 **Direction:** Southwest **Comments:** Photo of the active railroad tracks with adjacent Phragmites dominated wetland ditch.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 7 **Date:** 10/1/2019 **Direction:** West **Comments:** Photo of the landfill perimeter road along the northeast portion of the property.	
Photograph 8 **Date:** 10/1/2019 **Direction:** West **Comments:** Photo of the washdown sump tank along the northern perimeter of the landfill.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 9 **Date:** 10/1/2019 **Direction:** South **Comments:** Photo of the railroad tracks and powerline right-of-way on the western portion of the property.	
Photograph 10 **Date:** 10/1/2019 **Direction:** Northeast **Comments:** Photo of the Phragmites-dominated wetland ditch along the railroad tracks at the entrance of the property.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 11 **Date:** 10/1/2019 **Direction:** West **Comments:** Photo of the dry, shallow closed basin within the perimeter of the landfill.	
Photograph 12 **Date:** 10/1/2019 **Direction:** East **Comments:** Photo of the inundated pond within the landfill perimeter. Aquatic fauna was observed within the impoundment.	

GEOSYNTEC CONSULTANTS Photographic Record	Geosyntec consultants
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 13 **Date:** 10/1/2019 **Direction:** Northwest **Comments:** Photo of wetland habitat conditions at DP01.	
Photograph 14 **Date:** 10/1/2019 **Direction:** N/A **Comments:** Soil conditions at DP01.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 15 **Date:** 10/1/2019 **Direction:** East **Comments:** Photo of upland habitat conditions at DP02.	
Photograph 16 **Date:** 10/1/2019 **Direction:** N/A **Comments:** Soil conditions at DP02.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 17 **Date:** 10/1/2019 **Direction:** South **Comments:** Photo of wetland habitat conditions at DP03.	
Photograph 18 **Date:** 10/1/2019 **Direction:** N/A **Comments:** Soil conditions at DP03.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 19

Date: 10/1/2019

Direction: Southwest

Comments:
Photo of upland habitat conditions at DP04.

Photograph 20

Date: 10/1/2019

Direction: N/A

Comments:
Soil conditions at DP04.

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 21 **Date:** 10/1/2019 **Direction:** Northwest **Comments:** Photo of wetland habitat conditions at DP05.	
Photograph 22 **Date:** 10/1/2019 **Direction:** N/A **Comments:** Soil conditions at DP05.	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Tronox	**Project Number: MEM1653**
Site: Hawkins Point Plant Landfill Wetland Delineation	**Location: Baltimore City, MD**

Photograph 23 **Date:** 10/1/2019 **Direction:** Southeast **Comments:** Photo of upland habitat conditions at DP06.	
Photograph 24 **Date:** 10/1/2019 **Direction:** N/A **Comments:** Soil conditions at DP06.	

DATASHEETS

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-01

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Other Local relief (concave, convex, none): concave Slope %: 1

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.2035570 Long. -76.543502 Datum: WGS 1984

Soil Map Unit Name: Sassafras, gravelly loam, 0 to 8 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes X No ____ (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland?

Yes X **No** ____

Remarks:

Shallow herbaceous wetland ditch associated with overflow from sewer pipe manhole. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)	X	Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)	X	Geomorphic Position (D2)
	Inundation Visible on Aerial Imagery (B7)				Shallow Aquitard (D3)
					FAC-Neutral Test (D5)
	Water Stained Leaves (B9)				Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes X **No** ____

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

Primary hydrology of the site is frequent overflow of the sewer pipe manhole.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-01

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Sapling/Shrub Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Herb Stratum (Plot size: r=30')			
1. *Phragmites australis*	90	Y	FACW
2. *Baccharis halimifolia*	5	N	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
50% of total Cover: 47.5	20% of Total Cover: 19		
Woody Vine Stratum (Plot size: r=30')			
1. *Lonicera japonica*	5	Y	FACU
2. *Persicaria perfoliata*	5	Y	FAC
3.			
4.			
5.			
	10 = Total Cover		
50% of total Cover: 5	20% of Total Cover: 2		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	90	x 2	180
FAC species	10	x 3	30
FACU species	5	x 4	20
UPL species	0	x 5	0
Column Total	105 (A)		230 (B)

Prevalence Index: 2.2 (B/A)

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- x 2 - Dominance Test is >50%
- x 3 - Prevalence Index is ≤3.0*
- Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes X **No**

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-01

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-4	10YR 3/2	95	7.5YR 4/6	5	C	M	Silty loam	
4-12	10YR 4/1	90	7.5YR 4/1	10	C	M	Silty loam	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

	Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)				Indicators for Problematic Hydric Soils ***
	Histosol (A1)		Polyvalue Below Surface (S8) **(LRR S, T,U)**		1 cm Muck (A9) **(LRR O)**
	Histic Epipedon (A2)		Thin Dark Surface (S9) **(LRR S,T,U)**		2 cm Muck (A10) **(LRR S)**
	Black Histic (A3)		Loamy Mucky Mineral (F1) **(LRR O)**		Reduced Vertic (F18) **(outside MLRA 150A, B)**
	Hydrogen Sulfide (A4)		Loamy Gleyed Matirx (F2)		Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
	Stratified Layers (A5)	X	Depleated Matrix (F3)		Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
	Organic Bodies (A6) **(LRR P, T, U)**		Redox Dark Surface (F6)		Red Parent Material (TF2)
	5 cm Mucky Mineral (A7) **(LRR P, T, U)**		Depleted Dark Surface (F7)		Very Shallow Dark Surface (TF12)
	Muck Presence (A8) **(LRR U)**		Redox Depressions (F8)		Other (Explain in Remarks)
	1 cm Muck (A9) **(LRR P, T)**		Marl (F10) (LRR U)		
	Depleted Below Dark Surface (A11)		Depleted Ochric (F11) **(MLRA 151)**		
	Thick Dark Surface (A12)		Iron-Manganese Masses (F12) **(LRR O, P, T)**		
	Coast Prairie Redox (A16) **(MLRA 150A)**		Umbric Surface (F13) **(LRR P, T, U)**		
	Sandy Mucky Mineral (S1) **(LRR O, S)**		Delta Ochric (F17) **(MLRA 151)**		
	Sandy Gleyed Matrix (S4)		Reduced Vertic (F18) **(MRLA 150A, 150B)**		
	Sandy Redox (S5)		Piedmont Floodplain Soils (F19) **(MLRA 149A)**		
	Stripped Matrix (S6)		Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**		
	Dark Surface (S7) **(LRR P, S, T, U)**				

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-02

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): convex Slope %: 6

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.2035680 Long. -76.543556 Datum: WGS 1984

Soil Map Unit Name: Sassafras, gravelly loam, 0 to 8 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes X No ____ (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No ____

Hydric Soil Present? Yes ____ No ____

Wetland Hydrology Present? Yes ____ No ____

Is the Sampled Area within a Wetland?

Yes ____ **No** X

Remarks:

Mid slope upland on edge of wetland ditch. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)		Geomorphic Position (D2)
	Inundation Visible on Aerial Imagery (B7)				Shallow Aquitard (D3)
					FAC-Neutral Test (D5)
	Water Stained Leaves (B9)				Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes ____ **No** X

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-02

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Sapling/Shrub Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Herb Stratum (Plot size: r=30')			
1. *Festuca subverticillata*	60	Y	FACU
2. *Lespedeza cuneata*	25	Y	FACU
3. *Lonicera japonica*	10	N	FACU
4. *Solidago canadensis*	10	N	FACU
5. *Sorghum halepense*	5	N	FACU
6. *Daucus carota*	2	N	UPL
7. *Phragmites australis*	2	N	FACW
8.			
9.			
10.			
11.			
	114 = Total Cover		
50% of total Cover: 57	20% of Total Cover: 22.8		
Woody Vine Stratum (Plot size: r=30')			
1. *Rubus pensilvanicus*	5	Y	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
50% of total Cover: 2.5	20% of Total Cover: 1		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	2	x 2	4
FAC species	5	x 3	15
FACU species	110	x 4	440
UPL species	2	x 5	10
Column Total	119 (A)		469 (B)

Prevalence Index: 3.9 (B/A)

Hydrophytic Vegetation Indicators:

_ 1 - Rapid Test for Hydrophytic Vegetation

_ 2 - Dominance Test is >50%

_ 3 - Prevalence Index is ≤3.0*

_ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes _ **No** X

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-02

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-16	10YR 3/2	100					Silty loam	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)		Indicators for Problematic Hydric Soils ***
Histosol (A1)	Polyvalue Below Surface (S8) **(LRR S, T,U)**	1 cm Muck (A9) **(LRR O)**
Histic Epipedon (A2)	Thin Dark Surface (S9) **(LRR S,T,U)**	2 cm Muck (A10) **(LRR S)**
Black Histic (A3)	Loamy Mucky Mineral (F1) **(LRR O)**	Reduced Vertic (F18) **(outside MLRA 150A, B)**
Hydrogen Sulfide (A4)	Loamy Gleyed Matirx (F2)	Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
Stratified Layers (A5)	Depleated Matrix (F3)	Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
Organic Bodies (A6) **(LRR P, T, U)**	Redox Dark Surface (F6)	Red Parent Material (TF2)
5 cm Mucky Mineral (A7) **(LRR P, T, U)**	Depleted Dark Surface (F7)	Very Shallow Dark Surface (TF12)
Muck Presence (A8) **(LRR U)**	Redox Depressions (F8)	Other (Explain in Remarks)
1 cm Muck (A9) **(LRR P, T)**	Marl (F10) (LRR U)	
Depleted Below Dark Surface (A11)	Depleted Ochric (F11) **(MLRA 151)**	
Thick Dark Surface (A12)	Iron-Manganese Masses (F12) **(LRR O, P, T)**	
Coast Prairie Redox (A16) **(MLRA 150A)**	Umbric Surface (F13) **(LRR P, T, U)**	
Sandy Mucky Mineral (S1) **(LRR O, S)**	Delta Ochric (F17) **(MLRA 151)**	
Sandy Gleyed Matrix (S4)	Reduced Vertic (F18) **(MRLA 150A, 150B)**	
Sandy Redox (S5)	Piedmont Floodplain Soils (F19) **(MLRA 149A)**	
Stripped Matrix (S6)	Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**	
Dark Surface (S7) **(LRR P, S, T, U)**		

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-03

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Ponding Local relief (concave, convex, none): concave Slope %: 2

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.1999890 Long. -76.545378 Datum: WGS 1984

Soil Map Unit Name: Beltsville-Urban land complex, 0 to 8 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes X No ____ (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland?

Yes X **No** ____

Remarks:

Shallow flat, hydrology from adjacent ponding located outside the perimeter fence. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)	X	Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)	X	Geomorphic Position (D2)
	Inundation Visible on Aerial Imagery (B7)				Shallow Aquitard (D3)
				X	FAC-Neutral Test (D5)
X	Water Stained Leaves (B9)				Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes X **No** ____

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

Primary hydrology of the site is frequent backwater ponding from the adjacent site.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-03

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix nigra*	30	Y	OBL
2.			
3.			
4.			
5.			
6.			
7.			
	30 = Total Cover		
50% of total Cover: 15	20% of Total Cover: 6		

Sapling/Shrub Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Herb Stratum (Plot size: r=30')			
1. *Phragmites australis*	90	Y	FACW
2. *Onoclea sensibilis*	5	N	FACW
3. *Boehmeria cylindrica*	5	N	FACW
4. *Bidens frondosa*	5	N	FACW
5. *Liquidambar styraciflua*	2	N	FAC
6. *Salix nigra*	2	N	OBL
7.			
8.			
9.			
10.			
11.			
	109 = Total Cover		
50% of total Cover: 54.5	20% of Total Cover: 21.8		

Woody Vine Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 2 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	32	x 1	32
FACW species	105	x 2	210
FAC species	2	x 3	6
FACU species	0	x 4	0
UPL species	0	x 5	0
Column Total	139 (A)		248 (B)

Prevalence Index: 1.8 (B/A)

Hydrophytic Vegetation Indicators:

_ 1 - Rapid Test for Hydrophytic Vegetation

x 2 - Dominance Test is >50%

x 3 - Prevalence Index is ≤3.0*

_ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes X **No** _

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-03

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-4	7.5YR 3/2	80	7.5YR 4/6	20	C	M	Loamy sand	high organic content
4-12	5YR 6/4	90	5YR 5/6	10	C	M	Loamy sand	clay inclusions

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

	Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)				**Indicators for Problematic Hydric Soils *****
	Histosol (A1)		Polyvalue Below Surface (S8) **(LRR S, T,U)**		1 cm Muck (A9) **(LRR O)**
	Histic Epipedon (A2)		Thin Dark Surface (S9) **(LRR S,T,U)**		2 cm Muck (A10) **(LRR S)**
	Black Histic (A3)		Loamy Mucky Mineral (F1) **(LRR O)**		Reduced Vertic (F18) **(outside MLRA 150A, B)**
	Hydrogen Sulfide (A4)		Loamy Gleyed Matirx (F2)		Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
	Stratified Layers (A5)		Depleated Matrix (F3)		Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
	Organic Bodies (A6) **(LRR P, T, U)**		Redox Dark Surface (F6)		Red Parent Material (TF2)
	5 cm Mucky Mineral (A7) **(LRR P, T, U)**		Depleted Dark Surface (F7)		Very Shallow Dark Surface (TF12)
	Muck Presence (A8) **(LRR U)**		Redox Depressions (F8)		Other (Explain in Remarks)
	1 cm Muck (A9) **(LRR P, T)**		Marl (F10) (LRR U)		
	Depleted Below Dark Surface (A11)		Depleted Ochric (F11) **(MLRA 151)**		
	Thick Dark Surface (A12)		Iron-Manganese Masses (F12) **(LRR O, P, T)**		
	Coast Prairie Redox (A16) **(MLRA 150A)**		Umbric Surface (F13) **(LRR P, T, U)**		***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**
	Sandy Mucky Mineral (S1) **(LRR O, S)**		Delta Ochric (F17) **(MLRA 151)**		
	Sandy Gleyed Matrix (S4)		Reduced Vertic (F18) **(MRLA 150A, 150B)**		
X	Sandy Redox (S5)		Piedmont Floodplain Soils (F19) **(MLRA 149A)**		
	Stripped Matrix (S6)		Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**		
	Dark Surface (S7) **(LRR P, S, T, U)**				

Restrictive Layer (if observed)

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-04

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): convex Slope %: 3

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.2000140 Long. -76.545444 Datum: WGS 1984

Soil Map Unit Name: Beltsville-Urban land complex, 0 to 8 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes X No ____ (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland?

Yes ____ **No** X

Remarks:

Likely a former rubble stockpile located adjacent to wetland. Large cobble rock spread throughout area. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)		Geomorphic Position (D2)
	Inundation Visible on Aerial Imagery (B7)				Shallow Aquitard (D3)
					FAC-Neutral Test (D5)
	Water Stained Leaves (B9)				Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes ____ **No** X

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-04

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	45	Y	FAC
2. *Acer rubrum*	25	Y	FAC
3. *Nyssa sylvatica*	20	N	FAC
4. *Frangula alnus*	20	N	FAC
5. *Robinia pseudoacacia*	10	N	UPL
6.			
7.			
	120	= Total Cover	
50% of total Cover: 60	20% of Total Cover: 24		
Sapling/Shrub Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0	= Total Cover	
50% of total Cover: 0	20% of Total Cover: 0		
Herb Stratum (Plot size: r=30')			
1. *Lonicera japonica*	10	Y	FACU
2. *Solidago canadensis*	10	Y	FACU
3. *Rubus pensilvanicus*	5	N	FAC
4. *Elymus canadensis*	2	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	27	= Total Cover	
50% of total Cover: 13.5	20% of Total Cover: 5.4		
Woody Vine Stratum (Plot size: r=30')			
1. *Smilax rotundifolia*	10	Y	FAC
2.			
3.			
4.			
5.			
	10	= Total Cover	
50% of total Cover: 5	20% of Total Cover: 2		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 5 (B)

Percent of dominant species that are OBL, FACW, or FAC: 60% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	127	x 3	381
FACU species	20	x 4	80
UPL species	10	x 5	50
Column Total	157 (A)		511 (B)

Prevalence Index: 3.3 (B/A)

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- x 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0*
- ___ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes X **No** ___

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-04

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-2	10YR 3/2	100					Sandy loam	
2-12	5YR 5/3	100					Sandy clay	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Organic Bodies (A6) **(LRR P, T, U)**
- 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- Muck Presence (A8) **(LRR U)**
- 1 cm Muck (A9) **(LRR P, T)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Coast Prairie Redox (A16) **(MLRA 150A)**
- Sandy Mucky Mineral (S1) **(LRR O, S)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7) **(LRR P, S, T, U)**
- Polyvalue Below Surface (S8) **(LRR S, T,U)**
- Thin Dark Surface (S9) **(LRR S,T,U)**
- Loamy Mucky Mineral (F1) **(LRR O)**
- Loamy Gleyed Matirx (F2)
- Depleated Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Marl (F10) (LRR U)
- Depleted Ochric (F11) **(MLRA 151)**
- Iron-Manganese Masses (F12) **(LRR O, P, T)**
- Umbric Surface (F13) **(LRR P, T, U)**
- Delta Ochric (F17) **(MLRA 151)**
- Reduced Vertic (F18) **(MRLA 150A, 150B)**
- Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils ***

- 1 cm Muck (A9) **(LRR O)**
- 2 cm Muck (A10) **(LRR S)**
- Reduced Vertic (F18) **(outside MLRA 150A, B)**
- Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: Clay hardpan

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Large aggregate intermixed

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-05

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Ponding Local relief (concave, convex, none): concave Slope %: 1

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.2015590 Long. -76.546384 Datum: WGS 1984

Soil Map Unit Name: Udorthents, clayey, very deep, 0 to 15 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil X ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes X No ____ (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland?

Yes X **No** ____

Remarks:

Large, shallow enclosed basin that receives discharge from the upgradient sediment basin and overflow from the perimeter ditch located within the fenceline. Site is heavily infested with non-native, invasive species Phragmites. Powerline access road is elevated along the north and western perimeter of the wetland and causes an impoundment of the area. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)	X	Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)	X	Geomorphic Position (D2)
	Inundation Visible on Aerial Imagery (B7)				Shallow Aquitard (D3)
					FAC-Neutral Test (D5)
X	Water Stained Leaves (B9)				Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes X **No** ____

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

Primary hydrology of the site is frequent discharge from the sediment basin and overbank flow from the perimeter ditch within the fenceline.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-05

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Sapling/Shrub Stratum (Plot size: r=30')			
1. *Baccharis halimifolia*	10	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10 = Total Cover		
50% of total Cover: 5	20% of Total Cover: 2		
Herb Stratum (Plot size: r=30')			
1. *Phragmites australis*	95	Y	FACW
2. *Toxicodendron radicans*	2	N	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	97 = Total Cover		
50% of total Cover: 48.5	20% of Total Cover: 19.4		
Woody Vine Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 2 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	95	x 2	190
FAC species	12	x 3	36
FACU species	0	x 4	0
UPL species	0	x 5	0
Column Total	107 (A)		226 (B)

Prevalence Index: 2.1 (B/A)

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- x 2 - Dominance Test is >50%
- x 3 - Prevalence Index is ≤3.0*
- ___ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes X **No** ___

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-05

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-3	10YR 3/2	85	7.5YR 5/8	15	C	PI	Sandy loam	
4-6	10YR 3/3	100					Organic muck	
6-14	2.5Y 4/4	98	10YR 6/1	2	D	PI	Clay hardpan	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)				Indicators for Problematic Hydric Soils ***	
	Histosol (A1)		Polyvalue Below Surface (S8) **(LRR S, T,U)**		1 cm Muck (A9) **(LRR O)**
	Histic Epipedon (A2)		Thin Dark Surface (S9) **(LRR S,T,U)**		2 cm Muck (A10) **(LRR S)**
	Black Histic (A3)		Loamy Mucky Mineral (F1) **(LRR O)**		Reduced Vertic (F18) **(outside MLRA 150A, B)**
	Hydrogen Sulfide (A4)		Loamy Gleyed Matirx (F2)		Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
	Stratified Layers (A5)		Depleated Matrix (F3)		Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
	Organic Bodies (A6) **(LRR P, T, U)**	X	Redox Dark Surface (F6)		Red Parent Material (TF2)
	5 cm Mucky Mineral (A7) **(LRR P, T, U)**		Depleted Dark Surface (F7)		Very Shallow Dark Surface (TF12)
	Muck Presence (A8) **(LRR U)**		Redox Depressions (F8)		Other (Explain in Remarks)
	1 cm Muck (A9) **(LRR P, T)**		Marl (F10) (LRR U)		
	Depleted Below Dark Surface (A11)		Depleted Ochric (F11) **(MLRA 151)**		
	Thick Dark Surface (A12)		Iron-Manganese Masses (F12) **(LRR O, P, T)**		
	Coast Prairie Redox (A16) **(MLRA 150A)**		Umbric Surface (F13) **(LRR P, T, U)**		
	Sandy Mucky Mineral (S1) **(LRR O, S)**		Delta Ochric (F17) **(MLRA 151)**		
	Sandy Gleyed Matrix (S4)		Reduced Vertic (F18) **(MRLA 150A, 150B)**		
	Sandy Redox (S5)		Piedmont Floodplain Soils (F19) **(MLRA 149A)**		
	Stripped Matrix (S6)		Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**		
	Dark Surface (S7) **(LRR P, S, T, U)**				

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: Clay

Depth (inches): 14"

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Site: Hawkins Point Plant Landfill Property City/County: Baltimore City Sampling Date: 10/1/2019

Applicant/Owner: Tronox Limited State: MD Sampling Point: DP-06

Investigator(s): A. Mathes, C. Black Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): convex Slope %: 2

Subregion (LRR or MLRA): LRR: S , MLRA:149A Lat. 39.2025320 Long. -76.547645 Datum: WGS 1984

Soil Map Unit Name: Udorthents, clayey, very deep, 0 to 15 percent slopes NWI Classification: none

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology X naturally problematic?

Are Normal Circumstances Present? Yes ____ No X (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No ____

Hydric Soil Present? Yes ____ No ____

Wetland Hydrology Present? Yes ____ No ____

Is the Sampled Area within a Wetland?

Yes ____ **No** ____

Remarks:

Data point located along the roadside of the unpaved powerline access road adjacent to the railroad tracks. The road causes an impoundment of the wetland. See Hydrology Section for Climatic conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)		Secondary Indicators (minimum of two required)	
Surface Water (A1)	Aquatic Fauna (B13)		Surface Soil Cracks (B6)
High Water Table (A2)	Marl Deposits (B15) (LRR U)		Sparsely Vegetated Concave Surface (B8)
Saturation (A3)	Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
Water Marks (B1)	Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
Sediment Deposits (B2)	Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
Drift Deposits (B3)	Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
Algal Mat or Crust (B4)	Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
Iron Deposits (B5)	Other (Explain in Remarks)		Geomorphic Position (D2)
Inundation Visible on Aerial Imagery (B7)			Shallow Aquitard (D3)
			FAC-Neutral Test (D5)
Water Stained Leaves (B9)			Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present?

Yes ____ **No** X

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The field surveys were conducted Sept 30 and Oct 1, 2019 during a period in which the region had received significantly lower than normal seasonal rainfall amounts for the September month-to-date (a -3.87" deficiency from a 4.03" normal value). The observed Year-to-Date amount was 27.25" which is a -4.63" deficeit according to the National Weather Service BWI Airport weather station. The day of survey a Trace amount of rainfall was recorded. Considering the recent precipation and monthly deficient, the delineators felt that surface hydrology was not influenced by stormwater and that the seasonally dry conditions were pronounced. Evidence of the significant dry conditions were observed within the southwestern sediment basin that was completely dry, whereas available historical imagery shows the basin as typically innundated. A review of regional drought conditions from the website droughtmonitor.gov indicated Moderate Drought conditions (D01) existed for Baltimore City for the week of Oct 1, 2019.

VEGETATION (Four Strata) - Use scientific names of plants | Sampling Point: DP-06

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Sapling/Shrub Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		
Herb Stratum (Plot size: r=30')			
1. *Cynodon dactylon*	60	Y	FACU
2. *Solidago canadensis*	10	N	FACU
3. *Sorghum halepense*	10	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total Cover: 40	20% of Total Cover: 16		
Woody Vine Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 0 (A)

Total number of dominant species across all strata: 1 (B)

Percent of dominant species that are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	80	x 4	320
UPL species	0	x 5	0
Column Total	80 (A)		320 (B)

Prevalence Index: 4.0 (B/A)

Hydrophytic Vegetation Indicators:

_____ 1 - Rapid Test for Hydrophytic Vegetation

_____ 2 - Dominance Test is >50%

_____ 3 - Prevalence Index is ≤3.0*

_____ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes _____ **No** X

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP-06

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-12	7.5YR 5/3	100						

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Organic Bodies (A6) **(LRR P, T, U)**
- 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- Muck Presence (A8) **(LRR U)**
- 1 cm Muck (A9) **(LRR P, T)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Coast Prairie Redox (A16) **(MLRA 150A)**
- Sandy Mucky Mineral (S1) **(LRR O, S)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7) **(LRR P, S, T, U)**
- Polyvalue Below Surface (S8) **(LRR S, T,U)**
- Thin Dark Surface (S9) **(LRR S,T,U)**
- Loamy Mucky Mineral (F1) **(LRR O)**
- Loamy Gleyed Matirx (F2)
- Depleated Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Marl (F10) (LRR U)
- Depleted Ochric (F11) **(MLRA 151)**
- Iron-Manganese Masses (F12) **(LRR O, P, T)**
- Umbric Surface (F13) **(LRR P, T, U)**
- Delta Ochric (F17) **(MLRA 151)**
- Reduced Vertic (F18) **(MRLA 150A, 150B)**
- Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils ***

- 1 cm Muck (A9) **(LRR O)**
- 2 cm Muck (A10) **(LRR S)**
- Reduced Vertic (F18) **(outside MLRA 150A, B)**
- Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

APPENDIX B
Prior Subsurface Exploration Reports

Phase II Environmental Site Assessment Report
for
Cristal USA Facility
3801 Fort Armistead Road
Baltimore, Maryland 21226

Prepared for

Maryland Port Administration
World Trade Center
Suite 1900
401 East Pratt Street
Baltimore, Maryland 21202

Maryland Port Administration Contract 513806A

Prepared by

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November 2015
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EA Project No. 15061.06

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
µR/hr	Microroentgen(s) per hour
µg/L	Microgram(s) per liter
95%UCLM	95th percentile upper confidence limit on the mean
AMSL	Above mean sea level
AOC	Area of Concern
AST	Aboveground storage tank
ATC	Anticipated Typical Concentration
bgs	Below ground surface
BNA	Base neutral acid
COC	Chain-of-custody
COPC	Chemical of potential concern
DMCF	Dredged Material Containment Facility
DPT	Direct-push technology
DQO	Data Quality Objective
DRO	Diesel range organics
EA	EA Engineering, Science, and Technology, Inc., PBC
EM-31	Electro-magnetic 31
ESA	Environmental Site Assessment
FD	Field duplicate
ft	Foot (feet)
ft^2	Square foot (feet)
GPR	Ground-penetrating radar
GPS	Global positioning system
GRO	Gasoline range organics
HI	Hazard index
HQ	Hazard quotient
ID	Identification
IDW	Investigation-derived waste
in.	Inch(es)
Kemira	Kemira Water Solutions
MB	Method blank

MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MDL	Method detection limit
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
MGS	Maryland Geological Survey
MS	Matrix spike
MSD	Matrix spike duplicate
n	Number samples analyzed
OWS	Oil/water separator
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
pCi/g	PicoCuries per gram
pg/g	Picogram(s) per gram
pg/L	Picogram(s) per liter
PID	Photoionization detector
PVC	Polyvinyl chloride
PWAN/SWAN	Primary Waste Acid Neutralization/Secondary Waste Acid Neutralization
QC	Quality control
RB	Rinse blank
RCRA	Resource Conservation and Recovery Act
RL	Reporting limit
RPD	Relative percent difference
RSL	Regional Screening Level
s	Shallow soil
ss	Subsurface soil
SVOC	Semivolatile organic compound
TAL	Target analyte list
TB	Trip blank
TCLP	Toxicity characteristic leaching procedure
TEQ	Toxic Equivalency Quotient
TME	TM Engineering, Inc.
TPH	Total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound

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EXECUTIVE SUMMARY

EA Engineering, Science, and Technology, Inc., PBC was contracted by the Maryland Port Administration (MPA) to conduct a Phase II Environmental Site Assessment (ESA) of the Cristal USA Facility on Fort Armistead Road in Baltimore, Maryland (the Site). From approximately 1954 to 2011, the Site was used for the manufacturing of titanium dioxide and other titanium chemicals. Currently the property consists of approximately 178 acres of land that is zoned M-3 General Manufacturer and OS–Open Space District. Although the majority of manufacturing structures have been demolished, numerous buildings and four treatment/storage basins remain on the Site, along with a 30-acre solid waste landfill. The majority of the Site (140 acres) is located in Baltimore City, and the remaining 38 acres are located in Anne Arundel County, just south of the Baltimore City boundary. The Site is bordered by Fort Armistead Road and Fort Armistead Park to the north, the MPA-owned Cox Creek uplands to the south, industrial land use to the west, and the Patapsco River to the east. It should be noted that Kemira Water Solutions (Kemira) operates within approximately 10 acres of the central portion of the Site; the Kemira Site parcel is not included as part of this investigation.

The Phase II ESA evaluated soil, groundwater, sediment, and surface water sample data collected from the Site. The goal of this investigation is to evaluate the potential for the historical Site uses to have impacted the environmental integrity of soil and groundwater at the Site, to further evaluate areas of previously identified suspect conditions, and to provide Site-wide comprehensive characterization data. Information obtained as part of this investigation is intended to support efforts associated with the expansion of the adjoining Cox Creek Dredged Material Containment Facility (DMCF) and to support potential future use(s) of the Site by MPA.

Shallow and subsurface soil samples and/or groundwater samples were collected from four identified upland Areas of Concern (AOCs) including the Former Titanium Ore Storage area, the Spent Solvent Storage area, the Primary/Secondary Waste Acid Neutralization area and the Landfill area. A similar approach was implemented to characterize Site-wide locations in the upland areas of the Site, which were divided into four additional areas (Northwest Upland, West-Central Upland, East-Central Upland, and South Upland). Results from analyses of the samples collected from the AOC areas and Site-wide locations identified elevated concentrations of metals, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH)-diesel range organics (DRO), and dioxins/furans in soil and groundwater in certain areas of the Site. The pH of soils, which in some areas has been altered by historical Site operations, varied across the Site and with depth, in the range of 2.4 to 11.9, and was generally lower at depth. Soils with pHs below 3.5 occurred in the subsurface of the Primary Waste Acid Neutralization/Secondary Waste Acid Neutralization (PWAN/SWAN) area and at three scattered locations in the central portion of the Site near the treatment/storage basins. Radiation surveys and radioactive isotope analysis of soils from the Former Titanium Ore Storage area indicated residual radioactivity generally consistent with natural background levels.

Additionally, shallow and subsurface soil, surface sediment, and surface water samples were collected from the four treatment/storage basins (Batch Attack, Upper Settling, Middle Settling,

and Lower Settling), which were also identified as AOCs. Sediments and soils in the basins are thought to consist primarily of waste byproducts from titanium dioxide manufacturing. As a result of an underground leak discovered in the Batch Attack Basin in 1981, an Administrative Consent Order was signed in 1984 requiring low pH leachate to be returned to the lagoon for additional treatment. Results from analyses of these samples identified elevated concentrations of metals and dioxins/furans in soil and sediment from the basins. Surface water also contained metals at slightly elevated concentrations. The pH of sediment samples collected was generally neutral to alkaline, with a few samples having pH below 5; however, results of a separate analysis of deep sediments in the Batch Attack and Lower Settling Basins, conducted by TRC Companies, Inc. (TRC) on behalf of Cristal, indicate that low-pH sediments are present at various depths.

In addition to the analyses of discrete samples from the uplands and the basins, analysis of dioxins and furans was performed on soil samples from three discrete Site-wide locations, four composite soil samples from the areas of the landfill, and one composite soil sample from each of the other AOCs. Eighteen groundwater and three surface water samples were also analyzed for dioxins and furans.

A human health risk evaluation was performed on the soil and sediment data, to determine attainment for analytes in comparison to the Maryland Department of the Environment (MDE) Non-Residential Soil Cleanup Standards. Non-residential criteria are consistent with current Site use and zoning, and also with the anticipated land use as part of the proposed expanded Cox Creek DMCF. MDE has identified a remedial action level of 10^{-5} for carcinogenic risk, and a threshold hazard index (HI) of 1.0 for non-carcinogenic risk. Overall the reported concentrations in soil do not represent a significant human health risk to construction/ maintenance workers, who are identified as the primary receptors; however, isolated areas of impact and potential risk were observed. Specific areas of risk and other concerns are noted below:

- In the PWAN/SWAN area, elevated concentrations of metals (primarily arsenic and antimony) in shallow and subsurface soil drive both carcinogenic and non-cancer risks exceeding the MDE remedial action level of 10^{-5} and the non-cancer threshold HI of 1.0. Soil pH in this area was highly variable, ranging from 2.48 to 9.30, with generally more acidic soils in the subsurface.

- The PWAN/SWAN area also had one reported lead concentration exceeding the MDE Non-Residential Cleanup Standard, and toxicity characteristic leaching procedure (TCLP) analysis of this sample indicated that the lead may be leachable and therefore potentially mobile. TCLP results from the Former Titanium Ore Storage area also indicated potentially mobile lead.

- In the East-Central Upland area, PAHs in surface soil, primarily at location SB-44, drive carcinogenic risks exceeding the MDE remedial action level of 10^{-5}. TPH-DRO exceeding the MDE Non-Residential Cleanup Standard was also reported in surface soil from location SB-44.

- Vanadium drives non-cancer risks exceeding the acceptable threshold HI of 1.0 in surface and/or subsurface soil and sediment from the West-Central and South Upland areas, as well as the four basins (Batch Attack, Upper Settling, Middle Settling, and Lower Settling). Manganese is also a secondary, but substantial, contributor to risk in the Middle Settling Basin. Although vanadium concentrations were not reported for the TRC sediment cores from the Batch Attack Basin and Lower Settling Basin, overall concentrations of other metals in that dataset are of similar magnitude.

- In addition to location SB-44, TPH-DRO was present in soil at concentrations exceeding the MDE Non-Residential Cleanup Standard at one location in the Spent Solvent Storage area, and at two sample locations in the West-Central Upland area. Soil at these locations may have been impacted by nearby historical underground storage tanks and the presence of previously unknown oil/water separators.

- Groundwater concentrations were not incorporated into the risk assessment because groundwater is not used as a potable water supply, and no such use is expected in the future. Many of the metals and PAHs that were reported at concentrations exceeding MDE Non-Residential Cleanup Standards in soil were also reported at concentrations exceeding the MDE Cleanup Standards in groundwater. A few isolated exceedances of other metals, other PAHs, volatile organic compounds, and non-PAH semivolatile organic compounds were also reported in groundwater, in addition to dioxins, as described in the next paragraph. The results do not indicate any widespread plumes of organic contaminants in Site groundwater.

Dioxin and furan results from soil and groundwater analysis were also not incorporated into the risk assessment, due to the lack of a complete set of discrete, Site-wide data comparable to the data collected for other parameters. However, dioxins and furans are recognized byproducts of the chlorinators used in the chloride process for manufacturing titanium dioxide (USEPA 2001), and appear to be widespread in the Settling Basins that received waste products from the chloride process. Dioxin/furan results were used to calculate Toxic Equivalency Quotients (TEQs) for human exposure, which were compared to the United States Environmental Protection Agency Regional Screening Level (RSL) for Industrial Soil and Maximum Contaminant Level (MCL) for groundwater. This screening indicated that dioxins and furans in soil from the northern edge of the landfill (Area 1), as well as sediments from the Upper, Middle, and Lower Settling Basins, pose a potential risk to human health. The TEQs for the Upper and Middle Settling Basins were more than 20 times the RSL.

The Batch Attack Basin may contain dioxins/furans at lower concentrations because this basin received primarily sulfuric acid waste streams from the sulfate process (rather than the chloride process) for manufacturing titanium dioxide. The TEQs for groundwater from locations SB-53 and SB-59, in the South Upland area, were 10-20 times the MCL; no soils from this area were analyzed for dioxins and furans. The primary dioxin concerns appear to be in the sediments of the basins, and in the groundwater and potentially the soils of the South Upland area, which is

adjacent to the Lower and Middle Settling Basins. Elevated concentrations of metals were reported in these same areas and media. Additional characterization could help to refine the risks associated with dioxins and furans in these areas.

Table ES-1 summarizes the risk evaluation findings and other concerns identified for each of the AOCs (upland and basins) and the upland areas sampled as part of Site-wide sampling. The Phase II Investigation and the TRC basin investigation results provide sufficient characterization information to identify and evaluate potential remedial alternatives associated with Site redevelopment as a DMCF. Due to the complex nature of the Site, the remedial options will be discussed with the development team to focus cost estimating efforts.

Table ES-1 Summary of Phase II ESA Findings

Area	Human Health Risk Evaluation for Soil/Sediment[a]	Other Concerns
Upland Areas of Concern/Focus Areas		
Former Titanium Ore Storage Area	No risk concerns	Leachable lead at hazardous waste levels identified in one sample
Spent Solvent Storage Area	No risk concerns	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in surface and subsurface soil from one location.
Primary/Secondary Waste Acid Neutralization Area	Risk exceeding action level/threshold, driven by arsenic and antimony in surface and subsurface soil	Leachable lead at hazardous waste levels identified in one sample
Landfill Area	No risk concerns	Dioxins exceeded the USEPA RSL in one composite sample of waste.
Upland Site-Wide Sampling Grid		
Northwest Upland Area	No risk concerns	
West-Central Upland Area	Risk exceeding threshold, driven by vanadium in subsurface soil	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in two samples from near a former underground storage tank and an oil-water separator.
East-Central Upland Area	Risk exceeding action level, driven by PAHs in surface soil, primarily at one location	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in one sample, co-located with PAHs.
South Upland Area	Risk exceeding threshold, driven by vanadium in subsurface soil	Dioxins exceeded the USEPA MCL in two groundwater samples.
Treatment/Storage Basin Areas of Concern		
Upper Settling Basin	Risk exceeding threshold, driven by vanadium in surface and subsurface sediment and soil	High concentrations of chromium, iron, and manganese. Dioxins in sediment exceeded USEPA RSL.
Middle Basin	Risk exceeding threshold, driven by vanadium and manganese in sediment	High concentrations of chromium, iron, and manganese. Dioxins in sediment exceeded USEPA RSL.
Lower Settling Basin	Risk exceeding threshold, driven by vanadium in surface and subsurface sediment and soil	High concentrations of chromium, iron, and manganese. Dioxins in sediment exceeded USEPA RSL.
Batch Attack Basin	Risk exceeding threshold, driven by vanadium and manganese in sediment	Currently under MDE Administrative Consent Order. Low pH material identified at depths during another recent study. Groundwater remediation system in place to control low pH water leaching from Site.

(a) Results of screening-level human health risk evaluation, using MDE Non-Residential Cleanup Levels and based on a construction/maintenance worker exposure scenario. The MDE remedial action level for carcinogenic risk is 10^{-5}, and the threshold for non-carcinogenic risks is a hazard index of 1.0. Risk assessment did not include dioxin results.

NOTES:
MCL = Maximum Contaminant Level.
MDE = Maryland Department of the Environment.
PAH = Polycyclic aromatic hydrocarbon.
RSL = Regional Screening Level.
TPH-DRO = Total Petroleum Hydrocarbons–Diesel Range Organics.
USEPA = United States Environmental Protection Agency.

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1. INTRODUCTION

This Phase II Environmental Site Assessment (ESA) Report was prepared by EA Engineering, Science, and Technology, Inc., PBC (EA) for the Maryland Port Administration (MPA) for the Cristal USA Facility located at 3801 Fort Armistead Road in Baltimore, Maryland 21226 (the Site) (Figure 1-1).

1.1 PURPOSE AND SCOPE

The goal of this investigation is to evaluate the potential for the historical Site uses to have impacted the environmental integrity of soil and groundwater at the Site, to further evaluate areas of previously identified suspect conditions, and to provide Site-wide comprehensive characterization data. Information obtained as part of this investigation is intended to support efforts associated with the proposed expansion of the adjoining Cox Creek Dredged Material Containment Facility (DMCF) and to support potential future use(s) of the Site by MPA.

This Phase II ESA Report provides a detailed synopsis of the results of soil, sediment, groundwater, and surface water sampling performed during this sampling event. It also provides a screening against Maryland Department of the Environment (MDE) Generic Cleanup Standards (MDE 2008) and a statistical risk evaluation using MDE protocols.

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2. SITE AND PROJECT BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The Site consists of five adjoining parcels of land totaling approximately 178 acres and is zoned M-3 General Manufacturer (Baltimore City) and OS–Open Space District (Anne Arundel County). The Site was acquired by Cristal USA from Millennium Inorganic Chemicals in 2007. From approximately 1954 to 2011, the Site was used for the manufacturing of titanium dioxide and other titanium chemicals. Although these manufacturing activities have ceased and the majority of manufacturing structures have been demolished, numerous buildings and treatment/storage lagoons remain on the Site, along with a 30-acre solid waste landfill.

The majority of the Site (140 acres) is located in Baltimore City (Block 7006 and Lots 4 and 5) and the remaining 38 acres are located in Anne Arundel County (Map 6, Grid 8 and Parcels 1,2,3), just south of the Baltimore City boundary (Figure 1-1). It should be noted that Kemira Water Solutions (Kemira) operates within approximately 10 acres of the central portion of the Site; the Kemira Site parcel is not included as part of this investigation. The Site is bordered by Fort Armistead Road and Fort Armistead Park to the north, the MPA-owned Cox Creek upland to the south, industrial land use to the west, and the Patapsco River to the east.

The Site is serviced by municipal water provided by Baltimore City with supplemental process water pumped from the Patapsco River. Based on a review of the December 2012 Phase I ESA completed for the Site by TM Engineering, Inc. (TME 2012), a permitted water supply well exists on the Site; however, the well was never commissioned. In addition, the Environmental Data Resources, Inc. Geocheck™ Physical Setting Source Summary, included in the 2012 Phase I ESA, did not identify any potable water supply wells within a half-mile radius of the Site.

2.2 ENVIRONMENTAL SETTING

2.2.1 Topography

According to the United States Geological Survey topographic map of Curtis Bay, Maryland (1974), the Site is relatively flat with elevation ranging from 45 feet (ft) above mean sea level (AMSL) along the western Site boundary to approximately 3 ft AMSL along the eastern Site boundary. Note that this topographic map does not reflect the increased elevation of the landfill since 1974. Stormwater flow is discharged directly to the subsurface, is directed to settling basins located onsite, or is piped to the permitted outfall. The nearest surface water body, the Patapsco River, is situated approximately 200 ft east of the developed portion of the Site. The topography of the Site and surrounding area is illustrated in Figure 1-1 (Appendix A).

2.2.2 Geology

According to the Maryland Geologic Survey (MGS) 1976 Geologic Map of Baltimore County and City (MGS 1976), the Site lies within the Atlantic Coastal Plain Physiographic Province and is underlain by artificial fill and the Lower Cretaceous Potomac Group. Potomac Group

lithology at the Site consists of the clay and sand facies of the Patapsco Formation overlying the clay facies of the Arundel Clay.

Artificial fill materials are characterized as:

> "...heterogeneous materials such as: rock, unconsolidated sediment, slag, refuse, and dredge spoil."

The clay facies of the Patapsco Formation is characterized as:

> "Typically buff, red-yellow and brown mottled kaolinitic clay. Variable amounts of quartz, sand and silt as pods and interbeds dispersed throughout the clay. Rare occurrences of irregular siderite concretions and lignitized plant remains. Rare laminated silt-clay couplets contain plant debris. Deposition is oxidized flood plain-mud flat environment is postulated."

The sand facies of the Patapsco Formation is characterized as:

> "Well sorted, medium to fine grained quartz sand with locally abundant quartz gravel and clay clasts. Minimal clay-silt matrix in sand interstices. Sands are planar to high-angle cross-bedded and occasionally have fining upward sequences 3–5 meters thick. Ferruginous cements are typical as ledges at sand-clay boundaries, or as centimeter-sized spheroids and pods within the sand. Tourmaline and zircon with minor staurolite and rutile constitute the heavy mineral suite. Deposition in and around channels of low gradient streams."

The clay facies of the Arundel Clay is characterized as:

> "Gray, brown, black and red kaolinitic and illitic clays with quartz silt locally interbedded with quartz sand lenses and pods. The clays are typically poorly bedded to massive with occasional color mottling. Sparse to abundant irregular siderite ledges or concretions and lignitized wood remains. Elsewhere parallel to cross-laminated silts and clays contain sparse to abundant fern, cycadioid, and conifer remains."

Hydrogeological information derived from previous investigations (United States Environmental Protection Agency [USEPA] 1988) indicates the Patapsco Formation is about 250 ft thick at the Site. Underlying the Patapsco Formation, the Arundel Clay is reportedly 250 ft thick. An unconfined alluvial sand unit approximately equal to or near sea level has been identified as the uppermost aquifer in the eastern portion of the Site. This layer, 3 to 6 meters thick along the shoreline, thins to the west, and has an apparent hydraulic communication with the Patapsco River. Shallower water-bearing units may not be hydraulically connected to this uppermost aquifer.

2.2.3 Soils

According to the United States Department of Agriculture Natural Resource Conservation Service Web Soil Survey, soil onsite is classified as Udorthents, loamy, with 0 to 5 and 5 to 15 percent slopes; Udorthents, loamy, very deep, with 0 to 8 and 15 to 60 percent slopes; Udorthents, smoothed, with 0 to 35 percent slopes; Sassafras, gravelly loam, with 0 to 8 percent slopes; and Urban Land. The Udorthents, loamy soil type is characterized as a well-drained loam from 0 to 2 inches (in.) and a gravely loam from 2 to 72 in.; depth to the groundwater table is reported at 40 to 72 in. below ground surface (bgs). Sassafras, gravelly loam soil type is characterized as a well-drained gravelly loam from 0 to 35 in.; depth to the groundwater table is reported at 80 in. or more. Urban Land is defined as an area where more than 80 percent of the surface is covered by asphalt, concrete, buildings, or other impervious structures.

2.3 SITE HISTORY

Prior to development in the mid-1950s, the United States Army Corps of Engineers (USACE) used the area of the present surface impoundment as a dredged material dewatering area. Circa 1955, the Site was purchased from USACE by the Glidden Company for development as a manufacturing and packaging facility for titanium dioxide and ancillary byproducts, including gypsum, coppers, and carbon dioxide. The plant was eventually operated as the SCM-Adrian Joyce Works and then became a part of Millennium Inorganic Chemicals. Ownership was transferred to Cristal Global, Inc. from Millennium Inorganic Chemicals in 2007. Manufacturing operations were halted in March 2009 and permanently suspended in August 2010. Currently, most Site structures have been demolished.

In 1988, the USEPA Hazardous Waste Ground-Water Task Force issued a report, *Evaluation of SCM-Adrian Joyce Works, Baltimore, Maryland* (USEPA 1988), evaluating the facility's regulatory compliance and the condition of onsite groundwater. According to this report, the plant historically operated two separate and distinct production process systems to manufacture titanium dioxide: the sulfate process and the chloride process. The chloride process qualified for a hazardous waste exclusion, but the sulfate process generated regulated hazardous waste. In the sulfate process, titanium ores were digested with sulfuric acid, resulting in the creation of a residual waste sludge, known as Batch Attack Mud, which was treated onsite and eventually shipped offsite for landfilling, and spent sulfuric waste streams, which were stored in the onsite Batch Attack Lagoon, also known as the Batch Attack Basin, prior to treatment in the primary waste acid neutralization (PWAN) and secondary waste acid neutralization (SWAN) systems. In 1981, an underground leak of acidic wastewater was discovered in the Batch Attack Basin, and in 1984, a Consent Order was signed requiring the installation of a slurry wall and the installation of recovery wells to return captured leachate back to the lagoon.

As part of this Phase II ESA, the Site has been subdivided into focused Areas of Concern (AOCs) based on historical use and/or unique environmental conditions (Figure 2-1). A summary of the historical background for each of the AOCs (or Focus Areas) is provided below.

2.3.1 Former Titanium Ore Storage Area (Focus Area A)

Titanium ore naturally contains a certain degree of radioactivity. According to the TME Phase I ESA (TME 2012), the titanium ore storage areas, located in the southern portion of the Site, were periodically monitored and results indicated radiological activity consistent with background levels. The details regarding the monitoring are unknown and as such the areas of titanium ore storage were investigated for residual radioactivity, among other potential environmental concerns.

2.3.2 Spent Solvent Storage Area (Focus Area B)

Based on a review of the prior reports, a specific area of the Site was used for spent solvent storage; this area was determined to be located within the central portion of the Site, adjacent to the former Chemical Warehouse and an aboveground storage tank (AST) depot. It consists of an elevated concrete containment area that collected potential spills and meteoric water in a sump, then pumped the fluids into a filter vessel that reportedly gravity fed the liquids through filtration materials and discharged into the stormwater management system. The AST depot area currently consists of the remnants of the concrete tank support structures and a network of trench drains.

2.3.3 PWAN/SWAN Area (Focus Area C)

The Primary Waste Acid Neutralization /Secondary Waste Acid Neutralization (PWAN/SWAN) area, located in the northeastern portion of the Site, treated the acidic waste streams stored in the Batch Attack Basin and included numerous above ground tanks, some of which were present onsite at the time of the field investigation.

2.3.4 Basin Areas

Four unlined treatment/storage basins are present on the Site: the Batch Attack Basin, Upper Settling Basin, Middle Settling Basin, and Lower Settling Basin. The Middle Settling Basin has been in operation since 1970, and the other three basins have been in operation since 1955 (USEPA 1988). As described above, the Batch Attack Basin received spent sulfuric acid waste streams classified as hazardous waste, prior to treatment in the PWAN/SWAN area. During the 1980s, the Batch Attack Basin received approximately 1.4 million gallons of wastewater per day. The Upper Settling Basin received wastewaters from the chloride process, including non-contact cooling water, as well as neutralized weak acids from the sulfate process when the Batch Attack Basin was not available. From the Upper Settling Basin, the water flowed to the Lower Settling Basin. Although the area identified as the Lower Settling Basin during recent reconnaissance is approximately 10 acres, this basin was reported to cover 21.6 acres in the 1980s (USEPA 1988). Settled solids from the Lower Settling Basin were dredged and placed in the Middle Settling Basin; once dewatered sufficiently, the solids were then disposed in a landfill.

2.3.5 Cristal USA Landfill

A 30-acre solid waste landfill is present in the southwestern portion of the Site. It is clay-lined and contains an operating leachate collection system. Authorized wastes included process waste from titanium dioxide production, solids from the settling basins and Batch Attack Basin, as well as brick, clay, and rubble from plant demolition.

The volume and depth of the waste disposed of in the landfill is unknown. However, the original landfill design plans show the bottom elevation of the clay liner at elevations 10 ft AMSL and the adjacent elevation at approximately 40 ft AMSL, indicating an average depth of excavation of approximately 30 ft. The landfill was reportedly capped with 1 million cubic yards of clay material. Site reconnaissance indicated the landfill is comprised of four distinct areas:

- Area 1 – Capped Waste Fill Area – this area was reportedly filled to grade with waste material and finished with a thin clay cap.
- Area 2 – Uncapped Waste Fill Area – this area contains the stormwater management pond and was reportedly filled with waste material to grade but was not capped.
- Area 3 – Waste Fill with Clay Cap – this area was reportedly filled with waste material to grade and capped with clay up to an elevation of ±115 ft AMSL.
- Area 4 – Waste Fill to 72 ft AMSL with Clay Cap – this area was reportedly filled with waste to elevation ±72 ft AMSL then capped with clay to an elevation of ±145 ft AMSL.

2.4 FUTURE DEVELOPMENT

The short-term future use of the Site is proposed for the expansion of the southeasterly adjoining Cox Creek DMCF operations onto the Site. The proposed future development will consist of demolition of all remaining Site buildings and building remnants and the potential excavation of up to 15 ft of existing soils across the Site to accommodate the placement of future dredged material based on environmental and geotechnical considerations. The excavated soils from the Site are being considered for use in building earthen berms along the DMCF boundaries. Long-term future Site use following the dredged material placement has not been confirmed.

2.5 PRIOR ENVIRONMENTAL INVESTIGATIONS

Environmental investigations of the Site and surrounding area date back to the 1980s and include groundwater sampling, remedial activities, and limited Phase I and II ESAs. A summary of the relevant prior Site investigations is provided below.

2.5.1 Phase I Environmental Site Assessment

In December 2012, TME conducted a Phase I ESA of the Site (TME 2012). At the time of the Phase I ESA, the Site was occupied as it is presently, with the majority of the Site vacant with

the exception of the active adjacent Kemira operations. The scope of work of the Phase I ESA consisted of a visual site inspection, historic records review, and state and federal regulatory records review. Based on the information available and reviewed as part of the Phase I ESA, the following environmental conditions were identified at the Site:

- Leakage of sulfuric acid from the Batch Attack Lagoon on the Site occurred until the early 1980s when a subsurface cut-off wall and pumped recovery wells were installed under a Consent Order between SCM Chemicals (predecessor of Millennium Inorganic Chemicals) and MDE. Since residual acid is still being extracted, pumping of wells and treatment of effluent will continue indefinitely.

- Formal closure plans for the Batch Attack Lagoon and the other impoundments on the Site should be assessed and updated given the plant demolition and post-demolition surface water discharges from the Site.

- If any closure or re-use of the Batch Attack Lagoon, or any of the other impoundments on the Site, requires excavation of the sediments in the ponds, the sediments should be characterized by sampling and analytical testing. The results will assist in formulation of protocols for excavation and disposal of the spoils.

- A survey of paved and non-paved surfaces should be conducted to test for lead and asbestos content in surface and near surface soil due to demolition of onsite buildings and facilities with known asbestos-containing materials and lead.

- The site contained a number of underground storage tanks (USTs) and ASTs containing petroleum products. A survey of soil and near surface subsoil using off-gassing techniques should be conducted in the vicinity of former and existing petroleum product storage facilities (ASTs, USTs, and pads) to ensure no residual product remains.

- Acids and caustics were used in the manufacturing processes and in treatment of wastewater. Conduct a pH survey of near surface soil in the vicinity of tanks, storage pads, and other areas of use of caustic and acid. Access to soil may require coring of paved surfaces.

- Titanium ore used in manufacturing processes contained a certain degree of radioactivity. Ore yards (current and past) and the ore shed area should be tested for radiological activity in soil and groundwater (as may be encountered during testing of soil).

- An open coal stockpile existed near the Boiler House. Soil and groundwater in the coal stockpile area should be tested.

- PWAN/SWAN area: Soil off-gassing testing should be performed in the area where a tank associated with the BOC carbon dioxide gas operation was removed and around the vehicle maintenance building. Test pH in soil and groundwater in areas of caustic and

acid storage/use. Check pH in soil and groundwater in the vicinity of the removed acid tank near the pier and in the aragonite field.

- Random samples of surface soil should be checked in the vicinity of former stack locations to check for silica content. The rationale for the recommendation for surface soil sampling for silica was to evaluate the potential for particulate matter from historic air emissions to have settled in surface soil on the property.

2.5.2 Evaluation of SCM-Adrian Joyce Works

In April 1998, USEPA released an Update of the Hazardous Waste Groundwater Task Force report regarding the evaluation of the groundwater monitoring program at the SCM-Adrian Joyce Works, the Site occupants at the time (USEPA 1988). This update was prepared as a follow-up to an initial evaluation in 1996 regarding the construction and adequacy of a groundwater remediation system along the eastern portion of the Batch Attack Lagoon. The groundwater remediation system was designed and installed in 1984 following the release of acidic wastewater from the Batch Attack Lagoon.

Specifically, due to the spent sulfuric acid stored in the Batch Attack Lagoon, the Site was identified as a hazardous waste treatment, storage, and disposal facility, and therefore a USEPA-approved groundwater monitoring program needed to be in place to determine if the hazardous waste was being maintained and stored properly.

Between July and November 1984, following the release of sulfuric acid from the Batch Attack Lagoon to the Patapsco River, a slurry wall and a groundwater recovery and monitoring well system was installed along the eastern portion of the Batch Attack Lagoon. This well system replaced the prior monitoring well system. In June 1996, the Hazardous Waste Groundwater Task Force evaluated the adequacy of the groundwater monitoring program and whether the slurry wall and groundwater recovery wells were effective at containing the acidic wastewater within the Batch Attack Lagoon.

During the evaluation, the Task Force collected groundwater samples from the groundwater monitoring wells as well as the groundwater recovery wells and Batch Attack Lagoon for comparison. Results of the evaluation identified elevated concentrations of volatile organic compounds (VOCs) and metals in groundwater at concentrations at or above those identified in the recovery wells and the Batch Attack Lagoon, and that the source of the groundwater influence was a historic release from the Lagoon. In addition, groundwater concentrations of several VOCs (acetone, carbon disulfide, and benzene) and metals (aluminum, antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, vanadium, and zinc) were identified in the majority of the monitoring wells installed along the eastern portion of the Batch Attack Lagoon in excess of the currently applicable MDE Groundwater Cleanup Standards.

2.5.3 TRC Evaluation of Batch Attack Basin and Lower Settling Basin

In April 2015, TRC Companies, Inc. (TRC) conducted an assessment of the Batch Attack Lagoon and Lower Settling Basin. Results of this assessment, as provided to EA, are included in Appendix B. A total of 12 locations in the Batch Attack Basin and 2 locations in the Lower Settling Basin were evaluated as part of the assessment. The scope of the investigation consisted of sediment samples collection via hand auger and/or Vibracore™ equipment mounted on a pontoon boat or other portable coring platforms within the two impoundments. The lithology and pH of the sediment cores were evaluated and logged in 1-ft depth intervals for physical characteristics including grain size, color, odor, moisture content, consistency, and structure. Additionally, grab samples were collected from each sample location in 2-ft depth intervals and submitted for laboratory analysis of select metals (arsenic, barium, cadmium, chromium, iron, lead, manganese, and selenium).

Based on the information provided to EA (see Appendix B), the following environmental conditions were identified at the Site:

- In the Lower Settling Basin, sediment cores LSB-01 and LSB-02 were collected using Vibracore™ equipment mounted on a pontoon boat to a total depth of 22 to 24 ft below the sediment surface. The properties of the sediment columns were relatively consistent for the two sample locations. The non-native sediments were estimated to be a total of 11 ft thick at LSB-01 and 16 ft thick at LSB-02. At the time of the assessment, the sediments were submerged by approximately 1 to 2 ft thickness of surface water.

  The upper 8 to 9 ft of sediment thickness demonstrated slightly alkaline pH, ranging from 7.53 to 9.74. The lower portions of the cores (including all of LSB-02 and all but the lowest 4 ft of LSB-01) demonstrated acidic pH, ranging from 3.24 to 5.71, with the lowest pH encountered at approximately 13 to 14 ft below the sediment surface for both sample locations. At the bottom of both cores, pH increases with depth, to 7.42 in LSB-01 and to 5.56 in LSB-02.

  In the Lower Settling Basin, the laboratory results for the upper interval (with alkaline pH) reported detections of chromium, iron, and manganese in exceedance of the MDE Non-Residential Soil Cleanup Standard. The laboratory results for the lower intervals (with acidic pH) reported detections of arsenic in exceedance of the MDE Non-Residential Soil Cleanup Standards.

- In the Batch Attack Basin, the properties of the sediment columns varied based on location and distance from the inlet (western portion) of the basin. For the purposes of this discussion, they are divided into three sub-sets: exposed sediment, shallow-water sediment, and deep-water sediment. At the time of the assessment, the exposed sediments were not submerged by water; the shallow-water sediments were submerged by approximately 1 ft or less of surface water, and the deeper-water sediments were submerged by approximately 1 to 2 ft of surface water.

The exposed sediment locations (BAL-01, BAL-02, and BAL-03) were completed via hand auger and ranged in depth from 5 to 6 ft below grade. The non-native sediments were estimated to be approximately 3 to 6 ft thick. The sediment at BAL-01 ranged in pH from 2.90 to 6.70, with the lowest pH encountered at approximately 2 ft below grade. The sediment pH at BAL-02 was relatively consistent, ranging from 7.35 to 7.90. The sediment at BAL-03 ranged in pH from 3.97 to 6.02, with the lowest pH encountered at approximately 3 ft below grade. At the base of all three cores, pH increased with depth.

The shallow-water sediment locations in the Batch Attack Basin (BAL-04, BAL-05, BAL-06, BAL-07, BAL-08, and BAL-09) were completed via Vibracore™ and portable floating platform and range in depth from 13 to 18 ft below the sediment surface. The non-native sediments were estimated to be approximately 10 to 15 ft thick. The upper 3 to 5 ft of sediment thickness demonstrated circumneutral to alkaline pH ranging from 6.51 to 10.30. The next 10 to 13 ft thickness interval demonstrated acidic pH ranging from 2.02 to 5.70, with the lowest pH occurring at an average depth of 13 ft below the sediment surface and as deep as 18 ft below the sediment surface. With the exception of BAL-07 and BAL-08, a trend of pH increasing with depth was not established at the base of these sample locations.

The deep-water sediment locations (BAL-10, BAL-11, and BAL-14) were completed via Vibracore™ and pontoon boat, and ranged in depth from 23 to 26 ft below the sediment surface. The non-native sediments were estimated to be approximately 16 to 19 ft thick. The upper 6 to 8 ft of sediment thickness demonstrated alkaline pH ranging from 8.31 to 10.33. The next 16 to 19 ft thickness interval demonstrated acidic pH ranging from 2.04 to 5.56, with the lowest pH occurring at an average depth of 17.3 ft below the sediment surface and as deep as 18 ft below the sediment surface. There was a slight trend of pH increasing with depth at the base of these sample locations.

In the Batch Attack Basin, the laboratory results for the exposed sediment locations reported detections of arsenic in exceedance of the MDE Non-Residential Soil Cleanup Standard. For the shallow- and deep-water sediment locations, samples from the upper interval (with alkaline pH) had reported concentrations of chromium, iron, and manganese in exceedance of the MDE Non-Residential Soil Cleanup Standard. The laboratory results for the lower intervals (with acidic pH) reported detections of arsenic and lead in exceedance of the MDE Non-Residential Soil Cleanup Standards.

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3. FIELD AND ANALYTICAL INVESTIGATION METHODS

The goal of this investigation is to evaluate the potential for the historic Site uses to have impacted the environmental integrity of the Site, to further evaluate areas of previously identified suspect conditions, and to provide Site-wide comprehensive characterization data. Information obtained as part of this investigation is intended to support efforts associated with the proposed expansion of the adjoining Cox Creek DMCF and to support potential future use(s) of the Site by MPA.

3.1 UTILITY MARKOUT AND GEOPHYSICAL SURVEY

Prior to initiating field activities, EA coordinated with MissUtility and a private utility markout subcontractor, to obtain utility clearance for the Site investigation areas. In addition, EA personnel conducted a Site visit to confirm the proposed soil boring locations and below grade utility markings. EA marked each boring and determined its location on a scaled Site plan via measurements from existing Site features and the use of hand-held global positioning system (GPS) instrumentation. Reference datum is the Maryland State Planar Coordinate System.

Concurrent with the private utility markout, a geophysical survey was conducted within 13 areas of suspect USTs or other features of interest identified throughout the Site, using ground-penetrating radar (GPR) and Electro-Magnetic 31 (EM-31) Surveys. The surveys were performed on lines separated on an approximate 5-ft grid spacing. This spacing was selected in order to identify a UST size of 500 gallons or greater.

GPR uses radar pulses to image the subsurface of the Site. The depth range of GPR is limited by the electrical conductivity of the ground, and the transmitting frequency. As conductivity increases, the penetration depth decreases. As such, subsurface materials, such as concrete, reinforced concrete, or metallic debris may reduce the effective penetration depth. EM techniques incorporate the principle of electromagnetic induction. EM equipment consists of a very low frequency transmitter and a receiver coil. The transmitter induces an electrical current into the subsurface, which produces secondary fields. Subsurface materials and groundwater (to a maximum penetration depth of 6 meters) that are highly conductive are detected and recorded as anomalies. An in-phase component of EM-31 is used to identify buried metal objects (e.g., steel tanks). These techniques were utilized to identify remnant USTs that may remain in the subsurface. Information resulting from the geophysical surveys is discussed in Section 4.1.

3.2 SOIL AND GROUNDWATER SAMPLING FROM UPLAND AREAS

Soil Sampling

One hundred and thirteen soil borings were completed throughout the Site to further evaluate the potential for the historic Site uses to have impacted the Site (Figure 2-1). The soil borings were advanced for general Site-wide characterization data throughout the Site and within each of the AOCs described in Section 2.3. Field and analytical investigation methods specific to the Site-

wide sampling grid or the individual AOCs are discussed in the subsections below. Note that groundwater sampling methodologies are discussed below, and basin sediment and surface water sampling methodologies are discussed in Section 3.3.

Shallow and subsurface soil samples were collected using direct-push technology (DPT) methodologies. Where practicable, soil borings were advanced to depths ranging from 10 to 15 ft bgs. Soil borings were advanced deeper at locations proposed for the installation of temporary monitoring wells if groundwater was not encountered in the initial 15-ft thickness. Soil from the borings was collected continuously using 5-ft-long, 2-in. outside diameter sampling rods. Rods were lined with 60-in. polyvinyl chloride (PVC) liners, which allowed for discrete sampling of specific soil intervals. Soil lithology was recorded on boring logs for each borehole (Appendix C). Grab soil samples were collected from each DPT core (at approximate 2-ft intervals) and field screened using a photoionization detector (PID) and visual observations for the presence of total VOCs.

Two discrete soil samples were collected by default from most of the soil borings, including a shallow sample and a subsurface sample. The shallow soil samples were collected from as near to the ground surface as possible, to document conditions in the near-surface soils to address surface sources of contamination. Where a PID response was obtained during field screening, the subsurface sample was collected from the depth of the highest PID response. If there was no PID response or other obvious indications of impacts, the subsurface sample was collected immediately above the soil/groundwater interface, with groundwater depth determined by visual inspection of the soil core. The subsurface samples were intended to address potential vertical or horizontal migration from the surface sources as well as deeper sources of unknown origin.

Soil samples were homogenized across the targeted interval, except any subsamples for VOC analysis, for which a grab sample was collected from within the interval before the interval was homogenized for the sample collection. The samples were then placed into new, clean, laboratory provided sample containers. Following completion of each soil boring, soil cuttings generated during sampling activities were placed back into the boring. Impermeable surfaces were restored with like materials such as cement or an asphalt patch.

The ten steps of the sample collection protocol are summarized below:

1. The geologists and operator donned personal protective equipment.

2. The operator was directed to drive the sampler to the desired depth and retract the probe.

3. The operator withdrew the sampler, removed the PVC core liner from the sampler, and transported the sub-core to the onsite geologist for logging and field screening analysis. The sample was logged on the field boring log forms while it was still in the sampler.

4. The soil sample was immediately screened for VOCs using a PID, and sample intervals for laboratory analysis were selected.

5. A subsample was collected from the selected intervals for laboratory analysis of VOCs (as appropriate), and then the remaining mass of each sample was transferred to a dedicated plastic zip-locking baggie.

6. The material in the plastic bag was thoroughly homogenized.

7. The sample was then placed into the required number and type of sample jars.

8. Any remaining sample material and cuttings were then returned to the borehole. Like materials were added to restore the surface level.

9. The soil samples were submitted for laboratory analysis.

10. The DPT rods were decontaminated.

Select soil samples were submitted for laboratory analysis for one or more of the following: target analyte list (TAL) metals, pH, VOCs, semivolatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) diesel range organics (DRO) and gasoline range organics (GRO), dioxins/furans, and gamma spectroscopy. Note that each soil sample was analyzed for PAHs, and a 10 percent subset was also analyzed for SVOCs. The rationale for analyzing a 10 percent subset for the full SVOCs (PAHs and base neutral acids [BNAs]) was that the BNA subset of SVOCs was not anticipated to be as widespread across the Site. Laboratory analyses were performed using the acceptable analytical methods outlined in Section 3.9 of the *Voluntary Cleanup Program Guidance Document* (MDE 2006).

In addition, soil samples analyzed for TAL metals were requested to be retained by the laboratory for potential additional metals analysis. Seven samples were selected for chromium speciation analysis, based on total chromium concentrations exceeding the background concentration (MDE Anticipated Typical Concentrations). Six samples were analyzed by toxicity characteristic leaching procedure (TCLP) methodology, due to concentrations of total metals indicating the potential for soil concentrations to exceed TCLP thresholds. Although elemental mercury analysis was also considered, mercury concentrations were determined not to be sufficiently high to justify this analysis.

Groundwater Sampling

Nineteen select soil borings throughout the Site were completed as temporary groundwater monitoring wells, including one soil boring located downgradient of the landfill area. Thin, laterally discontinuous water-bearing units were encountered across the Site at depths ranging from 4 to 20 ft bgs. Conditions in the field necessitated deviation from the proposed locations for several of the temporary wells. Specifically, groundwater availability and new information/ observations acquired once the investigation was underway were used to determine the locations for the replacement wells. The temporary well locations, as completed, are provided in

Figure 2-1 (Appendix A). Note that the temporary wells proposed at locations SB-03, SB-06, SB-21, SB-39, and SB-41 were not completed due to the absence of sufficient water-bearing lithology; wells were completed at the following locations instead: SB-28, SB-42, SB-60, and SS-05.

The groundwater sampling was performed in general accordance with the USEPA Low-Flow Methodology and as described below.

The temporary groundwater wellpoints were constructed using 5 to 15 ft of 1-in.-diameter flush-threaded PVC screen (0.020 slot) and completed with solid PVC riser to the ground surface to allow for the collection of a grab groundwater sample. Dedicated equipment was used at each sample location. Well development was completed by surging and purging the temporary well using a hand bailer and peristaltic pump with dedicated tubing. Well development continued until at least three well volumes were removed and, where achievable, the purge water appeared clear and free of fines. Development water was discharged to the permeable ground surface.

After development of each well, a peristaltic pump with dedicated tubing was deployed to within the screened interval and connected to a water quality meter. Water quality parameters including pH, specific conductivity, temperature, oxidation/reduction potential, turbidity, and dissolved oxygen were monitored during low-flow purging and recorded to ensure groundwater quality stabilization was reached prior to sampling. When three consecutive water quality readings agreed within 10 percent, indicating stabilization, samples were collected by discharging purge water directly into the required number of new, clean, laboratory provided sample containers after disconnecting the tubing from the water quality meter. Purge water was discharged to the permeable ground surface. Following collection of the groundwater samples, the PVC screen and riser were removed, and unused portions of soil cores were returned to the boreholes, which were topped off with bentonite to grade.

Groundwater samples collected from each well were submitted for fixed laboratory analysis for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxin/furans. Fixed laboratory analysis was performed using the acceptable analytical methods outlined in Section 3.9 of the *MDE Voluntary Cleanup Program Guidance Document* (MDE 2006).

The sections below detail the soil and groundwater samples collected from each area, which are also summarized in Table 3-1. Note that in addition to the soil samples collected from the Upper and Lower Settling Basins, samples classified as sediment were also collected; these samples are summarized in Table 3-2. Results of the laboratory analyses are presented in Appendices D and E, and summarized in Section 4.

Table 3-1 Summary of Soil and Groundwater Samples Collected

Upland Area	No. of Soil Borings	No. of Soil Samples	No. of Groundwater Samples
Former Titanium Ore Storage Area	10	15	0
Spent Solvent Storage Area	6	12	2
PWAN/SWAN Area	13	26	2
Landfill Area (including SB-60)	11	22	1
Site-Wide Sampling Grid (including OWS samples)	64	128	14
Northwest Upland Area	*17*	*34*	*0*
West-Central Upland Area	*19*	*38*	*3*
East-Central Upland Area	*17*	*34*	*7*
South Upland Area	*11*	*22*	*4*
Upper Settling Basin	5	10	0
Lower Settling Basin	4	8	0
Total	113	221	19

NOTES: OWS = Oil/water separator.
PWAN/SWAN = Primary Waste Acid Neutralization/Secondary Waste Acid Neutralization.

3.2.1 Former Titanium Ore Storage Area (Focus Area A)

In order to evaluate the Former Titanium Ore Storage area, 10 soil borings (TS-01 through TS-10) were advanced via DPT (Figure 2-1). In addition to soil chemistry constituents, soil samples collected from the soil borings were evaluated to assess whether residual radioactivity associated with titanium ore processing was present. Radiation levels in soil were screened by field personnel using a radiation survey meter/frisker (Victoreen Model 190 with GM Model 489-110D probe), and by gamma spectroscopy in the laboratory.

Prior to advancing the soil borings, background radiation levels were surveyed at three locations onsite (SB-09, SB-59, and SB-60). These background locations were chosen to establish radiological levels in areas not associated with ore storage. Field screening was next conducted throughout the focus area, including at each of the proposed sample locations. Surface soil at each of the background and focus area locations was surveyed by scraping back approximately 1 in. of topsoil, placing the radiation survey meter at the soil surface, and recording the average reading.

To further assess radiological concentrations within the Former Titanium Ore Storage area, select soil samples for laboratory analysis were collected from each of the 10 soil borings advanced in this area, in addition to the three background locations from other areas of the Site (SB-09, SB-59, and SB-60). The soil samples for radiological analysis were collected from the shallow soils and submitted for laboratory analysis by gamma spectroscopy.

Non-radiological chemical analyses were performed on 15 samples from this area. At five of the boring locations, two soil samples for chemical analysis were collected, including a shallow sample and a subsurface sample; for the remaining five soil borings only a shallow sample was collected. The soil samples were submitted for laboratory analysis of one or more of the

following: TAL metals, pH, SVOCs/PAHs, and PCBs. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans.

Results of the field screening and laboratory analyses are presented in Section 4.2.

3.2.2 Spent Solvent Storage Area (Focus Area B)

In order to evaluate the Spent Solvent Storage area and features adjacent to the northwest (the former location of a chemical warehouse, several ASTs, and trench-drains), six soil borings (SS-01 through SS-06) were advanced via DPT (Figure 2-1). The locations of borings SS-02, SS-03, and SS-04 were relocated slightly to the northwest, due to near-surface refusal at the proposed locations. The adjusted locations are in an area that formerly included a chemical storage warehouse, several ASTs, and a system of trench-drains.

Two soil samples were collected from each soil boring, including a shallow sample and a subsurface sample. The soil samples were submitted for laboratory analysis for one or more of the following: TAL metals, pH, VOCs, SVOCs/PAHs, PCBs, and TPH DRO/GRO. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans. Results of the laboratory analyses are presented in Section 4.2. In addition, two borings were completed with temporary well points.

3.2.3 PWAN/SWAN Area (Focus Area C)

In order to evaluate the PWAN/SWAN area, 13 soil borings (AN-01 through AN-13) were advanced via DPT (Figure 2-1). Two soil samples were collected from each soil boring, including a shallow sample and a subsurface sample. The soil samples were submitted for laboratory analysis of TAL metals, pH, VOCs, SVOCs/PAHs, PCBs, and TPH DRO/GRO. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans. Results of the laboratory analyses are presented in Section 4.2. In addition, two borings were completed with temporary well points.

3.2.4 Landfill Area

In order to characterize the materials contained within the Cristal USA Landfill, 10 soil borings (LF-01 through LF-10) were advanced using hollow-stem auger drilling from grade to a depths of 15 to 75 ft below grade, and one soil boring (SB-60) was advanced using direct push to a depth of 20 ft below grade. Landfill development and completion documents provided by Cristal were used to develop the investigation approach; precise elevations were determined at the exact borehole locations using a GEO7X Trimble GPS altimeter with ±2-ft vertical accuracy to verify that advancing boreholes to the targeted depths will not directly impact the leachate collection system components. Based on the construction design and historic use, the Landfill was subdivided into four areas for characterization (Figure 2-1).

For Landfill Area 1 (2-ft clay cover waste fill area), soil borings LF-01 and LF-02 were advanced to depths of 20 and 22 ft below grade; for Landfill Area 2 (waste fill area with no clay cover), soil borings LF-03 and LF-04 were advanced to depths of 15 and 16 ft below grade; for Landfill Area 3 (waste fill with clay cover approximately 30 to 50 ft bgs), soil borings LF-05, LF-06, and LF-07 were advanced to depths of 48, 48, and 67 ft below grade; for Landfill Area 4 (waste fill with clay cover approximately 40 to 60 ft bgs), soil borings LF-08, LF-09, and LF-10 were advanced to a depths of 46, 67, and 75 ft below grade.

Two soil samples were collected from each soil boring, including a shallow sample and a subsurface sample. The shallow sample was collected from the surface to 2 ft bgs at all locations except for LF-01, LF-02, and LF-03. The shallow samples from these three locations were collected from the 2 to 4 ft bgs interval, to allow characterization of waste fill located near the surface. After the shallow sample was collected, augering was performed continuously through the clay cover, to the expected depth of waste fill material provided by the Millennium Chemical Site Supervisor, Mr. Frank Martin. Split-spoons were collected at 2-ft intervals from the expected depth of waste fill material to approximately 10 to 20 ft below that depth in order to collect a representative subsurface sample.

Soil lithology was recorded on boring logs for each borehole (Appendix C). Grab soil samples were collected from each spoon and field screened using a PID and visual observations for the presence of total VOCs. For Landfill Areas 1 and 2, both samples for each borehole consisted of waste fill material. Material encountered at Area 1 consisted of a gypsum material (LF-01) and construction debris (LF-02) with a 2-ft clay cover. Material at Area 2 consisted of compact silt with layers of sand with no clay cover (LF-03 and LF-04).

For Landfill Areas 3 and 4, surface samples for each borehole consisted of clay cover material, and subsurface samples consisted of representative waste fill material. Material encountered at Area 3 consisted of an organic black and white clayey silt (lagoon and gypsum material) with an approximate 35-ft clay cover for LF-05, organic black clayey silt (lagoon material) with an approximate 30-ft clay cover for LF-06, and a compact clay/silt mix with layers of sand for LF-07. Material at Area 4 consisted of sand and minor wood debris with clay lenses from 45 to 67 ft bgs at LF-08, an organic black clayey silt (lagoon material) with an approximate 40-ft clay cover for LF-09, and layers of compact silt and sand from 55 to 75 ft bgs at LF-10. The exact depth of the clay cover was unclear at LF-07, LF-08, and LF-10 due to the layers of sand observed throughout the known clay cover interval, and no distinguishable waste fill material layer observed. EA discussed this condition with the Millennium Chemical Site Supervisor, Mr. Frank Martin, who confirmed that sand was applied in layers in conjunction with the clay cover; however, the source of the sand was not provided.

In order to gather data representative of the Site boundary in the southwest portion of the Site, one soil boring (SB-60) was added to the southeast of the landfill stormwater pond. This boring was also completed with a temporary well point.

The soil samples were submitted for laboratory analysis of TAL metals, PAHs, pH, VOCs, PCBs, and/or TPH DRO/GRO. Within each of the landfill areas, one additional sample was composited from aliquots of shallow soil (for Areas 1 and 2) or subsurface soil (for Areas 3 and 4) from each of the sample locations and submitted for laboratory analysis of dioxin/furans. Results of the laboratory analyses are presented in Section 4.2.

3.2.5 Site-Wide Sampling Grid

An unbiased 250-ft sampling grid for soil boring locations was developed to address the remaining Site areas and develop a dataset of Site-wide information. Sixty soil borings (SB-01 through SB-59 and SB-61) were advanced via DPT from locations anticipated to represent background, upgradient, and downgradient Site conditions (Figure 2-1). The soil samples were submitted for laboratory analysis of TAL metals, SVOCs/PAHs, pH, VOCs, PCBs, TPH DRO/GRO, and/or dioxins/furans. Results of the laboratory analyses are presented in Section 4.2.

As the investigation was underway, new information/observations led to the addition of several DPT soil borings. The rationale for completion of the additional borings is provided below.

- Based on the discovery of a concrete subsurface oil/water separator (OWS) vault containing an estimated 1,000 gallons of oil, four additional soil borings (OWS-01, OWS-02, OWS-03, and OWS-04) were completed in the area between SB-18 and SB-20, immediately adjacent to the vault and associated piping. The findings of geophysical surveys, and other information regarding this area, are presented in Section 4.1.

- Based on discovery of a steel subsurface OWS tank containing an unknown volume of suspected diesel fuel and a nearby aboveground concrete OWS vault containing apparent meteoric water, one additional soil boring was completed in the area. SB-40 was re-located immediately adjacent to the underground tank and SB-61 was added immediately adjacent to the aboveground vault and associated subsurface piping. The findings of geophysical surveys, and other information regarding this area, are presented in Section 4.1.

- As discussed in Section 3.2.4, one soil boring (SB-60) was added to the southeast of the landfill stormwater pond in order to gather data representative of the Site boundary in the southwest portion of the Site.

In addition, 14 borings were completed with temporary well points.

For the purposes of data analysis and discussion, the Site-wide upland sampling locations were divided into four areas: the Northwest Upland, West-Central Upland, East-Central Upland, and South Upland areas (see Figure 2-1).

3.2.6 Basin Area Soils

In order to evaluate the soil in the dewatered portions of the treatment/storage basins (Upper Settling Basin and Lower Settling Basin), nine soil borings (UB-01 through UB-05 and LB-02 through LB-05) (Figure 2-1) were advanced. Note that locations LB-06, LB-07, and LB-08, and locations UB-06, UB-07, and UB-08 were sediment sampling locations (see Section 3.3). Soil borings from the Upper Settling Basin were advanced via DPT. Soil borings from the Lower Settling Basin were advanced via disposable scoops (surface samples) and hand augers (subsurface samples), due to the unanticipated saturation of the soil that made drill-rig access impossible. The soil samples were submitted for laboratory analysis of TAL metals, pH, SVOCs/PAHs, and PCBs. Results of the laboratory analyses are presented in Section 4.3.

The area adjacent to proposed coring location LB-01 was densely wooded and marshy, making drill-rig access and hand-augering impractical; therefore, the soil boring designated for that location was not completed.

Sediment and surface water sampling methodologies for the treatment/storage basins (Batch Attack Basin, Upper Settling Basin, Middle Settling Basin, and Lower Settling Basin) are discussed in Section 3.3. Note that the distinction in terminology between "soil" and "sediment" samples from these basins is a matter of which sampling methodology was initially judged to be feasible in each area. Soil samples are from areas that were initially judged to be suitable for DPT soil borings (although some were found to require hand augering, as described above). Sediment samples are from areas submerged in water or exposed areas with soft material that was judged to be unsuitable for access by DPT equipment (see Section 3.3).

3.3 SEDIMENT AND SURFACE WATER SAMPLING FROM THE BASINS

In addition to the soil samples in the basins collected using DPT or hand auger (see Section 3.2.6), sediment and surface water samples were also collected from the basins. The numbers of samples collected from each basin are summarized in Table 3-2.

Table 3-2 Summary of Sediment and Surface Water Samples Collected

Treatment/Storage Basin	No. of Surface Water Samples	No. of Open Water Sediment Samples	No. of Exposed Sediment Samples
Batch Attack Basin	1	4	5
Upper Settling Basin	1	3	0
Middle Settling Basin	0	0	5
Lower Settling Basin	1	3	0

Note that no surface water samples were collected from the Middle Settling Basin because no open water (more than 1 or 2 in. deep) was present in this basin.

Prior to conducting sediment sampling operations within each basin, water quality parameters including pH, specific conductance, conductance, temperature, turbidity, salinity, and oxidation-reduction potential were collected. At the same location, a surface water sample was also collected using a telescopic pole and several 1-liter sampling bottles. The sample bottles were

pre-cleaned and rinsed at least three times with Site water before collecting water for each surface water sample. This method was selected over the proposed method, to hold the appropriate pre-cleaned sample container just below the air-water interface and remove the cap, because it reduced the contact exposure of the technician performing the sampling to the water. During surface water sampling, no surface film or flotsam was observed at any of the surface water sampling locations. The surface water samples were submitted for laboratory analysis of TAL metals, VOCs, SVOCs/PAHs, pH, PCBs, and dioxins/furans.

The open water surface sediment samples were collected using a 9-in. by 9-in. stainless steel Ponar grab sampling device deployed from a single Jon boat in the Upper Settling Basin, and from the work platform in the Batch Attack and Lower Settling Basins. The work platform was constructed using two Jon boats secured together by a wooden frame and mechanical fasteners to enhance floatation and stability during sampling operations in deeper water.

Sample collection in the open water areas of the basins consisted of positioning the Jon boat or work platform as close to the proposed sampling location as safely and feasibly possible, and lowering the Ponar grab sampler to the bottom of the basin to recover the surface sediments. When the grab sampler was lowered into the sediment, the sampler initially penetrated approximately 2 to 3 in. into the sediment, enabling recovery from within 3 to 12 in. of the surface. Because of the size of the grab sampler and depth of recovery from each deployment, only one grab sample was necessary to recover sufficient volume for analytical testing (including the required field duplicates (FDs) and matrix spike (MS)/matrix spike duplicates (MSDs).

After each sample was collected, the sediment from the sampler was transferred to a heavy duty disposable aluminum pan, the boat returned to shore to homogenize the sediment, and the sediment was then transferred to new, clean, laboratory provided sample containers. For the composite sample, approximately 7 to 10 scoops of sediment from each sample location within each basin were homogenized in a separate aluminum pan and transferred to the new, clean, laboratory provided sample container. Before returning to the boat or work platform, the Ponar and any non-disposable equipment used for sampling were decontaminated using the following procedure: (1) rinse with deionized water; (2) application of nitric acid; (3) rinse with deionized water; (4) application of hexane; (5) application of methanol; and (6) final rinse with deionized water.

At each exposed surface sediment location, one surface sample from the top 18 in. was collected using a dedicated disposable scoop. In addition to the proposed samples from each basin, one additional discrete sample (BB-04 0-0.5, from location BB-04a) was collected from the exposed sediments of the Batch Attack Lagoon in order to characterize a distinct surficial lithology not represented in the other samples collected in that area.

The sediment samples were submitted for laboratory analysis of TAL metals, PAHs, pH, and PCBs. Within each basin, one additional sample was composited from aliquots of each sediment sample and submitted for laboratory analysis of dioxin/furans. Results of the laboratory analyses are presented in Section 4.3.

Table 3-3 summarizes the odor, color, and texture of each of the sediment samples collected.

Table 3-3 Descriptions of Sediment Samples

Sample ID	Odor	Color	Texture
BB-01	NA	Reddish Brown	Silty fine sand
BB-02	NA	Grey	Sandy silt
BB-03	NA	Red (0–3 inches) Brown (3–12 inches)	Silty clay
BB-04	NA	Grey (0–3 inches) Brown (3–12 inches)	Silt/Clay
BB-04a	NA	Orange (0-0.5 inches)	Silt/Clay
BB-05	NA	Red	Fine/Mucky
BB-06	NA	Brownish Grey	Fine/Mucky
BB-07	NA	Brown	Fine/Mucky
BB-08	NA	Dark Brown	Fine/Mucky
UB-06	NA	Whiter grey (white streaks in matrix looked like paint or some polymer)	Very fine
UB-07	NA	Whiter Grey (white streaks in matrix looked like paint or some polymer)	Very fine
UB-08	NA	Reddish Brown	Sandy silt
MB-01	NA	Brownish Grey	Fine silty clay
MB-02	NA	Brownish Grey	Fine silty clay
MB-03	NA	Brownish Grey	Fine silty clay
MB-04	NA	Brown	Fine sandy silt
MB-05	NA	Brown	Fine sandy silt
LB-06	NA	Brown	Fine silt
LB-07	NA	Greyish Brown	Fine silty clay
LB-08	NA	Brown	Fine sandy silt

NOTES: ID = Identification.
NA = Not applicable.

3.4 SAMPLE HANDLING AND ANALYSIS

Samples collected for laboratory analysis were recorded in the soil boring logs and/or project field notebooks. These notebooks will be kept in the project file for reference. Each location sampled during field activities was given a unique sample designation, and a unique sample identification (ID) was established for each discrete sampling point, as described in Section 3.4.1. The sample ID was included on the chain-of-custody and container label, and the information contained on the sample container label was entered into the appropriate data tables and appended to the laboratory deliverables.

Sample containers were affixed with a sample label filled out at the time of collection. Information on the sample label included, at a minimum, the following:

- Client
- Sample ID
- Date and time of collection
- Analysis

- Preservative
- Name of sampler.

Following sample collection, containers were sealed and placed in a cooler with bagged ice and cooled to 4 degrees Celsius (°C) or less using wet ice or refrigeration until they were submitted to TestAmerica for laboratory analysis.

3.4.1 Sample Identification

Sample locations including soil, sediment, groundwater, and surface water samples collected during the field work were assigned unique IDs according to the following:

Each discrete sample (from a single location) was given a unique designation:

Focused Area or Site-wide	Sediment/Soil	Groundwater/Surface Water
Former Titanium Ore Storage Area	TS - ## X-Y	TS - ##W
Spent Solvent Storage Area	SS - ## X-Y	SS - ##W
PWAN/SWAN Area	AN - ## X-Y	AN - ##W
Landfill Area	LF - ## X-Y	LF - ##W
Batch Attack Basin	BB - ## S	BB - ##W
Upper Settling Basin	UB - ## X-Y or S	UB - ##W
Middle Settling Basin	MB - ## S	MB - ##W
Lower Settling Basin	LB - ## X-Y or S	LB - ##W
Oil/Water Separator (west)	OWS - ## X-Y	OWS - ##W
Site-Wide Sampling	SB - ## X-Y	SB - ##W

In the sample designations, the number (##) designates the specific sample location. For soil samples, the X-Y identifies the depth at which the sample was taken, where X is the top of the sample interval and Y is the bottom of the sample interval in ft bgs. For sediment samples, the letter "S" indicates that the sample was collected at/near the surface; however, precise depth intervals could not be determined. One additional sediment sampling location was added in the Batch Attack Basin; this location was named "BB-04a," and the associated sample was designated "BB-04 0-0.5." IDs for groundwater and surface water samples are indicated by the letter "W" succeeding the ID ##.

Composite samples of soil and sediment were also collected from within focused areas, for analysis of dioxins/furans. Each composite sample was given a unique designation, indicating the sampling locations from which material was composited (or the area of the landfill, in one case):

TS - ## - ##
SS - ## - ##
AN - ## - ##
LF - ## - ##
LF - Area 4
BB - ## - ##

LB - ## - ##
MB - ## - ##
UB - ## - ##

where TS, SS, AN, LF, BB, LB, MB, and UB identify the composite sample as being collected within one of the Focused Areas (Section 2.3). The numbers (## - ##) identify the numerical series of sampling locations that comprised the composite sample. Landfill Area 4 includes locations LF-08, LF-09, and LF-10 (Figure 2-1).

FDs were designated such that the laboratory would not be able to discern the parent sample. The following sample identification numbers were assigned:

DUP - ##
FD - ##
LF - DUP - ##
GW - DUP - ##

where ## designates the duplicate number that was sequentially collected from the beginning to the end of the field effort. The prefix (DUP, FD, LF, or GW) was modified when there were multiple sampling crews collecting parent-duplicate sample pairs across the Site simultaneously. The parent sample associated with each duplicate sample was noted in the drilling logs and/or field notes.

For MS and MSD samples, MS or MSD was added to the end of the sample ID for the parent sample, or otherwise indicated on the chain-of-custody.

The data tables included in Appendix D include the sample IDs, with the locations, depth intervals, and the laboratory analyses performed for each sample.

3.4.2 Chain-of-Custody

Chain-of-custody (COC) forms were initiated by the sampler at the time samples were collected. EA relinquished samples to a TestAmerica courier who shipped the soil and water samples under strict COC to TestAmerica Laboratories for analysis. The courier repackaged the coolers if applicable and placed the COC in a plastic bag and taped it to the inside of the cooler lid. The cooler was sealed with adhesive tape, labeled, and secured with custody seals prior to shipping. Upon receipt and opening of the coolers, the laboratory sample custodian measured and recorded the temperature inside the coolers, which did not exceed 6°C. Samples were analyzed with standard turn-around times of 10 business days from receipt of samples.

3.5 WASTE MANAGEMENT

Investigation-derived waste (IDW) generated during the sampling activities was handled and characterized for disposal according to proper waste management procedures.

The waste management procedures for each of types of IDW generated were conducted as follows:

- **Soil Cuttings** – Soil and rock cuttings generated during drilling and sampling activities were returned down the borehole.

- **Solid Waste** – Solid waste and debris, such as disposable clothing, and any other disposable equipment or materials that may have contacted Site soil or water were appropriately bagged and disposed of as municipal solid waste.

- **Water** – Water generated during sampling activities was discharged to the permeable ground surface.

3.6 ANALYTICAL DATA

Soil, sediment, surface water, and groundwater samples were analyzed by TestAmerica's laboratories in Pittsburgh, Pennsylvania; Knoxville, Tennessee; and St. Louis, Missouri. A total of 252 soil/sediment samples and 22 groundwater/surface water samples were collected during this investigation. (Additional samples were collected for quality control; those samples are discussed in Section 3.6.1 below.) The analytical data reports are provided in Appendix E. The analytical methods used are presented below:

- VOCs via USEPA Method 8260C.

- SVOCs/PAHs via USEPA Method 8270D-Low Level.

- PCBs via USEPA Method 8082A.

- TAL Metals via USEPA Methods 6020A, 7470A, and 7471B.

- TPH DRO/GRO via USEPA 8015C.

- Dioxins and Furans via USEPA Method 1613B.

- pH via USEPA Method 9040C and 9045D.

- Gamma-Emitting Radionuclides via USEPA Method 901.1.

- TCLP Metals via USEPA Methods 6010C and 7470A, for select samples containing metals at concentrations in excess of the Resource Conservation and Recovery Act (RCRA) TCLP screening level multiplied by a factor of 20.

- Chromium Speciation via USEPA Method 7196A, for select soil samples containing total chromium at concentrations in excess of the MDE Non-Residential Soil Cleanup Standard.

Analysis for elemental mercury via USEPA Method 3200 was also proposed on select soil samples if total mercury results were reported at concentrations in excess of the MDE Non-Residential Soil Cleanup Standard (MDE 2008). However, only one mercury concentration exceeding the cleanup standard was reported, and mercury concentrations were determined not to be sufficiently high to justify this analysis.

3.6.1 Field Quality Control Samples

The overall Data Quality Objective (DQO) for the project was to provide data of known and documented quality to characterize current conditions at the Site. The definitive quality of the data was assured by: (1) using standard operating procedures and quality control (QC) processes during data collection; (2) documented control and traceability of reference standards, calibrations, and instrument performance; and (3) acceptable performance of field and laboratory QC procedures within the defined limits established for these procedures. Field QC samples including FD and MS/MSD samples were collected and analyzed to assess the quality and representativeness of the field sampling activities and the accuracy of the analytical results.

Field Duplicates

Blind FD pairs were collected, analyzed, and evaluated at a frequency of 10 percent for each matrix. FD samples were collected by alternating between filling the "parent" and duplicate containers. Twenty-six (26) soil/sediment FD pairs and two groundwater/surface water FD pairs were collected during this investigation. The results are used to assess field and laboratory precision.

Matrix Spike and Matrix Spike Duplicates

Fourteen (14) MS/MSD pairs were collected; one MS/MSD pair per 20 samples. Three times the normal sample volume was collected for the MD/MSD samples. MS/MSD pairs were collected by alternating between filling the three containers (parent, MS, and MSD). The level of recovery of an analyte in MS/MSD samples is dependent on the sample matrix, the method of analysis, and the contaminant. The concentration of the analyte relative to the detection limit of the method is also a factor. MS/MSD samples and samples spiked with surrogates, compounds similar to environmental contaminants but not likely to be present in the samples, were used to evaluate the effect of the sample matrix on the accuracy of the analytical data.

Rinse Blanks

Rinse blanks (RB) are samples of analyte-free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples to assess the adequacy

of the decontamination process. For QC purposes, 14 RB samples were collected, on days when equipment had been decontaminated and re-used for onsite sample collection.

Trip Blanks

A trip blank (TB) is a sample of laboratory organic-free reagent water that is provided with the sample containers by the laboratory. It accompanies the sample containers into the field and back to the laboratory. The analysis of the trip blank identifies possible contamination associated with the residence of samples and containers during the collection, transport, and laboratory time. Fifteen (15) TB samples were collected during this investigation, one per cooler transporting samples for VOC analysis.

3.6.2 Data Quality Discussion

The paragraphs below discuss the usability of the data and, where applicable, present the minor issues found that resulted in the addition of data qualifiers.

Sample Receipt

All samples were received by TestAmerica in good condition, properly preserved on ice and within temperature requirements.

Rinse Blanks

The majority of the rinse blank results were non-detect. There were some detections of metals, dioxin/furans, TPH DRO/GRO, VOCs, and SVOCs; however, the majority of these detections were low-level, with the result being greater than the method detection limit (MDL) but less than the reporting limit (RL).

Trip Blanks

Several of the TB samples had low-level detections of acetone and methylene chloride, a common lab contaminant.

Field and Laboratory Precision

For soil/sediment sample pairs, the FD relative percent difference (RPD) was generally acceptable, with the majority of the RPD values below 100 percent. RPDs between 100 and 200 percent were reported for some analytes in the soil/sediment FD pairs. The large range in RPD values in soil is likely due to the non-homogenous nature of the sample matrix, which may include particles of material high in constituents such as metals. For groundwater and surface water samples, the RPDs for the FD pairs were also generally acceptable, with the majority of the RPDs below 20 percent. However, dioxin/furans and metals each had five RPDs exceeding 20 percent (ranging from 21 to 129 percent). None of the RPD values for the FD pairs resulted in rejection of the data; all of the data were sufficiently precise for use.

Analytical Sensitivity

Sensitivity is a measure of method performance in terms of the ability to detect chemicals of concern at low enough concentrations to eliminate potential false negatives and to ensure the project goals in terms of actionable concentrations are met. Target detection limits are based on available standard methods applicable to media and are below most applicable regulatory screening criteria. Ideally the lowest of the detection limits outlined by the laboratories would be below the applicable screening level; analytically achievable quantitation limits are not always low enough to meet this goal. For this project, analytical methods were selected so that the reporting limit for each target analyte was below the applicable screening level and/or specific project requirements, wherever practical. For this project, sample results were reported as estimated values if concentrations were less than the RL but greater than MDL. The sensitivity requirements for this project were achieved where possible. Tables C-16 and C-17 in Appendix D show each analyte and the lab achievable detection limits, and the MDE Non-Residential Cleanup Standards for Soil and Groundwater are also provided in Appendix D.

Analytical Accuracy

An assessment of accuracy is presented by analytical group, below. A method blank (MB) is a laboratory QC sample that shows only laboratory sources of contamination introduced during sample preparation activities. Results that were influenced by MB contamination were B (or JB) qualified.

Volatiles

Methylene chloride was detected in several MBs at concentrations greater than the MDL but less than the RL. Toluene was detected in one MB at a concentration that was greater than the MDL but less than the RL. Methylene chloride and toluene results associated with these MBs have been flagged as estimates. Two MS/MSD samples (BB-08W and SB-60W) had high recoveries of one or more VOCs, and the associated results have been flagged with "F1" to indicate that they may be biased high.

Semivolatiles

Several samples were diluted because the sample matrix was dark and oily, or to bring concentrations of target compounds within calibration range, resulting in elevated RLs. Diethyl phthalate was detected in an MB at a concentration greater than the MDL but less than the RL, and the associated results have been B-flagged. Three MS/MSD samples (SB-36 0-2, BB-08W, and TS-07 4-6) had high recoveries for SVOCs, and the associated results have been flagged with "F1" to indicate that they may be biased high. Three MS/MSD samples (BB-08W, SB-48 0-2, and SB-60W) had low recoveries for SVOCs, and the associated results have been flagged with "F1" to indicate that they may be biased low. In one MS/MSD sample (SB-48 0-2), the RPD for pentachlorophenol exceeded the acceptance limit; the associated result was flagged with "F2."

PCBs

Several samples were diluted because the sample matrix was dark and oily or because of the abundance of target analytes, resulting in elevated RLs. Recovery of PCB Aroclor 1260 in the MS/MSD of BB-08W was below acceptance limits, and the associated results have been flagged with "F1" to indicate that they may be biased low. Recovery of PCB Aroclor 1016 in the MS/MSD of UB-01 5-7 was above acceptance limits, and the associated results have been flagged with "F1" to indicate that they may be biased high.

Metals

Several samples were diluted to bring the concentration of target analytes within the calibration range or due to the nature of the sample matrix, resulting in elevated RLs. Several metals were detected in MB samples at concentrations greater than the MDL but less than the RL; associated results have been B-flagged. Seventeen MS/MSD samples had low recoveries of one or more metals, and the associated results have been flagged with "F1" to indicate that they may be biased low; these samples are SB-02 13-15, UB-04 0-2, UB-01 5-7, SB-03 13-15, DUP-07, BB-08S, BB-08W, SB-05 0-2, SB-44 0-2, LF-08 65-67, AN-02 8-10, SB-35 9-11, TS-07 4-6, SB-46 0-2, LB-03 0-2, SB-60 12-14, and LF-05 0-2. Seventeen MS/MSD samples had high recoveries of one or more metals and associated results have been flagged with "F1" to indicate that they may be biased high; these samples are SB-02 13-15, UB-04 0-2, UB-01 5-7, SB-03 13-15, DUP-07, BB-08W, SB-44 0-2, LF-08 65-67, AN-02 8-10, SB-08 6-8, SB-35 9-11, SB-35 9-11, TS-07 4-6, SB-46 0-2, LB-03 0-2, SB-60 12-14, and LF-05 0-2. MS/MSD samples for which the RPD acceptance criteria were exceeded for one or more metals are as follows: SB-02 13-15, UB-04 0-2, UB-01 5-7, SB03 13-15, DUP-07, BB-08W, SB-05 0-2, SB-44 0-2, LF-08 65-67, SB-35 9-11, SB-35 9-11, TS-07 4-6, SB-46 0-2, SB-60 12-14, and LF-05 0-2; the associated results have been flagged with "F2."

TPH-DRO

TPH-DRO was detected in several MBs at a concentration greater than the MDL but less than the RL; the associated result values have been B-flagged. Samples SB-19 0-2, SB-21 0-2, OWS-03 02, SS-01 0-2, SS-01 6-8, Dup-07, SB-44 0-2, and LF-2 2-4 required dilution prior to analyses, and the reporting limits have been adjusted accordingly. Recovery of TPH-DRO in the MS of sample LF-05 42-44 exceeded acceptance limits, and the results have been flagged with "F1."

TPH GRO

Gasoline range organics (C6-C-10) were detected in several MBs at a concentration greater than the RL, and results have been B-flagged.

Dioxins and Furans

Samples UB-06-08S and MB 01-05S were diluted five-fold due to the analyte levels, resulting in elevated RLs. Several samples had MB detections, and the associated results have been B-flagged.

Gamma-Emitting Radionuclides

No QC issues were identified.

Chromium Speciation

No QC issues were identified.

TCLP Metals

Barium and silver were detected in four MB samples at concentrations that were greater than the MDL but less than the RL. The associated results have been B-flagged.

Findings

The data were obtained using approved methods and procedures and the data met the DQOs developed for this investigation. The analytical results for this sampling event met overall project objectives for the quantity and quality of data required to support the decision-making process and reporting activities of this investigation.

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4. RESULTS AND DISCUSSION

Results of the investigation are discussed by task in the following order: geophysical investigation (Section 4.1); upland soil and groundwater sampling (Section 4.2); and soil, sediment, and surface water sampling from the basins (Section 4.3).

4.1 GEOPHYSICAL SURVEYS AND ADDITIONAL FINDINGS

Based on the prior literature review, additional information provided by Site representatives, and new observations made during the field investigation, EA conducted GPR and EM-31 geophysical surveys in 13 areas of suspect/potential USTs and other features of interest (proximate to Soil Borings SB-04, SB-05, SB-06, SB-19, SB-20, SB-21, SB-24, SB-38, SB-40, SB-41, AN-13, the Western OWS area, and the Spent Solvent Storage area). The GPR and EM-31 were also used during the process of utility clearance and therefore the geophysical survey areas were extended near DPT locations to provide additional coverage for the UST surveys. Figures 2-1, 4-1, and 4-2 (Appendix A) indicate the location of the geophysical survey areas. The results of the geophysical surveys and additional findings are summarized below.

SB-04: One area proximate to SB-04 was surveyed based on observations made while the investigation was underway. A network of trench drains in the concrete along the former Anatase Slurry Plant, adjacent to the existing service road, was surveyed to provide additional information regarding these features. According to Mr. Andy Shinnick (the Millennium Chemical Construction Supervisor) and Mr. Frank Martin (the Millennium Chemical Site Supervisor) the drains were either pumped out manually or discharged into the storm drains, which then lead to a nearby sump. The survey area adjacent to the south of SB-04 measured approximately 1,000 square feet (ft^2). No anomalies or evidence of USTs was observed in this area.

SB-05: One area proximate to SB-05 was surveyed based on information obtained while the onsite activities were underway. According to Mr. Andy Shinnick, a vault housing two underground chemical storage tanks was previously located along the northeast portion of the former Sulfate Finishing Building; the vault and/or tanks were reportedly filled in place. The survey area adjacent to the south of SB-05 measured approximately 1,000 ft^2. No anomalies or evidence of USTs were observed in this area.

SB-06: One area proximate to SB-06 was surveyed based on the indication of storage tanks at that location, depicted east of the North Calciner Building on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area adjacent to the south of SB-06 measured approximately 900 ft^2. No anomalies or evidence of USTs were observed in this area. Additional information provided by Site representatives confirmed that the tanks formerly located in this area were ASTs.

SB-19: An area proximate to SB-19 was surveyed based on the indication of storage tanks in that vicinity on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area measured approximately 1,600 ft^2. Within this area, one anomaly was identified as a potential former UST location (Figure 4-1). The anomaly measured 6 ft by 16 ft, and appeared consistent

with the GPR signature of disturbed subsurface soil, such as a previous excavation. Based on the detection of this anomaly, the nearest proposed soil sample location (SB-19) was relocated proximal to the suspect former UST location.

SB-20: One area proximate to SB-20 was surveyed based on the presence of fill and vent pipes at that location. According to Mr. Andy Schinnick, the UST at this location has not been abandoned or excavated. The survey area surrounding the vent and fill pipes measured approximately 800 ft^2. The exact boundary of the suspect UST was unable to be determined due to the presence of standing water, which filled a depression, measuring approximately 5 ft by 10 ft, immediately surrounding the vent and fill pipes. No anomalies were identified and the tank edges were not visible in the scans; this may indicate that the UST is situated within the area where standing water was present. Based on the assumed presence of the UST, the nearest proposed soil sample location (SB-20) was relocated proximal to the suspect UST (Figure 4-1).

SB-21: One area proximate to SB-21 was surveyed based on the indication of storage tanks at that location on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area adjacent to SB-21 measured approximately 3,200 ft^2. Two anomalies were detected; one appeared consistent with the GPR signature of disturbed subsurface soil, such as a previous excavation, and the other anomaly was identified as a potential UST (Figure 4-1). The suspect UST measured 10 ft by 25 ft, was estimated to be 3.5 ft to 4 ft bgs, and appeared consistent with the GPR signature of a UST that was filled in place with concrete or grout. Based on the detection of this anomaly, the nearest proposed soil sample location (SB-21) was relocated proximal to the suspect UST.

SB-24: One area proximate to SB-24 was surveyed based on the indication of storage tanks at that location on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area adjacent to the north of SB-24 measured approximately 400 ft^2. No anomalies or evidence of USTs were observed; however, support structures for a former AST remain in this area.

SB-38: One area proximate to SB-38 was surveyed based on the indication of storage tanks and a fueling area at that location on a 1988 Tank Location Plan Map of the facility (TME 2012). This survey was originally proposed for SB-39, but based on a re-evaluation of the Site maps and features the survey area was relocated to SB-38. The survey area surrounding SB-38 measured approximately 3,200 ft^2. No anomalies or evidence of USTs were observed; however, an AST remains in this area.

SB-40 (Eastern OWS Area): One area proximate to SB-40 was surveyed based on the presence of an underground steel OWS tank and associated piping at that location. According to Mr. Frank Martin, the tank was installed in 2000, along with the adjacent gas turbines and a secondary aboveground concrete OWS to be used as a backup system. The survey area adjacent to SB-40 measured approximately 1,600 ft^2. The boundary of the underground OWS tank (Figure 4-2) measured approximately 6 ft by 12 ft, was estimated to be at least 3 ft bgs, and appeared consistent with the GPR signature of a UST. The underground tank has three steel stickup features that measure 32 in. above the ground surface and approximately 90 in. total depth. Based on the detection of this anomaly, the nearest proposed soil sample location (SB-40)

was relocated proximal to the underground steel OWS tank. Soil Boring SB-61 was added immediately adjacent to the aboveground vault and associated subsurface piping.

SB-41: One area proximate to SB-41 was proposed for a survey based on the indication of storage tanks at that location on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area surrounding SB-41 measured approximately 400 ft^2. No anomalies or evidence of USTs were observed; however, the tanks in this location were apparently ASTs, as confirmed by Site representatives and evidenced by two large containment berms that remain in this area.

AN-13: One area proximate to AN-13 was surveyed based on the indication of storage tanks at that location on a 1988 Tank Location Plan Map of the facility (TME 2012). The survey area surrounding AN-13 measured approximately 400 ft^2. No anomalies or evidence of USTs were observed; however, the tanks in this location were apparently ASTs, as confirmed by Site representatives and evidenced by a containment berm that remains in the area.

Western OWS Area: One area surrounding soil borings OWS-01, OWS-02, OWS-03, and OWS-04 was surveyed based on the discovery of an underground concrete OWS vault and associated piping at that location. The vault was covered with a metal lid and contained an estimated 1,000 gallons of oil. According to Mr. Frank Martin, the OWS vault was associated with the former Air Compressor building. The survey area surrounding the vault measured approximately 5,400 ft^2 (Figure 4-1). The survey grid also included water utility lines and a fenced area containing a compressed air pipeline, and various (out of service) pipeline stickups. The pipelines and other underground features were mapped in order to provide borehole clearance in advance of the drilling phase to facilitate delineation of any impacts potentially encountered.

Spent Solvent Storage Area (Focus Area B): The investigation of the Spent Solvent Storage area (Figure 4-2) was initially proposed to characterize the elevated containment and the area immediately adjacent to the structure described in Section 2.3.2. Two locations were proposed within the containment area and four locations were proposed for the areas immediately adjacent. GPR/EM surveys conducted proximate to each proposed soil boring location as part of the utility clearance phase of the investigation indicated that the concrete containment structure was reinforced with a re-bar or re-mesh component and the surrounding subsurface contained potential shallow obstructions.

During the drilling phase of the investigation, the DPT rig was unable to penetrate more than 2 in. into the reinforced concrete due to the presence of the re-bar; after three unsuccessful attempts within the containment, it was decided to relocate the two locations that had been proposed for completion inside the containment to the grassy areas west and north of the containment. For the adjacent areas, three soil borings were successfully completed; however, the DPT rig encountered refusal at depths ranging from 1 ft to 4 ft bgs during six attempts to the west and north of the containment. Ultimately, the three borings were located further northwest to characterize soils associated with other (similar) features. SS-02 was relocated to the southwest corner of the former Chemical Warehouse. SS-03 was relocated to southeast corner of the former Chemical Warehouse, at a location where impacts to surface soils were observed. SS-04 was relocated east of the former Chemical Warehouse, at a location where trench drains

were observed immediately adjacent to a former AST depot, as indicated on the 1988 Tank Location Plan Map of the facility (TME 2012).

4.2 UPLAND SOIL AND GROUNDWATER

Screening of analytical results for soil and groundwater is presented in Appendix D. Concentrations of analytes other than dioxins/furans in soil are screened against the MDE Non-Residential Soil Cleanup Standards (MDE 2008), based on expected future uses of the Site and of Site soil. Anticipated Typical Concentrations (ATCs) are also used in screening arsenic, chromium, and thallium concentrations in soil (MDE 2008). Concentrations of analytes other than dioxins/furans in groundwater are screened against the MDE Groundwater Cleanup Standards (MDE 2008).

Toxic equivalency quotients (TEQs) for dioxin/furan results were calculated according to USEPA guidance (USEPA 2013a), by summing the products of the individual compound concentrations and their World Health Organization 2005 toxic equivalency factors (Van den Berg et al. 2006). TEQs were screened against the USEPA Industrial Regional Screening Level (RSL) for soil and the USEPA Maximum Contaminant Level (MCL) for groundwater.

Tables summarizing exceedances of the MDE Cleanup Standards and dioxin/furan screening criteria are presented in this section.

Results are discussed by AOC, in the following order: Former Titanium Storage area (Section 4.2.1), Spent Solvent Storage area (Section 4.2.2), PWAN/SWAN area (Section 4.2.3), and Landfill areas (Section 4.2.4). As stated in Section 3.2.6, the Site-wide sampling locations were divided among four additional Upland Areas for the purposes of data analysis and discussion (Figure 2-1). These Upland Areas are addressed following the AOCs: Northwest (Section 4.2.5), West-Central (Section 4.2.6), East-Central (Section 4.2.7), and South (Section 4.2.8). Section 4.2.9 presents a discussion of the results from soil and groundwater sampling in all of the upland areas.

4.2.1 Former Titanium Ore Storage Area (Focus Area A)

Ten soil borings were advanced throughout the Former Titanium Ore Storage area to evaluate both soil chemistry and radiological conditions.

Soil Chemical Assessment

One shallow and one subsurface soil sample for chemical analysis were collected from 5 of the 10 borings (TS-02, TS-04, TS-06, TS-07, and TS-08), and only a shallow sample was collected from the other 5 borings (TS-01, TS-03, TS-05, TS-09, and TS-10), for a total of 15 soil samples. The soil samples were submitted for laboratory analysis of one or more of the following: TAL metals, pH, SVOCs/PAHs, and PCBs. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans. TCLP metals analysis was performed on subsurface soil from location TS-06, due to elevated total metals concentrations. Results indicate that soil in this area is minimally

impacted with metals and PAHs. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-1.

- Metals: Arsenic concentrations in soil slightly exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (5.9 milligrams per kilogram [mg/kg]) in shallow soil from location TS-03. Vanadium concentrations also exceeded the MDE Non-Residential Cleanup Standard in soil from locations TS-04, TS-07, TS-09, and TS-10, with the highest concentration (440 mg/kg) at TS-10, the southernmost location. Although total lead did not exceed the cleanup standard, TCLP analysis of the shallow soil from TS-06 indicated leachable lead at 91 milligrams per liter [mg/L], in excess of the RCRA TCLP threshold of 5 mg/L.

- PAHs: Benzo(a)pyrene was reported at a concentration exceeding the MDE Non-Residential Cleanup Standard in shallow soil from location TS-01.

The pH of soil samples from this area ranged from 4.06 to 11.9, with an average pH of 8.2 for shallow soil and 5.59 for subsurface soil. No SVOCs or PCBs were reported at concentrations exceeding MDE Non-Residential Cleanup Standards.

Chromium speciation analysis was also performed on subsurface soil from location TS-06 (13 to 15 ft depth), and indicated that the chromium is present in the hexavalent form. The chromium results do not indicate any exceedances of MDE cleanup criteria in this area.

Table 4-1 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the Former Titanium Ore Storage Area (n = 15)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	4	7.3	TS-06 (ss)	3.1 (3.7)
Vanadium	100	mg/kg	4	440	TS-10 (s)	131 (109)
PAHs						
Benzo(a)pyrene	0.39	mg/kg	1	1.4	TS-01 (s)	0.162 (0.013)

(a) For arsenic, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
s = Shallow soil.
ss = Subsurface soil.

Radiological Assessment

Radiation field-screening surveys were completed at three background locations and throughout the Former Titanium Ore Storage area. Average direct readings were recorded in microroentgens per hour (μR/hr) (Table 4-2).

Average background readings at the three locations selected to represent background conditions at the Site ranged from 7.5 to 15 µR/hr. Ambient background from natural terrestrial and cosmic radiation worldwide typically ranges from 7 to 23 µR/hr (United Nations 2010).

Table 4-2 Radiological Survey and Analytical Results for the Former Titanium Storage Area and Background Areas

Location	Average Direct Reading (µR/hr)	K-40 (pCi/g)	Thorium Decay Series			Uranium Decay Series	
			Ac-228 (pCi/g)	Pb-212 (pCi/g)	Tl-208 (pCi/g)	Bi-214 (pCi/g)	Pb-214 (pCi/g)
SB-09 (background)	14	5.86	1.00	0.918	0.24	0.681	0.633
SB-59 (background)	15	4.4	1.42	1.45	0.578	1.14	1.14
SB-60 (background)	7.5	--	0.374	0.303	0.148	0.281	--
TS-01	9.5	6.6	0.935	1.07	0.431	0.784	0.979
TS-02	20	4.68	1.33	1.01	0.379	1.03	1.11
TS-03	14	2.99	1.03	0.627	0.218	0.443	0.604
TS-04	10	2.82	1.16	0.867	0.260	1.98	2.02
TS-05	15	3.66	5.69	5.63	2.00	6.39	6.62
TS-06	15	4.78	2.58	2.34	0.673	6.11	6.67
TS-07	15	--	1.82	1.84	0.689	0.422	0.628
TS-08	9	7.84	1.24	1.22	0.388	0.786	1.00
TS-09	15	--	9.36	8.65	2.72	1.3	1.72
TS-10	18	3.93	--	0.832	0.214	0.606	0.725

Direct readings represent average values measured at each location.

NOTES: -- = Isotope not detected.
pCi/g = PicoCuries per gram.
µR/hr = Microroentgen per hour.

Radiation survey measurements conducted throughout the AOC (Focus Area A), including at each of the proposed sample locations, were generally consistent with background measurements. Average direct readings at locations within the Former Titanium Ore Storage area ranged from 9 µR/hr (TS-08) to 20 µR/hr (TS-02).

Naturally occurring isotopes, including potassium-40 and isotopes in the uranium and thorium decay series, were detected by laboratory gamma spectroscopy on shallow soil samples from the surveyed locations (Table 4-2). The majority of detected radionuclide concentrations are less than 5 picoCuries per gram (pCi/g). Potassium-40 was reported at a concentration exceeding 5 pCi/g in three samples, including the background sample from SB-09. Reported concentrations of isotopes in the uranium and/or thorium decay series exceeded 5 pCi/g in samples from locations TS-05, TS-06, and TS-09. No concentrations exceeded 10 pCi/g.

The results of the radiological analyses are generally consistent with the previous finding that radiological activity levels in the Former Titanium Ore Storage area are consistent with background levels (TME 2012). The slightly elevated levels of isotopes in the uranium and thorium decay series may be attributable to inputs from the titanium ore stored in this area.

4.2.2 Spent Solvent Storage Area (Focus Area B)

Soil Samples

Six soil borings were advanced in the Spent Solvent Storage area (SS-01 to SS-06) to evaluate soil and groundwater chemistry. Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 12 soil samples. The soil samples were submitted for laboratory analysis for one or more of the following: TAL metals, pH, VOCs, SVOCs/PAHs, PCBs, and TPH DRO/GRO. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans. TCLP metals analysis was performed on shallow soil from location SS-06, due to elevated total metals concentrations. Results indicate that soil in this area is moderately impacted with metals, TPH-DRO, and PAHs. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-3.

- Metals: Arsenic concentrations in soil slightly exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (11 mg/kg) in subsurface soil from location SS-04 (13 to 15 ft depth). Iron and vanadium concentrations also exceeded the MDE Non-Residential Cleanup Standards in subsurface soil from location SS-04. Lead was reported at a concentration exceeding the MDE Non-Residential Soil Cleanup Standard in shallow soil (1 to 3 ft depth) from location SS-06, and also was elevated in subsurface soil at this location. TCLP analysis was performed on this sample, but did not indicate any metals exceeding the RCRA TCLP threshold.

- Total Petroleum Hydrocarbons: TPH-DRO was reported at concentrations exceeding the MDE Non-Residential Soil Cleanup Standard in both soil samples collected from location SS-01 (0 to 2 ft and 6 to 8 ft depth). A slight petroleum odor and visual staining were observed in the 7 to 8 ft interval at those locations.

- PAHs: Benzo(a)pyrene was reported at concentrations exceeding the MDE Non-Residential Cleanup Standard in subsurface soil (6 to 8 ft depth) from location SS-01, and in shallow soil from location SS-02.

The pH of soil samples from this area ranged from 3.95 to 8.77, with an average pH of 8.61 for shallow soil and 5.66 for subsurface soil. No VOCs or PCBs were reported at concentrations exceeding MDE Non-Residential Cleanup Standards.

Table 4-3 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the Spent Solvent Storage Area (n = 12)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	7	11	SS-04 (ss)	3.3 (5.6)
Iron	72,000	mg/kg	1	87,000	SS-04 (ss)	14,100 (29,300)
Lead	1,000	mg/kg	1	4,300	SS-06 (s)	728 (28)
Vanadium	100	mg/kg	1	110	SS-04 (ss)	34 (55)
Petroleum Hydrocarbons						
TPH-DRO	620	mg/kg	2	3,600	SS-01 (ss)	437 (1,760)
PAHs						
Benzo(a)pyrene	0.39	mg/kg	2	1.1	SS-02 (s)	0.26 (0.12)

(a) For arsenic, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
PAH = Polycyclic aromatic hydrocarbon.
s = Shallow soil.
ss = Subsurface soil.
TPH-DRO = Total Petroleum Hydrocarbons–Diesel Range Organics.

Groundwater Samples

Two groundwater samples were collected from the Spent Solvent Storage area, at locations SS-03 and SS-05. Samples were analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullets and also in Table 4-4.

- Metals: The reported concentrations of aluminum, arsenic, iron, lead, manganese, and vanadium exceeded MDE Cleanup Standards at SS-03. At SS-05, aluminum, iron, and manganese concentrations exceeded the MDE Cleanup Standards.

- VOCs: The reported concentration of 1,2-dichloroethene in the sample from location SS-05 exceeded the MDE Cleanup Standard.

The pHs of the groundwater samples from this area were 6.65 (SS-05) and 6.88 (SS-03).

Table 4-4 Summary of Analytes Exceeding MDE Cleanup Standards in Groundwater Samples from the Spent Solvent Storage Area (n = 2)

Analyte	MDE Standard	Units	Number of Exceedances	Maximum Concentration	Location of Maximum	Mean Concentration in Groundwater[a]
Metals						
Aluminum	50	µg/L	2	7,200	SS-03	3,905
Arsenic	10	µg/L	1	16	SS-03	12
Iron	300	µg/L	2	47,000	SS-03	42,500
Lead	15	µg/L	1	23	SS-03	14
Manganese	50	µg/L	2	680	SS-05	455
Vanadium	3.7	µg/L	1	56	SS-03	29
VOCs						
1,2-dichloroethene	5.5	µg/L	1	12	SS-05	6.5

(a) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: µg/L = Micrograms per liter.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
VOC = Volatile organic compound.

4.2.3 PWAN/SWAN Area (Focus Area C)

Soil Samples

Thirteen soil borings (AN-01 through AN-13) were advanced in the PWAN/SWAN area to evaluate soil and groundwater chemistry. Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 26 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, pH, VOCs, SVOCs/PAHs, PCBs, and TPH DRO/GRO. One additional sample was composited from aliquots of shallow soil from each of the sample locations and submitted for laboratory analysis of dioxin/furans. TCLP metals analysis was performed on shallow soil from location AN-06, due to elevated total metals concentrations. Results indicate that soil in this area is moderately impacted with metals and PAHs. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-5.

- Metals: Arsenic concentrations in soil exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (220 mg/kg) in shallow soil from location AN-06 (0 to 2 ft depth). Shallow soil from location AN-06 also contained antimony, lead, and mercury at concentrations exceeding the MDE Non-Residential Cleanup Standards. TCLP analysis of the shallow soil from AN-06 indicated leachable lead at 48 mg/L, in excess of the RCRA TCLP threshold of 5 mg/L. Ten other soil samples (shallow and subsurface) also contained antimony at concentrations exceeding the MDE Non-Residential Cleanup Standards. Shallow soil from location AN-11 (0 to 2 ft depth) contained chromium and vanadium at a concentration exceeding the MDE Non-Residential Cleanup Standards; five other samples contained vanadium at lower concentrations that also exceeded the cleanup standard.

- PAHs: Four PAHs were reported at concentrations exceeding the MDE Non-Residential Cleanup Standards in shallow soil (0 to 2 ft depth) from locations AN-06 and/or AN-10,

with the higher concentrations at location AN-10. Location AN-10 is adjacent to a generator and substation.

No VOCs, TPH DRO/GRO, or PCBs were reported at concentrations exceeding MDE Non-Residential Cleanup Standards.

The pH of the soil samples in this acid neutralization area was variable, with generally lower pH in the subsurface. Shallow soils had an average pH of 6.61 (range: 3.82 to 9.30), while subsurface soils had an average pH of 4.93 (range: 2.48 to 8.36). The only shallow soil with pH below 4 was from location AN-12, and the only location with shallow or subsurface soil pH greater than 8 was AN-13.

Table 4-5 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the PWAN/SWAN Area (n = 26)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Antimony	41	mg/kg	11	740	AN-12 (s)	163 (120)
Arsenic	3.0 (3.6)	mg/kg	21	220	AN-06 (s)	26 (25)
Chromium	310 (28)	mg/kg	1	810	AN-11 (s)	96 (29)
Lead	1,000	mg/kg	1	7,100	AN-06 (s)	632 (86)
Mercury	10	mg/kg	1	22	AN-06 (s)	1.8 (0.092)
Vanadium	100	mg/kg	6	2,100	AN-11 (s)	234 (63)
PAHs						
Benzo(a)anthracene	3.9	mg/kg	1	7.5	AN-10 (s)	0.83 (0.037)
Benzo(a)pyrene	0.39	mg/kg	2	5.2	AN-10 (s)	0.61 (0.029)
Benzo(b)fluoranthene	3.9	mg/kg	1	6.3	AN-10 (s)	0.76 (0.036)
Dibenz(a,h)anthracene	0.39	mg/kg	2	1.1	AN-10 (s)	0.14 (0.011)

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligrams per kilogram.
n = Number samples analyzed.
PAHs = Polycyclic aromatic hydrocarbon.
s = Shallow soil.

Groundwater Samples

Two groundwater samples were collected from the PWAN/SWAN area, at locations AN-04 and AN-13. Samples were analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullet and also in Table 4-6.

- Metals: The reported concentrations of arsenic, iron, and manganese exceeded MDE Cleanup Standards at AN-13. At AN-04, aluminum and manganese concentrations exceeded the MDE Cleanup Standards.

The pHs of the groundwater samples from this area were 6.47 (AN-13) and 6.63 (AN-04).

Table 4-6 Summary of Analytes Exceeding MDE Cleanup Standards in Groundwater Samples from the PWAN/SWAN Area (n = 2)

Analyte	MDE Standard	Units	Number of Exceedances	Maximum Concentration	Location of Maximum	Mean Concentration in Groundwater[a]
Metals						
Aluminum	50	µg/L	1	340	AN-04	188
Arsenic	10	µg/L	1	47	AN-13	24
Iron	300	µg/L	1	21,000	AN-13	10,527
Manganese	50	µg/L	2	85	AN-04	81

(a) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: µg/L = Micrograms per liter.
n = Number samples analyzed.
MDE = Maryland Department of the Environment.

4.2.4 Landfill Area

Soil Samples

Eleven soil borings were advanced in the Landfill area to evaluate soil and groundwater chemistry (LF-01 through LF-10 and SB-60, which was installed to the southwest of the landfill stormwater pond). Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 22 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, PAHs, pH, VOCs, PCBs, and/or TPH DRO/GRO. Within each of the Landfill Areas (1 through 4), one additional sample was composited from aliquots of shallow soil (for Areas 1 and 2) or subsurface soil (for Areas 3 and 4) from each of the sample locations and submitted for laboratory analysis of dioxin/furans. Results indicate that soil in this area is moderately impacted with metals and PAHs. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-7.

- Metals: Chromium, iron, manganese, and vanadium were reported at concentrations exceeding the MDE Non-Residential Cleanup Standard in subsurface soil from locations LF-05 (42 to 44 ft depth) and LF-06 (46 to 48 ft depth) in Area 3, as well as LF-09 (44 to 46 ft depth) in Area 4. Manganese and vanadium also exceeded the cleanup standard in subsurface soil from location LF-02 (16 to 18 ft depth) in Area 1, and vanadium exceeded cleanup standards at additional locations in Areas 1 and 2 (LF-01, LF-03, and LF-04). Arsenic concentrations marginally exceeded the MDE Non-Residential Cleanup Standards and the ATCs in Areas 2, 3, and 4, with the highest concentration (6.7 mg/kg) in subsurface soil from location LF-10 (73 to 75 ft depth).

- PAHs: Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were reported at concentrations exceeding the MDE Non-Residential Cleanup Standards in soil from 2 to 4 ft depth at location LF-02. Benzo(a)pyrene also exceeded the cleanup level in the 16 to 18 ft interval from this location.

- Dioxins/Furans: The TEQ for the composite sample of shallow soil collected from Area 1 (locations LF-01 and LF-02) exceeded the USEPA RSL.

No VOCs, TPH DRO/GRO, or PCBs were reported at concentrations exceeding MDE Non-Residential Cleanup Standards.

Table 4-7 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the Landfill Area (n = 22)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	7	6.7	LF-10 (ss)	3.6 (3.2)
Chromium	310 (28)	mg/kg	3	2,900	LF-06 (ss)	39 (686)
Iron	72,000	mg/kg	3	120,000	LF-05 (ss)	15,200 (45,600)
Manganese	2,000	mg/kg	4	20,000	LF-05 (ss)	281 (5,480)
Vanadium	100	mg/kg	8	7,600	LF-06 (ss)	74 (1,800)
PAHs						
Benzo(a)anthracene	3.9	mg/kg	1	33	LF-02 (s)	3.4 (0.074)
Benzo(a)pyrene	0.39	mg/kg	2	24	LF-02 (s)	2.5 (0.058)
Benzo(b)fluoranthene	3.9	mg/kg	1	27	LF-02 (s)	2.8 (0.072)
Dibenz(a,h)anthracene	0.39	mg/kg	1	5.2	LF-02 (s)	0.56 (0.020)
Indeno(1,2,3-c,d)pyrene	3.9	mg/kg	1	16	LF-02 (s)	1.7 (0.039)
Dioxins/Furans						
Dioxin TEQ	22[c]	pg/g	1	37	LF-01-02	--

(a) For arsenic, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.
(c) USEPA Regional Screening Level for Industrial Soil, January 2015.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
PAH = Polycyclic aromatic hydrocarbon.
pg/g = Picograms per gram.
s = Shallow soil.
ss = Subsurface soil.
TEQ = Toxic equivalency quotient.

Groundwater Samples

One groundwater sample was collected from the Landfill area, at location SB-60. The sample was analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullets and also in Table 4-8.

- Metals: The reported concentrations of aluminum, iron, and manganese exceeded MDE Cleanup Standards.

- PAHs: The reported concentrations of six PAHs exceeded MDE Cleanup Standards.

The pH of the groundwater sample was 4.24.

Table 4-8 Summary of Analytes Exceeding MDE Cleanup Standards in the Groundwater Sample from the Landfill Area (n = 1)

Analyte	MDE Standard	Units	Concentration
Metals			
Aluminum	50	µg/L	2,500
Iron	300	µg/L	1,400
Manganese	50	µg/L	390
PAHs			
Benzo(a)anthracene	0.2	µg/L	1.9
Benzo(a)pyrene	0.2	µg/L	1.4
Benzo(b)fluoranthene	0.2	µg/L	2.2
Benzo(k)fluoranthene	0.3	µg/L	2.2
Dibenz(a,h)anthracene	0.2	µg/L	2.1
Indeno(1,2,3-c,d)pyrene	4.8	µg/L	2.0

NOTES: µg/L = Microgram(s) per liter.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
PAH = Polycyclic aromatic hydrocarbon.

4.2.5 Site-Wide Sampling in the Northwest Upland Area

Site-wide sampling in the Northwest Upland area included advancement of 17 soil borings (SB-1 to SB-17). Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 34 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, SVOCs/PAHs, pH, VOCs, PCBs, TPH DRO/GRO, and/or dioxin/furans. Results indicate that this portion of the Site is minimally impacted. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-9.

- Metals: Arsenic concentrations in soil exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (19 mg/kg) in shallow soil from location SB-17. Iron and vanadium concentrations exceeded the MDE Non-Residential Cleanup Standards in subsurface soil from location SB-10 (13 to 15 ft depth). Shallow soil from location SB-04 also contained vanadium at a concentration exceeding the cleanup standard. The highest iron concentration was reported for subsurface soil from location SB-02 (13 to 16 ft depth).

The pH of soil samples from this area ranged from 4.48 to 10.9, with an average pH of 7.36 for shallow soil and 5.96 for subsurface soil.

Table 4-9 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the Northwest Upland Area (n = 34)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	18	19	SB-17 (s)	5.6 (2.5)
Iron	72,000	mg/kg	2	120,000	SB-02 (ss)	22,300 (30,900)
Vanadium	100	mg/kg	2	180	SB-10 (ss)	45.1 (49.6)

(a) For arsenic, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligrams per kilogram.
n = Number samples analyzed.
s = Shallow soil.
ss = Subsurface soil.

4.2.6 Site-Wide Sampling in the West-Central Upland Area

Site-wide sampling in the West-Central Upland area included advancement of 19 soil borings (SB-18 to SB-22, SB-25 to SB-27, SB-29 to SB-31, SB-36 to SB-39, and OWS-01 to OWS-04).

Soil Samples

Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 38 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, SVOCs/PAHs, pH, VOCs, PCBs, TPH DRO/GRO, and/or dioxin/furans. Results indicate that this portion of the Site includes areas of moderate soil impacts. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-10.

- Metals: Arsenic concentrations in soil exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (25 mg/kg) in shallow soil from location SB-39, adjacent to the Upper Basin. The highest concentrations of chromium, magnesium, and vanadium were reported in subsurface soil (6 to 7 ft depth) from location SB-27, which is also adjacent to the upper basin. Other locations with exceedances of the MDE Non-Residential Cleanup Standards for chromium and/or vanadium included SB-20, SB-21, SB-22, and OWS-03, which are located to the north.

- Total Petroleum Hydrocarbons: TPH-DRO concentrations in shallow soil (0 to 2 ft bgs) from locations SB-19 and OWS-03 exceeded the MDE Non-Residential Cleanup Standard. These locations, respectively, are adjacent to a potential former UST, identified through a GPR anomaly, and an OWS vault. A slight solvent odor was observed in the 3 to 5 ft interval at location OWS-03; no staining or odor was observed at SB-19.

- PAHs: The concentration of benzo(a)pyrene in shallow soil from location SB-36 slightly exceeded the MDE Non-Residential Cleanup Standard.

The pH of soil samples from this area ranged from 2.85 to 11, with an average pH of 7.23 for shallow soil and 5.08 for subsurface soil.

Table 4-10 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the West-Central Upland Area (n = 38)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	16	25	SB-39 (s)	4.8 (3.7)
Chromium	310 (28)	mg/kg	2	1,700	SB-27 (ss)	43 (174)
Manganese	2,000	mg/kg	1	5,300	SB-27 (ss)	205 (365)
Vanadium	100	mg/kg	6	6,000	SB-27 (ss)	83 (496)
Petroleum Hydrocarbons						
TPH-DRO	620	mg/kg	2	2,400	OWS-03 (s)	384 (16)
PAHs						
Benzo(a)pyrene	0.39	mg/kg	1	0.41	SB-36 (s)	0.06 (0.0088)

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES:
ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
PAH = Polycyclic aromatic hydrocarbon.
s = Shallow soil.
ss = Subsurface soil.
TPH-DRO = Total Petroleum Hydrocarbons–Diesel Range Organics.

Groundwater Samples

Three groundwater samples were collected from the West-Central Upland area, at locations SB-19, SB-20, and SB-30. Samples were analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullets and also in Table 4-11.

- Metals: The reported concentrations of aluminum, beryllium, iron, manganese, nickel and vanadium exceeded MDE Cleanup Standards in at least two of the samples. The highest reported concentrations of aluminum, manganese, and nickel were from location SB-30, adjacent to the Upper Basin.

- SVOCs: The reported concentration of bis(2-ethylhexyl)phthalate in the sample from location SB-30 exceeded the MDE Cleanup Standard.

The pHs of the groundwater samples from this area were and 3.75 (SB-19), 7.04 (SB-20), and 4.33 (SB-30).

Table 4-11 Summary of Analytes Exceeding MDE Cleanup Standards in Groundwater Samples from the West-Central Upland Area (n = 3)

Analyte	MDE Standard	Units	Number of Exceedances	Maximum Concentration	Location of Maximum	Mean Concentration in Groundwater[a]
Metals						
Aluminum	50	µg/L	3	6,600	SB-30	3,367
Beryllium	4	µg/L	2	8.9	SB-19	1.0
Iron	300	µg/L	3	120,000	SB-19	59,700
Manganese	50	µg/L	3	2,000	SB-30	1,159
Nickel	73	µg/L	2	290	SB-30	139
Vanadium	3.7	µg/L	2	18	SB-20	10
SVOCs						
Bis(2-ethylhexyl)phthalate	6	µg/L	1	8.6	SB-30	4.9

(a) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: µg/L = Micrograms per liter.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
SVOC = Semivolatile organic compound.

4.2.7 Site-Wide Sampling in the East-Central Upland Area

Site-wide sampling in the East-Central Upland area included advancement of 17 soil borings (SB-23, SB-24, SB-28, SB-32 to SB-35, SB-40 to SB-45, SB-47, SB-52, SB-56, and SB-61).

Soil Samples

Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 34 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, SVOCs/PAHs, pH, VOCs, PCBs, and/or TPH DRO/GRO. TCLP metals analysis was performed on shallow soil from location SB-32, due to elevated total metals concentrations. Results indicate that this portion of the Site includes areas of moderate soil impacts. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-12.

- Metals: Arsenic concentrations in soil exceeded the MDE Non-Residential Cleanup Standards and the ATCs, with the highest concentration (43 mg/kg) in shallow soil from location SB-35, adjacent to the Batch Attack Basin. An exceedance of the MDE Non-Residential Cleanup Standard for iron was reported at SB-32, adjacent to the Upper Basin. Vanadium concentrations exceeding the cleanup standard were reported throughout this portion of the Site (at locations SB-28, SB-32, SB-34, SB-35, SB-44, SB-56, and SB-61), and antimony exceedances were reported at SB-43, SB-45, SB-47, and SB-61. An anomalously high concentration of chromium (2,700 mg/kg) was reported in the duplicate shallow soil sample from location SB-32, while the parent sample had a reported chromium concentration of 32 mg/kg. The duplicate result was the only reported exceedance of the MDE Non-Residential Cleanup Standard for chromium for this area.

- Total Petroleum Hydrocarbons: The TPH-DRO concentration reported for shallow soil from location SB-44 exceeded the MDE Non-Residential Cleanup Standard. No staining or odor was observed in soil from this location.

- PAHs: Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were reported at concentrations exceeding the MDE Non-Residential Cleanup Standards in soil from 0 to 2 ft depth at location SB-44, where the DRO exceedance was also reported. Other exceedances of the cleanup standards for PAHs were reported in shallow and subsurface soil from location SB-28, between the Spent Solvent Storage area, where DRO and PAH exceedances were reported, and the Upper Basin.

Chromium speciation analysis was also performed on shallow soil from location SB-32 (0 to 2 ft depth), and results indicated that the chromium is present in the hexavalent form. The chromium results do not indicate any exceedances of MDE cleanup criteria in this area.

The pH of soil samples from this area ranged from 3.12 to 11.1, with an average pH of 7.58 for shallow soil and 6.17 for subsurface soil.

Table 4-12 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the East-Central Upland Area (n = 34)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Antimony	41	mg/kg	5	580	SB-47 (s)	49 (18)
Arsenic	3.0 (3.6)	mg/kg	18	43	SB-35 (s)	8.8 (7.7)
Iron	72,000	mg/kg	1	86,000	SB-32 (ss)	21,300 (23,000)
Vanadium	100	mg/kg	9	540	SB-61 (ss)	127 (101)
Petroleum Hydrocarbons						
TPH-DRO	620	mg/kg	1	900	SB-44 (s)	280 (83)
PAHs						
Benzo(a)anthracene	3.9	mg/kg	1	24	SB-44 (s)	1.6 (0.083)
Benzo(a)pyrene	0.39	mg/kg	3	19	SB-44 (s)	1.3 (0.073)
Benzo(b)fluoranthene	3.9	mg/kg	1	45	SB-44 (s)	2.9 (0.089)
Dibenz(a,h)anthracene	0.39	mg/kg	2	3.9	SB-44 (s)	0.30 (0.021)
Indeno(1,2,3-c,d)pyrene	3.9	mg/kg	1	12	SB-44 (s)	0.85 (0.049)

(a) For arsenic, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES:
ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
PAH = Polycyclic aromatic hydrocarbon.
s = Shallow soil.
ss = Subsurface soil.
TPH-DRO = Total Petroleum Hydrocarbons--Diesel Range Organics.

Groundwater Samples

Seven groundwater samples were collected from the East-Central Upland area, at locations SB-24, SB-28, SB-35, SB-40, SB-42, SB-47, and SB-56. Samples were analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullets and also in Table 4-13.

- Metals: The reported concentrations of aluminum, antimony, arsenic, iron, lead, manganese, nickel, and vanadium exceeded MDE Cleanup Standards in one or more samples. Metals concentrations were generally highest at location SB-28, between the Spent Solvent Storage area and the Upper Basin. The fewest metals exceedances were reported at locations SB-24 (one exceedance), north of the Kemira Property; at SB-40 (three exceedances), north of the Upper Basin; and at SB-56 (three exceedances), adjacent to the southern end of the slurry wall. Groundwater from these three locations (as well as SB-42) had pH above 5, while pH was below 5 at SB-28, SB-35, and SB-47.

- VOCs: The reported concentration of benzene in the sample from location SB-35, north of the Batch Attack Basin, exceeded the MDE Cleanup Standard.

- SVOCs: The reported concentration of pentachlorophenol in the sample from location SB-47, along the southern boundary of the Batch Attack basin, exceeded the MDE Cleanup Standard. The reported concentration of bis(2-ethylhexyl)phthalate in the sample from location SB-35 also exceeded the cleanup standard.

- PAHs: PAH exceedances were reported from two locations within approximately 50 ft of the Batch Attack Basin: SB-35 and SB-47. Nine PAHs were reported at concentrations exceeding the MDE Non-Residential Cleanup Standards in groundwater at location SB-35, where the benzene exceedance was also reported. Five of these PAHs also exceeded the cleanup standards in groundwater from location SB-47, where the pentachlorophenol exceedance was also reported.

The pHs of the groundwater samples from this area ranged from 3.41 (SB-28) to 5.99 (SB-40).

Table 4-13 Summary of Analytes Exceeding MDE Cleanup Standards in Groundwater Samples from the East-Central Upland Area (n = 7)

Analyte	MDE Standard	Units	Number of Exceedances	Maximum Concentration	Location of Maximum	Mean Concentration in Groundwater[a]
Metals						
Aluminum	50	µg/L	5	22,000	SB-28	6,718
Antimony	6	µg/L	2	450	SB-28	70
Arsenic	10	µg/L	1	37	SB-28	8.3
Iron	300	µg/L	7	360,000	SB-28	169,657
Lead	15	µg/L	3	290	SB-42	104
Manganese	50	µg/L	6	8200	SB-47	3,849
Nickel	73	µg/L	2	170	SB-28	72
Vanadium	3.7	µg/L	4	92	SB-28	27
VOCs						
Benzene	5	µg/L	1	190	SB-35	28
SVOCs						
Bis(2-ethylhexyl)phthalate	6	µg/L	1	7.4	SB-35	2.1
Pentachlorophenol	1	µg/L	1	63	SB-47	9.9
PAHs						
2-methylnaphthalene	2.4	µg/L	2	4.2	SB-47	1.3
Benzo(a)anthracene	0.2	µg/L	2	4.7	SB-35	0.85
Benzo(a)pyrene	0.2	µg/L	2	3.3	SB-35	0.65
Benzo(b)fluoranthene	0.2	µg/L	2	4.9	SB-35	0.89
Benzo(k)fluoranthene	0.3	µg/L	1	5.5	SB-35	0.95
Chrysene	3	µg/L	1	5.1	SB-35	0.91
Dibenz(a,h)anthracene	0.2	µg/L	1	5.1	SB-35	0.91
Indeno(1,2,3-c,d)pyrene	4.8	µg/L	1	4.8	SB-35	0.85
Naphthalene	0.65	µg/L	2	110	SB-35	19

(a) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: µg/L = Microgram(s) per liter.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
PAH = Polycyclic Aromatic Hydrocarbon.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

4.2.8 Site-Wide Sampling in the South Upland Area

Site-wide sampling in the South Upland area included advancement of 11 soil borings (SB-46, SB-48 to SB-51, SB-53 to SB-55, SB-47, and SB-57 to SB-59).

Soil Samples

Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of 22 soil samples. The soil samples were submitted for laboratory analysis of TAL metals, SVOCs/PAHs, pH, VOCs, PCBs, and/or TPH DRO/GRO. TCLP metals analysis was performed on subsurface soil from location SB-55, due to elevated total metals concentrations. Results indicate that soils in this portion of the Site, adjacent to the Middle and Lower Basins, are impacted by metals. Results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-14.

- Metals: In soil samples collected to the west of the Lower Basin, concentrations of arsenic, cadmium, chromium, iron, manganese, and vanadium that exceeded the MDE Non-Residential Cleanup Standards (and the ATCs in the case of arsenic and chromium) were reported, with the highest concentrations generally in subsurface soil. No exceedances for metals other than arsenic were reported at locations SB-57, SB-58, or SB-59, south of the Lower Basin. Chromium speciation analysis was performed on subsurface soil from location SB-55 (6 to 8 ft depth), and results indicated that chromium was present in the hexavalent form (which is consistent with use of 310 mg/kg for screening). TCLP analysis was also performed on this sample, and did not indicate any metals exceeding the RCRA TCLP threshold.

- PAHs: Benzo(a)pyrene was reported at a concentration exceeding the MDE Non-Residential Cleanup Standard in soil from 0 to 2 ft depth at location SB-51.

The pH of soil samples from this area ranged from 3.7 to 9.12, with an average pH of 6.57 for shallow soil and 5.97 for subsurface soil.

Table 4-14 Summary of Analytes Exceeding MDE Cleanup Standards in Soil Samples from the South Upland Area (n = 22)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Shallow and (Subsurface) Soil[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	4	30	SB-46 (ss)	2.9 (4.1)
Cadmium	51	mg/kg	1	66	SB-49 (ss)	0.50 (7.0)
Chromium	310 (28)	mg/kg	5	2,800	SB-50 (ss)	147 (679)
Iron	72,000	mg/kg	1	110,000	SB-48 (s)	29,700 (24,500)
Manganese	2,000	mg/kg	5	7,300	SB-50 (ss)	823 (1,680)
Vanadium	100	mg/kg	8	6,600	SB-50 (ss)	292 (1,630)
PAHs						
Benzo(a)pyrene	0.39	mg/kg	1	1.7	SB-51 (s)	0.19 (ND)

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligram(s) per kilogram.
n = Number samples analyzed.
ND = Not detected.
PAH = Polycyclic aromatic hydrocarbon.
s = Shallow soil.
ss = Subsurface soil.

Groundwater Samples

Four groundwater samples were collected from the South Upland area, at locations SB-50, SB-53, SB-57, and SB-59. Samples were analyzed for TAL metals, pH, VOCs, SVOCs, PCBs, and/or dioxins/furans. Results exceeding the MDE Cleanup Standards are summarized in the following bullets and also in Table 4-15.

- Metals: All four groundwater samples collected from throughout the south portion of the Site contained multiple metals concentrations exceeding the MDE Cleanup Standards. Metals concentrations exceeding the cleanup standards included aluminum, beryllium, cadmium, chromium, iron, lead, manganese, mercury, nickel, and vanadium. Groundwater from location SB-53, at the southern edge of the Site, had the highest reported concentrations of multiple metals in this portion of the Site.

- Dioxins/furans: The TEQs for groundwater collected from locations SB-53 and SB-59 exceeded the USEPA MCL for dioxins/furans. Very low dioxin concentrations were reported in groundwater from SB-57, while groundwater from SB-50 was not analyzed for these analytes.

The pHs of the groundwater samples from this area ranged from 6.22 (SB-59) to 7.61 (SB-50).

Table 4-15 Summary of Analytes Exceeding MDE Cleanup Standards in Groundwater Samples from the South Upland Area (n = 4)

Analyte	MDE Standard	Units	Number of Exceedances	Maximum Concentration	Location of Maximum	Mean Concentration in Groundwater[a]
Metals						
Aluminum	50	µg/L	4	24,000	SB-53	8,550
Beryllium	4	µg/L	1	18	SB-53	7.5
Cadmium	5	µg/L	1	14	SB-59	8.8
Chromium	100	µg/L	3	3,000	SB-53	1,044
Iron	300	µg/L	4	190,000	SB-53	84,575
Lead	15	µg/L	1	42	SB-59	16
Manganese	50	µg/L	4	40,000	SB-53	14,200
Mercury	0.37	µg/L	1	0.66	SB-53	0.4
Nickel	73	µg/L	1	350	SB-53	117
Vanadium	3.7	µg/L	4	8,100	SB-53	2,751
Dioxins/Furans						
Dioxin TEQ	30[b]	pg/L	2	853	SB-53	453

(a) Mean concentrations are calculated using the reporting limit for non-detect values.
(b) USEPA Maximum Contaminant Level.

NOTES: µg/L = Micrograms per liter.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
pg/L = Picograms per liter.
TEQ = Toxic equivalency quotient.

4.2.9 Summary and Discussion of Results for the Upland Areas

Metals

Metals reported in soil throughout multiple upland areas at concentrations exceeding MDE Non-Residential Cleanup Standards include arsenic, chromium, iron, manganese, and vanadium. Cadmium, lead, and mercury were also reported at concentrations exceeding the cleanup standards in one or two samples each.

Of the metals with widespread exceedances in soil, chromium, iron, manganese, and vanadium are known components of titanium ore. However, these metals were least widespread in the Former Titanium Ore Storage area, indicating that these metals in other areas are likely associated with ore processing residuals rather than the whole ore. This is further supported by the fact that these metals are widespread in the landfill, where process waste was disposed. These metals are also widespread in the soils of the South Upland area, to the south/west of the Middle and Lower Settling Basins, where process residuals were stored and treated. One or more of these metals occurred at concentrations exceeding MDE Non-Residential Cleanup Standards in each area of the Site; however, concentrations were generally lower and exceedances less widespread in the other upland areas.

Arsenic was reported in soil from all areas at concentrations exceeding the MDE Non-Residential Cleanup Standard and the ATC. The highest arsenic concentrations, exceeding the cleanup standard by two orders of magnitude, were reported in the PWAN/SWAN area. The West-Central, East-Central, and South Upland areas had maximum arsenic concentrations exceeding the cleanup standard by one order of magnitude, while concentrations in other areas were lower.

Lead concentrations in soil exceeding the MDE Non-Residential Cleanup Standard were reported in one sample each from the PWAN/SWAN area and Spent Solvent Storage area. The only mercury concentration exceeding the cleanup standard was co-located with the lead exceedance in the PWAN/SWAN area (at location AN-06). The only exceedance for cadmium was from the South Upland area (at location SB-49).

In groundwater, concentrations of aluminum, iron, manganese, and vanadium exceeded the MDE Cleanup Standards across the central portion of the Site. Aluminum, iron, and manganese (but not vanadium) also exceeded cleanup standards in the PWAN/SWAN and Landfill areas. Other metals exceeding cleanup standards in one or more samples included antimony, arsenic, beryllium, cadmium, lead, mercury, and nickel.

The South Upland area had the most metals at reported concentrations exceeding the MDE Cleanup Standards, and also the highest reported concentrations of multiple metals, both in soil (excluding the landfill) and in groundwater. This area appears to have been part of the Lower Settling Basin as of the 1980s (USEPA 1988).

VOCs

The only VOCs exceeding MDE Cleanup Standards were 1,2-dichloroethene in groundwater from location SS-05, in the Spent Solvent Storage area, and benzene in groundwater from location SB-35, adjacent to the Batch Attack Basin. No VOC concentrations exceeding MDE Non-Residential Cleanup Standards were reported in soil.

PAHs

Exceedances of the MDE Non-Residential Cleanup Standards were reported in soil in all areas of the Site except for the Northwestern Portion. The PWAN/SWAN area, the Landfill area, and the

East-Central Upland area had the most reported PAH exceedances and highest PAH concentrations in soil. Still, PAH impacts were limited to three or fewer samples from each area, suggesting that they represent isolated impacts, potentially associated with point releases of hydrocarbons.

PAH exceedances of the MDE Groundwater Cleanup Standard were also reported in groundwater from the Landfill area and the East-Central Upland area; however, there is not a clear correlation between the exceedances in soil and groundwater in these areas. The most heavily PAH-impacted groundwater samples were from location SB-35, adjacent to the Batch Attack Basin, and location SB-60, southeast of the landfill stormwater pond.

TPH-DRO

Exceedances of the MDE Non-Residential Cleanup Standard for TPH-DRO were reported in soil from a few isolated locations: SS-01 in the Spent Solvent Storage area, SB-19 and OWS-03 in the West-Central Upland area, and SB-44 in the East-Central Upland area. A slight petroleum odor and visual staining were also observed at location SS-01, and a slight solvent odor was noted at location OWS-03. No staining or odor was observed at SB-19 or SB-44.

Other SVOCs

Bis(2-ethylhexyl)phthalate was reported at concentrations exceeding the MDE Cleanup Standard in groundwater from SB-30 and SB-35.

Pentachlorophenol was also reported at a concentration exceeding the MDE Cleanup Standard in groundwater from SB-35. No SVOC concentrations exceeding the MDE Non-Residential Cleanup Standards were reported in soil.

Dioxins/Furans

Figures 4-3 and 4-4 (Appendix A) illustrate the dioxin/furan results for soil and groundwater, respectively. The composite shallow soil sample collected from locations LF-01 and LF-02 (Area 1) at the landfill contained dioxins and furans at concentrations that yielded Dioxin TEQs exceeding the USEPA Industrial RSL for soil. Two groundwater samples collected from the South Upland area (SB-53 and SB-59) also had Dioxin TEQs exceeding the USEPA MCL. No soil samples from the South Upland area were analyzed for dioxins/furans; however, TEQs exceeding the USEPA RSL were also reported in sediments of the adjacent settling basins (see Figure 4-3 and Section 4.3).

4.3 SOIL, SEDIMENT, AND SURFACE WATER FROM THE BASINS

Screening of analytical results for soil, sediment, and surface water from the basins is presented in Appendix D. Concentrations of analytes other than dioxins/furans in soil and sediment are screened against the MDE Non-Residential Cleanup Standards (MDE 2008). ATCs are also used in screening arsenic, chromium, and thallium concentrations in soil (MDE 2008). Concentrations of analytes other than dioxins/furans in surface water are screened against the

MDE Numerical Criteria for Toxic Substances in Surface Waters, from the Code of Maryland Regulations 26.08.02.03-2.

TEQs for dioxin/furan results were calculated according to USEPA guidance (USEPA 2013a), by summing the products of the individual compound concentrations and their 2005 World Health Organization (WHO) toxic equivalency factors (van den Berg et al. 2006). TEQs for soil and sediment were screened against the USEPA Industrial RSL for soil, and TEQs for surface water were screened against the USEPA MCL for groundwater.

Tables summarizing exceedances of the screening levels described above are presented in this section.

Results are discussed by basin, in the following order: Batch Attack Basin (Section 4.3.1), Upper Settling Basin (Section 4.3.2), Middle Settling Basin (Section 4.3.3), and Lower Settling Basin (Section 4.3.4). Section 4.3.5 presents a discussion of the results for the basin samples.

4.3.1 Batch Attack Basin

Nine surface sediment samples (BB-01S through BB-08S, and one additional sample from location BB-04a, designated as BB-04 0-0.5) and one surface water sample (BB-08W) were collected from the Batch Attack Basin. The samples were submitted for laboratory analysis of TAL metals, pH, SVOCs/PAHs, and PCBs, and the surface water sample was also analyzed for VOCs. Additionally, one composite sediment sample (from locations BB-05 through BB-08) and the surface water sample from BB-08 were analyzed for dioxins/furans. Results indicate that sediment in this basin is moderately impacted with chromium. The surface water sample collected from location BB-08 (which had a pH of 7.51) did not contain any constituents at concentrations exceeding the MDE ecological or human health criteria for surface water. Sediment results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullet and also in Table 4-16.

- Metals: Chromium concentrations in sediment exceeded the MDE Non-Residential Cleanup Standard and the ATC, with the highest concentration (2,400 mg/kg) reported for the sample from location BB-07, in the eastern end of the basin. Chromium speciation analysis was performed on this sample. Results indicated that chromium was present primarily in the trivalent form (2,300 mg/kg), with a hexavalent component (68 mg/kg), which is below the cleanup standard of 310 mg/kg for hexavalent chromium. Exceedances of the MDE Non-Residential Cleanup Standards for iron, manganese, and vanadium were widespread in the basin, while an arsenic exceedance was reported in the sample from BB-01.

The pH of the sediment samples from this basin ranged from 7.62 (BB-07) to 9.24 (BB-02).

Table 4-16 Summary of Analytes Exceeding MDE Cleanup Standards in Sediment Samples from the Batch Attack Basin (n = 9)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Sediment[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	1	4	BB-01	2.1
Chromium	310 (28)	mg/kg	6	2,400	BB-07	1,030
Iron	1,000	mg/kg	6	170,000	BB-07	107,000
Manganese	2,000	mg/kg	7	26,000	BB-05	11,500
Vanadium	100	mg/kg	9	5,300	BB-08	2,430

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
n = Number samples analyzed.
mg/kg = Milligrams per kilogram.

4.3.2 Upper Settling Basin

Five soil borings (UB-01 through UB-05) were advanced in the Upper Settling Basin to evaluate soil chemistry. Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of ten soil samples. Additionally, three surface sediment samples (UB-06 through UB-08) and one surface water sample (from location UB-07) were collected. The samples were submitted for laboratory analysis of TAL metals, pH, SVOCs/PAHs, and PCBs, and the surface water sample was also analyzed for VOCs. Additionally, one composite sediment sample (from all three surface sediment sampling locations, UB-06 through UB-08) and the surface water sample from UB-07 were analyzed for dioxins/furans. TCLP metals analysis was performed on subsurface soil from location UB-03, due to elevated total metals concentrations.

Results indicate that soil and sediment in this basin are impacted with metals and dioxins/furans. Soil and sediment results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-17.

- Metals: Metals reported at concentrations exceeding the MDE Non-Residential Cleanup Standard (and ATCs as applicable) include antimony, arsenic, chromium, iron, manganese, and vanadium. Subsurface soil from location UB-03 contained the highest concentrations of multiple metals that were reported in this basin. Chromium speciation and TCLP analyses were performed on this sample. Speciation results indicated that chromium was present primarily in the hexavalent form (which is consistent with use of 310 mg/kg for screening). TCLP results did not indicate any metals exceeding the RCRA TCLP threshold.

- Dioxins/Furans: The dioxin TEQ in the composite sediment sample exceeded the USEPA MCL.

The pH of the soil and sediment samples from this basin ranged from 4.19 and 4.49 (UB-04) to 7.39 and 7.40 (UB-01), with pHs below 5 only reported for samples from two locations.

Surface water from location UB-07 had a pH of 7.02 and contained arsenic, thallium, and mercury at concentrations exceeding MDE criteria for human health.

Table 4-17 Summary of Analytes Exceeding MDE Cleanup Standards in Soil and Sediment Samples from the Upper Settling Basin (n = 13)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Soil and Sediment[b]
Metals						
Antimony	41	mg/kg	1	45	UB-01 (ss)	5.6
Arsenic	3.0 (3.6)	mg/kg	4	7	UB-05 (s)	3.2
Chromium	310 (28)	mg/kg	6	2,400	UB-03 (ss)	483
Iron	72,000	mg/kg	3	160,000	UB-03 (ss)	42,600
Manganese	2,000	mg/kg	4	9,500	UB-08	2,560
Vanadium	100	mg/kg	9	3,800	UB-03 (ss)	938
Dioxins/Furans						
Dioxin TEQ	22[c]	pg/g	1	600	--	--

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.
(c) USEPA Maximum Contaminant Level.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligrams per kilogram.
n = Number samples analyzed.
pg/g = Picograms per gram.
s = Shallow soil.
ss = Subsurface soil.
TEQ = Toxic equivalency quotient.

4.3.3 Middle Settling Basin

Five surface sediment samples (MB-01S through MB-05S) were collected from the Middle Settling Basin. The samples were submitted for laboratory analysis of TAL metals, pH, PAHs, and PCBs. Additionally, one composite sediment sample (from all five locations) was analyzed for dioxins/furans. TCLP metals analysis was performed on sediment from location MB-04, due to elevated total metals concentrations. Results indicate that sediment in this basin is impacted with metals. Sediment results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-18.

- Metals: Metals reported at concentrations exceeding the MDE Non-Residential Cleanup Standard (and ATCs as applicable) include chromium, iron, manganese, and vanadium. Chromium speciation and TCLP analyses were performed on the sample from location MB-04. Speciation results indicated that chromium was present primarily in the hexavalent form (which is consistent with use of 310 mg/kg for screening). TCLP results did not indicate any metals exceeding the RCRA TCLP threshold.

- Dioxins/Furans: The dioxin TEQ in the composite sediment sample exceeded the USEPA MCL.

The pH of the sediment samples from this basin were nearly uniform, ranging from 7.76 (MB-05) to 7.95 (MB-04).

Table 4-18 Summary of Analytes Exceeding MDE Cleanup Standards in Sediment Samples from the Middle Settling Basin (n = 5)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Sediment[b]
Metals						
Chromium	310 (28)	mg/kg	5	3,200	MB-03, 04	2,650
Iron	72,000	mg/kg	5	160,000	MB-01, 03	147,000
Manganese	2,000	mg/kg	5	34,000	MB-01	27,200
Vanadium	100	mg/kg	5	6,600	MB-03	5,520
Dioxins/Furans						
Dioxin TEQ	22[c]	pg/g	1	699	--	--

(a) For chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.
(c) USEPA Maximum Contaminant Level.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligrams per kilogram.
n = Number samples analyzed.
pg/g = Picograms per gram.
TEQ = Toxic equivalency quotient.

4.3.4 Lower Settling Basin

Four soil borings (LB-02 through LB-05) were advanced in the Lower Settling Basin to evaluate soil chemistry. Two soil samples for chemical analysis were collected from each boring, including a shallow sample and a subsurface sample, for a total of eight soil samples. Additionally, three surface sediment samples (LB-06 through LB-08) and one surface water sample (from location LB-08) were collected. The samples were submitted for laboratory analysis of TAL metals, pH, SVOCs/PAHs, and PCBs, and the surface water sample was also analyzed for VOCs. Additionally, one composite sediment sample (from all three locations) and the surface water sample from LB-08 were analyzed for dioxins/furans.

Results indicate that soil and sediment in this basin are impacted with metals and dioxins/furans. Soil and sediment results exceeding the MDE Non-Residential Cleanup Standards are summarized in the following bullets and also in Table 4-19.

- Metals: Metals reported at concentrations exceeding the MDE Non-Residential Cleanup Standard (and ATCs as applicable) include arsenic, chromium, iron, manganese, and vanadium. Chromium speciation analysis was performed on the sediment sample from location LB-07. Results indicated that chromium was present primarily in the trivalent

form (2,100 mg/kg), with a hexavalent component (23 mg/kg), which is below the cleanup standard of 310 mg/kg for hexavalent chromium.

- Dioxins/Furans: The dioxin TEQ in the composite sediment sample exceeded the USEPA MCL.

The pH of the soil and sediment samples from this basin ranged from 4.77 (LB-04 subsurface) to 8.26 (LB-03 subsurface), with the pH of all shallow/surface samples and most subsurface samples above 6.9.

Surface water from location LB-08 had a pH of 7.96 and contained arsenic at a concentration exceeding MDE criteria for human health.

Table 4-19 Summary of Analytes Exceeding MDE Cleanup Standards in Soil and Sediment Samples from the Lower Settling Basin (n = 11)

Analyte	MDE Non-Residential Standard (ATC)	Units	Number of Exceedances[a]	Maximum Concentration	Location of Maximum	Mean Concentration in Soil and Sediment[b]
Metals						
Arsenic	3.0 (3.6)	mg/kg	2	6.9	LB-05 (ss)	2.5
Chromium	310 (28)	mg/kg	9	3,000	LB-03 (ss)	1,820
Iron	72,000	mg/kg	7	170,000	LB-05 (s)	93,500
Manganese	2,000	mg/kg	9	34,000	LB-05 (s)	14,400
Vanadium	100	mg/kg	10	7,800	LB-03 (ss)	4,050
Dioxins/Furans						
Dioxin TEQ	22[c]	pg/g	1	169	--	--

(a) For arsenic and chromium, numbers reflect exceedances of both the MDE non-residential standard and the ATC.
(b) Mean concentrations are calculated using the reporting limit for non-detect values.
(c) USEPA Maximum Contaminant Level.

NOTES: ATC = Anticipated typical concentration for Eastern Maryland, as published by MDE.
MDE = Maryland Department of the Environment.
mg/kg = Milligrams per kilogram.
n = Number samples analyzed.
pg/g = Picograms per gram.
s = Shallow soil.
ss = Subsurface soil.
TEQ = Toxic equivalency quotient.

4.3.5 Summary and Discussion of Results for the Basin Samples

Metals

Soils and sediments containing metals at concentrations of a magnitude similar to those in the South Upland area (which is suspected to have once been part of the Lower Settling Basin), and exceeding MDE Non-Residential Cleanup Standards, were present in all four basins (Figure 4-5). Exceedances of the cleanup standards for chromium, iron, manganese, and vanadium were reported in sediments (and soils where collected) from throughout all four basins. These metals are thought to be associated with residuals from processing titanium ores (see Section 4.2.9).

As discussed in Section 2.5.3, the TRC analysis of subsurface sediments in the Batch Attack and Lower Settling Basins indicated that both pH and metals concentrations change markedly with depth. The upper 10 to 15 ft of sediments tended to have alkaline pH (roughly 7 to 10.3) and contain chromium, iron, and manganese at concentrations exceeding the MDE Non-Residential Cleanup Standards. Below these alkaline sediments, pH dropped abruptly, to values as low as 2 in the Batch Attack Basin, and concentrations of arsenic (as well as lead in the Batch Attack Basin) increased to above cleanup standards. This trend is seen to some degree in the data from the Lower Settling Basin collected as part of this Phase II ESA, as subsurface soil at location LB-04 (6 to 8 ft bgs) had a pH of 4.77, with lower reported concentrations of chromium, iron, and manganese (as well as vanadium) and a higher arsenic concentration than nearby surface sediments. No subsurface sediments were collected from the Batch Attack Basin as part of the Phase II ESA.

Figure 4-5 provides a comparison of the Phase II ESA surface sediment results to the TRC sediment core results for the Batch Attack Basin and the open water portion of the Lower Settling Basin. Whereas the Phase II ESA surface sediments were collected from approximately the top 6 in. of sediment, the TRC cores included sediments from as deep as 26 ft below the sediment surface. The maximum metals concentrations in the TRC core samples were higher than the maximum concentrations in the surface sediments for each basin. However, the average concentrations in surface sediment were in some cases higher than the average concentration throughout the cores. Overall, the metals results for sediments from all four basins, including the TRC data, indicate consistently elevated metals concentrations to the depths sampled.

Surface water from the Upper and Lower Settling Basins contained arsenic at a concentration exceeding the MDE Human Health Criteria (as well as the MDE Groundwater Cleanup Standard and ATC). Additionally, the Upper Basin contained mercury and thallium at concentrations exceeding human health criteria. Overall, the surface water does not seem to reflect the magnitude of metals impacts reported in the underlying sediments.

Dioxins/Furans

Sediments from the Upper, Middle, and Lower Settling Basins contained dioxins/furans at concentrations that led to Dioxin TEQs exceeding the USEPA Industrial RSL for soil. Dioxins and furans are recognized byproducts of the chlorinators used in the chloride process for manufacturing titanium dioxide (USEPA 2001). Therefore, it is hypothesized that the dioxins/furans in the basins are associated with this process. The Batch Attack Basin may contain dioxins/furans at lower concentrations because this basin received primarily sulfuric acid waste streams from the sulfate process (rather than the chloride process).

No Dioxin TEQs exceeding the USEPA MCL were reported in the surface water samples collected from the Batch Attack, Lower Settling, and Upper Settling Basins. However, as stated in Section 4.2.9, exceedances of the USEPA MCL for dioxins were reported in soils adjacent to the Middle and Lower Basins; these groundwater impacts may be associated with the dioxins/furans in sediments in these basins.

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5. HUMAN HEALTH RISK EVALUATION

5.1 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The purpose of the risk evaluation is to determine attainment of the MDE Soil Cleanup Standards for the Site. The determination of attainment is specific to the current and proposed future land use of the Site. The Site consists of five adjoining parcels of land totaling approximately 178 acres and is zoned M-3 General Manufacturer (Baltimore City) and OS–Open Space District (Anne Arundel County). The Site was acquired by Cristal USA from Millennium Inorganic Chemicals in 2007. From approximately 1954 to 2011, the Site was used for the manufacturing of titanium dioxide and other titanium chemicals. Although, the majority of manufacturing structures have been demolished, numerous buildings and treatment/storage lagoons remain on the Site.

The majority of the Site (140 acres) is located in Baltimore City and the remaining 38 acres are located in Anne Arundel County, just south of the Baltimore City boundary (Figure 1-1). It should be noted that Kemira operates within approximately 10 acres of the central portion of the Site. The Kemira Site parcel is not included as part of this risk assessment. The Site is bordered by Fort Armistead Road and Fort Armistead Park to the north, the MPA-owned Cox Creek uplands to the south, industrial land use to the west, and the Patapsco River to the east.

The Site is serviced by municipal water provided by Baltimore City with supplemental process water pumped from the Patapsco River. A permitted water supply well exists on the Site; however, the well was never commissioned. No potable water supply wells were identified within a half-mile radius of the Site.

Based upon the Site zoning, designated land use, and anticipated land use, the appropriate designation for the Site is non-residential. Non-residential is identified as "land that has a zoning designation by either county or local government that is not intended for residential land use. Typical non-residential land uses include, but are not limited to, land zoned for commercial or industrial uses" (MDE 2008). Therefore, the determination of attainment to MDE Cleanup Standards is based upon Non-Residential Soil Cleanup Standards. It is anticipated that the primary contact with the Site environmental media will be by construction workers or other maintenance workers working at the Site currently or in the future. Trespassers and Site visitors may also contact the Site. However, these receptors are expected to have relatively low contact with environmental media for very short time periods. The non-residential (i.e., construction/maintenance worker) exposure scenario represents conservative exposure scenarios that would account for all other expected receptor contact with the Site. Based upon current Site zoning and anticipated future use, it is not expected that a residential receptor or similar receptor (e.g., school children, recreational users, etc.) would be an appropriate receptor for the Site.

The primary medium of concern at the Site is soil. Both surface soil and sediment (less than 2 ft bgs) and subsurface soil samples (greater than 2 ft bgs) were collected. It is expected that any future re-use of the Site would involve significant demolition of buildings and soil movement. As a result, workers at the Site are expected to contact both surface and subsurface soil and sediment. Groundwater was not evaluated in the risk evaluation. Many of the MDE

Cleanup Standards for Groundwater are based on the USEPA MCL, which is not a risk-based number and cannot be used in the risk evaluation. Additionally, groundwater is not used as a potable water supply and is not expected to be used in the future.

5.2 RISK EVALUATION

Sections 4.2 and 4.3 present a comparison of soil/sediment sampling results to the MDE Non-Residential Soil Cleanup Standards. Based upon the Site history, investigations, and use, the Site was divided into AOCs for sample collection and comparison. The risk evaluation also divided the Site into similar AOCs which are also shown in Figure 2-1. Sample locations evaluated for each AOC are presented in Table 5-1. Generally, each of the focused study areas was evaluated as an entire area. These areas included:

1. Former Titanium Ore Storage Area (Focus Area A)
2. Spent Solvent Storage Area (Focus Area B)
3. PWAN/SWAN (Focus Area C)
4. Landfill Area
5. Batch Attack Basin
6. Upper Settling Basin
7. Middle Settling Basin
8. Lower Settling Basin.

If Site-wide (SB) samples were collected within an identified focused study area, they were included with the area for risk evaluation. For instance, sample SB-23 was collected from the edge of the Spent Solvent Storage area. As a result, soil sample SB-23 was evaluated with all samples associated with this AOC. Sediment samples collected from within the basins located at the Site were considered soil samples in the risk evaluation, as these basins are largely dewatered, and are expected to be dewatered completely prior to Site re-use.

Site-wide areas where samples were collected outside the AOCs were divided for purposes of data analysis and risk evaluation. Consistent with Section 4.2, Site-wide areas were defined as follows:

1. Site-Wide Sampling in the Northwest Upland Area
2. Site-Wide Sampling in the West-Central Upland Area
3. Site-Wide Sampling in the East-Central Upland Area
4. Site-Wide Sampling in the South Upland Area.

Analytical results from Site-wide samples collected on the border of two defined areas were evaluated by comparing analytical results from adjacent sampling sites to determine the appropriate placement for risk evaluation.

Dioxin/furan samples were collected throughout the Site. Most of these samples were collected as composite samples, and only one dioxin/furan sample was collected within each AOC. These samples were primarily collected to confirm the presence or absence of dioxins/furans at the Site.

The samples were not collected to determine the overall nature and extent of dioxins/furans. As a result, dioxins/furans were not evaluated in the risk evaluation.

For each chemical identified as above the MDE Non-Residential Cleanup Standard, the 95th percentile upper confidence limit on the mean (95%UCLM) value was determined. The 95%UCLM value represents human exposure to chemicals in Site soil for a specific area evaluated, rather than a point by point comparison. As recommended by USEPA, the statistical program ProUCL 5.00.0 was utilized to determine the 95%UCLM for each chemical in soil (USEPA 2013b). Values of the 95%UCLM for chemicals exceeding MDE Non-Residential Cleanup Standards in each area are presented in Tables 5-2 through 5-13. Outputs of the ProUCL program are included in Appendix F.

For the determination of the 95%UCLM, the evaluation of analytical data, on the basis of qualifiers in each medium of concern, was performed using the rationale below.

- Analytical results bearing the U qualifier (indicating that the chemical was not detected at the given RL) were retained in the dataset and considered non-detects with a numerical value equal to its RL.

- Analytical results bearing the J qualifier (the reported value is estimated) were retained at the measured concentration identified by the laboratory.

- Analytical results bearing the B qualifier (indicating that the chemical was detected in a blank) were retained at the measured concentration identified by the laboratory.

- Analytical results bearing the F1 qualifier (indicating the MS and/or MSD recovery was outside the acceptance limits) were retained at the measured concentration identified by the laboratory.

- Analytical results bearing the P qualifier (indicating the relative percent difference between the primary and confirmation column/detector was greater than 40 percent and the lower value was reported) were retained at the measured concentration identified by the laboratory.

If duplicate samples were collected or duplicate analyses were conducted on a single sample, the following guidelines were employed to select the appropriate sample measurement:

- If both samples/analyses showed that the analyte was present, the average of the two detected concentrations was retained for analysis, based on conservative professional judgment.

- If both samples/analyses were not detected, the lowest of the two non-detect concentration detection limits was retained for analysis.

- If only one sample/analysis indicated that the analyte was present, it was retained for analysis and the non-detect value was discarded.

The 95%UCLMs were compared to the MDE Non-Residential Soil Cleanup Standards to facilitate a risk management decision for either a specific area or for soil re-use. MDE has identified attainment when the 95%UCLM is equal to or below the standard (MDE 2008).

For areas where any of the chemical 95%UCLM values exceed the MDE Non-Residential Soil Cleanup Standard, an estimated risk level was determined for all chemicals. The estimated risk level was determined for each chemical of potential concern (COPC) by evaluating the 95%UCLM with the corresponding cleanup standard. The MDE Cleanup Standards represent the lowest levels of acceptable risk to human health as determined by MDE depending upon Site use. For chemicals in which the cleanup standard is based upon a cancer endpoint, the standard is based upon a risk level equal to 10^{-6}. For chemical in which the cleanup standard is based upon a non-cancer endpoint, the standard is based upon a hazard quotient (HQ) of 0.1. The estimated risk level for chemicals with a cancer endpoint is determined by dividing the 95%UCLM by the cleanup standard and multiplying by 10^{-6}. The estimated risk level for chemicals with a non-cancer endpoint is determined by dividing the 95%UCLM by the cleanup standard and multiplying by 0.1. The resulting risk levels were added to represent a cumulative risk level. MDE has identified a remedial action standard risk level of 10^{-5} for carcinogens and a hazard index (HI) of 1.0 for non-carcinogens (MDE 2008). If the cumulative HI was greater than 1, a breakdown by target organ was completed.

Lead was evaluated separately from other chemicals because the MDE Cleanup Standards for lead are based upon blood-modeling. USEPA guidance recommends the use of the arithmetic mean concentration for the evaluation of potential lead exposures (USEPA 1994, 2002). If the maximum detected concentration of lead for a given area was above the MDE Residential Soil Cleanup Standard of 400 mg/kg, the arithmetic mean concentration was determined and compared to the Non-Residential Cleanup Standard, which is 1,000 mg/kg.

5.2.1 Former Titanium Ore Storage Area (Focus Area A) Risk Evaluation

Sample locations evaluated for the Former Titanium Ore Storage area are presented in Table 5-1. Tables 5-2-1 and Table 5-2-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 2×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.3, which is below the acceptable threshold of 1.

The cancer risk level for subsurface soil was 3×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.2, which is below the acceptable threshold of 1.

5.2.2 Spent Solvent Storage Area (Focus Area B) Risk Evaluation

Sample locations evaluated for the Spent Solvent Storage area are presented in Table 5-1. In addition to the focus area samples, one Site-wide sample (SB-23) was included in the Spent Solvent Storage area. Tables 5-3-1 and Table 5-3-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 3×10^{-6}, which is

below the MDE remedial action level. All of the chemicals evaluated had an MDE Soil Cleanup Standard based upon a cancer endpoint. As a result, a non-cancer HI result was not calculated.

The cancer risk level for subsurface soil was 3×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.1, which is below the acceptable threshold of 1. The mean concentration of lead was below the MDE Non-Residential Cleanup Standard; however, the maximum concentration of lead exceeded the cleanup standard at one sampling location, SB-06, at 1 to 3 ft bgs with a concentration of 4,300 mg/kg. The next highest detection of lead was 130 mg/kg, with the remainder of the lead sample results below 25 mg/kg.

5.2.3 PWAN/SWAN Area (Focus Area C) Risk Evaluation

Sample locations evaluated for the PWAN/SWAN area are presented in Table 5-1. Tables 5-4-1 and Table 5-4-2 present the summary statistics for surface and subsurface soil in this area.

The cancer risk level for surface soil was 7×10^{-5}, which is above the MDE remedial action level of 10^{-5}. The cumulative cancer risk level for surface soil was primarily attributable to arsenic, which exceeded the MDE Non-Residential Cleanup Standard in nine sampling locations with a maximum of 220 mg/kg at sampling location AN-06 at 0 to 2 ft bgs. The next highest concentration of arsenic was 32 mg/kg at sample location AN-13 at 0 to 2 ft.

The non-cancer HI result for surface soil was 3, which is above the acceptable threshold of 1. The non-cancer HI exceedance was primarily attributable to antimony, which exceeded the MDE Non-Residential Cleanup Standard in five sampling locations with a maximum of 740 mg/kg at sampling location AN-12 at 0 to 2 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. The antimony target organ is blood and produced a total HI of 2, which was the only chemical that exceeded the target threshold of 1.

The mean concentration of lead in surface soil was below the MDE Non-Residential Cleanup Standard; however, the maximum concentration of lead exceeded the cleanup standard at one sampling location, AN-06, at 0 to 2 ft bgs with a concentration of 7,100 mg/kg. The next highest detection of lead was 280 mg/kg within sample location AN-12 at 0 to 2 ft bgs.

The cancer risk level for subsurface soil was 2×10^{-5}, which is above the MDE remedial action level. Arsenic was the only contributor to the cancer risk level, with exceedances in 15 sampling locations with a maximum of 110 mg/kg at sampling location AN-06 at 11 to 13 ft bgs.

The non-cancer HI result for subsurface soil was 2, which is above the acceptable threshold of 1. The non-cancer HI exceedance was primarily attributable to antimony, which exceeded the MDE Non-Residential Cleanup Standard in six sampling locations with a maximum of 640 mg/kg at sampling location AN-08 at 13 to 15 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. The antimony target organ is blood and produced a total HI of 2, which was the only chemical that exceeded the target threshold of 1.

5.2.4 Landfill Risk Evaluation

Sample locations evaluated for the landfill are presented in Table 5-1. Only surface soil samples were evaluated in the risk assessment, because disturbance of the landfill contents is not anticipated. Table 5-5 presents the summary statistics for the Landfill. The cancer risk level for the Landfill soil was 1×10^{-6}, which is below the MDE remedial action level. The only evaluated chemical, arsenic, has an MDE Soil Cleanup Standard based upon a cancer endpoint. As a result, a non-cancer HI result was not calculated.

5.2.5 Northwest Upland Area Risk Evaluation

Sample locations evaluated for the Northwest Upland area are presented in Table 5-1. Tables 5-6-1 and Table 5-6-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 3×10^{-6}, which is below the MDE remedial action level. The only evaluated chemical, arsenic, has an MDE Soil Cleanup Standard based upon a cancer endpoint. As a result, a non-cancer HI result was not calculated.

The cancer risk level for subsurface soil was 2×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.1, which is below the acceptable threshold of 1.

5.2.6 West-Central Upland Area Risk Evaluation

Sample locations evaluated for the West-Central Upland area are presented in Table 5-1. Tables 5-7-1 and Table 5-7-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 4×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.3, which is below the acceptable threshold of 1.

The cancer risk level for subsurface soil was 2×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 4, which is above the acceptable threshold of 1. The non-cancer HI exceedance was primarily attributable to vanadium, which exceeded the MDE Non-Residential Cleanup Standard in four sampling locations with a maximum of 6,000 mg/kg at sampling location SB-27 at 6 to 8 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. Only the HI for the vanadium target organ, hair follicles, exceeded the threshold of 1.

5.2.7 East-Central Upland Area Risk Evaluation

Sample locations evaluated for the East-Central Upland area are presented in Table 5-1. Tables 5-8-1 and Table 5-8-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 6×10^{-5}, which is above the MDE remedial action level. The non-cancer HI result was 0.8, which is below the acceptable threshold of 1. Benzo(a)pyrene was the primary contributor to the cancer risk level, with a risk of 3.2×10^{-5}. Other PAHs also contributed to cancer risk level. Sample location SB-44 at 0 to 2 ft bgs depth had the maximum detected concentration of benzo(a)pyrene (19 mg/kg) and all other PAHs. The next highest detection of benzo(a)pyrene was 1.9 mg/kg at sample location SB-28. All other benzo(a)pyrene detections were below 0.3 mg/kg.

The cancer risk level for subsurface soil was 5×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 0.5, which is below the acceptable threshold of 1.

5.2.8 South Upland Area Risk Evaluation

Sample locations evaluated for the South Upland area are presented in Table 5-1. Tables 5-9-1 and Table 5-9-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 6×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 1, which equals the acceptable threshold of 1.

The cancer risk level for subsurface soil was 6×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 7, which is above the acceptable threshold of 1. The non-cancer HI exceedance was attributable to vanadium (HQ = 6.6), which exceeded the MDE Non-Residential Cleanup Standard in four sampling locations, with a maximum of 6,600 mg/kg at sampling location SB-50 at 4 to 6 ft bgs. Because the cumulative HI was greater than 1, a breakdown by target organ was completed. Only the HI for the vanadium target organ (hair follicles) exceeded the threshold of 1.

5.2.9 Batch Attack Basin Risk Evaluation

Sample locations evaluated for the Batch Attack Basin are presented in Table 5-1. Only surface sediments/soils were collected from this basin. Table 5-10 presents the summary statistics for the Batch Attack Basin. The cancer risk level for the Batch Attack Basin soil was 9×10^{-7}, which is below the MDE remedial action level. The non-cancer HI result was 5, which is above the acceptable threshold of 1. The non-cancer HI exceedance is primarily attributable to vanadium, which exceeded the MDE Non-Residential Cleanup Standard in nine sampling locations with a maximum of 5,100 mg/kg at sampling locations BB-07S and BB-08S. Only the vanadium target organ (hair) exceeded the acceptable level of 1.

5.2.10 Upper Settling Basin Risk Evaluation

Sample locations evaluated for the Upper Settling Basin are presented in Table 5-1. Tables 5-11-1 and Table 5-11-2 present the summary statistics for surface and subsurface soil in this area. The cancer risk level for surface soil was 1×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 2, which is above the acceptable threshold of 1. The non-cancer HI exceedance was attributable to vanadium (HQ = 1.4), which exceeded the MDE Non-Residential Cleanup Standard in in seven sampling locations with a maximum of 2,700 mg/kg at sampling location UB-08 at 0 to 0.5 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. None of the target organs exceeded the acceptable level of 1.

The cancer risk level for subsurface soil was 2×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 4, which is above the acceptable threshold of 1. The non-cancer HI exceedance was attributable to vanadium (HQ = 2.6), which exceeded the MDE Non-Residential Cleanup Standard in in six sampling locations with a maximum of 3,800 mg/kg at

sampling location UB-03 at 3 to 5 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. Only the vanadium target organ (hair follicles) exceeded the threshold of 1.

5.2.11 Middle Settling Basin Risk Evaluation

Sample locations evaluated for the Middle Settling Basin are presented in Table 5-1. Table 5-12 presents the summary statistics for the Middle Basin surface soil. The cancer risk level for the Middle Basin surface soil was 1×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 9, which is above the acceptable threshold of 1. Both vanadium and manganese have HQs greater than 1. Vanadium exceeded MDE Non-Residential Cleanup Standards in five sampling locations with a maximum of 6,600 mg/kg at sampling location MB-03S at 0 to 2 ft. Manganese exceeded the MDE Non-Residential Cleanup Standard in five sampling locations. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. Only the target organs associated with vanadium (hair follicles) and manganese (central nervous system) exceeded the threshold of 1.

5.2.12 Lower Settling Basin Risk Evaluation

Sample locations evaluated for the Lower Settling Basin are presented in Table 5-1. Tables 5-13-1 and Table 5-13-2 present the summary statistics for the Lower Basin surface and subsurface soil. The cancer risk level for the Lower Basin surface soil was 7×10^{-7}, which is below the MDE remedial action level. The non-cancer HI result was 8, which is above the acceptable threshold of 1. The non-cancer HI exceedance was primarily attributable to vanadium, which exceeded the MDE Non-Residential Cleanup Standard in seven sampling locations with a maximum of 6,650 mg/kg at sampling location LB-05 at 0 to 2 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. Only the vanadium target organ exceeded the threshold of 1.

The cancer risk level for subsurface soil was 2×10^{-6}, which is below the MDE remedial action level. The non-cancer HI result was 9, which is above the acceptable threshold of 1. The non-cancer HI exceedance was attributable to vanadium (HQ = 7.8), which exceeded the MDE Non-Residential Cleanup Standard in in three sampling locations with a maximum of 7,800 mg/kg at sampling location LB-03 at 8 to 10 ft bgs. The cumulative HI was greater than 1; therefore, a breakdown by target organ was completed. Only the vanadium target organ (hair follicles) exceeded the threshold of 1.

5.3 CONCLUSIONS OF HUMAN HEALTH RISK EVALUATION

The Cristal USA Facility was evaluated by specific areas of use and potential contamination based upon past Site history. The analytical results from each area were compared to the MDE Non-Residential Cleanup Standards (MDE 2008). Any analyte that exceeded the MDE Non-Residential Cleanup Standard was evaluated further for attainment.

Each chemical with a value exceeding the MDE Non-Residential Soil Cleanup Standard was evaluated for attainment through the use of the 95%UCLM value. The 95%UCLM value

represents human exposure to chemicals in Site soil across an expected exposure area, rather than a point by point comparison. The 95%UCLMs were compared to the MDE Non-Residential Soil Cleanup Standards to make a risk management decision concerning potential re-use of the Site. An estimated risk level was determined for each COPC by dividing the 95%UCLM by the corresponding cleanup standard. MDE has identified a remedial action standard risk level of 10^{-5} for carcinogens and an HI of 1.0 for non-carcinogens (MDE 2008). In addition, non-carcinogenic chemicals cannot have a target-organ specific endpoint greater than 1.0. Lead was evaluated by comparing the maximum concentration and the mean concentration to the MDE Non-Residential Soil Cleanup Standard of 1,000 mg/kg.

The risk evaluation for each area evaluated determined that there are risk concerns for exposure in certain areas of the Site (Figure 5-1). For lead, the mean concentration across all specific areas evaluated was below the MDE Non-Residential Soil Cleanup Standard. However, the maximum detected concentration was above the MDE Non-Residential Soil Cleanup Standard in one surface soil sample (7,100 mg/kg) within the PWAN/SWAN (Focus Area C) and one subsurface soil sample (4,300 mg/kg) within the Spent Solvent Storage area (Focus Area B). All other detections of lead were below the MDE Non-Residential Soil Cleanup Standard of 1,000 mg/kg.

For cumulative cancer risks, risk levels were below the MDE remedial action level of 10^{-5} for all areas evaluated, except the PWAN/SWAN area (Focus Area C) and the East-Central Upland area.

For the PWAN/SWAN area (Focus Area C), arsenic was the primary risk driver in both surface soil and subsurface soil. The maximum detected concentrations of arsenic in surface soil (220 mg/kg) and subsurface soil (110 mg/kg) were found at sample location AN-06. In addition, elevated levels of arsenic (i.e., greater than an order of magnitude higher than the MDE Non-Residential Cleanup Standard) were found at sample locations AN-13 and AN-12.

For the East-Central Upland area, cancer risk above the MDE remedial action level was due to PAHs, primarily benzo(a)pyrene, in surface soil sample location SB-44. Subsurface soil samples did not reveal a concern. PAH detections in all other surface soil samples within the East-Central Upland area were an order of magnitude lower.

Exceedance of a non-cancer threshold of 1 were determined in the PWAN/SWAN area (Focus Area C), West-Central Upland area, South Upland area, Batch Attack Basin area, Upper Basin area, Middle Basin area, and Lower Basin area. There were no non-cancer concerns for the Former Titanium Ore Storage area (Focus Area A), Spent Solvent Storage area (Focus Area B), Landfill area, Northwest Upland area, and East-Central Upland area.

For the PWAN/SWAN area (Focus Area C), exceedance of the non-cancer threshold was due to antimony in both surface and subsurface soil. Exceedances of the MDE Non-Residential Soil Cleanup Standard for antimony were limited to those locations in the southernmost portion of the area (AN-03, AN-07, AN-08, AN-11, and AN-12).

For the remainder of the areas, exceedances of the non-cancer threshold of 1 were due to vanadium. Within the West-Central Upland area, subsurface soil samples revealed high levels of vanadium. Exceedances are driven by sampling location SB-27 at 6 to 8 ft bgs, with a maximum concentration of 6,000 mg/kg. Within the South Upland area, subsurface soil samples revealed high levels of vanadium with a non-cancer HI of 7. Exceedances are driven primarily from sampling location SB-50, with all other exceedances limited to sampling locations SB-49 and SB-55. Within the Batch Attack Basin, soil samples revealed high levels of vanadium with a non-cancer HI of 4. The highest exceedances occur within the central and eastern portion of the Batch Attack Basin that is highly saturated or is currently inundated with water and includes sample locations BB-03 through BB-08. Within the Upper Basin area, subsurface soil samples revealed high levels of vanadium with a non-cancer HI of 3. All sample locations, except UB-05, had exceedances in subsurface soils. Within the Middle Basin, surface soil samples at all five sampling locations revealed high levels of vanadium with a non-cancer HI of 6. Within the Lower Basin, surface and subsurface soil samples revealed high levels of vanadium with non-cancer HIs of 5 and 8, respectively. Sample location LB-04 at 6 to 8 ft bgs was the only sampling location without exceedances due to vanadium.

In summary, the PWAN/SWAN area (Focus Area C), West-Central Upland area, East-Central Upland area, South Upland area, Batch Attack Basin, Upper Basin, Middle Basin, and Lower Basin are recommended for additional risk management decisions. The remainder of the Site did not reveal human health concerns for potential worker exposures.

6. CONCLUSIONS

The Phase II ESA evaluated soil, groundwater, sediment, and surface water sample data collected from the Site. The goal of this investigation was to evaluate the potential for the historical Site uses to have impacted the environmental integrity of soil and groundwater at the Site, to further evaluate areas of previously identified suspect conditions, and to provide Site-wide comprehensive characterization data. Information obtained as part of this investigation is intended to support efforts associated with the proposed expansion of the adjoining Cox Creek DMCF and to support potential future use(s) of the Site by MPA.

Shallow and subsurface soil samples and/or groundwater samples were collected from four identified upland AOCs and from Site-wide locations in the upland areas of the Site, which were divided into four additional areas (Northwest Upland, West-Central Upland, East-Central Upland, and South Upland). Results from analyses of samples collected from the AOC areas and Site-wide locations identified elevated concentrations of metals, PAHs, TPH-DRO, and dioxins/furans in soil and groundwater in certain areas of the Site. The pH of soils, which in some areas has been altered by historical Site operations, varied across the Site and with depth, in the range of 2.4 to 11.9, and was generally lower at depth. Soils with pHs below 3.5 occurred in the subsurface of the PWAN/SWAN area and at three scattered locations in the central portion of the Site near the treatment/storage basins. Radiation surveys and radioactive isotope analysis of soils from the Former Titanium Ore Storage area indicated residual radioactivity generally consistent with natural background levels.

Additionally, shallow and subsurface soil, surface sediment, and/or surface water samples were collected from the four treatment/storage basins (Batch Attack, Upper Settling, Middle Settling, and Lower Settling), which were also identified as AOCs. Results from analyses of these samples identified elevated concentrations of metals and dioxins/furans in soil and sediment from the basins. Surface water also contained metals at slightly elevated concentrations. The pH of sediment samples collected was generally neutral to alkaline, with a few samples having pH below 5; however, results of a separate analysis of deep sediments in the Batch Attack and Lower Settling Basins, conducted by TRC on behalf of Cristal, indicate that low-pH sediments are present at various depths.

In addition to the analyses of discrete samples from the uplands and the basins, analysis of dioxins and furans was performed on soil samples from three discrete Site-wide locations, four composite soil samples from the areas of the landfill, and one composite soil sample from each of the other AOCs. Eighteen groundwater and three surface water samples were also analyzed for dioxins and furans.

A human health risk evaluation was performed on the soil and sediment data, to determine attainment for analytes in comparison to the MDE Non-Residential Soil Cleanup Standards. Non-residential criteria are consistent with current Site use and zoning, and also with the anticipated land use as part of the Cox Creek DMCF. MDE has identified a remedial action level of 10^{-5} for carcinogenic risk, and a threshold hazard index (HI) of 1.0 for non-carcinogenic risk. Overall the reported concentrations in soil do not represent a significant human health risk to

construction/ maintenance workers, who are identified as the primary receptors; however, isolated areas of impact and potential risk were observed (Figure 5-1). Specific areas of risk and other concerns are noted below:

- In the PWAN/SWAN area, elevated concentrations of metals (primarily arsenic and antimony) in shallow and subsurface soil drive both carcinogenic and non-cancer risks exceeding the MDE remedial action level of 10^{-5} for carcinogens and the non-cancer threshold HI of 1.0. Soil pH in this area was highly variable, ranging from 2.48 to 9.30, with generally more acidic soils in the subsurface.

- The PWAN/SWAN area also had one reported lead concentration exceeding the MDE Non-Residential Cleanup Standard, and TCLP analysis of this sample indicated that the lead may be leachable and therefore potentially mobile. TCLP results from the Former Titanium Ore Storage area also indicated potentially mobile lead.

- In the East-Central Upland area, PAHs in surface soil, primarily at location SB-44, drive carcinogenic risks exceeding the MDE remedial action level of 10^{-5}. TPH-DRO exceeding the MDE Non-Residential Cleanup Standard was also reported in surface soil from location SB-44.

- Vanadium drives non-cancer risks exceeding the acceptable threshold in surface and/or subsurface soil and sediment from the West-Central Upland and South Upland areas, as well as the four basins (Batch Attack, Upper Settling, Middle Settling, and Lower Settling). Manganese is also a secondary, but substantial contributor to risk in the Middle Settling Basin. Although vanadium concentrations were not reported for the TRC sediment cores, overall concentrations of other metals in that dataset are of similar magnitude.

- In addition to location SB-44, TPH-DRO was present in soil at concentrations exceeding the MDE Non-Residential Cleanup Standard at one location in the Spent Solvent Storage area, and at two sample locations in the West-Central Upland area. Soil at these locations may have been impacted by nearby OWSs and historic USTs.

Groundwater concentrations were not incorporated into the risk assessment because groundwater is not used as a potable water supply, and no such use is expected in the future. Many of the metals and PAHs that were reported at concentrations exceeding MDE Non-Residential Cleanup Standards in soil were also reported at concentrations exceeding the MDE Cleanup Standards in groundwater. A few isolated exceedances of other metals, other PAHs, VOCs, and non-PAH SVOCs were also reported in groundwater, in addition to dioxins, as described in the next paragraph. The results do not indicate any widespread plumes of organic contaminants in Site groundwater.

Dioxin and furan results were not incorporated into the risk assessment, due to the lack of a complete set of discrete, Site-wide data comparable to the data collected for other parameters. However, dioxins and furans are recognized byproducts of the chlorinators used in the chloride

process for manufacturing titanium dioxide (USEPA 2001), and appear to be widespread in the Settling Basins that received waste products from the chloride process. Dioxin/furan results were used to calculate TEQs for human exposure, which were compared to the USEPA RSL for Industrial Soil and MCL for groundwater. This screening indicated that dioxins and furans in soil from the northern edge of the landfill (Area 1), as well as sediments from the Upper, Middle, and Lower Settling Basins, pose a potential risk to human health. The TEQs for the Upper and Middle Settling Basins were more than 20 times the RSL. The Batch Attack Basin may contain dioxins/furans at lower concentrations because this basin received primarily sulfuric acid waste streams from the sulfate process (rather than the chloride process) for manufacturing titanium dioxide). The TEQs for groundwater from locations SB-53 and SB-59, in the South Upland area, were 10 to 20 times the MCL; no soils from this area were analyzed for dioxins and furans. The primary dioxin concerns appear to be in the sediments of the basins, and in the groundwater and potentially the soils of the South Upland area, which is adjacent to the Lower and Middle Settling Basins. Elevated concentrations of metals were reported in these same areas and media. Additional characterization could help to refine the risks associated with dioxins and furans in these areas.

Table 6-1 summarizes the risk evaluation findings and other concerns identified for each of the AOCs (upland and basins) and the upland areas sampled as part of Site-wide sampling. The Phase II Investigation and the TRC basin investigation results provide sufficient characterization information to identify and evaluate potential remedial alternatives associated with Site redevelopment as a DMCF. Due to the complex nature of the Site, the remedial options will be discussed with the development team to focus cost estimating efforts.

Table 6-1 Summary of Phase II ESA Findings

Area	Human Health Risk Evaluation for Soil/Sediment[a]	Other Concerns
Upland Areas of Concern/Focus Areas		
Former Titanium Ore Storage Area	No risk concerns	Leachable lead at hazardous waste levels identified in one sample
Spent Solvent Storage Area	No risk concerns	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in surface and subsurface soil from one location.
Primary/Secondary Waste Acid Neutralization Area	Risk exceeding action level/threshold, driven by arsenic and antimony in surface and subsurface soil	Leachable lead at hazardous waste levels identified in one sample
Landfill Area	No risk concerns	Dioxins exceeded the USEPA RSL in one composite sample of waste.
Upland Site-Wide Sampling Grid		
Northwest Upland Area	No risk concerns	
West-Central Upland Area	Risk exceeding threshold, driven by vanadium in subsurface soil	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in two samples from near a former underground storage tank and an oil-water separator.
East-Central Upland Area	Risk exceeding action level, driven by PAHs in surface soil, primarily at one location	TPH-DRO exceeded the MDE Non-Residential Cleanup Level in one sample, co-located with PAHs.
South Upland Area	Risk exceeding threshold, driven by vanadium in subsurface soil	Dioxins exceeded the USEPA MCL in two groundwater samples.
Treatment/Storage Basin Areas of Concern		
Upper Settling Basin	Risk exceeding threshold, driven by vanadium in surface and subsurface sediment and soil	High concentrations of chromium, iron. and manganese. Dioxins in sediment exceeded USEPA RSL.
Middle Basin	Risk exceeding threshold, driven by vanadium and manganese in sediment	High concentrations of chromium, iron, and manganese. Dioxins in sediment exceeded USEPA RSL.
Lower Settling Basin	Risk exceeding threshold, driven by vanadium in surface and subsurface sediment and soil	High concentrations of chromium, iron, and manganese. Dioxins in sediment exceeded USEPA RSL.
Batch Attack Basin	Risk exceeding threshold, driven by vanadium and manganese in sediment	Currently under MDE Administrative Consent Order. Low pH material identified at depths during another recent study. Groundwater remediation system in place to control low pH water leaching from site.

(a) Results of screening-level human health risk evaluation. using MDE Non-Residential Cleanup Levels and based on a construction/maintenance worker exposure scenario. The MDE remedial action level for carcinogenic risk is 10^{-5}. and the threshold for non-carcinogenic risks is a hazard index of 1.0. Risk assessment did not include dioxin results.

NOTES:
MCL = Maximum Contaminant Level.
MDE = Maryland Department of the Environment.
PAH = Polycyclic aromatic hydrocarbon.
RSL = Regional Screening Level.
TPH-DRO = Total Petroleum Hydrocarbons–Diesel Range Organics.
USEPA = United States Environmental Protection Agency.

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7. DISCLAIMER

EA does not warrant that there are no toxic or hazardous materials or contamination, nor does EA accept any liability if such are found at some future time, or could have been found if sampling or additional studies were conducted. EA does not assume responsibility for other environmental issues that may be associated with this subject property.

In view of the rapidly changing status of environmental laws, regulations, and guidelines, EA cannot be responsible for changes in laws, regulations, or guidelines which occur after the study has been completed and which may affect the subject property.

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8. REFERENCES

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Appendix A

Figures

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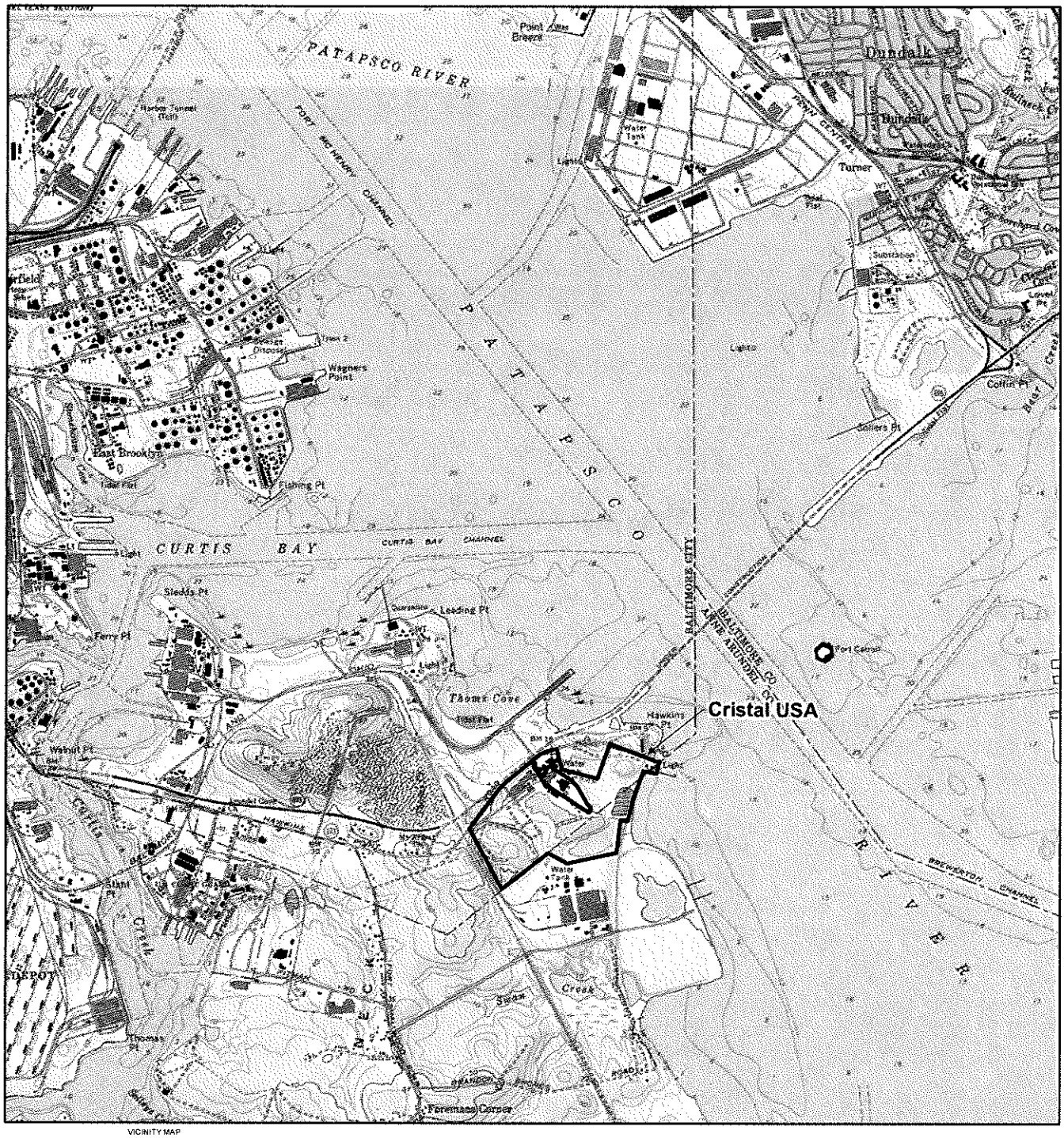
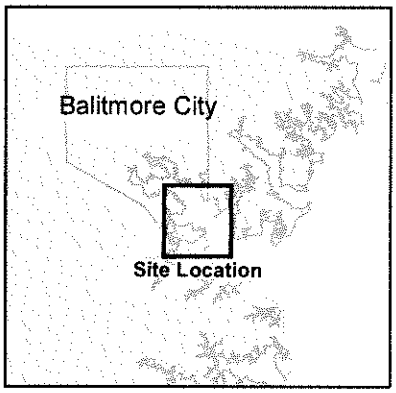


VICINITY MAP



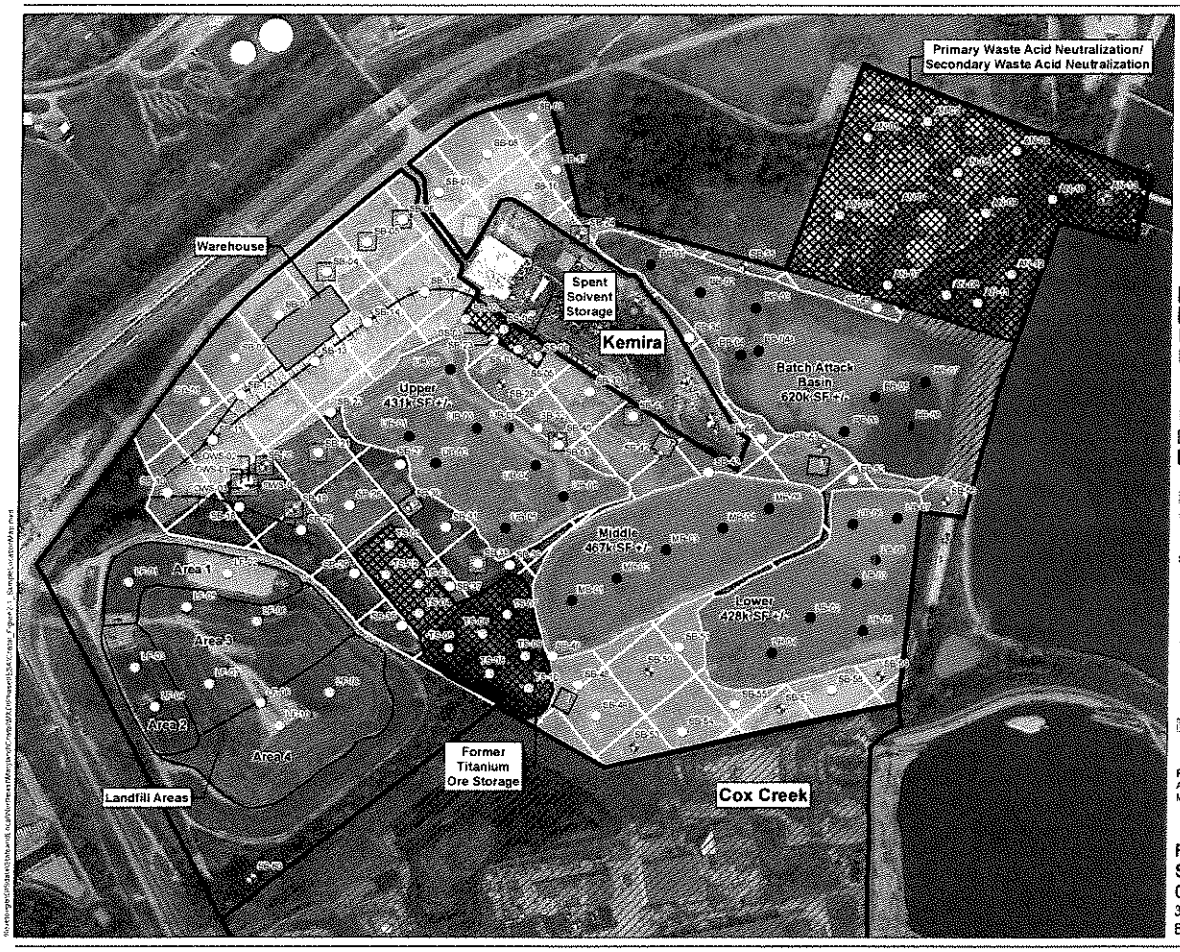
Approximate Site Boundary

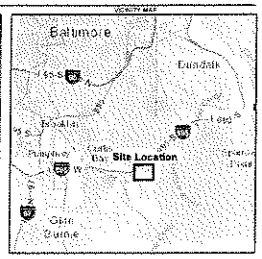
0 1,500 3,000
Feet

N

FIGURE 1-1
Site Location Map
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

References
Topo: USGS, 1974
Map Date: 6/24/2015





- Railroad Track
- Approximate Site Boundary
- Cox Creek Property
- Building
- Substation
- Batch Attack Basin
- Settling Basin
- Slurry Wall (approx.)
- Landfill Areas
- Focused Area
- Northwest Upland Area
- West-Central Upland Area
- East-Central Upland Area
- South Upland Area

Sample Locations

- Sitewide Soil (50)
- Sitewide Soil and GW (15)
- Focused Area-specific Soil (26)
- Focused Area-specific Soil and GW (4)
- Basin Sediment or Soil (26)
- Basin Sediment and Surface Water (3)
- Landfill (10)
- Approximate GPR/EM Survey Area

0 250 500
Feet

N

References
Aerial: Google Earth 2014
Map Date: 11/11/2015

FIGURE 2-1
Sample Location Map
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

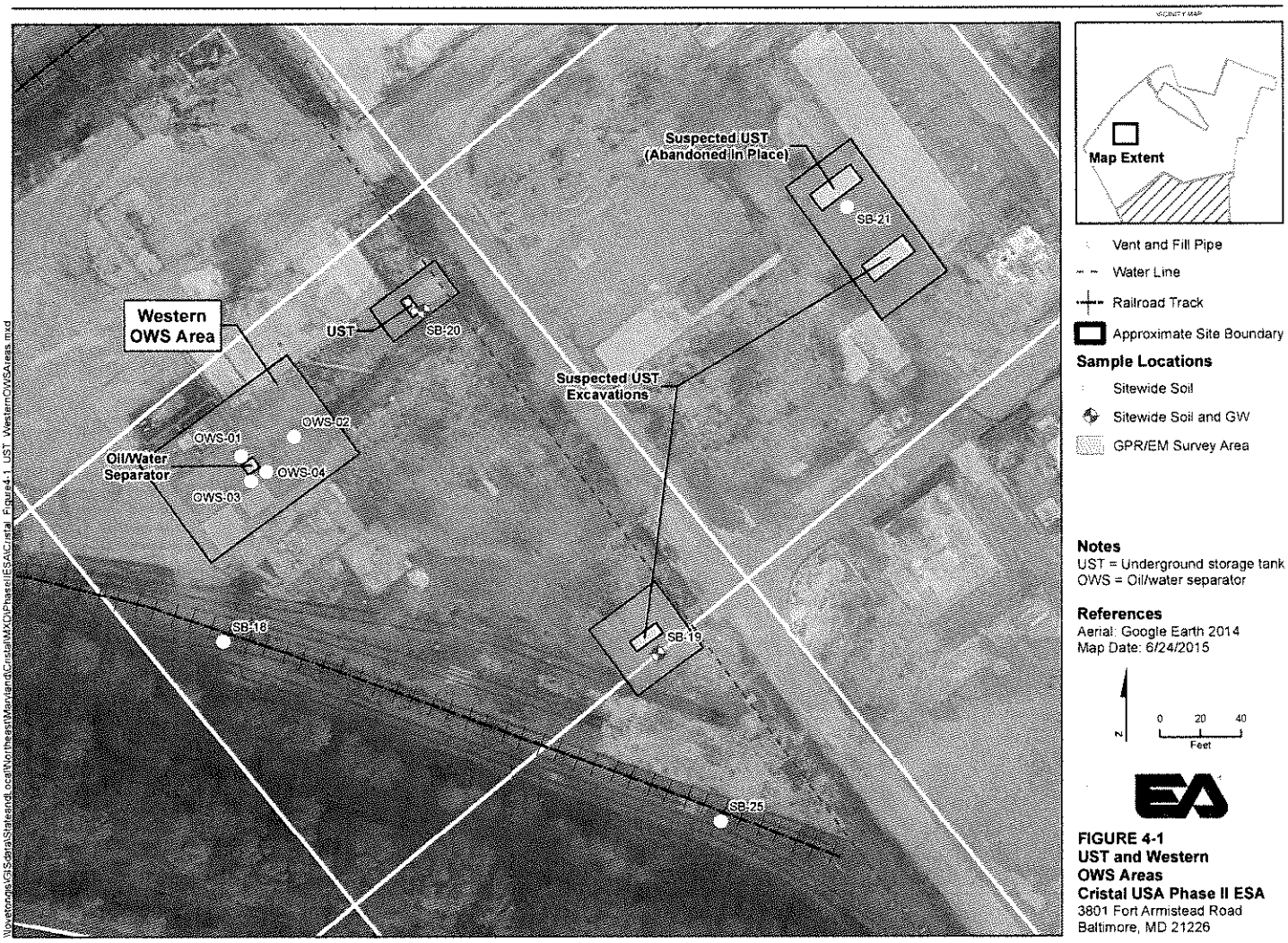


FIGURE 4-1
UST and Western
OWS Areas
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

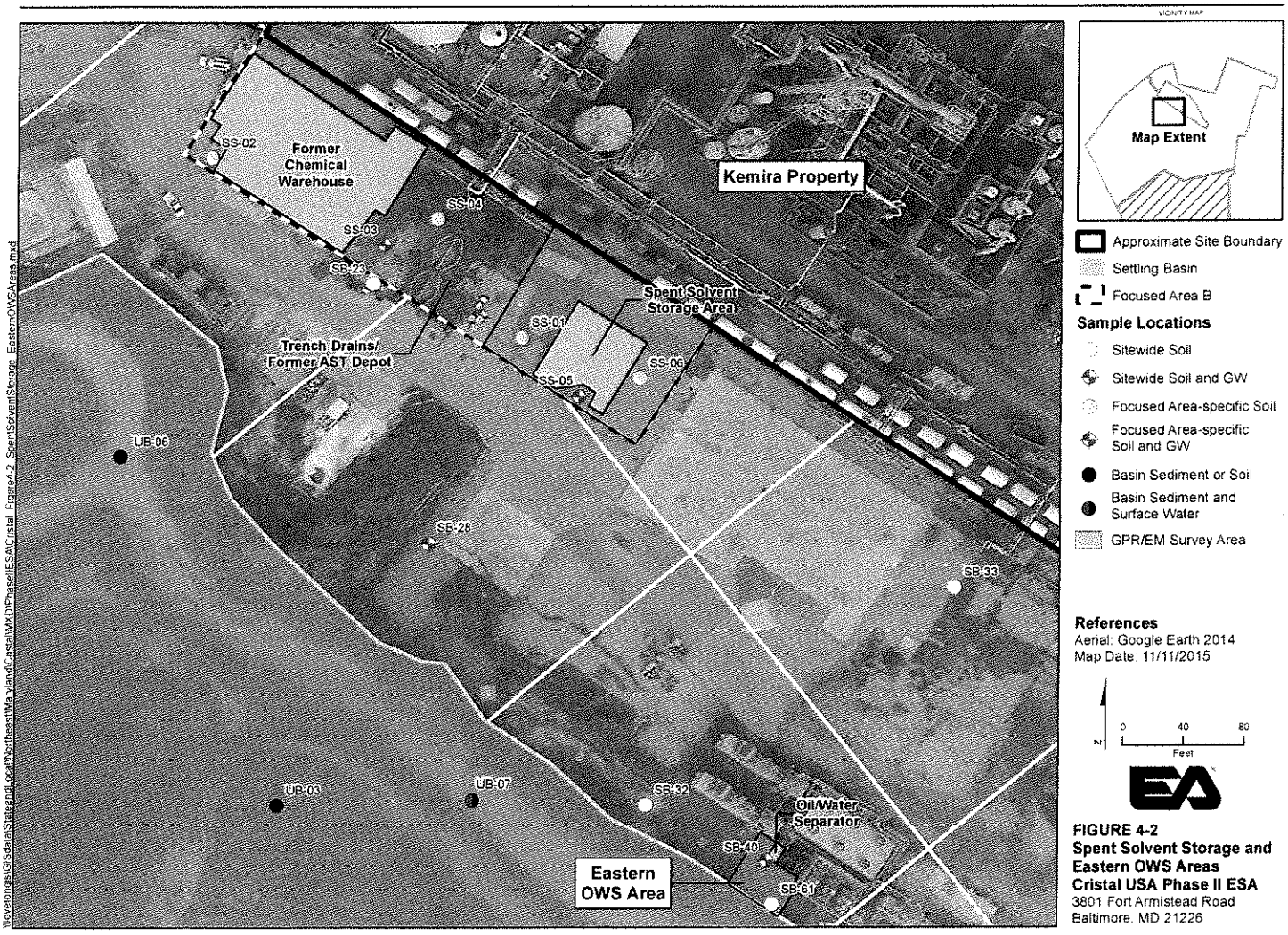


FIGURE 4-2
Spent Solvent Storage and Eastern OWS Areas
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

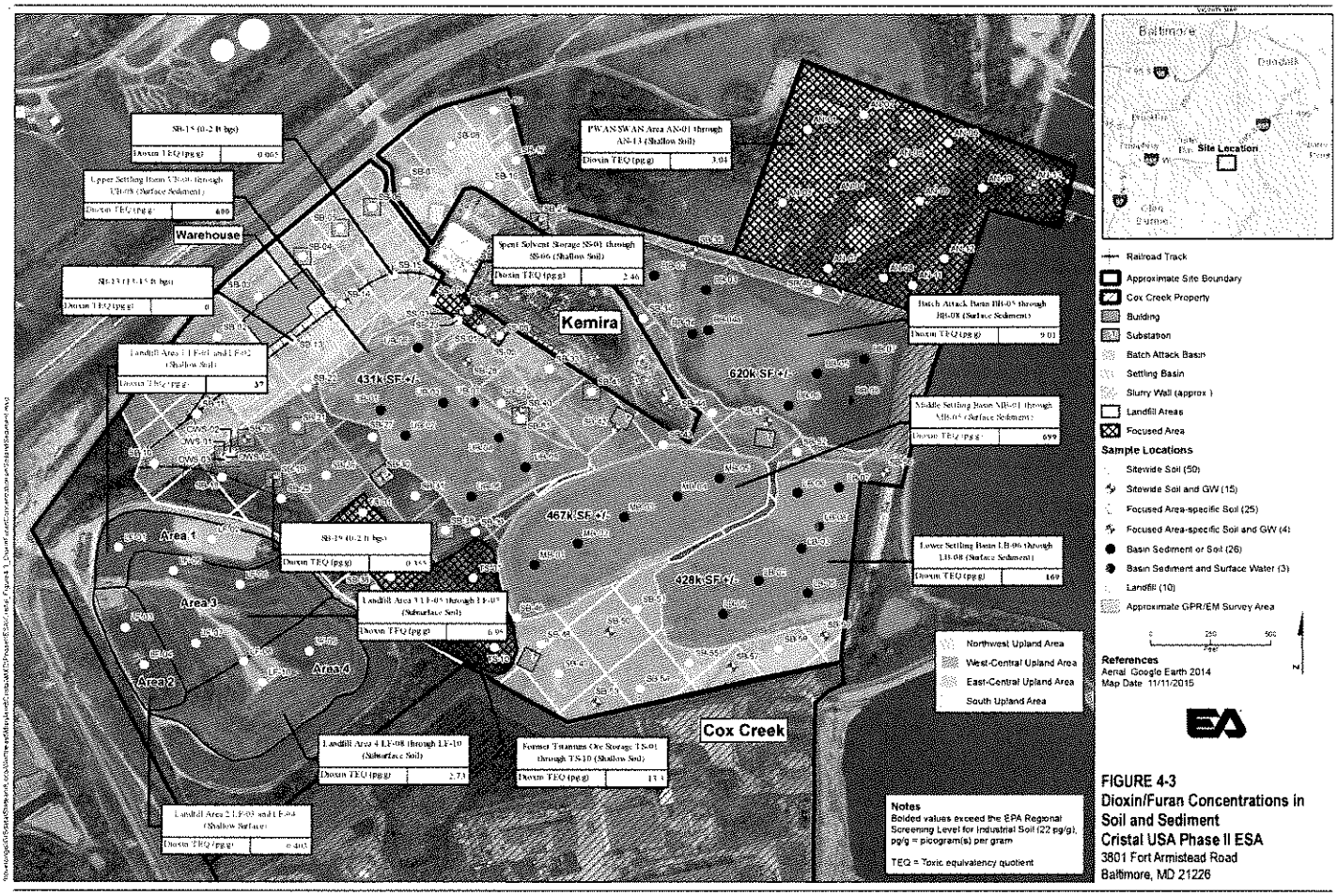


FIGURE 4-3
Dioxin/Furan Concentrations in Soil and Sediment
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

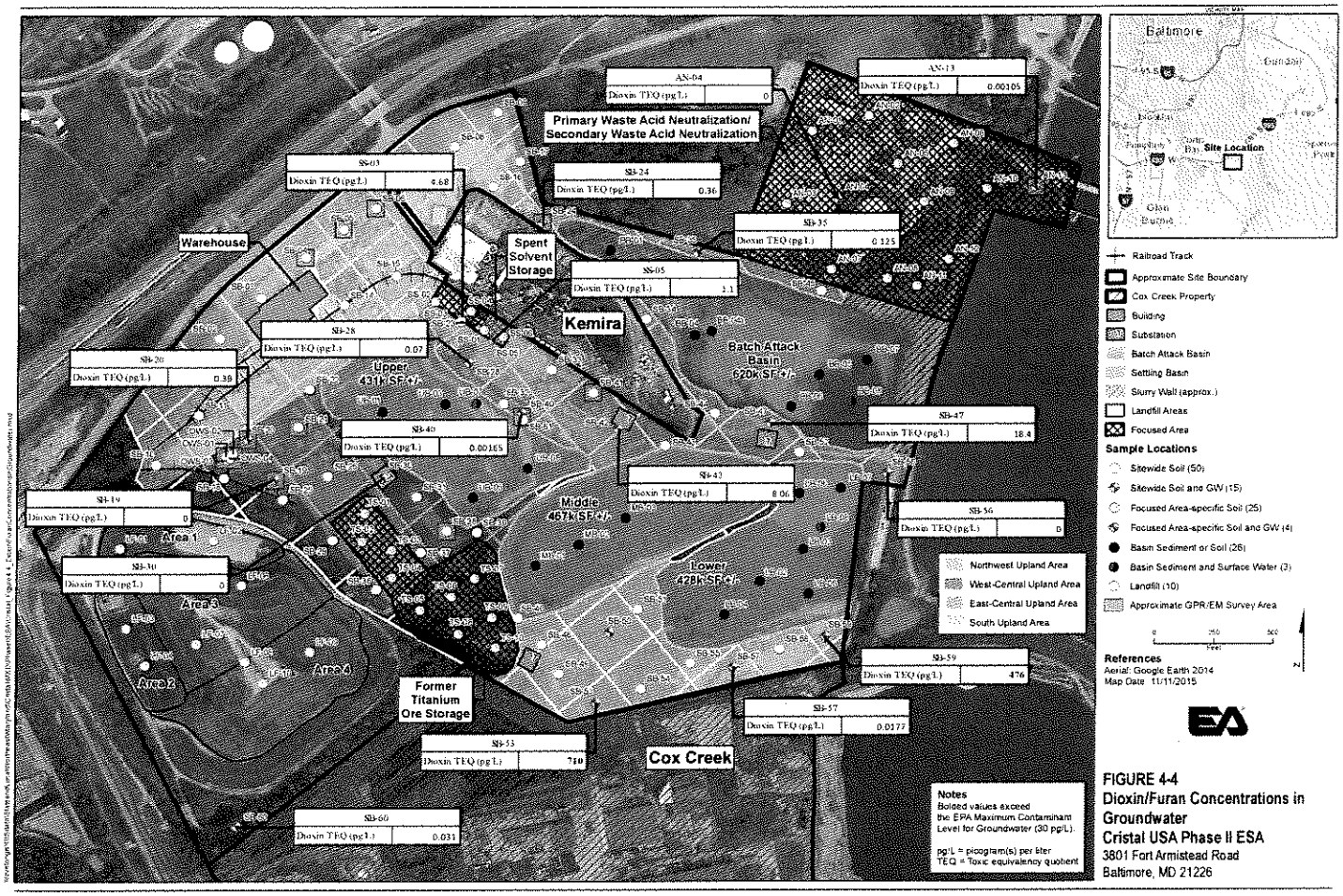
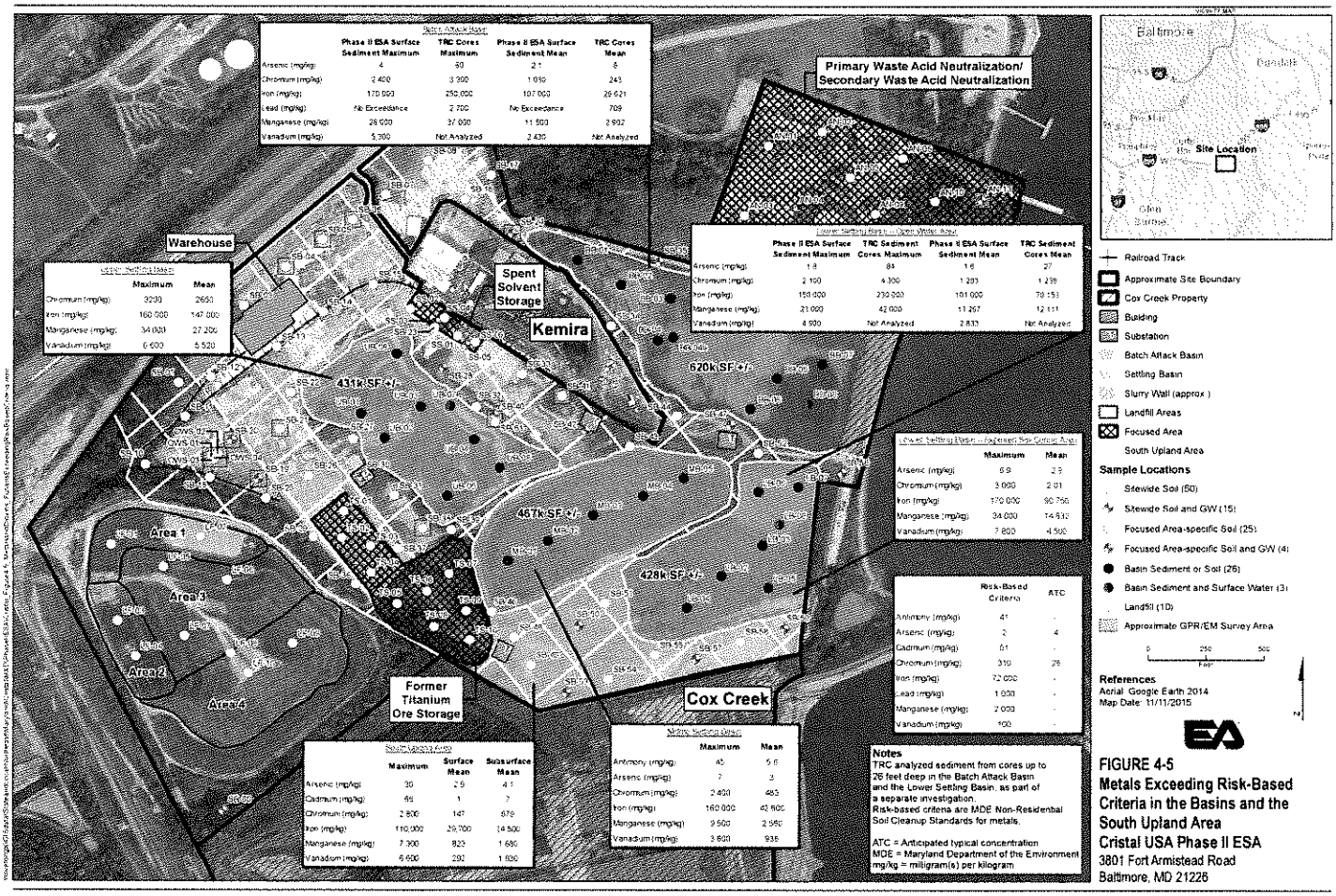


FIGURE 4-4
Dioxin/Furan Concentrations in Groundwater
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226



	Phase II ESA Surface Sediment Maximum	TRC Cores Maximum	Phase II ESA Surface Sediment Mean	TRC Cores Mean
Arsenic (mg/kg)	4	30	2.1	8
Chromium (mg/kg)	2,400	3,300	1,050	243
Iron (mg/kg)	170,000	250,000	107,000	29,621
Lead (mg/kg)	No Exceedance	2,700	No Exceedance	709
Manganese (mg/kg)	26,000	37,000	11,500	2,902
Vanadium (mg/kg)	5,300	Not Analyzed	2,430	Not Analyzed

	Maximum	Mean
Chromium (mg/kg)	3200	2650
Iron (mg/kg)	160,000	147,000
Manganese (mg/kg)	34,000	27,200
Vanadium (mg/kg)	6,600	5,520

	Phase II ESA Surface Sediment Maximum	TRC Sediment Cores Maximum	Phase II ESA Surface Sediment Mean	TRC Sediment Cores Mean
Arsenic (mg/kg)	1.8	83	1.6	27
Chromium (mg/kg)	2,100	4,300	1,203	1,239
Iron (mg/kg)	158,000	230,000	101,000	79,153
Manganese (mg/kg)	21,000	42,000	11,267	12,111
Vanadium (mg/kg)	4,900	Not Analyzed	2,833	Not Analyzed

	Maximum	Mean
Arsenic (mg/kg)	6.9	2.9
Chromium (mg/kg)	3,000	2,01
Iron (mg/kg)	170,000	90,756
Manganese (mg/kg)	34,000	14,510
Vanadium (mg/kg)	7,800	4,500

	Risk-Based Criteria	ATC
Antimony (mg/kg)	41	-
Arsenic (mg/kg)	3	4
Cadmium (mg/kg)	81	-
Chromium (mg/kg)	310	75
Iron (mg/kg)	72,000	-
Lead (mg/kg)	1,000	-
Manganese (mg/kg)	2,000	-
Vanadium (mg/kg)	100	-

	Maximum	Surface Mean	Subsurface Mean
Arsenic (mg/kg)	30	2.9	4.1
Cadmium (mg/kg)	68	1	2
Chromium (mg/kg)	2,800	147	578
Iron (mg/kg)	110,000	29,700	14,500
Manganese (mg/kg)	7,300	823	1,680
Vanadium (mg/kg)	6,600	292	1,630

	Maximum	Mean
Antimony (mg/kg)	45	5.6
Arsenic (mg/kg)	7	3
Chromium (mg/kg)	2,400	483
Iron (mg/kg)	160,000	42,605
Manganese (mg/kg)	9,500	2,960
Vanadium (mg/kg)	3,600	936

Notes
TRC analyzed sediment from cores up to 26 feet deep in the Batch Attack Basin and the Lower Settling Basin, as part of a separate investigation.
Risk-based criteria are MDE Non-Residential Soil Cleanup Standards for metals.

ATC = Anticipated typical concentration
MDE = Maryland Department of the Environment
mg/kg = milligram(s) per kilogram

References
Aerial: Google Earth 2014
Map Date: 11/11/2015

FIGURE 4-5
Metals Exceeding Risk-Based Criteria in the Basins and the South Upland Area
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226

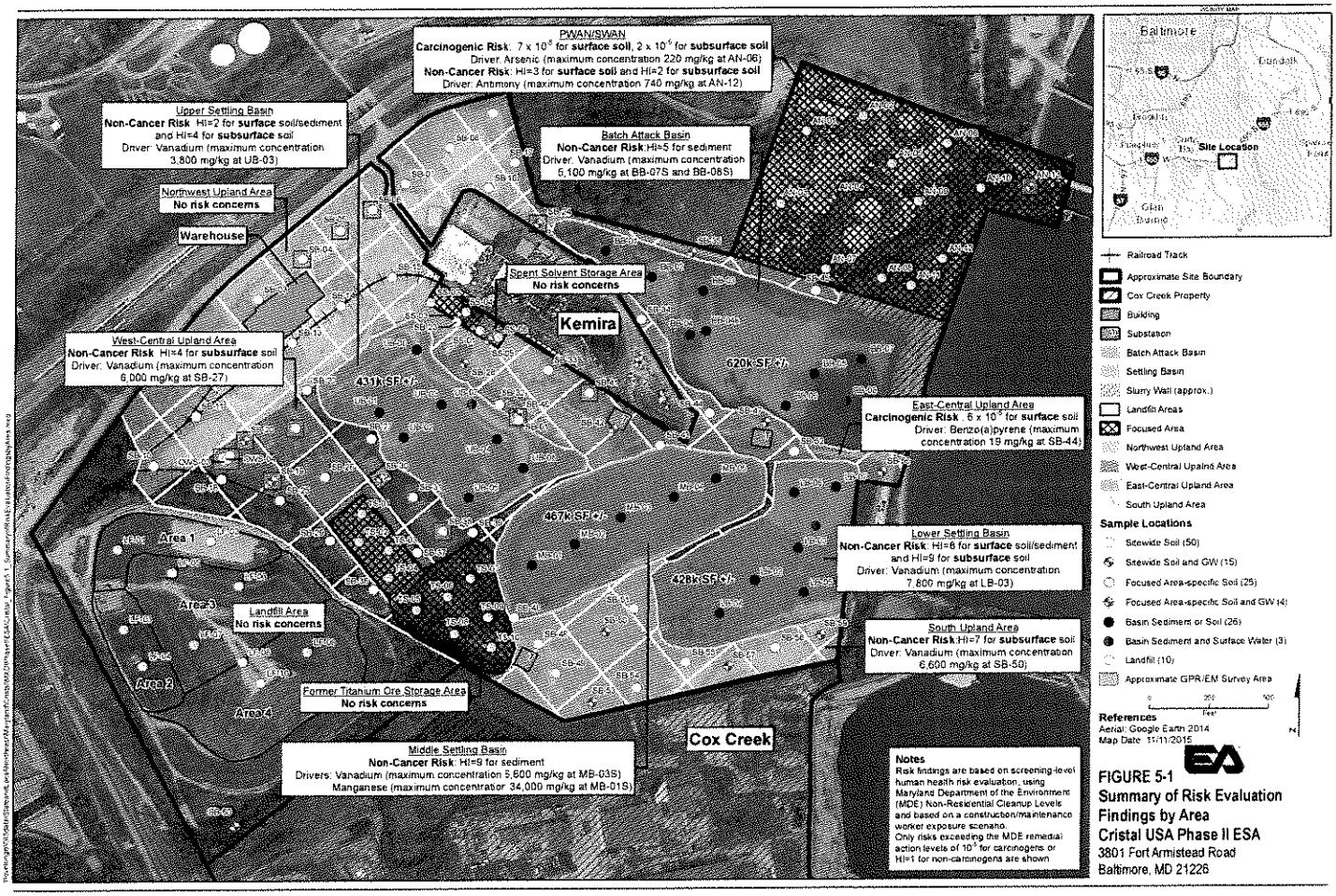
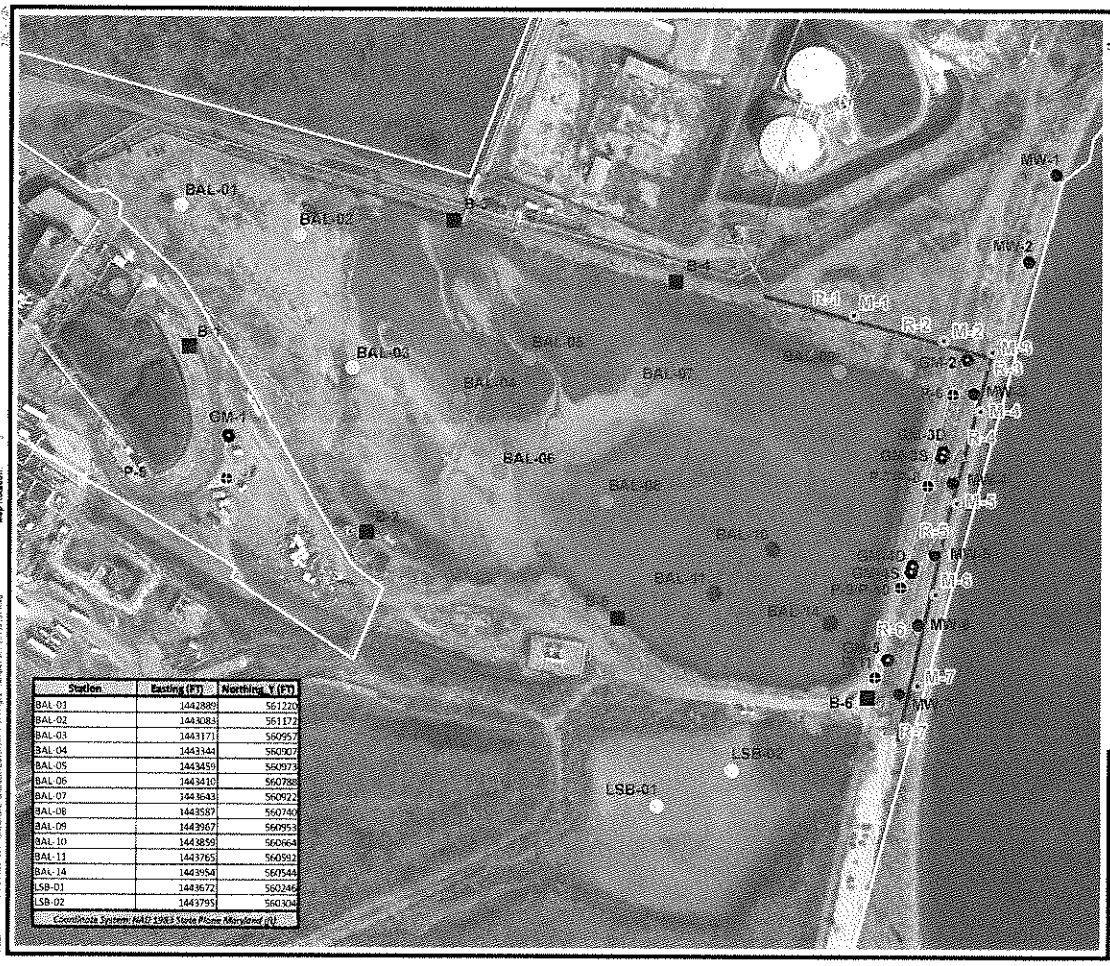


FIGURE 5-1
Summary of Risk Evaluation Findings by Area
Cristal USA Phase II ESA
3801 Fort Armistead Road
Baltimore, MD 21226



Station	Easting (FT)	Northing_Y (FT)
BAL-01	1442889	561220
BAL-02	1443083	561172
BAL-03	1443171	560957
BAL-04	1443344	560907
BAL-05	1443459	560973
BAL-06	1443410	560788
BAL-07	1443643	560922
BAL-08	1443587	560740
BAL-09	1443967	560953
BAL-10	1443859	560664
BAL-11	1443765	560592
BAL-14	1443954	560544
LSB-01	1443672	560246
LSB-02	1443795	560304

Coordinate System: NAD 1983 State Plane Maryland (ft)

LEGEND

- M Series - Denotes New Monitoring Well
- R Series - New Recovery Well
- MW Series - Denotes Existing Monitoring Well
- P Series - Existing Monitoring Well with Driven Split Spoon
- GM Series - Denotes Pumped Well Locations
- B Series - Denotes Auger Boring with Driven Split Spoon
- Barrier Wall
- Property Boundary
- BAL Sample via Hand Auger
- BAL Sampling Location via Vibracore and Portable Coring Platform
- BAL Sampling Location via Vibracore and Pontoon Boat
- LSB Sampling Location via Vibracore and Pontoon Boat

NOTES

1. Wells and slurry wall locations were obtained from Drawing 2 of 8 authored by Century Engineering, Inc. titled "Slurry Wall - Well Plan" on August 1984. Also obtained from Figure E-20, "Conceptual Plan and and Profile Cross Section of BAL", date unknown, and "Batch Attack Lagoon Aquifer Study" dated November 1983.
2. Property boundary location obtained from City of Baltimore CityView GIS on August 2014. The remainder of the property boundary, within Anne Arundel County, as approximate.
3) Aerial imagery obtained from Google, Inc. and is dated August 29, 2010.
4) Boundaries as shown areapproximate and may need to be field verified.

0 150 300 Feet

PROJECT
CRISTAL
BALTIMORE, MARYLAND

SHEET TITLE
BATCH ATTACK LAGOON (BAL) AND LOWER SETTLING BASIN (LSB) SAMPLING LOCATIONS

DRAWN BY	AMF	SCALE	PROJ. NO. 231885.0.0.7
CHECKED BY	GJS	1:1,800	FILE NO. Fig02_SampleLocs_20150501.mxd
APPROVED BY	HMM	DATE PRINTED	**FIGURE 2**
DATE	MAY 2015		

TRC
30 Fairwood Drive
Fairwood Place One, Suite 300
Greenville, SC 29615
Phone: 864 281 0030
www.trcsolutions.com

Saved By: AFRO, on 5/7/2015 15:12:56 PM
Path: P:\Vision\231881 - Cristal BAL Characterization\Aerial\Fig02_SampleLocs_20150501.mxd
Coordinate System: NAD 1983 State Plane Maryland FIPS 1900 Feet (Feet US)
Map Rotation: 0

Appendix B

Supporting Documentation

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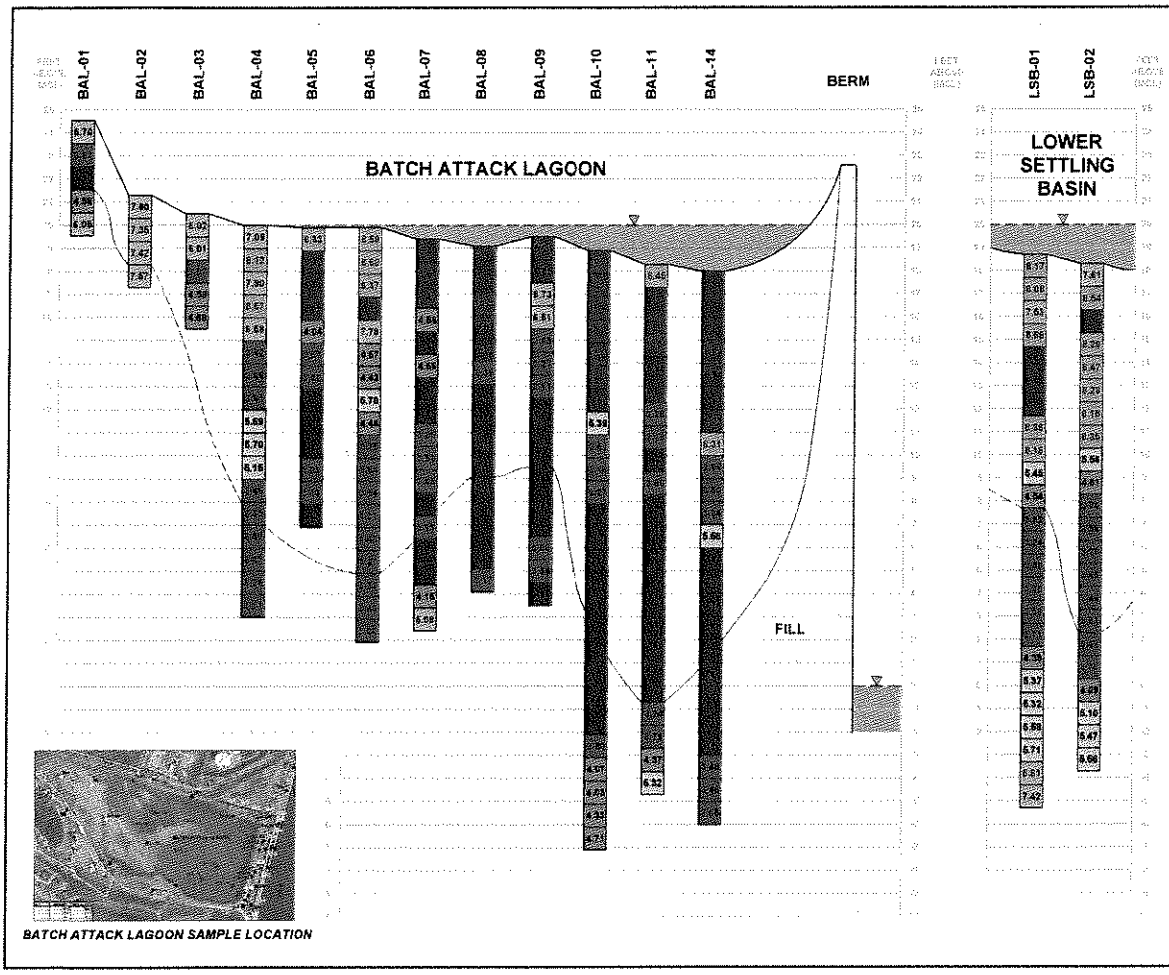
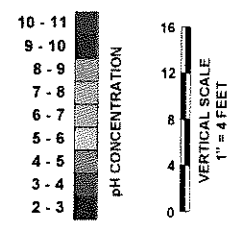


BATCH ATTACK LAGOON SAMPLE LOCATION

LOWER SETTLING BASIN SAMPLE LOCATION

KEY



INTERBEDDED WITH NATIVE MATERIAL (DASHED WHERE INFERRED)

NOTE

- NOT TO SCALE HORIZONTALLY
- ELEVATIONS BASED ON SURVEY (TO BE COMPLETED)
- MSL - MEAN SEA LEVEL (SITE REFERENCE)

CRISTAL
BALTIMORE, MARYLAND

pH AND DEPTH RELATIONSHIP

DRAWN BY	AMT		
CHECKED BY	MAK	AS SHOWN	
APPROVED BY	mmM		FIGURE 3
DATE	APRIL 2015		

TRC

Palmwood Plaza One,
Suite 350
50 Palmwood Drive
Greenville, SC 29615

Table 2
Sample Description Details
Cristal - Hawkins Point Plant

Sample ID	Depth (ft. below top of sediment)	pH	Sample Material	Color	Odor	Moisture Content	Consistency	Structure	Description
BAL-01	1	6.70	Silt/Gravel	Gray some Brown	None	Dry	Firm	Heterogeneous	80% silt, 20% gravel
	2	3.97	Residual	Gray	None	Dry	Firm	Homogeneous	
	3	2.90	Residual	Gray	None	Moist	Firm	Homogeneous	
	4	4.58	Silt	White	None	Moist	Firm	Homogeneous	
	5	6.05	Silt	Brown to Black	None	Moist	Firm	Homogeneous	
BAL-02	1	7.90	Silt/Sand	White	None	Dry	Firm	Homogeneous	50% silt, 50% fine-grained sand
	2	7.35	Silt/Sand	White	None	Dry	Firm	Homogeneous	50% silt, 50% fine-grained sand
	3	7.42	Residual	Gray to Black	None	Moist	Firm	Homogeneous	
	4	7.57	Residual/Native material	Gray to Black	None	Wet	Firm	Homogeneous	Rock at depth
BAL-03	1	6.02	Silt/Sand	Dark Brown	None	Dry	Firm	Homogeneous	75% silt, 25% fine-grained sand
	2	6.01	Silt/Sand	Dark Brown	None	Dry	Firm	Homogeneous	75% silt, 25% fine-grained sand
	3	3.97	Residual	Dark Brown	None	Moist	Firm	Homogeneous	
	4	4.58	Residual	Dark Brown	None	Moist	Firm	Homogeneous	
	5	4.68	Residual	Brown some Red	None	Wet	Firm	Homogeneous	
BAL-04	1	7.09	Residual	Dark Brown	None	Wet	Very soft	Homogeneous	Gelatinous material
	2	8.12	Residual	Light to dark Gray	None	Wet	Very soft	Heterogeneous	Some medium-grained material, gelatinous
	3	7.90	Residual	Light to dark Gray	None	Wet	Very soft	Heterogeneous	Some medium-grained material, gelatinous
	4	8.57	Residual	Light to dark Gray	None	Wet	Very soft	Heterogeneous	Some medium-grained material, gelatinous
	5	6.58	Residual	Light to dark Gray	None	Wet	Very soft	Heterogeneous	Some medium-grained material, gelatinous
	6	3.82	Residual	Light to dark Gray	None	Wet	Very soft	Homogeneous	Gelatinous material
	7	3.68	Residual	Gray	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous material
	8	3.81	Residual	Gray	Slight Odor	Wet	Very soft	Homogeneous	Some medium-grained material
	9	5.89	Residual	Gray	Slight Odor	Wet	Very soft	Homogeneous	Some medium-grained material
	10	5.70	Residual	Gray	Slight Odor	Wet	Soft	Homogeneous	Some medium-grained material
	11	5.15	Residual	Gray	Slight Odor	Wet	Soft	Homogeneous	Some medium-grained material
	12	3.46	Residual	Gray	None	Moist	Very soft	Homogeneous	
	13	3.33	Residual	Gray	None	Moist	Very soft	Homogeneous	
	14	3.52	Residual	Black	Slight Odor	Moist	Very soft	Homogeneous	
	15	3.47	Residual	Black	Slight Odor	Moist	Very soft	Homogeneous	
	16	3.28	Residual	Black	Strong Odor	Moist	Very soft	Homogeneous	Plastic material
	17	3.21	Residual	Brown	Strong Odor	Moist	Very soft	Homogeneous	Plastic material
BAL-05	1	8.33	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	2	9.12	Residual	Gray	None	Wet	Very soft	Homogeneous	
	3	9.51	Residual	Gray	None	Wet	Very soft	Homogeneous	
	4	9.36	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	5	4.04	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	6	3.57	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	7	3.22	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	8	2.83	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	9	2.85	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	10	2.90	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	11	3.23	Residual	Gray	Slight Odor	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	12	3.13	Residual	Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	13	2.89	Residual	Gray	None	Wet	Soft	Homogeneous	Paste-like material

Table 2
Sample Description Details
Cristal - Hawkins Point Plant

Sample ID	Depth (ft. below top of sediment)	pH	Sample Material	Color	Odor	Moisture Content	Consistency	Structure	Description
BAL-06	1	8.59	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose material
	2	8.60	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose material
	3	8.37	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose material
	4	9.10	Residual	Gray	None	Wet	Very soft	Homogeneous	Slightly firmer material than above
	5	7.78	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Gelatinous material
	6	4.57	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Gelatinous material
	7	4.43	Residual	White to Gray	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous material
	8	5.70	Residual	White to Gray	Slight Odor	Wet	Very soft	Heterogeneous	Thin lamination, fine to coarse-grained material
	9	4.44	Residual	White to Gray	Slight Odor	Wet	Very soft	Homogeneous	Loose and gelatinous material
	10	3.75	Residual	White to Gray	Slight Odor	Wet	Very soft	Homogeneous	Loose and gelatinous material
	11	3.54	Residual	White to Gray	Slight Odor	Wet	Very soft	Homogeneous	Loose and gelatinous material
	12	3.54	Residual	Black	Strong Odor	Wet	Very soft	Homogeneous	
	13	3.31	Residual	Gray	Strong Odor	Wet	Very soft	Heterogeneous	Some medium-grained material
	14	3.40	Residual	Gray	Strong Odor	Wet	Very soft	Heterogeneous	Some medium-grained material
	15	3.21	Residual	Gray	Strong Odor	Wet	Very soft	Heterogeneous	Some medium-grained material
	16	3.22	Peat	Light Brown	Strong Odor	Wet	Soft	Heterogeneous	Some organic matter (roots, grass stalks)
	17	3.43	Peat	Gray	Strong Odor	Moist	Firm	Homogeneous	
	18	3.20	Peat	Gray	Strong Odor	Moist	Firm	Homogeneous	
BAL-07	1	9.42	Residual	Brown	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	2	9.53	Residual	Black	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	3	9.41	Residual	Black	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	4	4.56	Residual	Light Gray	Slight Odor	Wet	Soft	Homogeneous	Gelatinous material
	5	2.96	Residual	Light Gray	Odor	Wet	Soft	Homogeneous	Gelatinous material
	6	4.66	Residual	Light Gray	Odor	Wet	Soft	Homogeneous	Gelatinous material
	7	2.96	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	8	2.94	Residual	Light Gray	Slight Odor	Wet	Very soft	Heterogeneous	Some coarse-grained, paste-like material
	9	3.85	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	10	3.53	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	11	3.08	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	12	2.83	Residual	Light Gray	Slight Odor	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	13	3.19	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	14	2.72	Residual	Light Gray	Slight Odor	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	15	2.02	Residual	Light Gray	Slight Odor	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	16	4.15	Residual	Dark Gray	Slight Odor	Wet	Very soft	Homogeneous	Loose material
	17	6.08	Residual	Dark Gray	Slight Odor	Wet	Very soft	Homogeneous	Loose material
BAL-08	1	9.14	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose and gelatinous material
	2	9.92	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose and gelatinous material
	3	10.30	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose and gelatinous material
	4	9.87	Residual	Black	None	Wet	Very soft	Heterogeneous	Thin lamination, some coarse-grained, gelatinous material
	5	9.22	Residual	Black	None	Wet	Very soft	Heterogeneous	Thin lamination, some coarse-grained, gelatinous material
	6	3.39	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	7	2.81	Residual	Light Gray	None	Wet	Very soft	Heterogeneous	Gelatinous to paste-like material
	8	2.19	Residual	Light Gray	Slight Odor	Moist	Very soft	Homogeneous	
	9	2.75	Residual	Light Gray	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous material
	10	2.49	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Gelatinous material
	11	2.76	Residual/Peat	Light Gray	Strong odor	Wet	Very soft	Heterogeneous	Some organic matter (roots, grass stalks), paste-like material
	12	2.40	Residual/Peat	Light Gray	Strong Odor	Wet	Very soft	Heterogeneous	Paste-like material
	13	2.53	Residual/Peat	Light Gray	Strong odor	Wet	Very soft	Heterogeneous	Some organic matter (roots, grass stalks, sticks), paste-like material
	14	2.86	Residual/Peat	Gray	Strong odor	Moist	Firm	Heterogeneous	Large organic matter (roots, grass stalks)
	15	3.17	Residual/Peat	Gray	Strong odor	Moist	Firm	Heterogeneous	Large organic matter (roots, grass stalks)

Table 2
Sample Description Details
Cristal - Hawkins Point Plant

Sample ID	Depth (ft. below top of sediment)	pH	Sample Material	Color	Odor	Moisture Content	Consistency	Structure	Description
BAL-09	1	9.24	Residual/debris	Brown	None	Wet	Very soft	Heterogeneous	Interbedded organic matter (grass stalks)
	2	9.65	Residual	Black	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous material
	3	6.73	Residual	Gray	None	Wet	Very soft	Homogeneous	Paste-like material
	4	6.51	Residual	Gray	None	Wet	Very soft	Homogeneous	Paste-like material
	5	3.69	Residual	Gray	None	Wet	Very soft	Homogeneous	Paste-like material
	6	3.27	Residual	Light Gray	Slight Odor	Moist	Very soft	Heterogeneous	Thin lamination and paste-like material
	7	3.11	Residual	Light Gray	Slight Odor	Moist	Very soft	Heterogeneous	Thin lamination and paste-like material
	8	2.71	Residual	Light Gray	Slight Odor	Moist	Very soft	Heterogeneous	Thin lamination and paste-like material
	9	2.75	Residual	Light Gray	Slight Odor	Moist	Very soft	Heterogeneous	Thin lamination and paste-like material
	10	2.84	Residual	Black	Strong Odor	Moist	Very soft	Homogeneous	Some fine-grained material
	11	2.54	Sand	Light Gray	Strong Odor	Moist	Very soft	Homogeneous	Well sorted, fine-grained sand
	12	2.73	Clay	Black	Strong Odor	Moist	Soft	Homogeneous	
	13	2.39	Clay	Black	Strong Odor	Moist	Soft	Homogeneous	
	14	3.00	Clay	Black	Strong Odor	Moist	Soft	Homogeneous	
	15	3.34	Clay	Black	Strong Odor	Moist	Soft	Homogeneous	
	16	2.96	Sand	Black	Strong Odor	Moist	Soft	Homogeneous	Fine-grained sand
BAL-10	1	10.21	Residual	Brown	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	2	10.16	Residual	Black	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	3	10.33	Residual	Black	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	4	10.29	Residual	Black	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	5	10.11	Residual	Black	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	6	10.26	Residual	Black	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	7	9.98	Residual	Black	Slight Odor	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	8	5.39	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	9	3.51	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	10	3.18	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	11	3.27	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Gelatinous to paste-like material
	12	2.97	Residual	Light Gray	None	Moist	Very soft	Heterogeneous	Thin lamination
	13	2.81	Residual	Light Gray	None	Moist	Very soft	Heterogeneous	Thin lamination
	14	2.80	Residual	Light Gray	None	Moist	Very soft	Heterogeneous	Thin lamination
	15	2.56	Residual	Light Gray	None	Moist	Very soft	Heterogeneous	Thin lamination
	16	2.43	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Paste-like material
	17	2.72	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Paste-like material
	18	2.38	Residual/Peat	Light Gray	Slight Odor	Wet	Very soft	Heterogeneous	Some organic matter, coarse-grained material
	19	2.51	Residual/Peat	Gray	None	Moist	Very soft	Heterogeneous	Some organic matter, coarse-grained material
	20	2.48	Residual/Peat	Dark Gray	Strong Odor	Moist	Firm	Homogeneous	Clay present
	21	2.87	Residual/Clay	Dark Gray	None	Moist	Firm	Homogeneous	Clay present
	22	3.80	Residual/Clay	Dark Gray	None	Moist	Firm	Homogeneous	Clay present
	23	4.07	Residual/Clay	Dark Gray	None	Moist	Firm	Homogeneous	Clay present
	24	4.03	Residual/Clay	Dark Gray	None	Moist	Firm	Homogeneous	Clay present
	25	4.33	Residual/Clay	Dark Gray	None	Moist	Firm	Homogeneous	Clay present
	26	4.71	Residual/Clay	Dark Gray	Strong odor	Moist	Firm	Homogeneous	Clay present

Table 2
Sample Description Details
Cristal - Hawkins Point Plant

Sample ID	Depth (ft. below top of sediment)	pH	Sample Material	Color	Odor	Moisture Content	Consistency	Structure	Description
BAL-11	1	8.45	Residual	Brown	None	Wet	Very soft	Homogeneous	Fine-grained material
	2	9.15	Residual	Brown	None	Wet	Very soft	Homogeneous	Fine-grained material
	3	9.98	Residual	Black	None	Wet	Very soft	Homogeneous	
	4	10.04	Residual	Black	None	Wet	Very soft	Homogeneous	
	5	9.98	Residual	Black	None	Wet	Very soft	Homogeneous	
	6	9.88	Residual	Black	None	Wet	Very soft	Homogeneous	Gelatinous material
	7	3.26	Residual	White to Gray	Strong odor	Wet	Very soft	Homogeneous	Sulfur odor, paste-like material
	8	3.13	Residual	White to Gray	Strong odor	Wet	Very soft	Homogeneous	Sulfur odor, paste-like material
	9	2.73	Residual	White to Gray	Strong odor	Wet	Very soft	Homogeneous	Sulfur odor, paste-like material
	10	3.90	Residual	White to Gray	Strong odor	Wet	Very soft	Homogeneous	Sulfur odor, paste-like material
	11	2.48	Residual	White to Gray	None	Wet	Very soft	Homogeneous	
	12	2.70	Residual	White to Gray	None	Wet	Very soft	Heterogeneous	Thin lamination, medium to coarse-grained material
	13	2.89	Residual	White to Gray	None	Wet	Very soft	Heterogeneous	Thin lamination, medium to coarse-grained material
	14	2.42	Residual	Black	None	Wet	Very soft	Homogeneous	Loose, medium to coarse-grained material
	15	2.36	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Loose, medium to coarse-grained material
	16	2.35	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Loose, medium to coarse-grained material
	17	2.60	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Loose, medium to coarse-grained material
	18	2.42	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Loose, medium to coarse-grained material
	19	2.71	Residual	Black	Strong Odor	Moist	Firm	Homogeneous	Fine-grained material
	20	3.24	Residual/Clay	Black	Strong Odor	Moist	Firm	Homogeneous	Clay to fine-grained material
	21	3.79	Clay	Gray	Strong Odor	Moist	Firm	Homogeneous	
	22	4.37	Clay	Gray	Strong Odor	Moist	Firm	Homogeneous	
	23	5.32	Clay	Black	Strong Odor	Moist	Firm	Homogeneous	
BAL-14	1	9.58	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material
	2	9.80	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	3	9.52	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	4	9.96	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	5	9.94	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	6	9.71	Residual	Black	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	7	9.32	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	8	8.31	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	9	3.86	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	10	3.60	Residual	White to Gray	None	Wet	Very soft	Homogeneous	Fine to coarse-grained material, gelatinous to paste-like material
	11	3.34	Residual	White to Gray	None	Moist	Very soft	Heterogeneous	Thin lamination, friable material
	12	5.56	Residual	White to Gray	None	Moist	Very soft	Heterogeneous	Thin lamination, friable material
	13	2.94	Residual	White to Gray	None	Moist	Very soft	Heterogeneous	Thin lamination, friable material
	14	2.37	Residual	Tan	None	Moist	Very soft	Homogeneous	
	15	2.16	Residual	Tan	None	Moist	Very soft	Homogeneous	
	16	2.09	Residual/Peat	Tan	None	Wet	Very soft	Heterogeneous	Some organic matter
	17	2.22	Residual/Peat	Black	Slight Odor	Moist	Firm	Homogeneous	Some organic matter and clay
	18	2.04	Residual/Peat	Black	Slight Odor	Moist	Firm	Homogeneous	Some organic matter and clay
	19	2.31	Residual/Peat	Black	Slight Odor	Moist	Firm	Homogeneous	Some organic matter and clay
	20	2.16	Residual/Peat	Black	Slight Odor	Moist	Firm	Homogeneous	Some organic matter and clay
	21	2.73	Residual	Gray	Slight Odor	Moist	Firm	Homogeneous	
	22	3.48	Residual	Gray	Slight Odor	Moist	Firm	Homogeneous	
	23	3.46	Residual	Gray	Slight Odor	Moist	Firm	Homogeneous	
	24	3.66	Sand	Black	Slight Odor	Moist	Soft	Homogeneous	Fine to medium-grained material

Table 2
Sample Description Details
Cristal - Hawkins Point Plant

Sample ID	Depth (ft. below top of sediment)	pH	Sample Material	Color	Odor	Moisture Content	Consistency	Structure	Description
LSB-01	1	8.17	Residual	Brown	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	2	8.08	Residual	Brown	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	3	7.53	Residual	Brown	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	4	8.69	Residual	Brown	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	5	9.00	Residual	Black	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	6	9.04	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	7	9.09	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	8	8.38	Residual	Light Gray	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	9	8.16	Residual	Dark Gray	None	Wet	Very soft	Homogeneous	Sticky, paste-like material
	10	5.45	Residual	Light Gray	None	Wet	Soft	Homogeneous	
	11	4.54	Residual	Light Gray	None	Wet	Soft	Homogeneous	
	12	3.82	Silt	White	None	Wet	Very soft	Homogeneous	Black grains present
	13	3.24	Silt	Light Gray	None	Wet	Very soft	Homogeneous	Black grains present
	14	3.40	Peat	Light Gray to Gray	None	Wet	Very soft	Heterogeneous	Organic matter (sticks, stalks, 2-inches in length)
	15	3.30	Clay	Dark Gray	None	Moist	Firm	Homogeneous	
	16	3.58	Clay	Dark Gray	None	Moist	Firm	Homogeneous	
	17	3.71	Clay	Light Gray	None	Moist	Soft	Homogeneous	Paste-like material
	18	4.39	Clay	Dark Gray	None	Moist	Soft	Homogeneous	Paste-like material
	19	5.37	Clay	Dark Gray	None	Moist	Soft	Homogeneous	
	20	5.32	Clay	Dark Gray	None	Moist	Soft	Homogeneous	
	21	5.58	Clay	Dark Gray	None	Moist	Soft	Homogeneous	
	22	5.71	Clay	Dark Gray	None	Moist	Soft	Homogeneous	
	23	6.81	Clay	Dark Gray	None	Moist	Soft	Homogeneous	
	24	7.42	Peat	Brown	None	Moist	Soft	Heterogeneous	Organic matter present
LSB-02	1	7.61	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	2	8.54	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	3	9.74	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	4	8.29	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	5	8.47	Residual	Brown	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	6	8.23	Residual	Black	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	7	8.18	Residual	Black	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	8	8.35	Residual	Black	None	Wet	Very soft	Homogeneous	Loose, gelatinous material
	9	5.56	Clay	Light Gray	None	Wet	Very soft	Homogeneous	Sticky material
	10	4.61	Clay	Light Gray	None	Wet	Very soft	Homogeneous	Sticky material
	11	3.70	Clay	Light Gray	None	Wet	Very soft	Homogeneous	Sticky material
	12	3.58	Clay	Light Gray	None	Wet	Very soft	Homogeneous	Sticky material
	13	3.70	Silt	White	None	Wet	Very soft	Homogeneous	Some black fine-grained material
	14	3.40	Clay	Dark Gray	None	Wet	Very soft	Heterogeneous	Some organic matter present
	15	3.44	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Plastic material
	16	3.83	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Plastic material
	17	3.47	Peat	Black to Brown	Slight Odor	Wet	Very soft	Heterogeneous	100% organic matter
	18	3.70	Clay	Dark Gray	None	Wet	Very soft	Heterogeneous	Sticky material, some organic matter present
	19	4.09	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Sticky material
	20	5.10	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Sticky material
	21	5.47	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Sticky material
	22	5.56	Clay	Dark Gray	None	Wet	Very soft	Homogeneous	Sticky material

Table 3
Analytical Summary Table
Cristal - Hawkins Point Plant

BORING NO.	DEPTH[2]	PARAMETER[1]							
		ARSENIC	BARIUM	CADMIUM	CHROMIUM	IRON	LEAD	MANGANESE	SELENIUM
BAL-01	1	3.2 j-	60	<0.30	32	5900	260	280 j+	<1.2 uj
	3	3.4	59	<0.29	35	2900	390	30	<1.2
	5	2.3	71	1.2	130	9400	150	39	<1.1
BAL-02	1	2.5	25	<0.34	94	1900	22	40	<1.4
	3	<0.86	56	<0.29	21	2200	370	90	<1.1
BAL-03	1	5.4	170	<0.28	34	18000	200	85	<1.1
	3	4.3	170	<0.29	30	19000	270	79	<1.2
	5	7.4	180	<0.31	43	31000	260	90	<1.2
BAL-04	1	<3.3	150	<22	1500	180000	<2.2	32000	9.4
	3	<3.9	120	<26	1600	190000	9.0	29000	9.4
	5	<1.3	1200	<0.42	90	5000	1500	170	<1.7
	7	6.1	980	<0.76	89	26000	1300	840	<3.0
	9	4.7	2000	<0.64	64	46000	1600	1700	<2.5
	11	<1.3	590	<0.43	19	6900	530	240	<1.7
	13	<1.1	930	<0.38	30	11000	640	320	<1.5
	13 (DU-150402)	4.6	1200	<0.46	47	15000	760	480	<1.8
	15	1.0	130	<0.33	59	9200	340	280	<1.3
	17	3.9	1100	0.64	76	26000	640	810	<2.1
BAL-05	1	<32	170	<11	1700	86000	<21	22000	<42
	3	<2.1	66	<14	110	9600	<1.4	930	<55
	5	1.7	710	<0.42	29	1900	750	35	<1.7
	7	3.2	1100	<0.46	66	3700	1500	110	<1.8
	9	12	1500	<0.81	140	21000	1600	560	<3.2
	11	12	2100	<0.52	130	12000	1300	460	<2.1
	13	4.2	2600	1.1	330	12000	2000	470	<1.8
BAL-06	1	<33	150	<11	1600	150000	<22	32000	12
	3	<32	150	<11	1900	180000	<21	28000	10
	5	<1.3	880	<0.43	28	2600	1100	100	<1.7
	7	10	1500	<0.81	91	24000	1900	540	<3.2
	9	14	1100	<0.87	430	35000	880	890	<3.5
	11	3.4	1400	<0.45	230	15000	1100	400	<1.8
	13	1.9	1900	<0.47	32	21000	1300	600	<1.9
	15	4.0	570	<0.43	46	15000	880	450	<1.7
	17	7.3	100	<0.44	58	19000	130	490	2.2
BAL-07	1	<2.2	61	<0.73	150	18000	<1.5	1300	<58
	3	<1.9	56	<0.64	70	7100	<1.3	770	<51
	5	<1.7	1900	<0.55	78	1900	2400	58	<44
	7	1.6	2100	<11	63	4300	2300	220	<43
	9	15	1500	<16	110	25000	1200	810	<65
	11	3.2	2100	<12	190	14000	1400	510	<47
	13	<7.9	2800	<11	51	15000	2700	530	<42
	15	4.1	2000	<10	49	14000	1400	490	<42
	17	3.3	1600	<12	130	12000	1200	730	<49
BAL-08	1	<31	170	<10	3300 j	250000	<21	35000	<83
	3	<33	140	<11	2000	170000	<22	28000	<89
	5	<5.2	24	<1.7	470	29000	<3.5	950	<140
	7	<2.0	2300	<0.66	110	6800	2100	160	<52
	9	2.6	1400	0.91	42	14000	1800	570	<38
	11	5.0	1900	<0.63	53	21000	1600	760	<50
	13	1.9	720	<0.53	95	20000	1100	700	<42
	15	60	63	1.2	120	31000	600	550	<35
BAL-09	1	<2.2	56	<0.74	230	22000	10	1700	6.8
	3	11	220	<0.50	14	510	520	74	<2.0
	5	<1.9	1400	<0.64	30	1400	2000	18	<2.6
	7	2.9	800	<0.82	24	2300	840	13	<3.3
	9	<1.8	2900	<0.61	40	3400	2500	14	<2.4
	11	2.5 j	27 j	<0.33	2.9	330	43 j	9.7	<1.3
	11 (DU-150403)	1.7	11 j	<0.30	3.8	240	14 j	6.3	<1.2
	13	24	87	<0.40	53	2600	150	41	2.9
	15	18	60	0.51	240	33000	47	480	<1.6
BAL-10	1	<2.1	59	<0.71	89	8800	5.8	780	4.3
	3	<2.4	61	<0.81	150	11000	7.0	780	<3.2
	5	<3.5	170	<1.2	330	27000	12	1800	13
	5 (DU-150404)	<3.1	200	<1.0	350	27000	<2.1	2000	11
	7	<4.1	63	<1.4	230	18000	9.0	1100	<5.4
	9	10	780	<0.58	18	430	1400	7.3	<2.3
	11	<1.7	1000	<0.56	49	4400	1900	18	<2.2
	13	13 j-	1800	<1.0	18	2300	730 j	31	<4.1 j-
	15	6.7	820	<0.93	35	2500	1000	45	<3.7

Table 3
Analytical Summary Table
Cristal - Hawkins Point Plant

BORING NO.	DEPTH[2]	PARAMETER[1]							
		ARSENIC	BARIUM	CADMIUM	CHROMIUM	IRON	LEAD	MANGANESE	SELENIUM
BAL-10 (cont.)	17	<1.8	3200	<0.62	65	3400	2500	34	<2.5
	19	<1.3	150	<0.44	69	5800	250	130	<1.8
	21	23	65	<0.38	150	13000	77	270	<1.5
	23	16	35	0.93	57	34000	25	720	1.7
	25	12	47	<0.41	47	38000	33	940	<1.6
BAL-11	1	<3.2	160	<54	2000	220000	<2.2	37000	11
	3	<3.2	100	<1.1	170	18000	<2.2	1300	5.9
	5	<3.0	80	<1.0	120	11000	<2.0	1000	<4.0
	7	<1.8	890	<0.59	23	740	810	14	<2.4
	9	<1.9	1800	<0.62	45	4600	2400	45	<2.5
	11	11	740	<0.83	20	2300	750	31	<3.3
	13	10	680 j	<0.83	21	2100	460 j	35	<3.3
	13 (DU-150401)	2.6	1800 j	<0.71	30	2500	1200 j	20	<2.8
	15	<1.8	2300	<0.59	75	4700	1700	68	<2.3
	17	<1.5	1000	<0.49	68	13000	860	450	<2.0
	19	40	72	0.83	36	20000	160	350	3.8
	21	9.7	54	<0.45	64	43000	25	1000	<1.8
	23	12	40	<0.38	37	36000	28	1300	<1.5
BAL-14	1	<2.8	110	<0.94	150	14000	<1.9	1000	<3.7
	3	<4.1	220	<1.4	250	20000	<2.7	2000	8.5
	5	<3.6 uj	150	<1.2	160	13000	<2.4	1100 j+	4.8
	7	<3.4	93	<1.1	210	19000	<2.3	1900	4.6
	9	<1.9	1800	<0.62	23	1100	1900	16	<2.5
	11	9.6	210	<1.1	9.6	620	470	21	<4.6
	13	11	470	<0.54	22	1300	370	7.0	<2.2
	15	<1.9	1200	<0.63	61	5700	950	9.3	<2.5
	17	34	170	<0.42	26	6100	290	110	1.8
	19	12	88	<0.41	32	11000	72	230	<1.6
	21	12	44	<0.37	85	12000	32	200	<1.5
	23	11	29	<0.33	66	26000	21	410	<1.3
LSB-01	1	<52	190	<1.7	2900	130000	<3.5	35000	13
	3	<37	110	<1.2	1400	100000	<2.5	10000	<5.0
	5	<39	64	<13	2400	170000	<13	32000	11
	7	<35	110	<12	2700	180000	<12	33000	12
	7 (DU-150405)	<40	120	1.5	3000	120000	<2.7	32000	11
	9	<34	99	1.2	2500	100000	6.0	28000	9.1
	11	4.4	40	<0.47	140	1800	38	100	<1.9
	13	6.2	27	<0.51	50	3600	30	130	<2.0
	15	61	87	1.9	170	15000	220	280	4.6
	17	9.2	31	<0.43	56	15000	26	360	<1.7
	19	13	59	<0.48	59	45000	30	1700	<1.9
	21	17	61	<0.47	61	43000	28	2200	2.4
	23	15	49	<0.41	51	30000	31	1100	<1.6
LSB-02	1	<26	190	<8.6	2900	220000	5.2	18000	8.5
	3	<18	140	<6.0	2400	190000	<12	16000	5.5
	5	<46	140	<1.5	3000	130000	<3.0	34000	13
	7	<41	110	<14	4300	230000	<14	42000	14
	9	4.4	59	<0.53	600	13000	42	1500	<2.1
	11	3.6	45	<0.49	110	780	50	83	<1.9
	13	<1.7	3.8	<0.57	9.7	1500	23	99	<2.3
	15	34	48	<0.38	140	17000	200	160	5.3
	17	84	50	2.0	640	36000	180	440	<4.4
	19	17	56	<0.50	66	37000	44	700	<2.0
	21	17	57	<0.51	67	47000	38	1800	<2.1

[1] Analytical results are reported in milligrams per kilogram (mg/kg).
[2] Feet below top of sediment.
< - Concentration less than the Quantitation Limit or not validated if accompanied by a "u" qualifier.
j - Concentration considered an estimate based on data validation.
j+ - Concentration considered an estimate biased high based on data validation.
j- - Concentration considered an estimate biased low based on data validation.
uj - Not detected; quantitation limit may be inaccurate or imprecise.
Bold indicates constituent detection.

C. Authorized Wastes for the 65-Acre Parcel:

The 65-acre parcel of the landfill may only accept coal combustion by product wastes generated from Brandon Shores, H.A. Wagner, and Crane energy production plants.

D. Authorized Wastes for the 30-Acre Parcel:

1. The 30-acre parcel of the landfill may accept the following wastes generated at the Hawkins Point Plant located at 3901 Fort Armistead Road, Baltimore, Maryland:

   i. Primary gypsum-sulfate process;

   ii. Secondary gypsum-sulfate process;

   iii. Lagoon dredging/chloride process solids-chloride process;

   iv. Neutralized batch mud-sulfate process;

   v. Miscellaneous-calciner brick, excavated soil from plant construction and maintenance, etc.,

   vi. Dewatered dredged solids from the chloride process settling basins;

   vii. Refractory brick and brick solids from the calciner kilns, batch attack vessels, and chlorinators;

   viii. Settled solids from the settling basins on the landfill;

   ix. Batch attack mud;

   x. Batch attack vessel refractory brick and brick solids;

   xi. Chlorinator refractory brick and brick solids;

   xii. Excavated soil, clay and rubble;

   xiii. Residual magnesium hydroxide, sodium hydroxide;

   xiv. Unreacted ore residues from the batch attack process;

   xv. Chlorinator bed material;

xvi. Lime grit; Process refractory;

xvii. Titanium oxide/sand mill wastes;

xviii. Sandblast material

xix. Silica wastes; and

xx. Road asphalt.

2. Third party waste that is compatible to the waste stream generated by the Hawkins Point Plant may be accepted at the 30-acre parcel. This waste stream shall be non-hazardous industrial waste or waste excluded from RCRA Subtitle C regulation under 40 CFR§261.4(b)(7).

3. If the permittee desires to dispose of any waste other than the authorized wastes, the permittee shall submit a written request to the Department for authorization to dispose of the waste, including a complete waste characterization. The Department shall respond to the permittee's request in a timely manner. The permittee shall not accept any waste material for which such a request is made until it receives written authorization from the Department.

E. Waste Characterization for the 30-Acre Parcel:

1. Third party waste described in Part II D.2 shall be sampled and analyzed in accordance with EPA approved Toxicity Characteristic Leaching Procedure (TCLP) and the EPA Publication SW-846 prior to disposal.

2. The permittee shall give notice to the Department of changes to the operation at the plant, which may affect the chemical characteristic of the authorized wastes. In the event of such changes, the permittee shall re-characterize the waste as specified in D.3, and submit the characterization data to the Department for a written authorization prior to the disposal at the landfill.

3. All data on waste characterization including routine daily waste analyses shall be kept in a logbook on-site. The logbook shall be available for inspection by the Department representative at all times during the operating hours of the landfill.

Appendix C

Soil Boring Logs

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SOIL BORING LOG		HOLE NUMBER AN-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near Maintenance Building in the northwestern portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 8:35	13. DATE AND TIME COMPLETED 4/6/15 8:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 13'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (AN-01 1-3) and 11 to 13 feet below grade (AN-01 11-13)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt and gravel	0.0	0-2'	AN-01 1-3 (one 8 oz. soil jar and encores)		90%	*No visual evidence of staining or odor observed*
	1-3'	Red-brown fine SAND	0.0	2-4'				
	3-4'	Tan fine SAND						
	4-5'	Red-brown medium-fine SAND, moist	0.0	4-6'				
	5-7'	Red-brown medium-fine SAND, moist	0.0	6-8'			75%	*No visual evidence of staining or odor observed*
	7-8'	Tan silty CLAY						
	8-9'	Red fine SAND, moist	0.0	8-10'				
	9-10'	Red and white CLAY						
	10-11'	Light red medium-fine SAND, moist	0.0	10-12'	AN-01 11-13 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	11-13'	Tan sandy CLAY, moist	0.0	12-14'				
	13-14'	Brown medium-fine SAND, wet						
	14-15'	Red medium-fine SAND, wet	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-01

SOIL BORING LOG		HOLE NUMBER AN-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near 0003 Sump in the northwestern portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 9:05	13. DATE AND TIME COMPLETED 4/6/15 9:25	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1.5 to 3.5 feet below grade (AN-02 1.5-3.5) and 8 to 10 feet below grade (AN-02 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	FILL (Red-brown medium fine SAND)	1.3	0-2'				
	0.5-1.5'	FILL (Concrete and gravel)						
	1.5-5'	Red-brown fine SAND	0.4	2-4'	AN-02 1.5-3.5 (one 8 oz. soil jar and encores); DUP-10		50%	*No visual evidence of staining or odor observed*
			0.5	4-6'				
	5-7'	Red-brown fine SAND	0.5	6-8'			75%	*No visual evidence of staining or odor observed*
	7-10'	Red medium-fine SAND, moist 8 to 10 feet	0.8	8-10'	AN-02 8-10 (one 8 oz. soil jar and encores); MS/MSD-05			
	10-14'	Red medium-fine SAND, wet	1.2	10-12'			75%	*No visual evidence of staining or odor observed*
			1.4	12-14'				
	14-14.5'	Tan and red CLAY						
	14.5-15'	Brown medium-fine SAND	1.5	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-02

SOIL BORING LOG		HOLE NUMBER AN-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near blue garage in the western portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 7:40	13. DATE AND TIME COMPLETED 4/6/15 8:00	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 11'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (AN-03 1-3) and 9 to 11 feet below grade (AN-03 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt	0.0	0-2'	AN-03 1-3 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	1-5'	Red-brown CLAY with line of black sand at 4.5 feet	0.0	2-4'				
			0.0	4-6'				
	5-7'	Brown CLAY, moist	0.0	6-8'			100%	*No visual evidence of staining or odor observed*
	7-10'	Red-brown fine SAND, moist	0.0	8-10'				
	10-11'	Red-brown fine SAND, moist	0.0	10-12'	AN-03 9-11 (one 8 oz. soil jar and encores)		100%	*No visual evidence of staining or odor observed*
	11-12'	Red-brown sandy CLAY, wet						
	12-15'	Light tan silty CLAY, moist	0.0	12-14'				
			0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT: CRISTAL USA FACILITY	HOLE NO.: AN-03

SOIL BORING LOG		HOLE NUMBER AN-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Concrete - Near diesel and gasoline aboveground storage tanks in the central portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 8:05	13. DATE AND TIME COMPLETED 4/6/15 8:20	
14. OVERBURDEN THICKNESS >13'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 13'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-04 0-2) and 6 to 8 feet below grade (AN-04 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Concrete and gravel	0.0	0-2'	AN-04 0-2 (one 8 oz. soil jar and encores)		100%	*No visual evidence of staining or odor observed*
	0.5-3'	Brown sandy CLAY, wet						
	3-4'	Red-brown fine SAND	0.0	2-4'				
	4-4.5'	Red and white CLAY						
	4.5-5'	Brown and red fine SAND	0.0	4-6'				
	5-8'	Red fine SAND	0.0	6-8'	AN-04 6-8 (one 8 oz. soil jar and encores)		50%	*No visual evidence of staining or odor observed*
	8-10'	Tan fine SAND, wet	0.0	8-10'				
	10-12'	Red fine SAND, moist	0.0	10-12'			50%	*No visual evidence of staining or odor observed*
	12-13'	Tan fine SAND, moist	0.0	12-13'				
		Borehole terminated at 13 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-04

SOIL BORING LOG		HOLE NUMBER AN-05	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - On hill in the northern portion of the PWAN/SWAN Area located near the large aboveground storage tanks		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 9:35	13. DATE AND TIME COMPLETED 4/6/15 9:55	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-05 0-2) and 13 to 15 feet below grade (AN-05 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Red medium-fine SAND and gravel	1.1	0-2'	AN-05 0-2 (one 8 oz. soil jar and encores)		60%	*No visual evidence of staining or odor observed*
	0.5-5'	Red fine SAND	1.0	2-4'				
			0.9	4-6'				
	5-9'	Red fine SAND	1.0	6-8'			60%	*No visual evidence of staining or odor observed*
			1.7	8-10'				
	9-10'	Red-orange fine SAND	0.9	10-12'				
	10-15'	Red-orange fine SAND	1.0	12-14'			60%	*No visual evidence of staining or odor observed*
			1.1	14-15'	AN-05 13-15 (one 8 oz. soil jar and encores)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-05

SOIL BORING LOG		HOLE NUMBER AN-06	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Roadway north of the Maintenance Building and along the northern property fence in the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 10:30	13. DATE AND TIME COMPLETED 4/6/15 10:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 13'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-06 0-2) and 11 to 13 feet below grade (AN-06 11-13)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND with little gravel	1.8	0-2'	AN-06 0-2 (one 8 oz. soil jar and encores)		60%	*No visual evidence of staining or odor observed*
	0.5-4'	Dark brown medium-fine SAND	0.9	2-4'				
	4-5'	Light red fine SAND	1.3	4-6'				
	5-9'	Light red fine SAND	1.4	6-8'			75%	*No visual evidence of staining or odor observed*
			0.7	8-10'				
	9-10'	Red coarse SAND with little gravel						
	10-11'	Red coarse SAND with little gravel	0.8	10-12'	AN-06 11-13 (one 8 oz. soil jar and encores)		60%	*No visual evidence of staining or odor observed*
	11-13'	Brown coarse SAND, moist	0.7	12-14'				
	13-15'	Red medium-fine SAND, wet	0.8	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-06

SOIL BORING LOG		HOLE NUMBER AN-07	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Near 10,800-gallon weak acid aboveground storage tank in the southern portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 13:35	13. DATE AND TIME COMPLETED 4/6/15 13:55	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 12'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-07 0-2) and 10 to 12 feet below grade (AN-07 10-12)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown CLAY	0.2	0-2'	AN-07 0-2 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-2'	Brown sandy CLAY						
	2-4'	Brown CLAY	0.6	2-4'				
	4-5'	Brown medium-fine SAND	0.9	4-6'				
	5-7'	Brown CLAY	1.2	6-8'			75%	*No visual evidence of staining or odor observed*
	7-9'	Gray-brown CLAY, moist	1.3	8-10'				
	9-10'	Red-brown sandy CLAY, moist						
	10-12'	Gray-brown medium-fine SAND, wet	1.0	10-12'	AN-07 10-12 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	12-13'	Brown medium-fine SAND, saturated	1.2	12-14'				
	13-14'	Brown sandy CLAY, moist						
	14-15'	Gray CLAY, moist	1.4	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-07

SOIL BORING LOG		HOLE NUMBER AN-08	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Along the southern portion of the large aboveground storage tanks in the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 12:55	13. DATE AND TIME COMPLETED 4/6/15 13:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 15'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-08 0-2) and 13 to 15 feet below grade (AN-08 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE / IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	Red-brown CLAY	0.4 2.0 0.8	0-2' 2-4' 4-6'	AN-08 0-2 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	5-10'	Red-brown CLAY, moist from 7 to 10 feet	0.9 0.7	6-8' 8-10'			50%	*No visual evidence of staining or odor observed*
	10-11'	Red-brown CLAY, moist	1.1	10-12'			50%	*No visual evidence of staining or odor observed*
	11-12'	Gray silty CLAY, moist						
	12-14.5'	Gray-brown CLAY, moist	1.7	12-14'				
	14.5-15'	Red-brown medium-fine SAND, wet at base	1.0	14-15'	AN-08 13-15 (one 8 oz. soil jar and encores)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-08

SOIL BORING LOG		HOLE NUMBER AN-09	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Western berm along the large aboveground storage tanks containment in the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 10:05	13. DATE AND TIME COMPLETED 4/6/15 10:25	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-09 0-2) and 13 to 15 feet below grade (AN-09 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Light brown fine SAND	1.1	0-2'	AN-09 0-2 (one 8 oz. soil jar and encores)		75%	*No visual evidence of staining or odor observed*
	1-4'	Red coarse SAND and gravel	1.2	2-4'				
	4-5'	Tan silty CLAY	1.4	4-6'				
	5-10'	Tan silty CLAY	1.1	6-8'			90%	*No visual evidence of staining or odor observed*
			1.5	8-10'				
	10-12'	Tan silty CLAY	2.0	10-12'			100%	*No visual evidence of staining or odor observed*
	12-15'	Tan fine SAND, moist	1.5	12-14'	AN-09 13-15 (one 8 oz. soil jar and encores)			
			1.5	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-09

SOIL BORING LOG		HOLE NUMBER AN-10	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Near prior large aboveground storage tank in the northeastern portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 11:30	13. DATE AND TIME COMPLETED 4/6/15 11:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 11'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-10 0-2) and 9 to 11 feet below grade (AN-10 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	0.9	0-2'	AN-10 0-2 (one 8 oz. soil jar and encores)		60%	*No visual evidence of staining or odor observed*
	0.5-2'	Red CLAY	1.1	2-4'				
	2-5'	Red-brown medium-fine SAND	1.2	4-6'				
	5-10'	Red-brown medium-fine SAND, moist at base	1.0	6-8'			60%	*No visual evidence of staining or odor observed*
			0.8	8-10'				
	10-11'	Red-brown medium-fine SAND	0.6	10-12'	AN-10 9-11 (one 8 oz. soil jar and encores); DUP-11		75%	*No visual evidence of staining or odor observed*
	11-13'	Dark brown coarse SAND, saturated	1.0	12-14'				
	13-15'	Brown medium-fine SAND, wet	1.4	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-10

SOIL BORING LOG		HOLE NUMBER AN-11	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Southeast of the large aboveground storage tanks and along the southern boundary of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 12:35	13. DATE AND TIME COMPLETED 4/6/15 12:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-11 0-2) and 8 to 10 feet below grade (AN-11 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown silty CLAY	1.4	0-2'	AN-11 0-2 (one 8 oz. soil jar and encores)		100%	*No visual evidence of staining or odor observed*
	1-1.5'	Tan silty CLAY, wet	1.7	2-4'				
	1.5-5'	Brown-red CLAY	2.2	4-6'				
	5-10'	Brown-red CLAY, moist	2.1	6-8'			50%	*No visual evidence of staining or odor observed*
			0.9	8-10'	AN-11 8-10 (one 8 oz. soil jar and encores)			
	10-13'	Brown-red CLAY, wet 10 to 11 feet, moist 11 to 13 feet	1.0	10-12'			75%	*No visual evidence of staining or odor observed*
			0.6	12-14'				
	13-15'	Brown CLAY, moist	0.6	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-11

SOIL BORING LOG		HOLE NUMBER AN-12	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - road along the shoreline and eastern boundary of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 11:55	13. DATE AND TIME COMPLETED 4/6/15 12:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-12 0-2) and 13 to 15 feet below grade (AN-12 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	Brown CLAY	1.4	0-2'	AN-12 0-2 (one 8 oz. soil jar and encores)		90%	*No visual evidence of staining or odor observed*
			1.6	2-4'				
			1.6	4-6'				
	5-10'	Gray-brown CLAY	1.2	6-8'			50%	*No visual evidence of staining or odor observed*
			1.0	8-10'				
	10-14.5'	Gray-brown CLAY	1.8	10-12'			60%	*No visual evidence of staining or odor observed*
			0.5	12-14'				
	14.5-15'	Brown coarse SAND	0.6	14-15'	AN-12 13-15 (one 8 oz. soil jar and encores)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-12

SOIL BORING LOG		HOLE NUMBER AN-13	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Pier in the northeastern portion of the PWAN/SWAN Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/6/15 11:05	13. DATE AND TIME COMPLETED 4/6/15 11:20	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (AN-13 0-2) and 4 to 6 feet below grade (AN-13 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND	0.7	0-2'	AN-13 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-2'	Red medium-fine SAND						
	2-5'	Brown fine SAND	0.9	2-4'				
			1.0	4-6'				
	5-9'	Brown fine SAND, saturated from 6 to 9 feet	1.1	6-8'	AN-13 4-6 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	9-10'	Red fine SAND, saturated	2.0	8-10'				
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface			Collected AN-01 to AN-13 COMP from surface soil of AN-01 to AN-13 soil borings (one 4 oz. soil jar)			

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	AN-13

SOIL BORING LOG		HOLE NUMBER OWS-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Northern end of the oil/water seperator located west of the prior Air Compressor Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 11:40	13. DATE AND TIME COMPLETED 3/31/15 12:05	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (OWS-01 0-2) and 13 to 15 feet below grade (OWS-01 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	1.3	0-2'	OWS-01 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Red and brown CLAY	1.4	2-4'				
			2.3	4-6'				
	5-9'	Red and brown CLAY	2.0	6-8'			100%	*No visual evidence of staining or odor observed*
			2.2	8-10'				
	9-10'	Red and brown CLAY	1.6	10-12'			100%	*No visual evidence of staining or odor observed*
	10-12'	Red and white mottled CLAY						
	12-15'	Red and white mottled CLAY, moist at base	1.7	12-14'	OWS-01 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			1.1	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	**OWS-01**

SOIL BORING LOG		HOLE NUMBER OWS-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Northeast of the oil/water seperator located west of the prior Air Compressor Building and near the water discharge pipe		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 12:10	13. DATE AND TIME COMPLETED 3/31/15 12:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 13'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (OWS-02 0-2) and 11 to 13 feet below grade (OWS-02 11-13)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-4'	Tan and red CLAY	0.9	0-2'	OWS-02 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
			1.1	2-4'				
	4-5'	Light brown fine SAND	1.2	4-6'				
	5-6'	Light brown fine SAND						
	6-10'	Red and white CLAY	0.7	6-8'			100%	*No visual evidence of staining or odor observed*
			0.6	8-10'				
	10-10.5'	Red and white CLAY	0.4	10-12'				
	10.5-15'	Gray fine SAND, wet 13 to 15 feet	0.2	12-14'	OWS-02 11-13 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			0.1	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	OWS-02

SOIL BORING LOG		HOLE NUMBER OWS-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Southwestern corner of the oil/water seperator located west of the prior Air Compressor Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 10:05	13. DATE AND TIME COMPLETED 3/31/15 10:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (OWS-03 0-2) and 13 to 15 feet below grade (OWS-03 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	0.8	0-2'	OWS-03 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*Slight solvent odor from 3 to 5 feet; no staining observed*
	0.5-5'	Red transitioning to red and brown CLAY; little gravel at 1.5 feet	1.2	2-4'				
			1.0	4-6'				
	5-7'	Red and white CLAY	1.1	6-8'			100%	*No visual evidence of staining or odor observed*
	7-8'	Dark red CLAY						
	8-9'	Dark red CLAY	1.0	8-10'			100%	*No visual evidence of staining or odor observed*
	9-12'	Tan and red CLAY	1.1	10-12'				
	12-15'	Tan and red CLAY	0.7	12-14'	OWS-03 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores); DUP-03		100%	*No visual evidence of staining or odor observed*
			1.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	OWS-03

SOIL BORING LOG		HOLE NUMBER OWS-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Southeastern corner of the oil/water seperator located west of the prior Air Compressor Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 10:35	13. DATE AND TIME COMPLETED 3/31/15 10:55	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (OWS-04 0-2) and 13 to 15 feet below grade (OWS-04 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE Cuttings	IF NOT A WELL, BACKFILLED WITH:	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	1.6	0-2'	OWS-04 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Red transitioning to white and red CLAY; little gravel at 1.5 feet	2.3	2-4'				
			1.5	4-6'				
	5-7'	Red and brown CLAY	2.0	6-8'			100%	*No visual evidence of staining or odor observed*
	7-9'	Dark red CLAY	2.2	8-10'				
	9-10'	Dark red CLAY	1.9	10-12'			100%	*No visual evidence of staining or odor observed*
	10-11'	Gray and red CLAY						
	11-12'	Gray sandy CLAY						
	12-13'	Gray sandy CLAY	1.6	12-14'			100%	*No visual evidence of staining or odor observed*
	13-15'	Gray fine SAND, moist	1.4	14-15'	OWS-04 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	OWS-04

SOIL BORING LOG		HOLE NUMBER SS-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Southwestern portion of the Spent Solvent Stoage Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 10:50	13. DATE AND TIME COMPLETED 4/2/15 11:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SS-01 0-2) and 6 to 8 feet below grade (SS-01 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Concrete	1.7	0-2'	SS-01 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	1-5'	Brown fine SAND with little gravel	1.5	2-4'				
			1.8	4-6'				
	5-9'	Brown fine SAND with little gravel, wet at 8 feet	1.3	6-8'	SS-01 6-8 (one 8 oz. soil jar, two 4 oz. soil jars and encores); DUP-07		50%	*Stained soil with a minor petroleum odor from 7 to 8 feet*
			1.0	8-10'				
	9-10'	Red CLAY						
	10-15'	Red CLAY	1.8	10-12'			75%	*No visual evidence of staining or odor observed*
			1.4	12-14'				
			1.5	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-01

SOIL BORING LOG		HOLE NUMBER SS-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - West end of Chemical Building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 7:55	13. DATE AND TIME COMPLETED 4/10/15 8:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SS-02 0-2) and 13 to 15 feet below grade (SS-02 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Dark brown medium-fine SAND with little gravel at top, moist	0.1	0-2'	SS-02 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	2-4'	Light red-brown sandy CLAY, moist	0.0	2-4'				
	4-5'	Red-brown CLAY	0.0	4-6'				
	5-10'	Red, brown and white CLAY	0.2 0.4	6-8' 8-10'			90%	*No visual evidence of staining or odor observed*
	10-15'	Red, white and purple CLAY	0.0 0.1 0.1	10-12' 12-14' 14-15'	SS-02 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
		Borehole terminated at 10 feet below grade5						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-02

SOIL BORING LOG		HOLE NUMBER SS-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - West of tank cradles located between the Chemical Building footprint and the Spent Solvent Storage Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 8:15	13. DATE AND TIME COMPLETED 4/10/15 8:40	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SS-03 0-2) and 4 to 6 feet below grade (SS-03 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Dark brown coarse SAND and gravel	0.0	0-2'	SS-03 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)*		75%	*No visual evidence of staining or odor observed*
	0.5-2'	Red-brown medium-fine SAND						
	2-4'	Red brown sandy CLAY	0.2	2-4'				
	4-5'	Light red medium-fine SAND, moist	0.2	4-6'				
	5-7'	Light red medium-fine SAND, moist, wet 6 to 7 feet	0.3	6-8'	SS-03 4-6 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	7-8'	Gray medium-fine SAND						
	8-10'	Light brown CLAY	0.2	8-10'				
	10-15'	Red, purple and brown CLAY	0.1	10-12'			100%	*No visual evidence of staining or odor observed*
			0.0	12-14'				
			0.0	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 4 feet of casing to ground surface						
		** Surface soil sample was collected from previously observed petroleum impacted soil (prior SB-23 boring attempt) which was located approximatley 5 feet east of this boring. A slight petroleum odor and PID reading of 10.6 ppm was observed in the soil sample.*						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-03

SOIL BORING LOG		HOLE NUMBER SS-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near drainage ditch to the east of tank cradles located between the Chemical Building footprint and the Spent Solvent Storage Area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 8:50	13. DATE AND TIME COMPLETED 4/10/15 9:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SS-04 0-2) and 13 to 15 feet below grade (SS-04 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	0.0	0-2'	SS-04 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	1-4'	Light brown-gray medium-fine SAND	0.1	2-4'				
	4-5'	Red and brown SANDY CLAY	0.4	4-6'				
	5-7'	Red-brown medium-fine SAND	0.3	6-8'			50%	*No visual evidence of staining or odor observed*
	7-10'	Brown CLAY	0.4	8-10'				
	10-15'	Red, white and purple CLAY	0.8	10-12'	SS-04 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			0.7	12-14'				
			0.8	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-04

SOIL BORING LOG		HOLE NUMBER SS-05	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near stormwater filter located along the southeastern portion of the Spent Solvent Stoage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 11:35	13. DATE AND TIME COMPLETED 4/2/15 12:15	
14. OVERBURDEN THICKNESS >20'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 20'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SS-05 1-3) and 6 to 8 feet below grade (SS-05 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt and gravel	1.4	0-2'	SS-05 1-3 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*Minor staining and petroleum odor from 2 to 5 feet*
	1-2'	Brown sandy CLAY						
	2-5'	Dark brown loamy SAND, moist	3.3	2-4'				
			2.0	4-6'				
	5-7'	Brown loamy SAND, moist	5.0	6-8'	SS-05 6-8 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*Solvent odor from 5 to 9 feet; no staining observed*
	7-9'	Gray fine SAND, moist, wet 8 to 9 feet	2.5	8-10'				
	9-10'	Brown CLAY						
	10-12'	Brown CLAY	1.6	10-12'			100%	*No visual evidence of staining or odor observed*
	12-15'	Red and tan CLAY	0.7	12-14'				
			2.0	14-15'				
	15-20'	Red and tan CLAY	0.9	15-17'			100%	*No visual evidence of staining or odor observed*
			1.3	17-19'				
			0.8	19-20'				
		Borehole terminated at 20 feet below grade; placed temporary groundwater monitoring well with 15 feet of screen and 5 feet of casing to ground surface due to perched water above the clay						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-05

SOIL BORING LOG		HOLE NUMBER SS-06	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Southeast end of the Spent Solvent Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 12:30	13. DATE AND TIME COMPLETED 4/2/15 13:00	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 7'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SS-06 1-3) and 5 to 7 feet below grade (SS-06 5-7)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt and concrete	1.5	0-2'	SS-06 1-3 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	1-5'	Tan fine SAND, moist from 4 to 5 feet	3.7	2-4'				
			1.3	4-6'				
	5-7'	Tan fine SAND and gravel, moist	1.1	6-8'	SS-06 5-7 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	7-9'	Light tan fine SAND with little gravel, saturated	1.2	8-10'				
	9-10'	Red CLAY						
	10-15'	Red and white CLAY	1.0	10-12'			90%	*No visual evidence of staining or odor observed*
			1.2	12-14'				
			2.2	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 15 feet of screen and 5 feet of casing to ground surface. *Later abandoned well due to better production within temporary well at SS-05*			Collected SS-01 to SS-06 COMP from surface soil of SS-01 to SS-06 soil borings (one 4 oz. soil jar)			

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SS-06

SOIL BORING LOG		HOLE NUMBER SB-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Fenced vegetated lot in the western portion of the property		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 8:15	13. DATE AND TIME COMPLETED 3/31/15 8:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-01 0-2) and 13 to 15 feet below grade (SB-01 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Red-brown sandy CLAY with little gravel	0.9	0-2'	SB-01 0-2 (one 8 oz. soil jar)			
	1-5'	Red and tan CLAY	1.3	2-4'			90%	*No visual evidence of staining or odor observed*
			0.7	4-6'				
	5-10'	Red and tan CLAY	1.4	6-8'			100%	*No visual evidence of staining or odor observed*
			1.1	8-10'				
	10-15'	Red and white CLAY	1.0	10-12'			100%	*No visual evidence of staining or odor observed*
			0.9	12-14'				
			1.4	14-15'	SB-01 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-01

SOIL BORING LOG		HOLE NUMBER SB-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Parking lot near the western portion of the warehouse		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 7:50	13. DATE AND TIME COMPLETED 3/31/15 8:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SB-02 1-3) and 13 to 15 feet below grade (SB-02 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt and concrete	1.4	0-2'	SB-02 1-3 (one 8 oz. soil jar); DUP-02		75%	*No visual evidence of staining or odor observed*
	1-3'	Red-brown sandy CLAY	1.8	2-4'				
	3-5'	Red and white CLAY	0.8	4-6'				
	5-10'	Red, white and purple CLAY	1.3	6-8'			100%	*No visual evidence of staining or odor observed*
			1.4	8-10'				
	10-15'	Red, white and purple CLAY	1.3	10-12'			100%	*No visual evidence of staining or odor observed*
			1.6	12-14'				
			1.2	14-15'	SB-02 13-15 (one 8 oz. soil jar); MS/MSD-01			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-02

SOIL BORING LOG		HOLE NUMBER SB-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Parking lot along the northern portion of the Warehouse		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 7:55	13. DATE AND TIME COMPLETED 4/2/15 8:25	
14. OVERBURDEN THICKNESS >20'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 20'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SB-03 1-3) and 13 to 15 feet below grade (SB-03 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen		

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Asphalt and concrete	0.6	0-2'				
	1-4'	FILL (brown medium-fine sand), moist; presumed to be perched stormwater	1.1	2-4'	SB-03 1-3 (one 8 oz. soil jar); DUP-06		100%	*No visual evidence of staining or odor observed*
	4-5'	Red-brown CLAY	0.8	4-6'				
	5-10'	Light red and tan CLAY	0.7 1.0	6-8' 8-10'			100%	*No visual evidence of staining or odor observed*
	10-12'	Red-brown CLAY	0.9	10-12'				
	12-15'	Light red and tan CLAY	1.0 0.9	12-14' 14-15'	SB-03 13-15 (one 8 oz. soil jar); MS/MSD-03		100%	*No visual evidence of staining or odor observed*
	15-20'	Light red and tan CLAY	1.2 0.6 0.7	15-17' 17-19' 19-20'			100%	*No visual evidence of staining or odor observed*
		The soil boring was to be completed with a temporary groundwater monitoring well; no evidence of water was observed at 15 feet below grade, so the borehole was extended to 20 feet. Due to dense clay from 4 to 20 feet and no evidence of water, the borehole was terminated and no well was installed.						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-03

SOIL BORING LOG		HOLE NUMBER SB-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Road, near the Sulfate Finishing Building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 8:30	13. DATE AND TIME COMPLETED 4/2/15 9:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-04 0-2) and 13 to 15 feet below grade (SB-04 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		The soil boring was to be advanced in the lower concrete slab along the building footprint. However, due to two layers of concrete, the second of which was impenatrable at 1.5 feet below grade, the boring was terminated and moved to the asphalt roadway adjacent to the building						
	0-0.5'	Asphalt	3.5	0-2'	SB-04 0-2 (one 8 oz. soil jar)			
	0.5-5'	Red and tan CLAY	3.2	2-4'			75%	*No visual evidence of staining or odor observed*
			1.8	4-6'				
	5-10'	Red and tan CLAY	1.6	6-8'			100%	*No visual evidence of staining or odor observed*
			2.6	8-10'				
	10-15'	Red and tan CLAY	1.5	10-12'			100%	*No visual evidence of staining or odor observed*
			0.9	12-14'	SB-04 13-15 (one 8 oz. soil jar)			
			1.7	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-04

SOIL BORING LOG		HOLE NUMBER SB-05	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Walkway along North Calciner Building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 9:20	13. DATE AND TIME COMPLETED 4/2/15 9:45	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-05 0-2) and 13 to 15 feet below grade (SB-05 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		The soil boring was to be advanced in the grass/exposed soil along the building footprint. However, due to refusal at six feet below grade, the boring was terminated and moved to the asphalt walkway adjacent to the building						
	0-0.5'	Asphalt	22.4	0-2'	SB-05 0-2 (one 8 oz. soil jar)		60%	*Slight petroleum odor from 1-5 feet; no staining observed*
	0.5-5'	Red-brown CLAY, moist from 4 to 5 feet	6.5	2-4'				
			3.3	4-6'				
	5-6'	Red-brown CLAY, moist	2.2	6-8'			75%	*No visual evidence of staining or odor observed*
	6-10'	Red CLAY	1.7	8-10'				
	10-15'	Red and tan CLAY	1.2	10-12'	SB-05 13-15 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
			1.5	12-14'				
			2.7	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-05

SOIL BORING LOG		HOLE NUMBER SB-06	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - East of the North Calciner Building footprint and near prior oil aboveground storage tanks		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 9:55	13. DATE AND TIME COMPLETED 4/2/15 10:20	
14. OVERBURDEN THICKNESS >20'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 20'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-06 0-2) and 13 to 15 feet below grade (SB-06 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Gravel and asphalt	1.5	0-2'	SB-06 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Dark red-brown CLAY	6.8	2-4'				
			3.0	4-6'				
	5-9'	Brown, red and tan CLAY	2.2	6-8'			75%	*No visual evidence of staining or odor observed*
			2.2	8-10'				
	9-10'	Red CLAY						
	10-15'	Brown, red and tan CLAY	0.6	10-12'			100%	*No visual evidence of staining or odor observed*
			1.6	12-14'	SB-06 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
			1.3	14-15'				
	15-20'	Brown, red and tan CLAY	1.6	15-17'			100%	*No visual evidence of staining or odor observed*
			1.4	17-19'				
			2.0	19-20'				
		The soil boring was to be completed with a temporary groundwater monitoring well; no evidence of water was observed at 15 feet below grade, so the borehole was extended to 20 feet. Due to dense clay from 0.5 to 20 feet and no evidence of water, the borehole was terminated and no well was installed.						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-06

SOIL BORING LOG		HOLE NUMBER SB-07	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Near Security Office		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 12:35	13. DATE AND TIME COMPLETED 4/7/15 12:55	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-07 0-2) and 13 to 15 feet below grade (SB-07 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown sandy CLAY	1.0	0-2'	SB-07 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-2'	Tan medium-fine SAND						
	2-5'	Red-brown medium-fine SAND	0.9	2-4'				
			0.8	4-6'				
	5-6'	Brown CLAY						
	6-10'	Red and white CLAY	1.0	6-8'			100%	*No visual evidence of staining or odor observed*
			0.9	8-10'				
	10-15'	Red and white CLAY	1.1	10-12'			100%	*No visual evidence of staining or odor observed*
			1.0	12-14'				
			1.0	14-15'	SB-07 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-07

SOIL BORING LOG		HOLE NUMBER SB-08	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Along the northwestern portion of the Research and Development building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 13:00	13. DATE AND TIME COMPLETED 4/7/15 13:10	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-08 0-2) and 6 to 8 feet below grade (SB-08 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Tan coarse SAND and gravel	0.9	0-2'	SB-08 0-2 (one 8 oz. soil jar); DUP-14		75%	*No visual evidence of staining or odor observed*
	0.5-4'	Red and gray CLAY	0.7	2-4'				
	4-5'	Light brown medium-fine SAND	1.1	4-6'				
	5-7'	Light brown medium-fine SAND	1.4	6-8'	SB-08 6-8 (one 8 oz. soil jar); MD/MSD-7		100%	*No visual evidence of staining or odor observed*
	7-8'	Dark brown fine SAND, moist						
	8-10'	Gray-brown loamy SAND, saturated	0.7	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-08

SOIL BORING LOG		HOLE NUMBER SB-09	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Along the northern corner property boundary fence		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 13:15	13 DATE AND TIME COMPLETED 4/7/15 13:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-09 0-2) and 8 to 10 feet below grade (SB-09 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	0.2	0-2'	SB-09 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-2'	Red-brown medium-fine SAND						
	2-5'	Red and white CLAY	0.4	2-4'				
			0.1	4-6'				
	5-6'	Red and white CLAY						
	6-10'	Light brown fine SAND	0.7	6-8'			50%	*No visual evidence of staining or odor observed*
			0.1	8-10'	SB-09 8-10 (one 8 oz. soil jar)			
	10-12'	Light brown fine SAND, wet, saturated 11 to 12 feet	0.6	10-12'			100%	*No visual evidence of staining or odor observed*
	12-14'	Dark gray CLAY, wet	0.2	12-14'				
	14-15'	Dark brown sandy CLAY, moist	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-09

SOIL BORING LOG		HOLE NUMBER SB-10	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad track spur along southwestern Site boundary		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 8:35	13. DATE AND TIME COMPLETED 3/30/15 9:00	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-10 0-2) and 13 to 15 feet below grade (SB-10 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown medium-fine sandy CLAY and gravel	2.0	0-2'	SB-10 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	1-4'	Red and white CLAY	1.2	2-4'				
	4-5'	Red CLAY	0.9	4-6'				
	5-5.5'	Red CLAY						
	5.5-6'	White SAND	1.0	6-8'			75%	*No visual evidence of staining or odor observed*
	6-10'	Red and white CLAY	1.5	8-10'				
	10-15'	Red, white and brown mottled CLAY, little moist at base	2.0	10-12'			100%	*No visual evidence of staining or odor observed*
			1.3	12-14'	SB-10 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
			1.2	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-10

SOIL BORING LOG		HOLE NUMBER SB-11	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Between railroad track and spur in northwestern portion of the property		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 9:10	13. DATE AND TIME COMPLETED 3/31/15 9:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-11 0-2) and 13 to 15 feet below grade (SB-11 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen		

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Red-brown sandy CLAY	1.2	0-2'	SB-11 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		60%	*No visual evidence of staining or odor observed*
	0.5-4'	Red and white CLAY	1.7	2-4'				
	4-5'	Light gray CLAY	1.0	4-6'				
	5-10'	Red, brown and purple CLAY	1.8	6-8'			100%	*No visual evidence of staining or odor observed*
			1.5	8-10'				
	10-15'	Red, brown and purple CLAY	1.3	10-12'	SB-11 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			1.6	12-14'				
			0.9	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-11

SOIL BORING LOG		HOLE NUMBER SB-12	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad track spur along the western portion of the Warehouse		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 8:40	13. DATE AND TIME COMPLETED 3/31/15 9:05	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-12 0-2) and 13 to 15 feet below grade (SB-12 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	1.7	0-2'	SB-12 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	0.5-5'	Red and brown CLAY	1.2	2-4'				
			1.9	4-6'				
	5-10'	Red, brown and purple CLAY	1.7	6-8'			100%	*No visual evidence of staining or odor observed*
			1.8	8-10'				
	10-14'	Red, brown and purple CLAY	1.1	10-12'	SB-12 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			1.2	12-14'				
	14-15'	Light brown CLAY	1.3	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-12

SOIL BORING LOG		HOLE NUMBER SB-13	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad tracks along the southern portion of the Warehouse		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 10:55	13. DATE AND TIME COMPLETED 4/10/15 11:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SB-13 1-3) and 13 to 15 feet below grade (SB-13 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Gravel	0.0	0-2'	SB-13 1-3 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	1-3'	Brown sandy CLAY	0.1	2-4'				
	3-4.5'	Brown CLAY						
	4.5-5'	Light brown medium-fine SAND	0.0	4-6'				
	5-8'	Light brown medium-fine SAND	0.0	6-8'			75%	*No visual evidence of staining or odor observed*
	8-8.5'	Red medium-fine SAND						
	8.5-9.5'	Red and brown sandy CLAY	0.0	8-10'				
	9.5-10'	Red CLAY						
	10-15'	Red, white and purple CLAY	0.0	10-12'	SB-13 13-15 (one 8 oz. soil jar, three 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			0.0	12-14'				
			0.3	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT: CRISTAL USA FACILITY	HOLE NO.: SB-13

SOIL BORING LOG		HOLE NUMBER SB-14	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad tracks near the southeastern portion of the Warehouse		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 10:30	13. DATE AND TIME COMPLETED 4/10/15 10:50	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-14 0-2) and 4 to 6 feet below grade (SB-14 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	FILL (light brown coarse SAND and gravel, white paint-like substance throughout)	0.0 0.0 0.0	0-2' 2-4' 4-6'	SB-14 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	5-6'	FILL (gravel, white paint-like substance)	0.1	6-8'	SB-14 4-6 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	6-10'	Brown sandy CLAY, wet, moist 8 to 10 feet	0.1	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-14

SOIL BORING LOG		HOLE NUMBER SB-15	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad tracks near Kemira boundary		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 9:25	13. DATE AND TIME COMPLETED 4/10/15 9:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-15 0-2) and 13 to 15 feet below grade (SB-15 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Dark brown coarse SAND and gravel	0.1	0-2'	SB-15 0-2 (one 8 oz. soil jar, three 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	2-3'	Red and brown CLAY	0.2	2-4'				
	3-3.5'	Tan fine SAND						
	3.5-5'	Red and brown CLAY	0.1	4-6'				
	5-10'	Red and white CLAY	0.2	6-8'			75%	*No visual evidence of staining or odor observed*
			0.1	8-10'				
	10-15'	Red, brown and white CLAY	0.2	10-12'			100%	*No visual evidence of staining or odor observed*
			0.1	12-14'				
			0.2	14-15'	SB-15 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores); DUP-19			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-15

SOIL BORING LOG		HOLE NUMBER SB-16	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Small parking lot along the southwestern portion of the Research and Development building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 12:20	13. DATE AND TIME COMPLETED 4/7/15 12:30	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 9'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-16 0-2) and 7 to 9 feet below grade (SB-16 7-9)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt and gravel	0.9	0-2'	SB-16 0-2 (one 8 oz. soil jar)		90%	*No visual evidence of staining or odor observed*
	0.5-4'	Red and brown transitioning to brown CLAY	0.8	2-4'				
	4-5'	Brown medium-fine SAND	0.8	4-6'				
	5-7'	Tan fine SAND	0.6	6-8'			100%	*No visual evidence of staining or odor observed*
	7-10'	Light brown fine SAND, moist, wet 9 to 10 feet	1.0	8-10'	SB-16 7-9 (one 8 oz. soil jar)			
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-16

SOIL BORING LOG		HOLE NUMBER SB-17	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Along the northeastern property boundary fence		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 11:55	13. DATE AND TIME COMPLETED 4/7/15 12:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 9'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-17 0-2) and 7 to 9 feet below grade (SB-17 7-9)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown sandy CLAY	2.1	0-2'	SB-17 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-4'	Red and brown CLAY	2.2	2-4'				
	4-5'	Tan fine SAND	1.9	4-6'				
	5-7'	Tan fine SAND	1.5	6-8'			50%	*No visual evidence of staining or odor observed*
	7-9'	Brown sandy CLAY and gravel	1.7	8-10'	SB-17 7-9 (one 8 oz. soil jar)			
	9-10'	Light brown medium-fine SAND, wet						
	10-12'	Light brown medium-fine SAND, saturated	2.0	10-12'			50%	*No visual evidence of staining or odor observed*
	12-15'	Light gray fine SAND, saturated	2.2	12-14				
			2.4	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	**SB-17**

SOIL BORING LOG		HOLE NUMBER SB-18	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Railroad track spur along southwestern Site boundary		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 9:10	13. DATE AND TIME COMPLETED 3/30/15 9:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-18 0-2) and 13 to 15 feet below grade (SB-18 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Brown coarse SAND and gravel	1.5	0-2'	SB-18 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	2-5'	Red and white CLAY, moist	1.1	2-4'				
			1.7	4-6'				
	5-10'	Red and white mottled CLAY	1.4	6-8'			100%	*No visual evidence of staining or odor observed*
			1.8	8-10'				
	10-15'	Red and white CLAY	1.3	10-12'			100%	*No visual evidence of staining or odor observed*
			1.6	12-14'	SB-18 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
			1.3	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-18

SOIL BORING LOG		HOLE NUMBER SB-19	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - South of prior Air Compressor building and near potential diesel underground storage tank		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 12:20	13. DATE AND TIME COMPLETED 3/30/15 12:40	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 12'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-19 0-2) and 10 to 12 feet below grade (SB-19 10-12)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown sandy CLAY and gravel	2.0	0-2'	SB-19 0-2 (one 8 oz. soil jar, three 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-1'	Red sandy CLAY with little gravel	0.8	2-4'				
	1-5'	Red and brown CLAY	3.0	4-6'				
	5-8'	Red and brown CLAY	1.9	6-8'			90%	*No visual evidence of staining or odor observed*
	8-10'	Gray fine sandy CLAY, moist	3.0	8-10'				
	10-15'	Dark gray and brown CLAY, wet 12 to 13 feet, moist 13-15 feet	2.7	10-12'	SB-19 10-12 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			2.9	12-14'				
			2.1	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 10 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-19

SOIL BORING LOG		HOLE NUMBER SB-20	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - East of Electrical and Instrument Shop and near current underground storage tank vent and fill port		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 12:55	13. DATE AND TIME COMPLETED 3/30/15 13:20	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 11'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-20 0-2) and 9 to 11 feet below grade (SB-20 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown sandy CLAY and gravel	2.2	0-2'	SB-20 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	0.5-5'	Red and brown CLAY	1.5	2-4'				
			1.6	4-6'				
	5-10'	Red and white CLAY transitioning into light tan and red CLAY	0.6	6-8'			75%	*No visual evidence of staining or odor observed*
			1.2	8-10'				
	10-11'	Tan CLAY	2.1	10-12'	SB-20 9-11 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		90%	*No visual evidence of staining or odor observed*
	11-14'	Brown medium-fine SAND, saturated	2.4	12-14'				
	14-15'	Red CLAY	2.0	14-15'				
		Borehole terminated at 15 feet below grade, placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT.	HOLE NO.:
CRISTAL USA FACILITY	SB-20

SOIL BORING LOG		HOLE NUMBER SB-21	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - West of prior Flue Pond and near potential toluene underground storage tanks		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 13:30	13. DATE AND TIME COMPLETED 3/30/15 14:10	
14. OVERBURDEN THICKNESS >25'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 25'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-21 0-2) and 13 to 15 feet below grade (SB-21 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Drilling refusal was encountered at one foot below grade during the first two attempts; the soil boring was moved approximately two feet southeast of the original location.						
	0-5'	FILL (dark brown coarse sand and gravel)	1.7 2.1 0.5	0-2' 2-4' 4-6'	SB-21 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	5-6'	Brown medium-fine SAND, moist						
	6-10'	Red and white CLAY	2.1 1.8	6-8' 8-10'			75%	*No visual evidence of staining or odor observed*
	10-15'	Red, orange, purple and white CLAY	0.1 0.5 1.5	10-12' 12-14' 14-15'	SB-21 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
	15-20'	Red, orange, purple and white CLAY	2.4 1.3	16-18' 18-20'			100%	*No visual evidence of staining or odor observed*
	20-25'	Red, orange, purple and white CLAY	2.5 1.3 1.0	20-22' 22-24' 24-25'			100%	*No visual evidence of staining or odor observed*
		The soil boring was to be completed with a temporary groundwater monitoring well; no evidence of water was observed at 15 feet below grade, so the borehole was extended to 25 feet. Due to dense clay from 6 to 25 feet and no evidence of water, the borehole was terminated and no well was installed.						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-21

SOIL BORING LOG		HOLE NUMBER SB-22
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.	SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY		
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - At end of Loncar Lane and near northwestern portion of the Upper Basin	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 12:50	13. DATE AND TIME COMPLETED 3/31/15 13:05
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 9'	
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA	
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-22 0-2) and 7 to 9 feet below grade (SB-22 7-9)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	1.9	0-2'	SB-22 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-1.5'	FILL (dark brown coarse sand with little gravel)						
	1.5-5'	Brown sandy CLAY	1.3	2-4'				
			1.4	4-6'				
	5-6'	Brown sandy CLAY, moist	1.9	6-8'			100%	*No visual evidence of staining or odor observed*
	6-10'	Brown loamy SAND, moist, saturated from 9 to 10 feet	2.3	8-10'	SB-22 7-9 (one 8 oz. soil jar)			
		Borehole terminated at 10 feet below grade						

PROJECT: CRISTAL USA FACILITY	HOLE NO.: SB-22

SOIL BORING LOG		HOLE NUMBER SB-23	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - near the southeastern portion of the Chemical Warehouse building footprint		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 8:00	13. DATE AND TIME COMPLETED 4/3/15 8:35	
14. OVERBURDEN THICKNESS >8'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 8'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 1 to 3 feet below grade (SB-23 1-3) and 4 to 6 feet below grade (SB-23 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE Cuttings	IF NOT A WELL, BACKFILLED WITH:	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		The soil boring was to be advanced along the eastern portion of the Chemical Warehouse building footprint. However, due to refusal on concrete at two feet below grade, the boring was moved closer to the roadway. It should be noted that a petroleum odor with an elevated PID reading of 115 ppm was observed in the surface soil. Drilling refusal was encountered at five feet below grade during the second attempt; the boring was moved to the roadway.						
	0-1'	Asphalt	1.6	0-2'	SB-23 1-3 (one 8 oz. soil jar)		75%	*Staining and slight petroleum/solvent odor from 4.5 to 5 feet*
	1-4'	Brown sandy CLAY and gravel	1.5	2-4'				
	4-4.5'	Red coarse SAND						
	4.5-5'	Dark brown fine SAND, moist	2.5	4-6'				
	5-7'	Dark brown/black fine SAND and gravel, moist, saturated 6 to 7 feet	1.9	6-8'	SB-23 4-6 (one 8 oz. soil jar)		50%	*Slight solvent odor from 5 to 8 feet; no staining observed*
	7-7.5'	Dark green CLAY, moist						
	7.5-8'	Gray CLAY						
		Drilling refusal at 8 feet below grade; borehole terminated						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-23

SOIL BORING LOG		HOLE NUMBER SB-24	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - near water tower and prior gasoline and diesel aboveground storage tanks		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 11:30	13. DATE AND TIME COMPLETED 4/7/15 11:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-24 0-2) and 8 to 10 feet below grade (SB-24 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	0.4	0-2'	SB-24 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-4'	Red and white CLAY	1.0	2-4'				
	4-5'	Brown silty CLAY	0.7	4-6'				
	5-7'	Brown silty CLAY	0.6	6-8'			50%	*No visual evidence of staining or odor observed*
	7-10'	Light brown medium-fine SAND, wet at base	0.4	8-10'	SB-24 8-10 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
	10-15'	Light brown medium-fine SAND, saturated	0.2	10-12'			50%	*No visual evidence of staining or odor observed*
			0.3	12-14'				
			0.4	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-24

SOIL BORING LOG		HOLE NUMBER SB-25	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - End of railroad spur along southwestern Site boundary		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 9:50	13. DATE AND TIME COMPLETED 3/30/15 10:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-25 0-2) and 13 to 15 feet below grade (SB-25 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Gravel	1.5	0-2'	SB-25 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Red and white CLAY	2.0	2-4'				
			1.5	4-6'				
	5-10'	Red, brown and purple CLAY	2.1	6-8'			100%	*No visual evidence of staining or odor observed*
			1.3	8-10'				
	10-13'	Red, brown and purple CLAY	1.3	10-12'	SB-25 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
			1.6	12-14'				
	13-14'	Red and brown CLAY; line of brown fine sand at 13.5 feet						
	14-15'	White CLAY, white sand at base	1.2	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-25

SOIL BORING LOG		HOLE NUMBER SB-26	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - North of prior Chloride Ore Storage building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCs / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 11:50	13. DATE AND TIME COMPLETED 3/30/15 12:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-26 0-2) and 13 to 15 feet below grade (SB-26 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1.5'	Brown coarse SAND and gravel	1.4	0-2'	SB-26 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		60%	*No visual evidence of staining or odor observed*
	1.5-2.5'	Brown CLAY	2.8	2-4'				
	2.5-5'	Red and white CLAY	1.3	4-6'				
	5-7'	Brown, white and red CLAY	1.9	6-8'			100%	*No visual evidence of staining or odor observed*
	7-10'	White, brown and purple CLAY	1.5	8-10'				
	10-14'	White, brown and purple CLAY	1.6	10-12'			100%	*No visual evidence of staining or odor observed*
			2.4	12-14'	SB-26 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
	14-14.5'	White fine silty SAND						
	14.5-15'	White, brown and purple CLAY	1.9	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-26

SOIL BORING LOG		HOLE NUMBER SB-27	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Along western portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/31/15 13:15	13. DATE AND TIME COMPLETED 3/31/15 13:35	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-27 0-2) and 6 to 8 feet below grade (SB-27 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	1.1	0-2'	SB-27 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-4'	Tan SILT	0.8	2-4'				
	4-5'	Dark brown loamy SAND	0.4	4-6'				
	5-8'	Dark brown loamy SAND, wet	1.6	6-8'	SB-27 6-8 (one 8 oz. soil jar)		90%	*No visual evidence of staining or odor observed*
	8-8.5'	Gray SILT, saturated						
	8.5-10'	Dark brown to black medium-fine SAND, saturated	1.1	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-27

SOIL BORING LOG		HOLE NUMBER SB-28	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Along the eastern portion of the Upper Basin and across from the Spent Solvent area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 8:35	13. DATE AND TIME COMPLETED 4/3/15 9:00	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 4.5'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-28 0-2) and 2.5 to 4.5 feet below grade (SB-28 2.5-4.5)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	1.3	0-2'	SB-28 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-3'	Tan medium-fine SAND with line of gravel at 2 feet						
	3-4'	Brown sandy CLAY, moist	1.2	2-4'				
	4-4.5'	Tan medium-fine SAND			SB-28 2.5-4.5 (one 8 oz. soil jar)			
	4.5-5'	Tan coarse SAND and gravel, saturated	3.2	4-6'				
	5-7'	Light tan medium-fine SAND with little gravel, saturated	2.5	6-8'			75%	*No visual evidence of staining or odor observed*
	7-10'	White fine SAND, saturated	2.2	8-10'				
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-28

SOIL BORING LOG		HOLE NUMBER SB-29	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Along the eastern portion of the Landfill boundary		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 10:05	13. DATE AND TIME COMPLETED 3/30/15 10:40	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10.5'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-29 0-2) and 8 to 10 feet below grade (SB-29 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt and gravel	1.6	0-2'	SB-29 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-4'	Red and white CLAY	1.4	2-4'				
	4-5'	Brown sandy CLAY	1.2	4-6'				
	5-6'	Brown sandy CLAY, little moist						
	6-8'	Red CLAY	1.5	6-8'			100%	*No visual evidence of staining or odor observed*
	8-9'	White fine SAND	1.6	8-10'	SB-29 8-10 (one 8 oz. soil jar)			
	9-10'	Light tan fine SAND, moist						
	10-12'	Light tan fine SAND, moist, wet 10.5 to 11.5 feet	2.0	10-12'			100%	*No visual evidence of staining or odor observed*
	12-15'	Light gray fine silty SAND, moist	1.7	12-14'				
			1.1	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-29

SOIL BORING LOG		HOLE NUMBER SB-30	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Prior transformer station along the western portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCs / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 9:15	13. DATE AND TIME COMPLETED 4/1/15 9:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 11'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-30 0-2) and 9 to 11 feet below grade (SB-30 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown sandy CLAY and gravel	1.1	0-2'	SB-30 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*No visual evidence of staining or odor observed*
	0.5-4.5'	Red-brown CLAY	1.0	2-4'				
	4.5-5'	Brown coarse SAND and gravel, moist	0.9	4-6'				
	5-9'	Brown coarse SAND and gravel, moist	1.3	6-8'			25%	*No visual evidence of staining or odor observed*
			0.7	8-10'				
	9-10'	Red CLAY						
	10-11'	Red CLAY	1.0	10-12'	SB-30 9-11 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	11-12'	Red fine SAND, wet						
	12-14'	Light brown fine SAND, wet	1.3	12-14'				
	14-15'	Red and white CLAY	1.2	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-30

SOIL BORING LOG		HOLE NUMBER SB-31	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near low-lying area along the western portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 9:55	13. DATE AND TIME COMPLETED 4/1/15 10:20	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-31 0-2) and 13 to 15 feet below grade (SB-31 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	White coarse SAND and gravel	1.1	0-2'	SB-31 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	0.5-1.5'	Brown CLAY with little coarse sand						
	1.5-2.5'	Brown CLAY	2.7	2-4'				
	2.5-5'	Red CLAY	3.3	4-6'				
	5-10'	Red CLAY	3.9	6-8'			100%	*No visual evidence of staining or odor observed*
			3.1	8-10'				
	10-15'	Red CLAY	3.4	10-12'			100%	*No visual evidence of staining or odor observed*
			3.0	12-14'				
			3.0	14-15'	SB-31 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-31

SOIL BORING LOG		HOLE NUMBER SB-32	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near Gas Turbines and along the eastern portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 9:50	13. DATE AND TIME COMPLETED 4/3/15 10:10	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 4'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-32 0-2) and 2 to 4 feet below grade (SB-32 2-4)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-4'	Brown medium-fine SAND with little gravel	0.6 1.1	0-2' 2-4'	SB-32 0-2 (one 8 oz. soil jar); DUP-08 SB-32 2-4 (one 8 oz. soil jar); MS/MSD-04		75%	*No visual evidence of staining or odor observed*
	4-5'	Brown CLAY, wet						
	5-10'	Tan loamy SAND, saturated	2.7	5-10'			50%	*No visual evidence of staining or odor observed*
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-32

SOIL BORING LOG		HOLE NUMBER SB-33	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Along the northwestern portion of the prior Boiler House building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 9:05	13. DATE AND TIME COMPLETED 4/3/15 9:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-33 0-2) and 13 to 15 feet below grade (SB-33 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Drilling refusal was encountered at one foot below grade at several locations (prior building foundation?); moved soil boring to the asphalt along the northwestern portion of the gravel area.						
	0-1'	Asphalt, concrete and gravel	1.0	0-2'	SB-33 0-2 (one 8 oz. soil jar)			
	1-5'	Red CLAY	2.3	2-4'			90%	*No visual evidence of staining or odor observed*
			0.7	4-6'				
	5-10'	Red and white CLAY	1.3	6-8'			100%	*No visual evidence of staining or odor observed*
			0.7	8-10'				
	10-15'	Red and white CLAY	1.3	10-12'			100%	*No visual evidence of staining or odor observed*
			1.8	12-14'				
			1.0	14-15'	SB-33 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-33

SOIL BORING LOG		HOLE NUMBER SB-34	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - southwest portion of the Batch Attach Lagoon		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 10:30	13. DATE AND TIME COMPLETED 4/7/15 10:45	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 14'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-34 0-2) and 12 to 14 feet below grade (SB-34 12-14)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Tan fine SAND	0.4	0-2'	SB-34 0-2 (one 8 oz. soil jar)		90%	*No visual evidence of staining or odor observed*
	1-3'	Brown medium-fine SAND with little gravel	0.5	2-4'				
	3-4'	Gray fine SAND						
	4-5'	Dark brown fine SAND	1.2	4-6'				
	5-6'	Dark brown fine SAND	0.7	6-8'			75%	*No visual evidence of staining or odor observed*
	6-9'	Red and white CLAY	0.8	8-10'				
	9-10'	Gray-brown fine SAND, moist						
	10-11'	Gray-brown fine SAND, moist	0.9	10-12'	SB-34 12-14 (one 8 oz. soil jar); DUP-13		90%	*No visual evidence of staining or odor observed*
	11-13'	Red and brown CLAY	0.9	12-14'				
	13-14'	Tan to red fine SAND, moist						
	14-15'	Dark gray CLAY, wet	1.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-34

SOIL BORING LOG		HOLE NUMBER SB-35	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - PWAN/SWAN access road		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/2/15 7:30	13. DATE AND TIME COMPLETED 4/2/15 7:50	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 11'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-35 0-2) and 9 to 11 feet below grade (SB-35 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	1.0	0-2'	SB-35 0-2 (one 8 oz. soil jar); DUP-12		75%	*No visual evidence of staining or odor observed*
	0.5-2'	Brown to dark brown coarse SAND and gravel						
	2-4'	Light brown medium-fine SAND with little gravel	0.8	2-4'				
	4-5'	Red sandy CLAY	0.9	4-6'				
	5-10'	Red-brown sandy CLAY, moist at base	0.8	6-8'			75%	*No visual evidence of staining or odor observed*
			1.2	8-10'				
	10-15'	Gray CLAY, moist, wet 11 to 15 feet	0.2	10-12'	SB-35 9-11 (one 8 oz. soil jar); MS/MSD-06		100%	*No visual evidence of staining or odor observed*
			0.8	12-14'				
			0.4	14-15'				
		Borehole terminated at 15 feet below grade, placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-35

SOIL BORING LOG		HOLE NUMBER SB-36	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near Landfill access road		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 3/30/15 10:45	13. DATE AND TIME COMPLETED 3/30/15 11:05	
14. OVERBURDEN THICKNESS >11'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 11'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-36 0-2) and 9 to 11 feet below grade (SB-36 9-11)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	0.8	0-2'	SB-35 0-2 (one 8 oz. soil jar)		75%	*Staining and slight petroleum odor from 2 to 2.5 feet*
	0.5-2'	FILL (Brown coarse sand and gravel)						
	2-2.5'	FILL (Fine grained gravel), moist	2.3	2-4'				
	2.5-5'	Red and white CLAY	2.1	4-6'				
	5-9'	Red and white CLAY, compacted	2.2	6-8'			100%	*No visual evidence of staining or odor observed*
			1.7	8-10'				
	9-9.5'	Red CLAY						
	9.5-10'	Red CLAY	0.9	10-11'	SB-35 9-11 (one 8 oz. soil jar); DUP-01		75%	*No visual evidence of staining or odor observed*
	10-11'	Red and white CLAY, compacted						
		Drilling refusal at 11 feet below grade; borehole terminated						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-36

SOIL BORING LOG		HOLE NUMBER SB-37	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - At end of road near the prior titanium ore storage		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 13:15	13. DATE AND TIME COMPLETED 4/1/15 13:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-37 0-2) and 13 to 15 feet below grade (SB-37 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	2.0	0-2'	SB-37 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	0.5-2'	Brown coarse SAND and gravel						
	2-5'	Red-purple CLAY	2.4	2-4'				
			1.6	4-6'				
	5-7'	Red-purple CLAY	2.2	6-8'			100%	*No visual evidence of staining or odor observed*
	7-10'	Red and white CLAY	1.4	8-10'				
	10-15'	Dark red and white CLAY	1.1	10-12'			100%	*No visual evidence of staining or odor observed*
			1.3	12-14'				
			1.1	14-15'	SB-37 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-37

SOIL BORING LOG		HOLE NUMBER SB-38	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Concrete - Ramp to 35,000-gallon sodium hydroxide aboveground storage tank along the southwestern portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 11:40	13. DATE AND TIME COMPLETED 4/1/15 12:20	
14. OVERBURDEN THICKNESS >20'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 20'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-38 0-2) and 13 to 15 feet below grade (SB-38 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Concrete and gravel	1.5	0-2'	SB-38 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Red and white CLAY	2.1	2-4'				
			2.7	4-6'				
	5-10'	Red, white and purple CLAY	2.5	6-8'			100%	*No visual evidence of staining or odor observed*
			1.6	8-10'				
	10-15'	Red and white CLAY	1.7	10-12'			100%	*No visual evidence of staining or odor observed*
			1.2	12-14'	SB-38 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
			1.6	14-16'				
	15-20'	Red and white CLAY	1.0	16-18'			100%	*No visual evidence of staining or odor observed*
			0.6	18-20'				
		The soil boring was to be completed with a temporary groundwater monitoring well; no evidence of water was observed at 15 feet below grade, so the borehole was extended to 20 feet. Due to dense clay from 0.5 to 20 feet and no evidence of water, the borehole was terminated and no well was installed.						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-38

SOIL BORING LOG		HOLE NUMBER SB-39		
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.			SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY				
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT			
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Near 002 Neutralization Computerized Acid Waste Control System shed			
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 12:30	13. DATE AND TIME COMPLETED 4/7/15 12:55		
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA			
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA			
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA			
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-39 0-2) and 13 to 15 feet below grade (SB-39 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID			SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen		

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown sandy CLAY and gravel	3.6	0-2'	SB-39 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	1-5'	Red, orange and tan CLAY	2.8 1.1	2-4' 4-6'				
	5-10'	Red, orange and tan CLAY	1.2 3.0	6-8' 8-10'			100%	*No visual evidence of staining or odor observed*
	10-15'	Red, orange and tan CLAY	2.4 2.8 1.6	10-12' 12-14' 14-15'	SB-39 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		100%	*No visual evidence of staining or odor observed*
		The soil boring was to be completed with a temporary groundwater monitoring well; due to diffcult drilling conditions, dense clay from 1 to 15 feet and no evidence of water, the borehole was terminated at 15 feet below grade and no well was installed.						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-39

SOIL BORING LOG

HOLE NUMBER: **SB-40**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Gravel - Along the southern portion of the oil/water seperator green stickups located near the Gas Turbines	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/3/15 10:15	13. DATE AND TIME COMPLETED: 4/3/15 10:40
14. OVERBURDEN THICKNESS: >10'	15. DEPTH GROUNDWATER ENCOUNTERED: 5'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? YES, TEMPORARY / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 3 to 5 feet below grade (SB-40 3-5) and 8 to 10 feet below grade (SB-40 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-3'	FILL (pea gravel)	3.4	0-2'				
			3.2	2-4'	SB-40 3-5 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		25%	*No visual evidence of staining or odor observed*
	3-5'	Brown sandy CLAY and gravel	3.9	4-6'				
	5-10'	Red-brown sandy CLAY and gravel, wet	3.5	6-8'			50%	*No visual evidence of staining or odor observed*
			3.7	8-10'				
		A second boring was set immediately adjacent to the first boring to get more soil for sample collection. The 0 to 5 foot core was the same, however the 5 to 10 foot core consisted of light tan to white sticky loam (process waste?); per EA, collected subsurface sample from base of this core.			SB-40 8-10 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			*No visual evidence of staining or odor observed in second borehole*
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface						**Rain and humidity may be affecting the PID*

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **SB-40**

SOIL BORING LOG		HOLE NUMBER SB-41	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Prior AST area located along the western portion of the Kemira boundary fence		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 12:10	13. DATE AND TIME COMPLETED 4/3/15 12:40	
14. OVERBURDEN THICKNESS >17'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 17'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-41 0-2) and 13 to 15 feet below grade (SB-41 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Red-brown CLAY with little gravel	20.9	0-2'	SB-41 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		50%	*Staining from 1 to 2 feet; no odor*
	1-2'	Tan fine SAND						
	2-5'	Red and white CLAY	3.8	2-4'				
			3.7	4-6'				
	5-10'	Red and white CLAY	2.6	6-8'			75%	*No visual evidence of staining or odor observed*
			8.7	8-10'				
	10-14'	Red and white CLAY	1.2	10-12'			100%	*No visual evidence of staining or odor observed*
			3.9	12-14'	SB-41 13-15 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
			0.2	14-15'				
	14-17'	Red and white CLAY	1.8	15-17'			75%	*No visual evidence of staining or odor observed*
		Drilling refusal at 17 feet below grade; borehole terminated. The soil boring was to be completed with a temporary groundwater monitoring well, however as no evidence of water was observed, no well was installed						**Rain and humidity may be affecting the PID*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-41

SOIL BORING LOG

HOLE NUMBER: **SB-42**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Gravel - Prior transformer area located along the western portion of the Kemira boundary fence	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/3/15 12:45	13. DATE AND TIME COMPLETED: 4/3/15 13:15
14. OVERBURDEN THICKNESS: >15'	15. DEPTH GROUNDWATER ENCOUNTERED: 7'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? YES, TEMPORARY — IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (SB-42 0-2) and 5 to 7 feet below grade (SB-42 5-7)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Gravel	6.0	0-2'	SB-42 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-1'	Tan CLAY						
	1-5'	Red-brown medium-fine SAND	3.9	2-4'				
			7.3	4-6'				
	5-9'	Red-brown medium-fine SAND, moist 5 to 7 feet, saturated 7 to 9 feet	6.9	6-8'	SB-42 5-7 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
			4.9	8-10'				
	9-10'	Red-brown sandy CLAY, moist						
	10-11'	Red-brown sandy CLAY, moist	4.1	10-12'			90%	*No visual evidence of staining or odor observed*
	11-15'	Red CLAY	4.4	12-14'				
			5.0	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						**Rain and humidity may be affecting the PID*

PROJECT: **CRISTAL USA FACILITY** HOLE NO.: **SB-42**

SOIL BORING LOG		HOLE NUMBER SB-43	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Along the southeastern portion of the Kemira boundary fence		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 13:20	13. DATE AND TIME COMPLETED 4/3/15 13:40	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-43 0-2) and 4 to 6 feet below grade (SB-43 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	DIRECT READING* (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Brown medium-fine SAND and gravel	9.9	0-2'	SB-43 0-2 (one 8 oz. soil jar)		75%	*Minor petroleum odor and staining from 4 to 5 feet*
	2-5'	Red-brown CLAY	15.8	2-4'				
			18.8	4-6'				
	5-6'	Red-brown CLAY						
	6-7'	Gray-brown silty CLAY, wet	15.4	6-8'	SB-43 4-6 (one 8 oz. soil jar); DUP-09		60%	*Minor petroleum odor and staining from 5 to 6 feet*
	7-10'	Red-orange sandy CLAY, moist	12.1	8-10'				
	10-14'	Brown sandy CLAY, moist	12.3	10-12'			75%	*No visual evidence of staining or odor observed*
			13.6	12-14'				
	14-15'	Red CLAY, moist	10.1	14-15'				
		Borehole terminated at 15 feet below grade						**Rain and humidity may be affecting the PID*

PROJECT: CRISTAL USA FACILITY	HOLE NO.: SB-43

SOIL BORING LOG		HOLE NUMBER SB-44	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near southern portion of the Kemira boundary fence and Batch Attach Lagoon		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCs / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 13:45	13. DATE AND TIME COMPLETED 4/3/15 14:05	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 10'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-44 0-2) and 8 to 10 feet below grade (SB-44 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-3'	Red-brown sandy CLAY	4.4	0-2'	SB-44 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
			7.7	2-4'				
	3-3.5'	White loamy SAND						
	3.5-5'	Gray loamy SAND	10.8	4-6'				
	5.5-6'	Brown fine SAND						
	6-9'	Red-brown CLAY	9.6	6-8'			50%	*No visual evidence of staining or odor observed*
			10.1	8-10'	SB-44 8-10 (one 8 oz. soil jar)			
	9-10'	Brown fine SAND						
	10-12'	Brown fine SAND, wet	12.7	10-12'			60%	*No visual evidence of staining or odor observed*
	12-14.5'	Red-white CLAY, wet from 12 to 13 feet	13.6	12-14'				
	14.5-15'	Dark gray CLAY	18.0	14-15'				
		Borehole terminated at 15 feet below grade						**Rain and humidity may be affecting the PID*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-44

SOIL BORING LOG		HOLE NUMBER SB-45	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Berm located between the Batch Attach Lagoon and the PWAN/SWAN area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 9:40	13. DATE AND TIME COMPLETED 4/7/15 10:10	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 4'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-45 0-2) and 2 to 4 feet below grade (SB-45 2-4)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Drilling refusal was encountered at five feet below grade on possible rock or concrete; moved soil boring approximately 2 feet to the west						
	0-0.5'	Tan coarse SAND and gravel	0.7	0-2'	SB-45 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)			
	0.5-4'	Red-brown CLAY	1.0	2-4'	SB-45 2-4 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of petroleum staining or odor observed; sulfur odor observed from 4 to 5 feet*
	4-5'	Gray CLAY, wet	1.3	4-6'				
	5-6'	Gray CLAY, wet						
	6-10'	Red and brown CLAY, moist	1.0 1.0	6-8' 8-10'			50%	*No visual evidence of petroleum staining or odor observed; sulfur odor observed from 5 to 6 feet*
	10-14'	Red and brown CLAY, moist	0.8 1.3	10-12' 12-14'			50%	*No visual evidence of staining or odor observed*
	14-15'	Light brown medium-fine SAND, moist	1.4	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-45

SOIL BORING LOG		HOLE NUMBER SB-46	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Along the southwestern portion of the Middle Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 12:15	13. DATE AND TIME COMPLETED 4/8/15 12:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 12'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-46 0-2) and 10 to 12 feet below grade (SB-46 10-12)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown sandy CLAY and gravel	0.5	0-2'	SB-46 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-5'	Red to brown CLAY	0.6	2-4'				
			1.0	4-6'				
	5-10'	Red to brown CLAY	0.6	6-8'			50%	*No visual evidence of staining or odor observed*
			0.5	8-10'				
	10-12'	Red, white and purple CLAY	0.3	10-12'	SB-46 10-12 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	12-13'	Red and purple CLAY, wet	0.1	12-14'				
	13-15'	Red and tan CLAY	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-46

SOIL BORING LOG		HOLE NUMBER SB-47	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near transformer substation located along the southern portion of the Batch Attack Lagoon		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 8:10	13. DATE AND TIME COMPLETED 4/7/15 8:30	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 9'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-47 0-2) and 7 to 9 feet below grade (SB-47 7-9)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-4'	Brown CLAY	1.1	0-2'	SB-47 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
			1.4	2-4'				
	4-5'	Gray CLAY, moist	1.3	4-6'				
	5-9'	Red CLAY	1.5	6-8'	SB-47 7-9 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
			1.2	8-10'				
	9-10'	Brown coarse SAND, wet						
	10-12'	Brown coarse SAND, wet	1.1	10-12'			25%	*No visual evidence of staining or odor observed*
	12-15'	Red and white CLAY, moist	1.2	12-14'				
			1.3	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-47

SOIL BORING LOG		HOLE NUMBER SB-48	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Near transformer substation located along the southern portion of the prior titanium ore storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 12:40	13. DATE AND TIME COMPLETED 4/8/15 12:55	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-48 0-2) and 13 to 15 feet below grade (SB-48 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Red sandy CLAY and gravel	0.3	0-2'	SB-48 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	1-4'	Brown sandy CLAY	0.5	2-4'				
	4-5'	Red and brown CLAY	0.4	4-6'				
	5-7'	Red and brown CLAY	0.6	6-8'			75%	*No visual evidence of staining or odor observed*
	7-10'	Red and purple CLAY	0.8	8-10'				
	10-11'	Red and purple CLAY	0.9	10-12'			100%	*No visual evidence of staining or odor observed*
	11-15'	White and red CLAY	0.8	12-14'	SB-48 13-15 (one 8 oz. soil jar)			
			1.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT: CRISTAL USA FACILITY	HOLE NO.: SB-48

SOIL BORING LOG		HOLE NUMBER SB-49	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Red clay - Southern portion of the property		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 13:00	13. DATE AND TIME COMPLETED 4/8/15 13:15	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-49 0-2) and 4 to 6 feet below grade (SB-49 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Red CLAY with little gravel	0.4	0-2'	SB-49 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	2-4'	Gray-brown CLAY, moist	0.0	2-4'				
	4-5'	Brown CLAY, moist	0.7	4-6'				
	5-7'	Brown CLAY, moist, wet 6 to 7 feet	0.1	6-8'	SB-49 4-6 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	7-10'	Dark gray loamy SAND, wet	0.9	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-49

SOIL BORING LOG		HOLE NUMBER SB-50	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Southern portion of the property		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 12:00	13. DATE AND TIME COMPLETED 4/10/15 12:15	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-50 0-2) and 4 to 6 feet below grade (SB-50 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-4'	Red CLAY and gravel	0.0 0.0	0-2' 2-4'	SB-50 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		25%	*No visual evidence of staining or odor observed*
	4-5'	Brown loamy CLAY, moist	0.0	4-6'				
	5-10'	Dark gray loamy CLAY, moist, wet 6 to 10 feet	0.0 0.0	6-8' 8-10'	SB-50 4-6 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		25%	*No visual evidence of staining or odor observed*
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-50

SOIL BORING LOG		HOLE NUMBER SB-51	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - Along the western portion of the Lower Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/10/15 12:25	13. DATE AND TIME COMPLETED 4/10/15 12:40	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 5'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-51 0-2) and 3 to 5 feet below grade (SB-51 3-5)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Dark brown sandy CLAY and gravel	0.0	0-2'	SB-51 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	2-5'	Tan silty CLAY, moist	0.0	2-4'				
			0.0	4-6'	SB-51 3-5 (one 8 oz. soil jar)			
	5-10'	Tan silty CLAY, saturated	0.0	6-8'			75%	*No visual evidence of staining or odor observed*
			0.0	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-51

SOIL BORING LOG

HOLE NUMBER: **SB-52**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Gravel - road between the Batch Attack Lagoon and the Lower Basin	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/7/15 8:35	13. DATE AND TIME COMPLETED: 4/7/15 8:55
14. OVERBURDEN THICKNESS: >15'	15. DEPTH GROUNDWATER ENCOUNTERED: NA	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (SB-52 0-2) and 13 to 15 feet below grade (SB-52 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: Cuttings / IF NOT A WELL, BACKFILLED WITH:	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	0.9	0-2'	SB-52 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-4'	Red and brown CLAY	1.0	2-4'				
	4-4.5'	Black medium-fine SAND, moist						
	4.5-5'	Red CLAY	1.4	4-6'				
	5-6'	Red CLAY						
	6-7'	Black medium-fine SAND, moist	1.5	6-8'			75%	*No visual evidence of staining or odor observed*
	7-10'	Red CLAY with line of gravel at 9.5 feet	1.6	8-10'				
	10-15'	Red and brown CLAY	1.0	10-12'			75%	*No visual evidence of staining or odor observed*
			1.2	12-14'				
			1.8	14-15'	SB-52 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT: **CRISTAL USA FACILITY**	HOLE NO.: **SB-52**

SOIL BORING LOG

HOLE NUMBER: SB-53

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Dan Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Red clay - Near southern property boundary fence	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/8/15 13:20	13. DATE AND TIME COMPLETED: 4/8/15 13:45
14. OVERBURDEN THICKNESS: >15'	15. DEPTH GROUNDWATER ENCOUNTERED: 7'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? YES, TEMPORARY / IF SO COMPLETE CONSTRUCTION DIAGRAM:	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (SB-53 0-2) and 5 to 7 feet below grade (SB-53 5-7)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE:	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	Red and white CLAY	0.0	0-2'	SB-53 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
			0.2	2-4'				
			0.1	4-6'				
	5-7'	Red and white CLAY	0.7	6-8'	SB-53 5-7 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	7-10'	Dark brown and gray loamy SAND, wet	0.6	8-10'				
	10-11'	Black sandy CLAY, wet	0.1	10-12'			75%	*No visual evidence of staining or odor observed*
	11-12'	White loamy SAND with little gravel, wet						
	12-15'	Dark gray loamy SAND, wet	0.3	12-14'				
			0.3	14-15'				
		Borehole terminated at 15 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 5 feet of casing to ground surface						

PROJECT: CRISTAL USA FACILITY

HOLE NO.: SB-53

SOIL BORING LOG

HOLE NUMBER: **SB-54**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Red clay - Southern portion of the property	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/9/15 8:00	13. DATE AND TIME COMPLETED: 4/9/15 8:15
14. OVERBURDEN THICKNESS: >15'	15. DEPTH GROUNDWATER ENCOUNTERED: 13'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (SB-54 0-2) and 11 to 13 feet below grade (SB-54 11-13)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-3'	Red CLAY	0.0	0-2'	SB-54 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
			0.0	2-4'				
	3-4'	Brown sandy CLAY						
	4-5'	Dark brown sandy CLAY	0.0	4-6'				
	5-6'	Dark brown sandy CLAY						
	6-8'	Red CLAY	0.0	6-8'			50%	*No visual evidence of staining or odor observed*
	8-9'	Brown medium-fine SAND	0.0	8-10'				
	9-10'	Red medium-fine SAND						
	10-13'	Red medium-fine sandy CLAY, moist	0.0	10-12'	SB-54 11-13 (one 8 oz. soil jar); DUP-17		60%	*No visual evidence of staining or odor observed*
			0.0	12-14'				
	13-14'	Brown loamy SAND, wet						
	14-15'	Dark brown loamy SAND, wet	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **SB-54**

SOIL BORING LOG		HOLE NUMBER SB-55	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED. IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Red clay - Along the southwestern portion of the Lower Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/9/15 8:20	13. DATE AND TIME COMPLETED 4/9/15 8:35	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 8'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-55 0-2) and 6 to 8 feet below grade (SB-55 6-8)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Red CLAY	0.0	0-2'	SB-55 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	2-5'	Dark brown sandy CLAY, moist	0.0	2-4'				
			0.0	4-6'				
	5-10'	Dark brown sandy CLAY, moist, wet 8 to 10 feet	0.0	6-8'	SB-55 6-8 (one 8 oz. soil jar)		90%	*No visual evidence of staining or odor observed*
			0.0	8-10'				
	10-12'	Brown loamy SAND, wet	0.0	10-12'			100%	*No visual evidence of staining or odor observed*
	12-14'	White loamy SAND, sticky, wet	0.0	12-14'				
	14-15'	Dark gray loamy SAND, wet	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-55

SOIL BORING LOG		HOLE NUMBER SB-56
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.	SHEET SHEETS 1 of 1
5. PROJECT CRISTAL USA FACILITY		
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Road near 002 Outfall	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/7/15 9:00	13. DATE AND TIME COMPLETED 4/7/15 9:25
14. OVERBURDEN THICKNESS >24'	15. DEPTH GROUNDWATER ENCOUNTERED 20'	
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA	
18. TOTAL DEPTH OF HOLE 24'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA	
20. WELL INSTALLED? YES, TEMPORARY / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-56 0-2) and 18 to 20 feet below grade (SB-56 18-20)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	FILL (white to brown coarse sand and gravel)	0.3 0.3 0.9	0-2' 2-4' 4-6'	SB-56 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	5-7'	Red and brown sandy CLAY, moist	1.0	6-8'			50%	*No visual evidence of staining or odor observed*
	7-10'	Red CLAY, moist	0.7	8-10'				
	10-15'	Red CLAY, moist	0.6 0.4 1.0	10-12' 12-14' 14-15'			50%	*No visual evidence of staining or odor observed*
	15-17'	Gray and brown CLAY, moist	0.7	15-17'			50%	*No visual evidence of staining or odor observed*
	17-20'	Brown-red coarse SAND and gravel, moist	0.9	17-19'	SB-56 18-20 (one 8 oz. soil jar)			
	20-24'	Red-brown to tan coarse SAND, wet	0.4 0.8 0.7	19-20' 20-22' 22-24'			50%	*No visual evidence of staining or odor observed*
		Borehole terminated at 24 feet below grade; placed temporary groundwater monitoring well with 10 feet of screen and 15 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-56

SOIL BORING LOG		HOLE NUMBER SB-57	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Red clay - Near southern portion of the Lower Basin		
11. DIRECT READING PARAMETERS. PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 8:40	13. DATE AND TIME COMPLETED 4/8/15 9:00	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-57 0-2) and 4 to 6 feet below grade (SB-57 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Red CLAY	0.0	0-2'	SB-57 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	0.5-5'	Light brown medium-fine SAND, moist at base	0.0	2-4'				
			0.0	4-6'				
	5-10'	Light brown medium-fine SAND, moist 5 to 6 feet, saturated 6 to 8 feet, wet 8 to 10 feet	0.0	6-8'	SB-57 4-6 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
			0.0	8-10'				
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-57

SOIL BORING LOG		HOLE NUMBER SB-58	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Red clay - Near southern portion of the Lower Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/9/15 9:05	13. DATE AND TIME COMPLETED 4/9/15 9:25	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED 13'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-58 0-2) and 11 to 13 feet below grade (SB-58 11-13)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Red CLAY	0.0	0-2'	SB-58 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	2-3'	Red-brown medium-fine SAND	0.0	2-4'				
	3-5'	Red CLAY	0.0	4-6'				
	5-10'	Red and white CLAY	0.0	6-8'			75%	*No visual evidence of staining or odor observed*
			0.0	8-10'				
	10-13'	Red and white CLAY	0.0	10-12'	SB-58 11-13 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	13-13.5'	Brown loamy SAND, wet	0.0	12-14'				
	13.5-14'	Red CLAY						
	14-15'	Gray silty CLAY	0.0	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-58

SOIL BORING LOG		HOLE NUMBER SB-59	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Red clay - Along southeastern portion of the Lower Basin and near the southeastern property boundary fence		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/9/15 9:35	13. DATE AND TIME COMPLETED 4/9/15 9:55	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? YES, TEMPORARY IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB		
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-59 0-2) and 4 to 6 feet below grade (SB-59 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen		

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	Red and white CLAY	0.0 0.0 0.0	0-2' 2-4' 4-6'	SB-59 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	5-6'	Red and white CLAY			SB-59 4-6 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	6-8'	Dark brown loamy SAND, wet	0.0	6-8'				
	8-10'	Gray loamy SAND, wet	0.0	8-10'				
		Borehole terminated at 10 feet below grade; placed temporary groundwater monitoring well with 5 feet of screen and 5 feet of casing to ground surface						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-59

SOIL BORING LOG

HOLE NUMBER: **SB-60**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET 1 of 1 SHEETS
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Grass - Road along the southern portion of the Landfill	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/10/15 13:00	13. DATE AND TIME COMPLETED: 4/10/15 13:20
14. OVERBURDEN THICKNESS: >20'	15. DEPTH GROUNDWATER ENCOUNTERED: 14'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 20'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? YES, TEMPORARY — IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (SB-60 0-2) and 12 to 14 feet below grade (SB-60 12-14)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Dark brown coarse SAND and gravel	0.0	0-2'	SB-60 0-2 (one 8 oz. soil jar and one 4 oz. soil jar); DUP-20		75%	*No visual evidence of staining or odor observed*
	1-5'	Light red-brown medium-fine SAND, moist	0.0	2-4'				
			0.0	4-6'				
	5-6'	Light red-brown medium-fine SAND, moist						
	6-7'	Gray-brown CLAY, wet	0.0	6-8'			50%	*No visual evidence of staining or odor observed*
	7-10'	Red CLAY	0.0	8-10'				
	10-13'	Red CLAY	0.0	10-12'				
			0.0	12-14'	SB-60 12-14 (one 8 oz. soil jar); MS/MSD-10		75%	*No visual evidence of staining or odor observed*
	13-14'	Light red-brown sandy CLAY						
	14-15'	Orange-brown medium-fine SAND, saturated	0.0	14-16'				
	15-20'	Red and white CLAY	0.0	16-18'			100%	*No visual evidence of staining or odor observed*
			0.0	18-20'				
		Borehole terminated at 20 feet below grade, placed temporary groundwater monitoring well with 10 feet of screen and 10 feet of casing to ground surface						

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **SB-60**

SOIL BORING LOG		HOLE NUMBER SB-61	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near the aboveground oil/water seperator located near the Gas Turbines		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/3/15 10:45	13. DATE AND TIME COMPLETED 4/3/15 11:15	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 6'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (SB-61 0-2) and 4 to 6 feet below grade (SB-61 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING* (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Gravel	0.0	0-2'	SB-61 0-2 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Brown sandy CLAY with little gravel, moist at 5 feet	0.8	2-4'				
			1.6	4-6'				
	5-6'	Brown sandy CLAY with little gravel, moist						
	6-8'	Gray loamy SAND, wet	1.4	6-8'	SB-61 4-6 (one 8 oz. soil jar, two 4 oz. soil jars and encores)		75%	*No visual evidence of staining or odor observed*
	8-10'	Brown fine sandy CLAY, saturated	0.9	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	SB-61

SOIL BORING LOG		HOLE NUMBER TS-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near the northern portion of the prior Chloride Ore Storage Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 7:35	13. DATE AND TIME COMPLETED 4/8/15 7:40	
14. OVERBURDEN THICKNESS >5'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 5'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (TS-01 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	0.4	0-2'	TS-01 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	0.5-1'	Crushed rock	0.5	2-4'				
	1-5'	Brown sandy CLAY and gravel	0.2	4-5'				
		Drilling refusal on concrete at 5 feet below grade; borehole terminated						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-01

SOIL BORING LOG		HOLE NUMBER TS-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Near the western portion of the prior Chloride Ore Storage Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 7:45	13. DATE AND TIME COMPLETED 4/8/15 8:00	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (TS-02 0-2) and 13 to 15 feet below grade (TS-02 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	0.3	0-2'	TS-02 0-2 (one 8 oz. soil jar)			
	0.5-3'	Red-brown CLAY	0.4	2-4'			100%	*No visual evidence of staining or odor observed*
	3-5'	Red CLAY	0.4	4-6'				
	5-10'	Red and white CLAY	0.4	6-8'			100%	*No visual evidence of staining or odor observed*
			0.2	8-10'				
	10-11'	Red and white CLAY	0.4	10-12'				
	11-12'	Red-brown sandy CLAY						
	12-15'	Light brown sandy CLAY, moist	0.5	12-14'			100%	*No visual evidence of staining or odor observed*
			0.6	14-15'	TS-02 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-02

SOIL BORING LOG		HOLE NUMBER TS-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near the eastern portion of the prior Chloride Ore Storage Building and several storage containers		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 8:10	13. DATE AND TIME COMPLETED 4/8/15 8:20	
14. OVERBURDEN THICKNESS >5'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 5'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (TS-03 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Asphalt	0.3	0-2'	TS-03 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	0.5-2'	Red-brown sandy CLAY	0.5	2-4'				
	2-5'	Red CLAY	0.1	4-5'				
		Borehole terminated at 5 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-03

SOIL BORING LOG		HOLE NUMBER TS-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Asphalt - Near the southwestern portion of the prior Chloride Ore Storage Building		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 8:25	13. DATE AND TIME COMPLETED 4/8/15 8:45	
14. OVERBURDEN THICKNESS 10'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (TS-04 0-2) and 8 to 10 feet below grade (TS-04 8-10)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	0.2	0-2'	TS-04 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*
	1-3'	Brown medium-fine SAND	0.1	2-4'				
	3-5'	Red CLAY	0.0	4-6'				
	5-10'	Red and white CLAY	0.2	6-8'			100%	*No visual evidence of staining or odor observed*
			0.6	8-10'	TS-04 8-10 (one 8 oz. soil jar); DUP-15			
		Drilling refusal at 10 feet below grade; borehole terminated						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-04

SOIL BORING LOG		HOLE NUMBER TS-05	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - On road to the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 9:00	13. DATE AND TIME COMPLETED 4/8/15 9:05	
14. OVERBURDEN THICKNESS >5'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 5'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (TS-05 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	0.0	0-2'	TS-05 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	1-4'	Light brown medium-fine SAND	0.5	2-4'				
	4-5'	Red CLAY	0.2	4-5'				
		Borehole terminated at 5 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-05

SOIL BORING LOG		HOLE NUMBER TS-06	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - On top of the hill in the northwestern portion of the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 9:55	13. DATE AND TIME COMPLETED 4/8/15 10:15	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (TS-06 0-2) and 13 to 15 feet below grade (TS-06 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	FILL (Brown sandy clay and gravel)	0.3	0-2'	TS-06 0-2 (one 8 oz. soil jar)		50%	*No visual evidence of staining or odor observed*
	1-2'	FILL (Gray medium-fine sand and gravel, white loam at 2 feet)						
	2-3'	FILL (Brown sandy clay and gravel)	0.9	2-4'				
	3-5'	FILL (Red clay)	0.4	4-6'				
	5-6'	FILL (Dark brown fine sand)						
	6-8'	FILL (Brown sandy clay)	0.9	6-8'			75%	*No visual evidence of staining or odor observed*
	8-10'	FILL (Dark brown medium-fine sand and gravel, line of white sticky loam at 9 feet)	1.0	8-10'				
	10-15'	FILL (Dark brown medium-fine sand), moist at base	0.0	10-12'			50%	*No visual evidence of staining or odor observed*
			0.4	12-14'				
			0.8	14-15'	TS-06 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-06

SOIL BORING LOG

HOLE NUMBER: **TS-07**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.		SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY			
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Grass - In northern portion of the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/8/15 10:20	13. DATE AND TIME COMPLETED: 4/8/15 10:35	
14. OVERBURDEN THICKNESS: >10'	15. DEPTH GROUNDWATER ENCOUNTERED: 6'		
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA		
18. TOTAL DEPTH OF HOLE: 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA		
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM		SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (TS-07 0-2) and 4 to 6 feet below grade (TS-07 4-6)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE:	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Light brown medium-fine SAND	0.7	0-2'	TS-07 0-2 (one 8 oz. soil jar); DUP-16		75%	*No visual evidence of staining or odor observed*
	2-5'	Light brown-orange silty CLAY	0.4	2-4'				
			0.6	4-5'				
	5-10'	Light brown-orange silty CLAY, saturated from 6 to 10 feet	0.1	6-8'	TS-07 4-6 (one 8 oz. soil jar); MS/MSD-08		75%	*No visual evidence of staining or odor observed*
			0.8	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **TS-07**

SOIL BORING LOG		HOLE NUMBER TS-08	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Dan Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - In southern portion of the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 9:10	13. DATE AND TIME COMPLETED 4/8/15 9:25	
14. OVERBURDEN THICKNESS >15'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (TS-08 0-2) and 13 to 15 feet below grade (TS-08 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Brown coarse SAND and gravel	0.5	0-2'	TS-08 0-2 (one 8 oz. soil jar)			
	1-4.5'	Red CLAY	0.9	2-4'			75%	*No visual evidence of staining or odor observed*
	4.5-5'	Red-brown medium-fine SAND	0.2	4-5'				
	5-10'	Red and white CLAY	0.4	6-8'			100%	*No visual evidence of staining or odor observed*
			0.8	8-10'				
	10-15'	Red CLAY	0.7	10-12'			100%	*No visual evidence of staining or odor observed*
			0.1	12-14'				
			0.8	14-15'	TS-08 13-15 (one 8 oz. soil jar)			
		Borehole terminated at 15 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-08

SOIL BORING LOG		HOLE NUMBER TS-09	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Grass - In eastern portion of the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 10:50	13. DATE AND TIME COMPLETED 4/8/15 11:00	
14. OVERBURDEN THICKNESS >5'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 5'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (TS-09 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-5'	Orange-brown silty CLAY, moist at base	0.7 1.0 0.8	0-2' 2-4' 4-5'	TS-09 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
		Borehole terminated at 5 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-09

SOIL BORING LOG		HOLE NUMBER TS-10	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - In southeastern portion of the prior Titanium Ore Storage area		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/8/15 9:35	13. DATE AND TIME COMPLETED 4/8/15 9:50	
14. OVERBURDEN THICKNESS >5'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 5'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (TS-10 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Brown coarse SAND and gravel	1.0	0-2'	TS-10 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-1'	Tan medium-fine SAND	0.2	2-4'				
	1-5'	Red and white CLAY	1.2	4-5'				
		Borehole terminated at 5 feet below grade			Collected TS-01 to TS-10 COMP from surface soil of TS-01 to TS-10 soil borings (one 4 oz. soil jar)			

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	TS-10

SOIL BORING LOG		HOLE NUMBER UB-01	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Northern portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 7:45	13. DATE AND TIME COMPLETED 4/1/15 8:05	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 7'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (UB-01 0-2) and 5 to 7 feet below grade (UB-01 5-7)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen		

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-1'	Red brown sandy CLAY and little gravel	0.7	0-2'	UB-01 0-2 (one 8 oz. soil jar); DUP-04		75%	*No visual evidence of staining or odor observed*
	1-3'	Light brown fine SAND, moist	0.5	2-4'				
	3-5'	Brown sandy CLAY, moist	0.6	4-6'				
	5-7'	Brown sandy CLAY with little gravel, moist	0.8	6-8'	UB-01 5-7 (one 8 oz. soil jar); MS/MSD-02		100%	*No visual evidence of staining or odor observed*
	7-9'	Brown sandy CLAY, wet	0.8	8-10'				
	9-10'	Dark gray fine SAND, wet						
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	UB-01

SOIL BORING LOG		HOLE NUMBER UB-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL GEOPROBE 7822DT		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE HDPE	10. SURFACE ELEVATION AND CONDITIONS Gravel - Western portion of the Upper Basin		
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED 4/1/15 8:10	13. DATE AND TIME COMPLETED 4/1/15 8:20	
14. OVERBURDEN THICKNESS >10'	15. DEPTH GROUNDWATER ENCOUNTERED 5'		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil samples collected at 0 to 2 feet below grade (UB-02 0-2) and 3 to 5 feet below grade (UB-02 3-5)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet (approximate) for VOCs with a PID		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-2'	Red-brown CLAY	0.6	0-2'	UB-02 0-2 (one 8 oz. soil jar)		90%	*No visual evidence of staining or odor observed*
	2-3.5'	Light tan loamy SAND, moist	1.0	2-4'				
	3.5-4'	Dark brown silty SAND, moist						
	4-5'	White loamy SAND, moist	0.4	4-6'	UB-02 3-5 (one 8 oz. soil jar)			
	5-7'	White loamy SAND, wet, saturated 6 to 7 feet	0.5	6-8'			90%	*No visual evidence of staining or odor observed*
	7-9.5'	Dark brown loamy SAND, wet	0.8	8-10'				
	9.5-10'	White loamy SAND, wet						
		Borehole terminated at 10 feet below grade						

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	UB-02

SOIL BORING LOG

HOLE NUMBER: **UB-03**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET 1 of 1 SHEETS
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Grass - Central portion of the Upper Basin	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/1/15 8:30	13. DATE AND TIME COMPLETED: 4/1/15 8:45
14. OVERBURDEN THICKNESS: >10'	15. DEPTH GROUNDWATER ENCOUNTERED: 5'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (UB-03 0-2) and 3 to 5 feet below grade (UB-03 3-5)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-3'	Dark brown sandy CLAY with little gravel	0.8	0-2'	UB-03 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
			0.7	2-4'				
	3-5'	Brown loamy SAND, moist, wet at base	0.6	4-6'	UB-03 3-5 (one 8 oz. soil jar)			
	5-7'	Brown loamy SAND, wet	1.0	6-8'			90%	*No visual evidence of staining or odor observed*
	7-10'	Dark gray silty SAND, wet	0.5	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **UB-03**

SOIL BORING LOG

HOLE NUMBER: UB-04

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Grass - Southeastern portion of the Upper Basin	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/1/15 13:45	13. DATE AND TIME COMPLETED: 4/1/15 14:05
14. OVERBURDEN THICKNESS: >10'	15. DEPTH GROUNDWATER ENCOUNTERED: 4'	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 10'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (UB-04 0-2) and 2 to 4 feet below grade (UB-04 2-4)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: Cuttings / IF NOT A WELL, BACKFILLED WITH:	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-4'	Red CLAY	0.8	0-2'	UB-02 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
			2.0	2-4'	UB-04 2-4 (one 8 oz. soil jar)			
	4-5'	Black loamy SAND, wet	1.5	4-6'				
	5-8'	Black loamy SAND, wet	2.5	6-8'			75%	*No visual evidence of staining or odor observed*
	8-10'	Dark brown medium-fine SAND, saturated	1.8	8-10'				
		Borehole terminated at 10 feet below grade						

PROJECT: CRISTAL USA FACILITY

HOLE NO.: UB-04

SOIL BORING LOG

HOLE NUMBER: **UB-05**

1. COMPANY NAME: URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR: GSI Mid-Atlantic, Inc.	SHEET: 1 of 1
3. PROJECT: CRISTAL USA FACILITY		
7. NAME OF DRILLER: Don Marchese	8. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE 7822DT	
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 in. x 5 ft. macrocore TYPE OF LINER USED, IF APPLICABLE: HDPE	10. SURFACE ELEVATION AND CONDITIONS: Grass - Southwestern portion of the Upper Basin	
11. DIRECT READING PARAMETERS: PID / TOTAL VOCS / 11.7 EV / MINIRAE 3000	12. DATE AND TIME STARTED: 4/1/15 10:30	13. DATE AND TIME COMPLETED: 4/1/15 10:50
14. OVERBURDEN THICKNESS: >15'	15. DEPTH GROUNDWATER ENCOUNTERED: NA	
16. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
18. TOTAL DEPTH OF HOLE: 15'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	
20. WELL INSTALLED? NO / IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS: Soil samples collected at 0 to 2 feet below grade (UB-05 0-2) and 13 to 15 feet below grade (UB-05 13-15)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS: Every 2 feet (approximate) for VOCs with a PID	SCREENING ANALYSIS: VOCs
22. DISPOSITION OF HOLE: IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST: Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
	0-0.5'	Tan fine SAND, wet	1.0	0-2'	UB-05 0-2 (one 8 oz. soil jar)		75%	*No visual evidence of staining or odor observed*
	0.5-5'	Red-brown CLAY	2.3	2-4'				
			2.7	4-6'				
	5-10'	Red and white CLAY	2.1	6-8'			100%	*No visual evidence of staining or odor observed*
			1.6	8-10'				
	10-15'	Red and white CLAY	1.7	10-12'			100%	*No visual evidence of staining or odor observed*
			2.0	12-14'	UB-05 13-15 (one 8 oz. soil jar); DUP-05			
			1.7	14-15'				
		Borehole terminated at 15 feet below grade						

PROJECT: **CRISTAL USA FACILITY**

HOLE NO.: **UB-05**

SOIL BORING LOG		HOLE NUMBER LB-02	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER NA	8. MANUFACTURER'S DESIGNATION OF DRILL NA		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT NA TYPE OF LINER USED, IF APPLICABLE NA	10. SURFACE ELEVATION AND CONDITIONS Grass - Central portion of the Lower Basin		
11. DIRECT READING PARAMETERS: NA	12. DATE AND TIME STARTED 4/9/15 11:32	13. DATE AND TIME COMPLETED 4/9/15 11:35	
14. OVERBURDEN THICKNESS > 2'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 2'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (LB-02 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS 2 feet		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Lower Basin is too wet and tree covered to access with the Geoprobe drill rig. Used a trowel to collect a surface soil sample						
	0-2'	Dark brown loamy SAND, wet			LB-02 0-2 (one 8 oz. soil jar)		100%	*No visual evidence of staining or odor observed*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	LB-02

SOIL BORING LOG		HOLE NUMBER LB-03	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER NA	8. MANUFACTURER'S DESIGNATION OF DRILL NA		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT NA TYPE OF LINER USED, IF APPLICABLE NA	10. SURFACE ELEVATION AND CONDITIONS Grass - Eastern portion of the Lower Basin		
11. DIRECT READING PARAMETERS: NA	12. DATE AND TIME STARTED 4/9/15 11:25	13. DATE AND TIME COMPLETED 4/9/15 11:30	
14. OVERBURDEN THICKNESS > 2'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 2'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (LB-03 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE IF NOT A WELL, BACKFILLED WITH: Cuttings		23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Lower Basin is too wet and tree covered to access with the Geoprobe drill rig. Used a trowel to collect a surface soil sample						
	0-2'	Dark brown loamy SAND, wet			LB-03 0-2 (one 8 oz. soil jar); MS/MSD-09			*No visual evidence of staining or odor observed*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	LB-03

SOIL BORING LOG		HOLE NUMBER LB-04	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET 1 of 1 SHEETS
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER NA	8. MANUFACTURER'S DESIGNATION OF DRILL NA		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT NA TYPE OF LINER USED, IF APPLICABLE NA	10. SURFACE ELEVATION AND CONDITIONS Grass - Southwestern portion of the Lower Basin		
11. DIRECT READING PARAMETERS: NA	12. DATE AND TIME STARTED 4/9/15 11:55	13. DATE AND TIME COMPLETED 4/9/15 12:00	
14. OVERBURDEN THICKNESS > 2'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 2'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (LB-04 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE Cuttings	IF NOT A WELL, BACKFILLED WITH:	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Lower Basin is too wet and tree covered to access with the Geoprobe drill rig. Used a trowel to collect a surface soil sample						
	0-2'	Red and brown CLAY			LB-04 0-2 (one 8 oz. soil jar)			*No visual evidence of staining or odor observed*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	LB-04

SOIL BORING LOG		HOLE NUMBER LB-05	
1. COMPANY NAME URBAN GREEN ENVIRONMENTAL, LLC	2. DRILL SUBCONTRACTOR GSI Mid-Atlantic, Inc.		SHEET SHEETS 1 of 1
3. PROJECT CRISTAL USA FACILITY			
7. NAME OF DRILLER NA	8. MANUFACTURER'S DESIGNATION OF DRILL NA		
9. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT NA TYPE OF LINER USED, IF APPLICABLE NA	10. SURFACE ELEVATION AND CONDITIONS Grass - Southeastern portion of the Lower Basin		
11. DIRECT READING PARAMETERS: NA	12. DATE AND TIME STARTED 4/9/15 11:15	13. DATE AND TIME COMPLETED 4/9/15 11:20	
14. OVERBURDEN THICKNESS > 2'	15. DEPTH GROUNDWATER ENCOUNTERED NA		
16. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA		
18. TOTAL DEPTH OF HOLE 2'	19. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA		
20. WELL INSTALLED? NO	IF SO COMPLETE CONSTRUCTION DIAGRAM	SAMPLE TYPE: GRAB	
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS Soil sample collected at 0 to 2 feet below grade (LB-05 0-2)	SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS Every 2 feet		SCREENING ANALYSIS VOCs
22. DISPOSITION OF HOLE	IF NOT A WELL, BACKFILLED WITH: Cuttings	23. GEOLOGIST Katherine Christensen	

USCS LOG (a)	DEPTH (FT) (b)	DESCRIPTION OF MATERIALS (c)	DIRECT READING (d) VOC (ppm)	DIRECT READING (d) Depth of Reading	ANALYTICAL SAMPLE DESIGN. (e)	DEPTH (FT) (f)	RECOVERY % (g)	REMARKS
		Lower Basin is too wet and tree covered to access with the Geoprobe drill rig. Used a trowel to collect a surface soil sample						
	0-2'	Dark brown loamy SAND, moist			LB-05 0-2 (one 8 oz. soil jar); DUP-18			*No visual evidence of staining or odor observed*

PROJECT:	HOLE NO.:
CRISTAL USA FACILITY	LB-05

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1440819.169, 560033.1515
Surface Elevation: 42' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 1
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-01
Sampling Method:		Sheet 1 of 1
Standard Split Spoon Sampler		

				Drilling	
Water Level	N/A			Start	Finish
Time	-			1040	1130
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	Surface Conditions: grass
	N/A				1		0-2 ft augered Clay cover
					2		
Grab	21	LF-01 2-4	0.0	4		SM	17 inches - sandy SILT, moist, fine to medium grained, 10 YR 2/2
				4	3	ML	4 inches - clayey SILT, wood, 10 YR 3/4
			0.0	3			LF-01 2-4 sampled at 1050
				4	4		
	24		0.0	2		OL	Clayey SILT, powdery, organics, 2.5 YR 3/1
				2	5		
			0.0	3			
				4	6		
	24		0.0	3			
				4	7	ML	7 inches - SILT, white, powdery, wet, 2.5 Y 8/3
			0.0	9			
				92	8		
	12		0.0	2			saturated
				2	9		
			0.0	2			
				2	10		
	24		0.0	2			
				2	11	ML	9 inches - SILT trace of fine grained sand, white, powdery
			0.0	5		SM	5 inches - SILT trace of fine grained sand, powdery, 10 YR 7/1
				4	12		
	24		0.0	2		ML	18 inches - SILT, powdery, saturated, 10 YR 5/4
				3	13	ML	6 inches - SILT powdery, saturated, 2.5 Y 8/2
			0.0	4			
				5	14		
	24		0.0	1		OL	Clayey SILT, powdery, organics, moist, 2.5 YR 3/1
					15		
			0.0	1			
					16		
	24		0.0	1		OL	10 inches - SILT, powdery, moist, GLEY 2 4/5B
				2	17	ML	8 inches - SILT, white 7.5 Y 8/2, saturated
			0.0	2			
				2	18		
Grab	24	LF-01 18-20	0.0	1		OL	6 inches - clayey SILT, powdery, organics, 2.5 YR 3/1
				1	19	ML	6 inches - SILT, white, saturated, powdery
			0.0	1		OL	10 inches clayey SILT, powdery, organics, 2.5 YR 3/1
				1	20		**FINAL DEPTH** LF-01 18-20 sampled at 1135

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441206.317, 560067.5158
Surface Elevation: 64' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 1
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-02
Sampling Method:		Sheet 1 of 2
Standard Split Spoon Sampler		Drilling

Water Level	N/A		
Time	-		
Date	N/A		
Reference	N/A		

Start	Finish
1225	1320

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	
							Surface Conditions: grass
	N/A				1		0-2 augered Clay cover
					2		
Grab	12	LF-02 2-4	0.0	23		SW	Brick/concrete debris with well-graded SANDS
				18	3		
			0.0	15			LF-02 2-4 sampled at 1245
				23	4		
	16		0.0	21		SM	SILT with SAND, grey 10YR 7/1 to white 2.5 Y 8/1
				22	5		
			0.0	23			
				22	6		
	12		0.0	17		SW	Brick/concrete debris with well-graded SANDS 7.5 YR 7/1
				15	7		2 inches of gravel at 4 inches, last 2 inches white fines
			0.0	12			
				22	8		
	14		0.0	4		**SM**	Concrete debris, SAND with SILT 7.5 YR 7/1
				9	9		
			0.0	19			
				22	10		
	16		0.0	8			
				12	11		
			0.0	21			
				23	12		
	14		0.0	11			
				9	13		
			0.0	8			
				8	14		
	18		0.0	5		OL	Clayey SILT 2.5 YR 4/6, organics, powdery
				2	15		
			0.0	3			
				4	16		
Grab	20	LF-02 16-18 DUP-LF-02	0.0	5			
				2	17		
			0.0	9		ML	6 inches SILT trace sand, 10 YR 3/7, mottled black
				9	18		LF-02 16-18 sampled at 1420/DUP-LF-02
	1		0.0	12		SM	Silty SAND, greyish white with gravel
				14	19		
			0.0	6			
				5	20		
	1		0.0	4		OL	Clayey SILT 2.5 YR 4/6, organics, powdery
				2	21		**CONTINUED**

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441206.317, 560067.5158
Surface Elevation: 64' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 1
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-02
Sampling Method:		
Standard Split Spoon Sampler		Sheet 2 of 2

				Drilling	
Water Level	N/A			Start	Finish
Time	-			1225	1320
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log
			0.0	2			
				2	22		

Surface Conditions: grass

FINAL DEPTH

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1440847.763, 559703.1733
Surface Elevation: 35.25' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 2
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-03
Sampling Method:		Sheet 1 of 1
Standard Split Spoon Sampler		Drilling

Water Level	N/A			Start	Finish
Time	-			0730	0810
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	
	20		0.0	1	1	SM	6 inches - sandy SILT, fine to medium grained, 7.5 YR 3/3
				4		SP	4 inches - SAND trace silt, medium grained, poorly graded, 5 YR 5/8
			0.0	3	2		
				3			
Grab	16	LF-03 2-4	0.0	5	3	ML	clayey SILT, white mottled red, stiff, compact
				8			LF-03 2-4 sampled at 0745
			0.0	10	4		
				10			
	17		0.0	3	5		
				5			
			0.0	7	6		
				8			
	18		0.0	8	7		mottled with grey from 10-15 inches
				10			
			0.0	14	8		
				16			
	14		0.0	4	9		red mottled white 2.5 YR 4/6
				4			
			0.0	5	10	SP	2 inches - medium grained SAND, poorly graded 10 YR 4/4
				7		ML	8 inches - clayey SILT, red mottled with white, stiff, compact
	18		0.0	2	11	SP	8 inches - medium grained SAND, poorly graded, 10 YR 4/4
				3		ML	2 inches - clayey SILT, trace fine grained sand, 7.5 YR 4/3
			0.0	4	12		
				6			
	14		0.0	7	13		
				9			
Grab		LF-03 13-15 DUP-LF-01	0.0	10	14	ML	6 inches - clayey SILT, white mottle red, moist
	12			10			
			0.0	8	15	ML	5 inches - SILT, white with tan 7.5 YR 5/4 mottling, powdery
				6			**FINAL DEPTH** LF-03 13-15 sampled at 0820/DUP-LF-01

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1440926.775, 559549.8432
Surface Elevation: 36' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 2
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-04
Sampling Method:		
Standard Split Spoon Sampler		Sheet 1 of 1
		Drilling

				Start	Finish
Water Level	N/A				
Time	-			0900	0940
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	
								Surface Conditions: grass
Grab	20	LF-04 0-2	0.0	1			SM	4 inches - sandy SILT, fine to medium grained, 7.5 YR 3/3
				1	1		SM	4 inches - sandy SILT, moist, fine to medium grained, 5 YR 5/8
			0.0	2			CL	12 inches - silty CLAY, mottled white/red, stiff, compact
				5	2			LF-04 0-2 sampled at 0905
	18		0.0	5			SP	12 inches - silty SAND fine to medium grained, poorly graded, 7.5 YR 6/6
				5	3		ML	6 inches - SILT trace of fine grained sand, 7.5 YR 3/2
			0.0	10				
				12	4			
	19		0.0	11			ML	SILT, white, compact, mottled with red
				11	5			
			0.0	12				
				13	6			
	17		0.0	5				
				5	7		ML	6 inches - SILT, trace medium grained sand, white, compact, mottled
			0.0	9				with red
				9	8			
	19		0.0	4			ML	SILT, compact, powdery, white, mottled with red and tan
				4	9			
			0.0	6				
				9	10			
	22		0.0	4			SM	Sandy SILT, fine to medium grained, white, mottled with red
				7	11			
			0.0	8				
				8	12			
	12		0.0	9			ML	Clayey SILT, 6 inches red with white mottle, 6 inches white with red mottle
				8	13			
			0.0	8				
				9	14			
Grab	18	LF-04 14-16	0.0	9				
				11	15			
			0.0	11				
				12	16			FINAL DEPTH LF-04 14-16 sampled at 0945

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441047.256, 559937.1929
Surface Elevation: 67.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-05
Sampling Method:		Sheet 1 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			1105	1320
Time	-				
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	
Grab	8	LF-05 0-2	0.0	2	1	SM	5 inches - sandy SILT, fine grained, 10 YR 3/2
				3		CL	3 inches - silty CLAY, red, 10 R 4/8, mottled with white, low plasticity
			0.0	2	2		
				3			LF-05 0-2 sampled at 1115
					3		2-28 ft bgs augered
					4		
					5		
					6		
					7		
					8		
					9		
					10		
					11		
					12		
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		
					21		

CONTINUED

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441047.256, 559937.1929
Surface Elevation: 67.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-05
Sampling Method:		Sheet 2 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			1105	1320
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: grass
					22			
					23			
					24			
					25			
					26			
					27			
					28			
			0.0	3			ML	7 inches - clayey SILT, stiff, compact, white 7.5 YR 8/1
	20			7	29		SP	6 inches - SAND, coarse, poorly graded, saturated, 7.5 YR 6/3
			0.6	9			SM	7 inches - silty SAND, fine to medium grained, moist, 2.5 YR 6/4
				9	30			
			0.3	5			ML	18 inches - clayey SILT, mottled, with 5 inches (from 17-22 inches) SILT
	24			10	31			trace fine grained sand, 7.5 YR 8/1
			0.3	10				
				13	32			
			0.0	11			CL	silty CLAY, stiff, compact, mottled white/red
	20			10	33			
			0.3	17				
				15	34			
			0.0	3			ML	15 inches - SILT, white, compact
	24			4	35		OL	9 inches - clayey SILT, 2.5 YR 3/1, powdery, organics
			0.0	4				
				5	36			
			0.0	3				
	23			3	37			
			0.0	3				
				3	38			
			0.0	2				
	24			1	39			
			0.0	2				
				1	40			
			0.0	2				
	24			3	41			
			0.0	4				with white SILT throughout
				4	42			CONTINUED

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441047.256, 559937.1929
Surface Elevation: 67.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-05
Sampling Method:		Sheet 3 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			1105	1320
Time	-				
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log
Grab	24	LF-05 42-44	0.0	3	43	
				3		
			0.0	3		
				4	44	
	24		0.0	4		
				3	45	
			0.0	3		
				4	46	
	24		0.0	3		
				4	47	
			0.0	4		
				4	48	

with white SILT throughout

LF-05 42-44 samples at 1245

FINAL DEPTH

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441323.992, 559880.297
Surface Elevation: 68.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-06
Sampling Method:		Sheet 1 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0730	1045
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: grass
Grab	16	LF-06 0-2	0.0	2	1		SM	7 inches - sandy SILT, fine grained, 10 YR 3/2
				3			CL	7 inches - silty CLAY trace fine grained sand, white/red mottle
			0.0	2			SM	2 inches - sandy SILT, fine grained, 10 YR 3/2
				3	2			LF-06 0-2 sampled at 0750
								2-28 ft bgs augered
					3			
					4			
					5			
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			CONTINUED

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441323.992, 559880.297
Surface Elevation: 68.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-06
Sampling Method:		Sheet 2 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A				
Time	-			0750	1045
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	Surface Conditions: grass
					22		
					23		
					24		
					25		
					26		
					27		
					28		
	21		1.6	5	29	SM	19 inches - sandy SILT, fine to medium grained, mottled white/red/tan, compact
			0.6	7		OL	2 inches - clayey SILT, 2.5 YR 3/1, powdery, organics
				7	30		
	24		0.0	1			
				2	31		
			0.0	2			
				1	32		
	24		0.0	1			
				1	33		
			0.0	2			
				2	34		
	24		0.0	1			
				1	35		
			0.0	1			
				2	36		
	24		0.0	1			
				1	37		moist
			0.0	2			
				1	38		
	24		0.0	2			
				1	39		
			0.0	1			
				2	40		
	24		0.0	1			
				1	41		
			0.0	1			
				1	42		CONTINUED

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441323.992, 559880.297
Surface Elevation: 68.75' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-06
Sampling Method:		Sheet 3 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A				
Time	-			0730	1045
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log
	24		0.0	1	43	
				1		
			0.0	1	44	
				1		
	24		0.0	2	45	
				1		
			0.0	2	46	
				2		
Grab	24	LF-06 46-48	0.0	4	47	
				3		
			0.0	4	48	
				4		

FINAL DEPTH LF-06 46-48 sampled at 0925

Logged by: Caron Mierczak Date: 04/13/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441139.824, 559638.6233
Surface Elevation: 88' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-07
Sampling Method:		Sheet 1 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			1130	0800
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	
								Surface Conditions: grass
Grab	16	LF-07 0-2	0.0	1	1		SM	8 inches - sandy SILT, fine grained, trace clay, 7.5 YR 4/3
				4			CL	8 inches - silty CLAY, trace sand fine grained, mottled purple/white/tan/
			0.0	3				pink, stiff, compact
				3	2			LF-07 0-2 sampled at 1145
					3			2-49 ft bgs augered
					4			
					5			
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			CONTINUED

Logged by: Caron Mierczak Date: 4/7/15-4/8/15

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441139.824, 559638.6233
Surface Elevation: 88' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-07
Sampling Method:		
Standard Split Spoon Sampler		Sheet 2 of 4
		Drilling

				Start	Finish
Water Level	N/A				
Time	-			1130	0800
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log
					22		
					23		
					24		
					25		
					26		
					27		
					28		
					29		
					30		
					31		
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		
					41		
					42		

Surface Conditions: grass

CONTINUED

Logged by: Caron Mierczak Date: 4/7/15-4/8/15

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441139.824, 559638.6233
Surface Elevation: 88' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-07
Sampling Method:		Sheet 3 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			1130	0800
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: grass
					43			
					44			
					45			
					46			
					47			
					48			
					49			
	24		0.0	9			CL	silty CLAY, compact, stiff, mottled white/pink
				13	50			
			0.0	15				
				15	51			
	24		0.0	9			SP	10 inches - SAND fine to medium grained, poorly graded, 5 YR 5/2
				8	52			black wood
			0.0	9			ML	14 inches - clayey SILT trace medium grained sand, compact, 2.5 YR 5/4
				11	53			last 7 inches mottled with white
	17		1.0	13				
				14	54			
			1.3	22				
				26	55			
	24		2.2	7			SP	22 inches - SAND fine to medium grained, poorly graded, 5 YR 5/2
				11	56			with black mottling last 10 inches
			1.8	12			SP	2 inches - SAND fine to medium grained, poorly graded, 7.5 YR 6/3
				12	57			
	24		0.3	13				
				16	58		ML	6 inches - clayey SILT trace fine grained sand, rock, 2.5 YR 4/8
			0.6	15			ML	6 inches - clayey SILT, mottled white/red
				15	59			
	24		0.6	9			SM	18 inches - silty SAND, fine to medium grained, poorly graded, 5 YR 5/8
				17	60		CL	6 inches - silty CLAY, mottled white/red, stiff, compact
			0.3	17				
				19	61			
	18		0.2	17			ML	14 inches - SILT, white, trace fine grained sand
				18	62		ML	4 inches - SILT, white mottled with grey, GLEY 1 7/N
			0.0	18				
				20	63			**CONTINUED**

Logged by: Caron Mierczak Date: 4/7/15-4/8/15

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441139.824, 559638.6233
Surface Elevation: 88' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 3
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-07
Sampling Method:		Sheet 4 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A				
Time	-			1130	0800
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	
								Surface Conditions: grass
	24		0.0	8			ML	19 inches - SILT, trace fine sand, white mottled with grey
				17	64		CL	5 inches - silty CLAY, mottled red and white, compact, stiff
			0.0	17				
				24	65			
Grab	24	LF-07 65-67	0.0	14			ML	6 inches - clayey SILT trace fine grained sand, 10 R 5/6
				28	66		CL	4 inches - silty CLAY, compact, stiff, mottled white/red
			0.0	23			ML	14 inches - clayey SILT, compact, white with mottling, 10 R 8/1
				24	67			
								FINAL DEPTH LF-07 65-67 sampled at 0810

Logged by: Caron Mierczak Date: 4/7/15-4/8/15

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441341.379, 559564.1488
Surface Elevation: 128' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4

Drilling Method:	Boring No.
Track-mounted Hollow Stem Auger Rig	LF-08

Sampling Method:	Sheet 1 of 4
Standard Split Spoon Sampler	Drilling

Water Level	N/A			Start	Finish
Time	-			0905	1320
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: clay
Grab	22	LF-08 0-2	0.0	8			ML	12 inches - clayey SILT, trace fine grained sand, compact, 5 YR 5/6 with
				11	1			white mottle
			0.0	7			CL	10 inches - SAND, medium to coarse grained, compact, poorly graded
				7	2			5 YR 6/8
					3			LF-08 0-2 sampled at 0930
					4			2-45 ft bgs augered
					5			
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			CONTINUED

Logged by: Caron Mierczak Date: 04/06/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441341.379, 559564.1488
Surface Elevation: 128' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-08
Sampling Method:		
Standard Split Spoon Sampler		Sheet 2 of 4
		Drilling

				Start	Finish
Water Level	N/A				
Time	-			0905	1320
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: clay
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			
					35			
					36			
					37			
					38			
					39			
					40			
					41			
					42			CONTINUED

Logged by: Caron Mierczak Date: 04/06/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441341.379, 559564.1488
Surface Elevation: 128' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-08
Sampling Method:		Sheet 3 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A				
Time	-			0905	1320
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: clay
					43			
					44			
					45			
	15		0.0	4			ML	clayey SILT, compact, white 10 R 8/1 with red mottling
				6	46			
			0.0	6				
				9	47			
	18		0.0	10				
				12	48			last 4 inches trace fine grained sand
			0.0	11				
				11	49			
	24		1.5	5				
				6	50		SM	10 inches - sandy SILT, tracy clay, fine grained, 7.5 YR 3/1
			0.3	8			SM	2 inches - sandy SILT, fine grained, 7.5 YR 5/6
				10	51			
	24		0.2	12				
				11	52		SP	10 inches - SAND, wet, coarse, 7.5 YR 6/4, black stain last 4 inches
			0.0	12			CL	2 inches - CLAY with medium grained SAND, 10 R 5/8
				18	53			
	22		0.4	6			SP	4 inches - SAND, wet, coarse, 7.5 YR 6/4 with black stain
				10	54		SP	18 inches - SAND, medium to coarse grained, poorly graded, moist
			0.5	10				7.5 YR 5/8
				12	55			
	24		0.2	4			SP	6 inches - silty SAND, fine to medium grained, poorly graded
				7	56		CL	18 inches - CLAY, white/red mottled, compact, stiff, 7.5 YR 8/1
			0.2	10				
				13	57			
	10		0.0	12				
				18	58			
			0.1	16				last 2 inches rock
				15	59			
	24		0.4	8			SP	14 inches - SAND, fine to medium grained, poorly graded, 7.5 YR 4/2
				8	60		SP	2 inches - SAND, fine to medium grained, poorly graded, black stained
			0.1	8			CL	6 inches - sandy CLAY, medium grained, 10 R 4/4
				8	61		ML	2 inches clayey SILT, compact, 7.5 YT 8/1
	24		0.5	9				
				12	62			
			0.1	15			SP	10 inches - SAND, coarse grained, moist, 7.5 YR 5/4
				15	63		SP	5 inches - SAND, medium grained, poorly graded, 2.5 YR 4/8 black mottle

CONTINUED

Logged by: Caron Mierczak Date: 04/06/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441341.379, 559564.1488
Surface Elevation: 128' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-08
Sampling Method:		Sheet 4 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0905	1320
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: clay
	24		0.3	4				↓
				7	64			
			0.1	10			SP	5 inches - SAND, moist, fine to medium grained, poorly graded,
				22	65			2.5 YR 5/4
			0.0	11			SP	10 inches - SAND, moist, fine to medium grained, poorly graded
Grab	24	LF-08 65-67		8	66			7.5 YR 8/3, black wood
			0.0	11			SM	14 inches - silty SAND trace clay, fine to medium grained, compact
				11	67			2.5 YR 5/4
								FINAL DEPTH LF-08 65-67 sampled at 1325

Logged by: Caron Mierczak Date: 04/06/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441611.431, 559605.6809
Surface Elevation: 109' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-09
Sampling Method:		Sheet 1 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0730	0945
Time	-				
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	
Grab	24	LF-09 0-2	0.0	6	1	ML	10 inches - SILT trace sand, fine-grained, 10 YR 3/3
				4			10 inches - clayey SILT trace sand, fine-grained, 10 YR 3/1
			0.0	12	2	CL	4 inches - silty CLAY, compact, 10 R 5/6
				11			LF-09 0-2 sampled at 0810
					3		
					4		2-30 ft bgs augered
					5		
					6		
					7		
					8		
					9		
					10		
					11		
					12		
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		
					21		CONTINUED

Logged by: Caron Mierczak Date: 04/07/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441611.431, 559605.6809
Surface Elevation: 109' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-09
Sampling Method:		
Standard Split Spoon Sampler		Sheet 2 of 3

				Drilling	
Water Level	N/A			Start	Finish
Time	-			0730	0945
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: grass
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
			1.0	5			CL	4 inches - CLAY with white/red mottling, stiff, compact
	24			9	31		SM	4 inches - silty SAND, fine to medium grained, 7.5 YR 3/1
			0.8	11			CL	6 inches - CLAY with medium grained sand, mottled tan/red
				13	32		SP	8 inches - SAND, fine to medium grained, poorly graded 7.5 YR 7/6
			0.5	12				
	24			14	33			
			0.0	12			SM	10 inches - sandy SILT, stiff, compact, 10 R 5/6
				14	34			
			0.6	3			SP	6 inches - SAND fine to medium grained, poorly graded 7.5 Y 7/6
	24			4	35		CL	8 inches - silty CLAY stiff, compact, mottled tan/white/pink/purple
			0.3	6			ML	10 inches - clayey SILT, trace fine grained sand, mottled pink/white/tan
				8	36			
			0.0	6			CL	10 inches - silty CLAY, stiff compact, mottled tan/white/pink/purple
	22			11	37		SW	12 inches - SAND, well-graded, 5 YR 6/4
			1.3	11				
				12	38			
			0.0	4			CL	10 inches - silty CLAY, trace medium grained sand, mottled red/white
	24			8	39		SM	11 inches - silty SAND, moist, fine to medium grained 2.5 YR 4/4
			0.2	8			OL	3 inches - clayey SILT 2.5 YR 3/1, powdery, organics
				11	40			
			0.0	2				
	24			2	41			moist
			0.0	2				
				2	42			**CONTINUED**

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441611.431, 559605.6809
Surface Elevation: 109' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-09
Sampling Method:		Sheet 3 of 3
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0730	0945
Time	-				
Date	N/A				
Reference	N/A				

Surface Conditions: grass

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	
	24		0.0	2				
				2	43			
			0.0	2				
				3	44			
Grab	19	LF-09 44-46	0.0	2				
				3	45			
			0.0	5			OL	4 inches - clayey SILT, trace medium grained sand, 2.5 YR 4/6
				9	46			mottled with white, powdery, organics, black wood
								FINAL DEPTH LF-09 44-46 sampled at 0950

Logged by: Caron Mierczak Date: 04/09/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441417.763, 559477.0868
Surface Elevation: 137' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4

Drilling Method: Track-mounted Hollow Stem Auger Rig
Boring No. LF-10
Sampling Method: Standard Split Spoon Sampler
Sheet 1 of 4

Water Level	N/A		
Time	-		
Date	N/A		
Reference	N/A		

Drilling: Start 0850 — Finish 1415

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	
								Surface Conditions: clay
Grab	22	LF-10 0-2	0.0	5	1		ML	18 inches - clayey SILT, compact, stiff, 5 YR 5/6
				6				4 inches - silty CLAY, white with purple mottling, 5 YR 8/1
			0.0	7			CL	
				7	2			LF-10 0-2 sampled at 0948
								2-55 ft bgs augered
					3			
					4			
					5			
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			CONTINUED

Logged by: Caron Mierczak — Date: 04/03/2015

Drilling Contractor: Findling — Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441417.763, 559477.0868
Surface Elevation: 137' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-10
Sampling Method:		Sheet 2 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0850	1415
Time	-				
Date	N/A				
Reference	N/A				

Surface Conditions: clay

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log
					22		
					23		
					24		
					25		
					26		
					27		
					28		
					29		
					30		
					31		
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		
					41		
					42		

CONTINUED

Logged by: Caron Mierczak Date: 04/03/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441417.763, 559477.0868
Surface Elevation: 137' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-10
Sampling Method:		
Standard Split Spoon Sampler		Sheet 3 of 4

				Drilling	
Water Level	N/A			Start	Finish
Time	-			0850	1415
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions: clay
					43			
					44			
					45			
					46			
					47			
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
	20		0.0	6	56		ML	Clayey SILT, stiff, compact, 5YR 5/6 with last 4 inches mottled white
				7				
			0.0	12				
				14	57			
	18		0.0	12			SP	6 inches - silty SAND, medium grained, poorly graded, 5 YR 6/6
				14	58		SP	12 inches - SAND trace clay, coarse, poorly graded, 10 YR 5/6
			0.0	16				
				17	59			
	22		0.0	10			ML	Clayey SILT, trace fine grained sand, compact, 5 R 6/8 with white mottle
				11	60			
			0.0	14				
				15	61			
	17		0.0	15			ML	15 inches - clayey SILT, trace fine grained sand, 2.5 YR 4/4
				19	62		ML	2 inches - clayey SILT, trace fine grained sand, GLEY 2 7/10B
			0.0	23				
				24	63			**CONTINUED**

Logged by: Caron Mierczak Date: 04/03/2015

Drilling Contractor: Findling Driller: Chad Chism

EA Engineering, Science, and Technology, Inc.

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Coordinates: 1441417.763, 559477.0868
Surface Elevation: 137' MSL
Casing Below Surface: N/A
Reference Elevation:
Reference Desc: MD State Plane System (US Survey Feet)

Job. No.	Client:	Location:
1506106	MPA	Landfill Area 4
Drilling Method:		Boring No.
Track-mounted Hollow Stem Auger Rig		LF-10
Sampling Method:		Sheet 4 of 4
Standard Split Spoon Sampler		Drilling

				Start	Finish
Water Level	N/A			0850	1415
Time	-				
Date	N/A				
Reference	N/A				

Sample Type	Inches Drvn/In. Recvrd	Sample No.	PID ppm	Blows per 6 in.	Depth in Feet	USCS Log	Surface Conditions: clay
	24		0.0	22	64	SM	8 inches - sandy SILT, fine to medium grained, compact, 2.5 Y 5/4
				49		CH	2 inches - fatty CLAY, high plasticity, 10 YR 7/1
			0.0	22	65	SP	14 inches - SAND, fine to medium grained, loose, poorly graded, 10 YR 6/4
				24			
	24		3.6	9	66	ML	12 inches - clayey SILT, compact, red
				14		ML	6 inches - clayey SILT, compact, white
			1.8	14	67	SP	6 inches - SAND, fine to medium grained, black staining, loose, poorly graded
				16			
	20		0.0	20	68	ML	6 inches - clayey SILT, compact, red
				20		SP	8 inches - SAND, medium to coarse grained, moist, loose, poorly graded, 10 YR 6/4
			0.0	21	69		
				24			
	20		0.0	5	70		
				9			
			0.0	12	71		
				15			
	24		0.0	4	72		
				12			
			0.0	15	73		
				16			
Grab	24	LF-10 73-75	1.6	11	74		saturated at 8 inches
				15			
			2.9	12	75		
				18		ML	6 inches - clayey SILT, compact, 2.5 YR 4/4
							FINAL DEPTH LF-10 73-75 sampled at 1415

Logged by: Caron Mierczak Date: 04/03/2015

Drilling Contractor: Findling Driller: Chad Chism

Appendix D

Soil Laboratory Results Summary Tables

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Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-01	AN-01	AN-01 to AN-13	AN-02	AN-02	AN-02	AN-03	AN-03	AN-04	AN-04	AN-05	AN-05	AN-06	AN-06	AN-07
Sample Name:				AN-01 11-13	AN-01 1-3	AN-01-13	AN-02 1.5-3.5	AN-02 8-10	DUP-10	AN-03 1-3	AN-03 9-11	AN-04 0-2	AN-04 6-8	AN-05 0-2	AN-05 13-15	AN-06	AN-06 11-13	AN-07
Date Sampled:				4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015
Parent Sample ID:									AN-02 1.5-3.5									
Depth Interval (ft):				11-13	1-3		1.5-3.5	8-10	1.5-3.5	1-3	9-11	0-2	6-8	0-2	13-15	0-2	11-13	0-2
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit															
Dioxin/Furan (SW1613B)																		
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	9 6 B	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	70 B	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	1 2 J	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	2 2 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	0 59 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	1 4 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	1 7 J	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HXCDF)	NSI	NSI	pg g	--	--	0 26 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	1 6 BJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	0 63 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	0 48 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	0 77 QJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	0 93 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSI	NSI	pg g	--	--	0 15 J	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	0 25 QJ	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSI	NSI	pg g	--	--	3200 BJ	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSI	NSI	pg g	--	--	35 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ - - HE WHO	22	NSI	pg g	--	--	0 0384	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																		
Aluminum	100000	NSI	mg kg	830	27000	--	4700	7500 F1	4100	3800	16000	13000	11000	18000	280	1500	180	3400
Antimony	41	NSI	mg kg	0 70	**85**	--	0 26	0 15 J	0 20 J	**180**	0 46	25	0 78	5 8	0 38 J	**57**	4 6	**97 B**
Arsenic	3 0	5 6	mg kg	2 4	**34**	--	2 5	**5 1 F1**	**4 9**	**6 4**	**13**	**4 3**	**22**	**4 7**	0 74	**220**	**110**	**9 1 B**
Barium	20000	NSI	mg kg	4 9	41	--	60	6 5	4 3	93	6 0	11	3 6	12	1 4	130	2 4	42
Beryllium	200	NSI	mg kg	0 015 J	0 18	--	0 090 J	0 021 J	0 13	0 36	0 21 J	0 18	0 18	0 13	0 012 J	0 093 J	0 069 J	0 39
Cadmium	51	NSI	mg kg	0 12 J	0 07 J	--	0 015 J	0 11 J	0 030 J	0 099 J	0 080 J	0 16 J	0 023 J	0 0096 J	0 11 J	0 32	0 093 J	0 16
Calcium	NSI	NSI	mg kg	190	980	--	680	380	1000	6100	590	1800 B	240	340	33 J	11000	46 J	110000
Chromium	410	29	mg kg	**52 B**	9 5 B	--	12 B	4 0 B	14 B	**33 B**	6 2 B	**130 B**	12 B	2 5 B	1 1 B	3 5 B	4 1 B	**120 B**
Cobalt	NSI	NSI	mg kg	0 065	1 2	--	1 2	0 49	1 2	2 6	0 73	2 9	0 17	0 73	0 34	1 4	0 075	4 4
Copper	4300	NSI	mg kg	1 7	44	--	30	9 2	60	140	7 2	76	23	12	4 3	110	17	49
Iron	72000	NSI	mg kg	1500	28000	--	16000	8100	27000	37000	14000	31000	27000	14000	5400	18000	13000	28000
Lead	1000	NSI	mg kg	5 4	21	--	8 2	3 7 F1	10	84	3 0	28	1 5	6 2	0 80	**7100**	2 4	55 B
Magnesium	NSI	NSI	mg kg	50 J	250	--	850	100	700	430	150	2600	28 J	460	30 J	240	14 J	870
Manganese	2000	NSI	mg kg	2 5	22	--	26	7 5	31	92	20	250	11	17	9 6	62	5 1	150
Nickel	2000	NSI	mg kg	0 17 B	3 5 B	--	3 8 B	9 69 B	5 0 B	5 4 B	2 6 B	39 B	0 34 B	5 7 B	0 54 B	2 5 B	0 16 B	8 7 B
Potassium	NSI	NSI	mg kg	200	240	--	630	120	560	370	210	79	130	160	51 J	320	130	380 B
Selenium	510	NSI	mg kg	0 074 J	0 28 J	--	0 13 J	0 055 J	0 26 J	0 26 J	0 12 J	0 54 J	0 27 J	0 14 J	0 077 J	30	2 2	0 66
Silver	510	NSI	mg kg	0 030 J	0 15	--	0 030 J	0 025 J	0 052 J	0 41	0 123 J	0 087 J	0 011 J	0 015 J	0 11 J	4 4	0 0070 J	0 25
Sodium	NSL	NSI	mg kg	63	510	--	73	33 J	100	120	15 J	200	48 J	140	15 J	200	25 J	200
Thallium	7 2	3 9	mg kg	0 024 JB	0 21 B	--	0 10 JB	0 030 JB	0 090 JB	0 11 JB	0 29 B	0 046 JB	0 035 JB	0 080 JB	0 032 JB	2 2 B	0 22 B	0 15 B
Vanadium	100	NSI	mg kg	52	46	--	24	49	37	56	17	**240**	**120**	52	10	14	69	**200**
Zinc	33000	NSI	mg kg	0 66	20	--	12	2 4	14	45	5 2	35	4 7	5 8	1 2	71	2 1	64

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-01	AN-01	AN-01 to AN-13	AN-02	AN-02	AN-02	AN-03	AN-03	AN-04	AN-04	AN-05	AN-05	AN-06	AN-06	AN-07
Sample Name:				AN-01 11-13	AN-01 1-3	AN-01-13	AN-02 1.5-3.5	AN-02 8-10	DUP-10	AN-03 1-3	AN-03 9-11	AN-04 0-2	AN-04 6-8	AN-05 0-2	AN-05 13-15	AN-06 0-2	AN-06 11-13	AN-07 0-2
Date Sampled:				4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015
Parent Sample ID:									AN-02 1.5-3.5									
Depth Interval (ft):				11-13	1-3		1.5-3.5	8-10	1.5-3.5	1-3	9-11	0-2	6-8	0-2	13-15	0-2	11-13	0-2
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit															
Mercury (SW7471B)																		
Mercury	10	NSL	mg/kg	0.035 U	0.068	--	0.039 U	0.034 U	0.016 U	0.026 U	0.031 U	0.048 U	0.036 U	0.034 U	0.038 U	22	0.032 U	0.078
DRO/GRO (SW8015C)																		
Diesel Range Organics	620	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gasoline Range Organics	620000	NSL	µg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs (SW8082A)																		
Aroclor 1016	41	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1221	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1232	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1242	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1248	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1254	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.0052 U
Aroclor 1260	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.018
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	--	--	--	0.0047 U	0.0046 U	0.0048 U	--	--	--	--	--	--	--	--	0.018
VOCS (SW8260C)																		
1,1,1-trichloroethane	200000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,1,2-trichloroethane	90	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,1-dichloroethane	20000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,1-dichloroethene	5100	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,2-Dibromo-3-chloropropane	5.6	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,2-dibromoethane	1.4	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,2-dichloroethane	31	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,2-dichloroethene	920	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
1,2-dichloropropane	42	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
2-butanone	61000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Acetone	92000	NSL	mg/kg	0.019 U	0.016 U	--	0.016 U	0.021 U	0.018 U	0.018 U	0.019 U	0.028 U	0.017 U	0.019 U	0.019 U	0.017 U	0.017 U	0.021 U
Benzene	52	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Bromodichloromethane	46	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Bromoform	360	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Bromomethane	140	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Carbon disulfide	10000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Carbon tetrachloride	22	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Chlorobenzene	2000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Chloroethane	990	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Chloroform	1600	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Chloromethane	NSL	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
cis-1,2-dichloroethene	1600	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
cis-1,3-dichloropropene	29	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Dibromochloromethane	34	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Ethylbenzene	10000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Isopropylbenzene	10000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Methyl tert-butyl ether	220	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Methylene Chloride	380	NSL	mg/kg	0.0023 JB	0.0017 JB	--	0.0016 JB	0.0020 JB	0.0021 JB	0.0018 JB	0.0023 JB	0.0033 JB	0.0026 JB	0.0025 JB	0.0023 JB	0.0019 JB	0.0019 JB	0.0019 JB
Styrene	20000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Tetrachloroethene	53	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Toluene	8200	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-01	AN-01	AN-01 to AN-13	AN-02	AN-02	AN-02	AN-03	AN-03	AN-04	AN-04	AN-05	AN-05	AN-06	AN-06	AN-07
Sample Name:				AN-01 11-13	AN-01 1-3	AN-01-13	AN-02 1.5-3.5	AN-02 8-10	DUP-10	AN-03 1-3	AN-03 9-11	AN-04 0-2	AN-04 6-8	AN-05 0-2	AN-05 13-15	AN-06 0-2	AN-06 11-13	AN-07 0-2
Date Sampled:				4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015
Parent Sample ID:									AN-02 1.5-3.5									
Depth Interval (ft):				11-13	1-3		1.5-3.5	8-10	1.5-3.5	1-3	9-11	0-2	6-8	0-2	13-15	0-2	11-13	0-2
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**															
trans-1,2-dichloroethane	2000	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
trans-1,3-dichloropropene	29	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Trichloroethene	7.2	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Vinyl chloride	4	NSL	mg/kg	0.0047 U	0.0040 U	--	0.0041 U	0.0050 U	0.0046 U	0.0046 U	0.0047 U	0.0070 U	0.0042 U	0.0048 U	0.0047 U	0.0043 U	0.0043 U	0.0050 U
Xylenes, Total	20000	NSL	mg/kg	0.0141 U	0.012 U	--	0.012 U	0.015 U	0.014 U	0.0141 U	0.014 U	0.021 U	0.013 U	0.015 U	0.014 U	0.013 U	0.013 U	0.015 U
SVOCS (SW8270D)																		
1,2,4-trichlorobenzene	1000	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dichlorobenzene	9200	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-dichlorobenzene	410	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	--	0.19 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-dinitrotoluene	200	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-dinitrotoluene	100	NSL	mg/kg	--	0.047 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2-chlorophenol	510	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg	0.0080 U	0.016	--	0.0075 U	0.0074 U	0.0077 U	0.0054 J	0.0077 U	0.011 U	0.0076 U	0.0072 U	0.0077 U	0.076	0.0124 U	0.0133
2-methylphenol	5100	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-dichlorobenzidine	6.4	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--
4-chloroaniline	410	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--
4-methylphenol	510	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	6100	NSL	mg/kg	0.0080 U	0.0045 J	--	0.0075 U	0.0074 U	0.0077 U	0.0048 J	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	0.33	0.0124 U	0.0071 J
Acenaphthylene	6100	NSL	mg/kg	0.0080 U	0.012	--	0.0075 U	0.0074 U	0.0077 U	0.0032 J	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	0.49	0.0124 U	0.048
Anthracene	51000	NSL	mg/kg	0.0080 U	0.015	--	0.0075 U	0.0074 U	0.0077 U	0.0039 J	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	0.78	0.0124 U	0.049
Benzo(a)anthracene	39	NSL	mg/kg	0.0080 U	0.12	--	0.0075 U	0.0074 U	0.0077 U	0.022	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	2.9	0.0097 J	0.14
Benzo(a)pyrene	0.39	NSL	mg/kg	0.0080 U	0.16	--	0.0075 U	0.0074 U	0.0077 U	0.02	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	2.3	0.0076 J	0.16
Benzo(b)fluoranthene	3.9	NSL	mg/kg	0.0080 U	0.25	--	0.0075 U	0.0074 U	0.0077 U	0.031	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	3	0.0089 J	0.2
Benzo(g,h,i)perylene	3100	NSL	mg/kg	0.0080 U	0.11	--	0.0075 U	0.0074 U	0.0077 U	0.017	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	1.9	0.0065 J	0.16
Benzo(k)fluoranthene	39	NSL	mg/kg	0.0080 U	0.085	--	0.0075 U	0.0074 U	0.0077 U	0.01	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	1.4	0.0063 J	0.0962

Table D-1
Cristal USA Facility
PWAN/SWAN Area

				Location ID:	AN-01	AN-01	AN-01 to AN-13	AN-02	AN-02	AN-02	AN-03	AN-03	AN-04	AN-04	AN-05	AN-05	AN-06	AN-06	AN-07
				Sample Name:	AN-01 11-13	AN-01 1-3	AN-01-13	AN-02 1.5-3.5	AN-02 8-10	DUP-10	AN-03 1-3	AN-03 9-11	AN-04 0-2	AN-04 6-8	AN-05 0-2	AN-05 13-15	AN-06 0-2	AN-06 11-13	AN-07 0-2
				Date Sampled:	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015
				Parent Sample ID:						AN-02 1.5-3.5									
				Depth Interval (ft):	11-13	1-3		1.5-3.5	8-10	1.5-3.5	1-3	9-11	0-2	6-8	0-2	13-15	0-2	11-13	0-2
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	140	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	900	NSL	mg/kg	0.0080 U	0.12	--	0.0075 U	0.0074 U	0.0077 U	0.028	0.0077 U	0.011 J	0.0076 U	0.0076 U	0.0077 U	2.9	0.0098 J	0.13	--
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.0080 U	0.04	--	0.0075 U	0.0074 U	0.0077 U	0.0048 J	0.0077 U	0.011 J	0.0076 U	0.0076 U	0.0077 U	0.61	0.014 U	0.04	--
Dibenzofuran	100	NSL	mg/kg	--	0.0076 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	4100	NSL	mg/kg	0.0080 U	0.2	--	0.0075 U	0.0074 U	0.0077 U	0.068	0.0077 U	0.011 J	0.0076 U	0.0038 J	0.0077 U	5.8	0.016	0.24	--
Fluorene	4100	NSL	mg/kg	0.0080 U	0.0072 J	--	0.0075 U	0.0074 U	0.0077 U	0.0077 U	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	0.22	0.014 U	0.0096 J	--
Hexachloro-1,3-butadiene	37	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	260	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno[1,2,3-c,d]pyrene	3.9	NSL	mg/kg	0.0080 U	0.11	--	0.0075 U	0.0074 U	0.0077 U	0.014	0.0077 U	0.011 J	0.0076 U	0.0076 U	0.0077 U	1.8	0.0069 J	0.12	--
Isophorone	3600	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	2000	NSL	mg/kg	0.0080 U	0.05	--	0.0075 U	0.0074 U	0.0077 U	0.0053 J	0.0077 U	0.011 U	0.0076 U	0.0076 U	0.0077 U	0.091	0.014 U	0.022	--
Nitrobenzene	53	NSL	mg/kg	--	0.074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-nitroso-n-propylamine	0.41	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	24	NSL	mg/kg	--	0.037 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	31000	NSL	mg/kg	0.0080 U	0.1	--	0.0075 U	0.0074 U	0.0077 U	0.041	0.0077 U	0.011 U	0.0076 U	0.0036 J	0.0077 U	4.1	0.014 U	0.13	--
Phenol	31000	NSL	mg/kg	--	0.0074 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	3100	NSL	mg/kg	0.0080 U	0.14	--	0.0075 U	0.0074 U	0.0077 U	0.059	0.0077 U	0.011 U	0.0076 U	0.0029 J	0.0077 U	3.5	0.012 J	0.22	--
pH (SW9045D)																			
pH	NSL	NSL	pH units	6.73 H	4.75 H	--	6.72 H	7.47 H	7.02 H	4.84 H	5.22 H	5.45 H	5.80 H	7.67 H	2.48 H	7.47 H	3.69 H	7.63 H	--

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup standards for soil

ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

= USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

~~Gray shaded values exceed ATC Eastern~~

pg/g = picogram per gram

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

B = Compound was found in the blank and sample

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

* = RND response or retention time outside applicable limits

E = Result exceeds calibration range

F1 = MS and or MSD Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF = Field parameter with a holding time of 15 minutes

U = Not Detected

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-07	AN-08	AN-08	AN-09	AN-09	AN-10	AN-10	AN-10	AN-11	AN-11	AN-12	AN-12	AN-13	AN-13
Sample Name:				AN-07 10-12	AN-08 0-2	AN-08 13-15	AN-09 0-2	AN-09 13-15	AN-10 0-2	AN-10 9-11	DUP-11	AN-11 0-2	AN-11 8-10	AN-12 0-2	AN-12 13-15	AN-13 0-2	AN-13 4-6
Date Sampled:				4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015
Parent Sample ID:											AN-10 9-11						
Depth Interval (ft):				10-12	0-2	13-15	0-2	13-15	0-2	9-11	9-11	0-2	8-10	0-2	13-15	0-2	4-6
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit														
Dioxin/Furan (SW1613B)																	
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HXCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF: WHO	22	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																	
Aluminum	100000	NSL	mg/kg	3000	3400	3500	3300	9300	2900	1800	1600	8100	4000	3300	3500	3700	570
Antimony	41	NSL	mg/kg	**49 B**	**620 B**	**640 B**	76	0.26	24 B	0.25 B	0.76 B	13 B	**560 B**	**740 B**	**300 B**	3.6	0.92
Arsenic	3.6	3.6	mg/kg	**7.7 B**	**10 B**	**6.5 B**	**3.9**	**41**	**16 B**	**4.6 B**	**4.4 B**	1.7 B	**7.2 B**	**11 B**	**69 B**	**32**	**90**
Barium	20000	NSL	mg/kg	20	170	190	20	46	34	11	10	36	140	200	310	47	8.0
Beryllium	200	NSL	mg/kg	0.29	0.20	0.27	1.1 C	0.614 J	0.52	0.087 J	0.12	1.5 C	0.23	0.17	0.25	0.24	0.043 J
Cadmium	51	NSL	mg/kg	0.18	0.077 J	0.46	0.22 J	0.10 J	0.063 J	0.013 J	0.11 C	0.28 J	0.021 J	0.050 J	0.077 J	0.22	0.029 J
Calcium	NSL	NSL	mg/kg	70000	13000	1800	270000	92	42000	170	160	190000	700	3600	490	85000	280
Chromium	310	28	mg/kg	**210 B**	28 B	21 B	**35 B**	5.2 B	25 B	7.1 B	8.1 B	**810 B**	21 B	23 B	28 B	8.1 B	2.2 B
Cobalt	NSL	NSL	mg/kg	2.7	1.5	4.3	0.54	0.34	5.5	0.70	0.81	6.8	2.8	1.7	3.2	2.1	0.14
Copper	4100	NSL	mg/kg	41	350	430	14	13	30	13	13	35	220	130	290	54	7.6
Iron	72000	NSL	mg/kg	15000	26000	23000	8500	4300	25000	11000	12000	68000	23000	27000	26000	9900	5200
Lead	1000	NSL	mg/kg	190 B	220 B	220 B	26	19	170 B	4.9 B	4.6 B	5.3 B	190 B	280 B	630 B	170	5.0
Magnesium	NSL	NSL	mg/kg	480	190	310	1100	510	2200	150	140	540	380	200	430	4800	47
Manganese	2000	NSL	mg/kg	200	88	140	25	8.2	47	26	33	910	93	67	140	150	4.2
Nickel	2000	NSL	mg/kg	5.4 B	5.9 B	18 B	2.1 B	0.42 B	11 B	1.6 B	2.7 B	14 B	7.5 B	7.8 B	11 B	3.6 B	0.51 B
Potassium	NSL	NSL	mg/kg	120 B	320 B	270 B	1400 J	210	380 B	130 B	320 B	110 B	330 B	360 B	900 B	1000	190
Selenium	510	NSL	mg/kg	0.60	0.23 J	0.22 J	0.85 J	0.19 J	0.96	0.18 J	0.14 J	7.4 J	0.21 J	0.29 J	2.0	0.53 J	0.76
Silver	510	NSL	mg/kg	0.31 J	0.85	0.61	1.1 J	0.0075 J	0.16	0.0045 J	0.13 J	0.22 J	0.71	1.1	6.6 J	0.31	0.0055 J
Sodium	NSL	NSL	mg/kg	270	340	170	1700	540	150	13 J	11 J	170 J	110	220	330	340	69
Thallium	7.2	5.9	mg/kg	0.12 B	0.43 B	0.24 B	0.050 BJ	0.025 BJ	0.17 B	0.032 BJ	0.027 BJ	0.054 BJ	0.19 B	1.3 B	1.2 B	0.15 B	0.23 B
Vanadium	100	NSL	mg/kg	**330**	53	38	**120**	9.2	74	21	20	**2100**	46	56	89	22	2.4
Zinc	31000	NSL	mg/kg	26	15	45	14	1.4	80	6.1	6.4	23	15	14	28	74	7.4

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-07	AN-08	AN-08	AN-09	AN-09	AN-10	AN-10	AN-10	AN-11	AN-11	AN-12	AN-12	AN-13	AN-13
Sample Name:				AN-07 10-12	AN-08 0-2	AN-08 13-15	AN-09 0-2	AN-09 13-15	AN-10 0-2	AN-10 9-11	DUP-11	AN-11 0-2	AN-11 8-10	AN-12 0-2	AN-12 13-15	AN-13 0-2	AN-13 4-6
Date Sampled:				4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015	4/6/2015
Parent Sample ID:											AN-10 9-11						
Depth Interval (ft):				10-12	0-2	13-15	0-2	13-15	0-2	9-11	9-11	0-2	8-10	0-2	13-15	0-2	4-6
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit														
Mercury (SW7471B)																	
Mercury	10	NSL	mg/kg	0.012 J	0.22	0.063	0.017 J	0.037 J	0.75	0.030 J	0.036 J	0.048 J	0.14	0.36	0.65	0.080	0.039
DRO/GRO (SW8015C)																	
Diesel Range Organics	620	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	55 B	12 JB
Gasoline Range Organics	620000	NSL	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	62 J	92 J
PCBS (SW8082A)																	
Aroclor 1016	41	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1221	1.4	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1232	1.4	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1242	1.4	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1248	1.4	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1254	1.4	NSL	mg/kg	0.0052 U	--	--	0.0048 U	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Aroclor 1260	1.4	NSL	mg/kg	0.0020 J	--	--	0.0033 J	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.0052 U	--	--	0.0033 J	0.0047 U	--	--	--	--	--	--	--	0.0046 U	0.0051 U
VOCS (SW8260C)																	
1,1,1-trichloroethane	200000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,1,2,2-tetrachloroethane	35	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,1,2-trichloroethane	50	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,1-dichloroethane	20000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,1-dichloroethene	5300	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,2-dibromoethane	1.4	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,2-dichloroethane	41	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,2-dichloroethene	920	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
1,2-dichloropropane	42	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
2-butanone	61000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0043 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Acetone	920000	NSL	mg/kg	0.021	0.017 J	0.018 J	0.021	0.017 J	0.017 J	0.021 J	0.023 J	0.027 J	0.018 J	0.019 J	0.017 J	0.018 J	0.021 J
Benzene	52	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Bromodichloromethane	46	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Bromoform	360	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Bromomethane	140	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0043 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Carbon disulfide	1000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Carbon tetrachloride	22	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Chlorobenzene	2000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Chloroethane	990	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Chloroform	1000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Chloromethane	NSL	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
cis-1,2-dichloroethene	1000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
cis-1,3-dichloropropene	20	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Dibromochloromethane	44	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Ethylbenzene	10000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Isopropylbenzene	10000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Methyl tert-butyl ether	726	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0043 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Methylene Chloride	880	NSL	mg/kg	0.0025 JB	0.0016 JB	0.0017 JB	0.0019 JB	0.0017 JB	0.0014 JB	0.0017 JB	0.0016 JB	0.0021 JB	0.0015 JB	0.00093 JB	0.0017 JB	0.0022 JB	0.0030 JB
Styrene	20000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Tetrachloroethene	5.3	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Toluene	8200	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0049 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-07	AN-08	AN-08	AN-09	AN-09	AN-10	AN-10	AN-10	AN-11	AN-11	AN-12	AN-12	AN-13	AN-13
Sample Name:				AN-07 10-12	AN-08 0-2	AN-08 13-15	AN-09 0-2	AN-09 13-15	AN-10 0-2	AN-10 9-11	DUP-11	AN-11 0-2	AN-11 8-10	AN-12 0-2	AN-12 13-15	AN-13 0-2	AN-13 4-6
Date Sampled:				4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015
Parent Sample ID:											AN-10 9-11						
Depth Interval (ft):				10-12	0-2	13-15	0-2	13-15	0-2	9-11	9-11	0-2	8-10	0-2	13-15	0-2	4-6
Analyte	MHE Non-Residential Soil	AZC Eastern	Unit														
trans-1,2-dichloroethene	2000	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0040 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
trans-1,3-dichloropropene	20	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0040 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Trichloroethene	2.2	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0040 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Vinyl chloride	4	NSL	mg/kg	0.0050 U	0.0043 U	0.0045 U	0.0040 U	0.0043 U	0.0043 U	0.0051 U	0.0057 U	0.0067 U	0.0044 U	0.0047 U	0.0043 U	0.0045 U	0.0052 U
Xylenes, Total	20000	NSL	mg/kg	0.015 U	0.013 U	0.013 U	0.012 U	0.013 U	0.013 U	0.015 U	0.017 U	0.02 U	0.013 U	0.014 U	0.013 U	0.014 U	0.016 U
SVOCS (SW8270D)																	
1,2,4-trichlorobenzene	1000	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
1,2-dichlorobenzene	9200	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
1,3-dichlorobenzene	310	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2,4-dichlorophenol	310	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2,4-dinitrophenol	200	NSL	mg/kg	--	0.2 U	--	--	--	--	--	--	--	--	--	--	0.38 U	--
2,4-dinitrotoluene	200	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2,6-dinitrotoluene	100	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2-chloronaphthalene	8200	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
2-chlorophenol	510	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
2-methylnaphthalene	410	NSL	mg/kg	0.0084 U	0.0039 J	0.0067 J	0.0060 J	0.0076 U	0.025 J	0.0071 U	0.0071 U	0.01 U	0.034	0.0059 J	0.013	0.015 U	0.0082 U
2-methylphenol	5100	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
3,3'-dichlorobenzidine	6.4	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
4-chloroaniline	410	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
4-methylphenol	510	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Acenaphthene	6100	NSL	mg/kg	0.0084 U	0.0078 U	0.0077 U	0.0077 U	0.0076 U	0.39	0.0071 U	0.0071 U	0.041 J	0.035	0.0083 U	0.0077 U	0.015 U	0.0082 U
Acenaphthylene	6100	NSL	mg/kg	0.0084 U	0.0039 J	0.01	0.0025 U	0.0076 U	0.55	0.0071 U	0.0071 U	0.011 U	0.056	0.0083 U	0.0042 J	0.011 J	0.0082 U
Anthracene	31000	NSL	mg/kg	0.0084 U	0.0069 J	0.014	0.0070 J	0.0076 U	2.5	0.0071 U	0.0071 U	0.011 U	0.31	0.0083 U	0.0077 U	0.0082 J	0.0082 U
Benzo(a)anthracene	3.9	NSL	mg/kg	0.012	0.047	0.079	0.0080	0.0076 U	7.5	0.0071 U	0.0071 U	0.011 U	0.28	0.012	0.038	0.025	0.0082 U
Benzo(a)pyrene	0.39	NSL	mg/kg	0.0092	0.035	0.06	0.0060 J	0.0076 U	5.2	0.0071 U	0.0071 U	0.011 U	0.21	0.0083 U	0.032	0.026	0.0082 U
Benzo(b)fluoranthene	3.9	NSL	mg/kg	0.0084 U	0.059	0.086	0.0089	0.0076 U	6.3	0.0071 U	0.0071 U	0.011 U	0.25	0.0083 U	0.047	0.022	0.0082 U
Benzo(g,h,i)perylene	3100	NSL	mg/kg	0.0084 U	0.034	0.043	0.0057 J	0.0076 U	3.6	0.0071 U	0.0071 U	0.011 U	0.14	0.0083 U	0.047	0.028	0.0082 U
Benzo(k)fluoranthene	39	NSL	mg/kg	0.0084 U	0.025	0.028	0.0060 J	0.0076 U	2.5	0.0071 U	0.0071 U	0.011 U	0.088	0.0083 U	0.014	0.026	0.0082 U

Table D-1
Cristal USA Facility
PWAN/SWAN Area

Location ID:				AN-07	AN-08	AN-08	AN-09	AN-09	AN-10	AN-10	AN-10	AN-11	AN-11	AN-12	AN-12	AN-13	AN-13
Sample Name:				AN-07 10-12	AN-08 0-2	AN-08 13-15	AN-09 0-2	AN-09 13-15	AN-10 0-2	AN-10 9-11	DUP-11	AN-11 0-2	AN-11 8-10	AN-12 0-2	AN-12 13-15	AN-13 0-2	AN-13 4-6
Date Sampled:				4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015	4 6 2015
Parent Sample ID:											AN-10 9-11						
Depth Interval (ft):				10-12	0-2	13-15	0-2	13-15	0-2	9-11	9-11	0-2	8-10	0-2	13-15	0-2	4-6
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**														
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	0.12	--	--	--	--	--	--	--	--	--	--	0.35 U	--
Carbazole	140	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.0035 J	--
Chrysene	390	NSL	mg/kg	0.012	0.055	0.079	0.01	0.0076 U	6.3	0.0071 U	0.0071 U	0.011	0.27	0.017	0.048	0.03	0.0082 U
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.0084 U	0.011	0.01	0.0077 U	0.0076 U	1.1	0.0071 U	0.0071 U	0.011	0.036	0.0083 U	0.0072 U	0.015 U	0.0082 U
Dibenzofuran	100	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Diethyl phthalate	82000	NSL	mg/kg	--	0.012 J	--	--	--	--	--	--	--	--	--	--	0.11 JB	--
Di-n-butyl phthalate	16000	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Fluoranthene	4100	NSL	mg/kg	0.025	0.085	0.16	0.014	0.0076 U	16	0.0071 U	0.0071 U	0.0055 J	0.056	0.023	0.057	0.053	0.0082 U
Fluorene	4100	NSL	mg/kg	0.0084 U	0.0036 J	0.0073 J	0.0077 U	0.0076 U	0.42	0.0071 U	0.0071 U	0.011	0.054	0.0083 U	0.0072 U	0.015 U	0.0082 U
Hexachloro-1,3-butadiene	37	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
Hexachlorobenzene	5.8	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Hexachloroethane	200	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Indeno[1,2,3-cd]pyrene	3.9	NSL	mg/kg	0.0084 U	0.031	0.046	0.0062 J	0.0076 U	3.5	0.0071 U	0.0071 U	0.011	0.13	0.0083 U	0.027	0.022	0.0082 U
Isophorone	3600	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Naphthalene	2000	NSL	mg/kg	0.0084 U	0.0043 J	0.0098	0.0041 J	0.0076 U	0.22 J	0.0071 U	0.0071 U	0.011	0.063	0.0026 J	0.0091	0.013 U	0.0082 U
Nitrobenzene	51	NSL	mg/kg	--	0.077 U	--	--	--	--	--	--	--	--	--	--	0.15 U	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Pentachlorophenol	24	NSL	mg/kg	--	0.038 U	--	--	--	--	--	--	--	--	--	--	0.073 U	--
Phenanthrene	31000	NSL	mg/kg	0.0084 U	0.041	0.1	0.012	0.0076 U	13	0.0071 U	0.0071 U	0.0039 J	0.03	0.014	0.045	0.022	0.0082 U
Phenol	31000	NSL	mg/kg	--	0.0078 U	--	--	--	--	--	--	--	--	--	--	0.015 U	--
Pyrene	3100	NSL	mg/kg	0.029	0.064	0.14	0.021	0.0076 U	13	0.0071 U	0.0071 U	0.0042 J	0.04	0.02	0.052	0.036	0.0082 U
pH (SW9045D)																	
pH	NSL	NSL	pH units	7.69 H	5.17 H	5.18 H	7.84 H	5.08 H	7.64 H	4.47 H	4.36 H	7.52 H	5.13 H	3.82 H	2.73 H	9.36 H	8.36 H

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup standards for soil

ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded value exceed ATC Eastern

pg/g = picograms per gram

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

B = Compound was found in the blank and sample

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

* = ISTD response or retention time outside applicable limits

E = Result exceeds calibration range

H = MS and or MSD Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF = Field parameter with a holding time of 15 minutes

U = Not Detected

Table D-2
Cristal USA Facility
Batch Attack Basin

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID:	BB-01	BB-02	BB-03	BB-04	BB-04	BB-05	BB-06	BB-07	BB-05 to BB-08	BB-08	BB-08
				Sample Name:	BB-01	BB-02	BB-03	BB-04 0-0.5	BB-04	BB-05	BB-06	BB-07	BB-05-08	BB-08	FD-1-040220
				Date Sampled:	4 3 2015	4 3 2015	4 3 2015	4 3 2015	4 3 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015
				Parent Sample ID:											BB-08
Dioxin/Furan (SW1613B)															
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	48 B	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	32 B	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	30 B	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	25 HQ	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	0.97 QH	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	6.2 QH	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	0.76 Q	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	15 Q	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	2.5 CHJ	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	13 B	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	0.80 QHJ	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	2.6 QJ	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	3.1 QJ	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	0.40 J	--	--
2,3,7,8-tetrachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	4.3 BQ	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	230 B	--	--
OCDF (octachlorodibenzofuran)	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	1400 BQ	--	--
Dioxin TEQs - TEF WHO	22	NSI	pg g	--	--	--	--	--	--	--	--	--	9402	--	--
Metals (SW6020A)															
Aluminum	1060000	NSI	mg kg	5800 B	4800 B	17000 B	34000 B	7000 B	19000 B	32000 B	21000 B	--	--	20000 B	19000 B
Antimony	41	NSI	mg kg	34 B	6.3 B	2.7 B	22 B	36 B	0.75 J	2.5	1.9 J	--	--	1.6 J	2.4 J
Arsenic	3.0	3.6	mg kg	**4.0**	1.2	1.0 J	**3.4**	1.8	1.4 J	2.5	1.7 J	--	--	1.5 J	1.5 J
Barium	20000	NSI	mg kg	65	190	230	60	170	200	44 B	230	--	--	190	180
Beryllium	200	NSI	mg kg	0.58 JB	0.47 JB	2.7 B	2.7 B	1.1 B	1.4	2.9	3.2	--	--	3.3	3.0
Cadmium	93	NSI	mg kg	0.21 JB	0.29 JB	2.2 B	1.3 B	0.91 B	1.5 J	0.41 J	1.4 J	--	--	1.8 J	1.2 J
Calcium	NSI	NSI	mg kg	86000	49000	42000	70000	47000	16000	30000 B	16000	--	--	19000	19000
Chromium	310	28	mg kg	97	67	**1600**	240	**590**	**1900**	**400**	**2400**	--	--	**2000**	**1900**
Cobalt	NSI	NSI	mg kg	4.0 B	3.5 B	28 B	9.7 B	7.7 B	9.6 B	13 B	18 B	--	--	35 B	41 B
Copper	4360	NSI	mg kg	53	35	21	16	51	19	8.5	25	--	--	22	22
Iron	72000	NSI	mg kg	16000 B	7700 B	**130000 B**	**140000 B**	42000 B	**150000 B**	**160000 B**	**170000 B**	--	--	**150000 B**	**140000 B**
Lead	1000	NSI	mg kg	53 B	220 B	38 B	31 B	100 B	9.7	15 B	10	--	--	8.8	8.8
Magnesium	NSI	NSI	mg kg	6100 B	65000 B	11000 B	6800 B	15000 B	11000 B	38000 B	5100 B	--	--	10000 B	11000 B
Manganese	2000	NSI	mg kg	300 B	930 B	**14000 B**	**4900 B**	**4000 B**	**26000**	**5600 B**	**25000**	--	--	**23000**	**22000**
Nickel	2000	NSI	mg kg	25	7.0	150	330	62	250	390	260	--	--	240	230
Potassium	NSI	NSI	mg kg	520 B	170 B	340 U	600 B	97 B	190 B	360 B	200 U	--	--	250 U	59 JB
Selenium	510	NSI	mg kg	1.7 JB	1.2 JB	1.6 JB	15 U	0.67 JB	1.3 J	1.3 J	1.9 J	--	--	2.8 J	1.6 J
Silver	510	NSI	mg kg	0.33 J	0.29 J	2.7	0.54 J	1.4	2.8	0.53	2.5	--	--	2.9	1.8 J
Sodium	NSI	NSI	mg kg	240 B	320 B	760 B	2500 B	430 B	2400 B	7400 B	1800 B	--	--	3100 B	3300 B
Thallium	7.2	4.9	mg kg	0.074 JB	0.13 JB	0.17 JB	3.6 J	0.12 JB	1.9 J	0.612 JB	2.0 J	--	--	2.5 J	0.17 JB
Vanadium	100	NSI	mg kg	**220 B**	**150 B**	**3680 B**	**450 B**	**1600 B**	**4500**	**950**	**5100**	--	--	**5300**	**4900**

Table D-2
Cristal USA Facility
Batch Attack Basin

			Location ID:	BB-01	BB-02	BB-03	BB-04	BB-04	BB-05	BB-06	BB-07	BB-05 to BB-08	BB-08	BB-08
			Sample Name:	BB-01	BB-02	BB-03	BB-04 0-0.5	BB-04	BB-05	BB-06	BB-07	BB-05-08	BB-08	FD-1-04022015
			Date Sampled:	4 3 2015	4 3-2015	4 3-2015	4 3 2015	4 3 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015
			Parent Sample ID:											BB-08
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**											
Zinc	31000	NSL	mg/kg	130	37	26	120	41	38 B	140 B	44 B	--	45 B	44 B
Mercury (SW7471B)														
Mercury	10	NSL	mg/kg	0.11	1.8	0.085	0.099	0.68	0.043 J	0.085 J	0.14	--	0.60	0.64
PCBS (SW8082A)														
Aroclor 1016	41	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1221	1.4	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1232	1.4	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1242	1.4	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1248	1.4	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1254	1.4	NSL	mg/kg	0.0026 U	0.0033 U	0.0061 U	0.013 U	0.0038 U	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Aroclor 1260	1.4	NSL	mg/kg	0.014	0.011	0.0061 U	0.013 U	0.016	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.014	0.011	0.0061 U	0.013 U	0.016	0.0078 U	0.021 U	0.0084 U	--	0.013 U	0.011 U
SVOCS (SW8270D)														
2-methylnaphthalene	410	NSL	mg/kg	0.021 U	0.0019 J	0.0098 U	0.13 U	0.031 U	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Acenaphthene	6100	NSL	mg/kg	0.021 U	0.0012 J	0.0098 U	0.13 U	0.012 J	0.0695 J	0.16 U	0.067 U	--	0.087 U	0.091 U
Acenaphthylene	6100	NSL	mg/kg	0.021 U	0.0023 J	0.0098 U	0.13 U	0.031 U	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Anthracene	31000	NSL	mg/kg	0.0068 J	0.0024 J	0.0098 U	0.037 J	0.023 J	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Benzo[a]anthracene	3.9	NSL	mg/kg	0.023	0.01	0.0027 J	0.047 J	0.081	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Benzo[a]pyrene	0.39	NSL	mg/kg	0.021	0.011	0.0098 U	0.042 J	0.075	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Benzo[b]fluoranthene	3.9	NSL	mg/kg	0.027	0.011	0.0098 U	0.059 J	0.086	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Benzo[g,h,i]perylene	3100	NSL	mg/kg	0.025	0.011	0.0098 U	0.1 U	0.074	0.063 U	0.16 U	0.067 U	--	0.087 U [F1]	0.091 U
Benzo[k]fluoranthene	39	NSL	mg/kg	0.012 J	0.0056 J	0.0098 U	0.023 J	0.027 J	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Chrysene	390	NSL	mg/kg	0.023	0.012	0.0038 J	0.053 J	0.088	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.021 U	0.0044 J	0.0098 U	0.1 U	0.031 U	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Fluoranthene	4300	NSL	mg/kg	0.049	0.02	0.0083 J	0.14	0.15	0.035 J	0.11 J	0.031 J	--	0.027 J	0.027 J
Fluorene	4100	NSL	mg/kg	0.021 U	0.0053 U	0.0098 U	0.1 U	0.031 U	0.031 J	0.16 U	0.067 U	--	0.087 U	0.091 U
Indeno[1,2,3-c,d]pyrene	3.9	NSL	mg/kg	0.02 J	0.0096 J	0.0098 U	0.1 U	0.065	0.063 U	0.16 U	0.067 U	--	0.087 U [F1]	0.091 U
Naphthalene	2800	NSL	mg/kg	0.021 U	0.0024 J	0.0098 U	0.1 U	0.0675 J	0.063 U	0.16 U	0.067 U	--	0.087 U	0.091 U
Phenanthrene	31000	NSL	mg/kg	0.027	0.0096	0.0063 J	0.11	0.079	0.052 J	0.078 J	0.043 J	--	0.035 J	0.039 J
Pyrene	3100	NSL	mg/kg	0.033	0.015	0.0061 U	0.09 J	0.11	0.052 J	0.069 J	0.024 J	--	0.018 J	0.091 U
pH (SW9045D)														
pH	NSL	NSL	pH units	7.74 H	8.24 H	7.92 H	8.08 H	7.89 H	7.92 H	8.26 H	7.62 H	--	7.96 H	7.79 H

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup

ATC Eastern: Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

1 USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded values exceed ATC Eastern

pg/g = picogram per gram

mg/kg = milligrams per kilogram

B = Compound was found in the blank and sample

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an

* = RSTD response or retention time outside applicable limits

E = Result exceeds calibration range

F1 = MS and or MSD Recovery is outside acceptance limits.

Q = One or more quality control criteria failed

H = Field parameter with a holding time of 15 minutes

U = Not Detected

Table D-3
Cristal USA Facility
Lower Settling Basin

Location ID:				LB-02	LB-02	LB-02	LB-03	LB-03	LB-04	LB-04	LB-04	LB-05	LB-05	LB-05	LB-06	LB-07	LB-06 to LB-08	LB-08
Sample Name:				DUP-22	LB-02 0-2	LB-02 8-10	LB-03 0-2	LB-03 8-10	DUP-21	LB-04 0-2	LB-04 6-8	DUP-18	LB-05 0-2	LB-05 6-8	LB-06	LB-07	LB-06-08	LB-08
Date Sampled:				4 16 2015	4 9 2015	4 16 2015	4 9 2015	4 16 2015	4 16 2015	4 9 2015	4 16 2015	4 9 2015	4 9 2015	4 16 2015	4 2 2015	4 2 2015	4 2 2015	4 2 2015
Parent Sample ID:				LB-02 8-10					LB-04 6-8			LB-05 0-2						
Depth Interval (ft):				8-10	0-2	8-10	0-2	8-10	6-8	0-2	6-8	0-2	0-2	6-8	-	-	-	-
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**															
Dioxin/Furan (SW 1613B)																		
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	380 B	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-furan	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	99 B	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	360 B	--
1,2,3,4,7,8-hexachlorodibenzofurans	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	230 BQ	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	2.3 QBJ	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	140 BQ	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9 QJ	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDFs)	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	120 Q	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	4.6 QBJ	--
1,2,3,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	430 B	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	1.9 QBJ	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	15 Q	--
2,3,4,7,8-pentachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	69	--
2,3,7,8-tetrachlorodibenzodioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	2.1 U	--
2,3,7,8-tetrachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	200 B	--
OCDD octachlorodibenzo-p-dioxin	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	860 B	--
OCDF octachlorodibenzofuran	NSI	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	4300 BQ	--
Dioxin TEQs - TEF WHO	22	NSI	pg g	--	--	--	--	--	--	--	--	--	--	--	--	--	**169.528**	--
Metals (SW6020A)																		
Aluminum	100000	NSI	mg kg	11000	18000	11000	17000	9560	2800	3500	3300	22000	23000	11000	26000 B	20000 B	--	11000 B
Antimony	41	NSI	mg kg	1.8	0.62 J	1.2	0.70 BJ	1.4	0.37 J	0.79	0.17 J	0.89 J	0.73 J	2.9	2.2 J	2.2 J	--	1.1 J
Arsenic	3.0	3.6	mg kg	2.5	1.9 J	2.4	1.8 BJ	1.4	**3.2**	2.6	**4.3**	1.8 J	1.6 J	**6.9**	1.6 J	1.8 J	--	1.5 J
Barium	20000	NSI	mg kg	130	110	120	130	140	39	24	23	140	140	130	110	160	--	69
Beryllium	200	NSI	mg kg	2.3	3.8	2.4	3.0	2.0	1.0	1.2	0.90	4.1	4.1	1.4	1.6 J	2.8 J	--	1.3 J
Cadmium	51	NSI	mg kg	7.9	1.3 J	3.5	1.3 J	0.6	0.097 J	1.9	0.12 J	29	27	5.6	0.72 J	1.4 J	--	0.60 J
Calcium	NSI	NSI	mg kg	26000 B	5700	15000 B	15000 BJ	16000 B	190 BJ	2200	280 B	6700	6600	10000 B	20000	36000	--	24000
Chromium	410	28	mg kg	**3400 B**	**2500**	**2200 B**	**2500**	**3000 B**	32 B	**190**	**43 B**	**3100**	**3000**	**2700 B**	**1700**	**2100**	--	**530**
Cobalt	NSI	NSI	mg kg	10	19	11	15	7.6	26	16	15	64	44	43	19 B	27 B	--	10 B
Copper	4100	NSI	mg kg	25	28	20	25	17	26	24	16	53	53	72	32	28	--	19
Iron	72000	NSI	mg kg	**77000**	**130000**	**79000**	**140000**	72000	14000	28000	16000	**180000**	**170000**	**91000**	**100000 B**	**150000 B**	--	53000 B
Lead	1000	NSI	mg kg	6.3	7.5	5.5	7.1	4.1	4.6	7.3	4.1	9.3	8.4	4.4	9.4	11	--	6.3
Magnesium	NSI	NSI	mg kg	7500	4300	5100	5500	9700	330	720	350	9600	9600	2300	5400 B	4700 B	--	2300 B
Manganese	2000	NSI	mg kg	**7300**	**29000**	**11000**	**26000**	**7500**	26	1800 B	260	**16000 B**	**14000 B**	**9100**	**9300**	**23000**	--	**7500**
Nickel	2000	NSI	mg kg	130	180	110	160	110	31	46	28	250	230	180	160	220	--	93
Potassium	NSI	NSI	mg kg	1900 J	1400 J	2100 J	1800 J	2200 J	230	850	200	1200 J	1200 J	1600 J	1900 BJ	1300 BJ	--	550 B
Selenium	520	NSI	mg kg	2.0 B	1.3 J	1.7 B	2.0 BJ	1.5 B	0.55 BJ	0.17 J	0.45 BJ	1.7 J	1.6 J	1.9 BJ	1.4 J	1.5 J	--	0.91 J
Silver	520	NSI	mg kg	1.6	4.0	7.2	4.4	1.4	0.024 J	0.39	0.077 J	5.8	5.3	1.1	1.0 J	2.6 J	--	0.89 J
Sodium	NSI	NSI	mg kg	2400 B	1300 J	1400 B	1800 J	1500 B	39 BJ	28 J	43 BJ	1000 J	1400 J	890 B	3900 B	3400 B	--	1200 B
Thallium	7.2	3.9	mg kg	0.083 J	0.23 J	0.075 J	0.090 J	0.065 J	0.13	0.075 J	0.12 J	0.25 J	0.43 J	0.25 J	0.11 BJ	0.10 J	--	0.058 BJ
Vanadium	100	NSI	mg kg	**8600**	**4900**	**5000**	**4600**	**7800**	49	**400**	100	**6800**	**6500**	**6500**	**2400**	**4900**	--	**1200**
Zinc	31000	NSI	mg kg	71	45	45	41	46	65	43	54	96	100	260	140 B	70 B	--	67 B

Table D-3
Cristal USA Facility
Lower Settling Basin

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID: LB-02 / Sample Name: DUP-22 / Date Sampled: 4 16 2015 / Parent Sample ID: LB-02 8-10 / Depth Interval (ft): 8-10	LB-02 / LB-02 0-2 / 4 9 2015 / 0-2	LB-02 / LB-02 8-10 / 4 16 2015 / 8-10	LB-03 / LB-03 0-2 / 4 9 2015 / 0-2	LB-03 / LB-03 8-10 / 4 16 2015 / 8-10	LB-04 / DUP-21 / 4 16 2015 / 8-8	LB-04 / LB-04 0-2 / 4 9 2015 / 0-2	LB-04 / LB-04 6-8 / 4 16 2015 / 6-8	LB-05 / DUP-18 / 4 9 2015 / LB-05 0-2 / 0-2	LB-05 / LB-05 0-2 / 4 9 2015 / 0-2	LB-05 / LB-05 6-8 / 4 16 2015 / 6-8	LB-06 / LB-06 / 4 2 2015 / -	LB-07 / LB-07 / 4 2 2015 / -	LB-06 to LB-08 / LB-06-08 / 4 2 2015 / -	LB-08 / LB-08 / 4 2 2015 / -
Mercury (SW7471B)																		
Mercury	19	NSL	mg/kg	0.13	0.090 U	0.18	0.0991 UF1	0.19	0.079 U	0.040 U	0.041 U	0.11 U	0.11 U	0.28	0.20	0.28	--	0.086
PCBS (SW8082A)																		
Aroclor 1016	41	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1221	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1232	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1242	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1248	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1254	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Aroclor 1260	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.016 U	0.013 U	0.017 U	0.013 U	0.019 U	0.0051 U	0.0052 U	0.0054 U	0.014 U	0.014 U	0.017 U	0.011 U	0.012 U	--	0.0073 U
SVOCS (SW8270D)																		
2-methylnaphthalene	410	NSL	mg/kg	0.03 J	0.0052 J	0.027 J	0.0073 J	0.016 J	0.0083 U	0.0026 J	0.0088 U	0.021 J	0.0065 J	0.14 U	0.086 U	0.099 U	--	0.059 U
Acenaphthene	6100	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.0080 J	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Acenaphthylene	6100	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Anthracene	31000	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Benzo[a]anthracene	3.9	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Benzo[a]pyrene	0.39	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Benzo[b]fluoranthene	3.9	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Benzo[g,h,i]perylene	3100	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Benzo[k]fluoranthene	39	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Chrysene	390	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Fluoranthene	4100	NSL	mg/kg	0.041 J	0.0051 J	0.035 J	0.012 J	0.01 J	0.0083 U	0.0032 J	0.0088 U	0.023 U	0.0080 J	0.032 J	0.052 J	0.054 J	--	0.043 J
Fluorene	4100	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.021 U	0.01 J	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Indeno[1,2,3-c,d]pyrene	3.9	NSL	mg/kg	0.13 U	0.018 U	0.14 U	0.02 U	0.031 U	0.0083 U	0.0083 U	0.0088 U	0.023 U	0.022 U	0.14 U	0.086 U	0.099 U	--	0.059 U
Naphthalene	2000	NSL	mg/kg	0.04 J	0.019	0.034 J	0.011 J	0.012 J	0.0083 U	0.0069 J	0.0088 U	0.041	0.03	0.14 U	0.086 U	0.099 U	--	0.059 U
Phenanthrene	31000	NSL	mg/kg	0.06 J	0.0068 J	0.081 J	0.014 J	0.022 J	0.0083 U	0.0038 J	0.0088 U	0.011 J	0.011 J	0.14 U	0.051 J	0.068 J	--	0.042 J
Pyrene	3100	NSL	mg/kg	0.036 J	0.0042 J	0.047 J	0.013 J	0.0099 J	0.0083 U	0.0027 J	0.0088 U	0.023 U	0.0075 J	0.038 J	0.033 J	0.036 J	--	0.032 J
pH (SW9045D)																		
pH	NSL	NSL	pH units	7.26 H	7.48 H	7.36 H	7.39 H	8.26 H	3.87 H	7.26 H	4.27 H	7.32 H	7.44 H	7.47 H	6.95 H	7.47 H	--	7.08 H

Notes:
MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
= USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res.
Gray shaded values exceed ATC Eastern
pg g-1 = picograms per gram
mg/kg = milligrams per kilogram
B = Compound was found in the blank and sample.
J = Result is less than the RL but greater than or equal to the MDL and the concentration is
* = ISTD response or retention time outside applicable limits
E = Result exceeds calibration range
H = MS and or MDS Recovery is outside acceptance limits.
Q = One or more quality control criteria failed
HF = Field parameter with a holding time of 15 minutes
U = Not Detected

Table D-4
Cristal USA Facility
Landfill Areas

Location ID:				LF-01	LF-01	LF Area 1	LF-02	LF-02	LF-02	LF-03	LF-03	LF-03	LF Area 2	LF-04	LF-04	LF-05	LF-05	LF Area 3	LF-06	LF-06
Sample Name:				LF-01 18-20	LF-01 2-4	LF-01-02	DUP-LF-02	LF-02 16-18	LF-02 2-4	DUP-LF-03	LF-03 13-15	LF-03 2-4	LF-03-04	LF-04 0-2	LF-04 14-16	LF-05 0-2	LF-05 42-44	LF-05-07	LF-06 0-2	LF-06 46-48
Date Sampled:				4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/13/2015	4/13/2015	4/13/2015	4/13/2015	4/13/2015
Parent Sample ID:							LF-02 16-18				LF-03 13-15									
Depth Interval (ft):				18-20	2-4	-	16-18	16-18	2-4	13-15	13-15	2-4	-	0-2	14-16	0-2	42-44	-	0-2	46-48
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit																	
Dioxin/Furan (SW1613B)																				
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	110 B	--	--	--	--	--	--	0.90 BJ	--	--	--	--	20 B	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	130 B	--	--	--	--	--	--	4.6 BJ	--	--	--	--	5 TB	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	89 B	--	--	--	--	--	--	0.56 QBJ	--	--	--	--	16	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	140	--	--	--	--	--	--	1.8 J	--	--	--	--	25 QB	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	0.68 QJ	--	--	--	--	--	--	0.076 QJ	--	--	--	--	4.8 UJ	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	28 J	--	--	--	--	--	--	0.21 QJ	--	--	--	--	4.8 QBJ	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	3.4 J	--	--	--	--	--	--	0.12 QJ	--	--	--	--	0.32 QBJ	--	--
1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	28 Q	--	--	--	--	--	--	0.10 QJ	--	--	--	--	11 Q	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	2.1 QJ	--	--	--	--	--	--	0.15 QJ	--	--	--	--	0.30 QJ	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	85 B	--	--	--	--	--	--	0.48 QBJ	--	--	--	--	13	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	1.6 QBJ	--	--	--	--	--	--	0.14 QBJ	--	--	--	--	0.22 QJ	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	4.0 J	--	--	--	--	--	--	0.055 QJ	--	--	--	--	0.55 QBJ	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	35 B	--	--	--	--	--	--	0.12 BJ	--	--	--	--	3.3 QJ	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	0.32 QJ	--	--	--	--	--	--	0.061 QJ	--	--	--	--	0.33 QJ	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	3.3	--	--	--	--	--	--	0.18 J	--	--	--	--	3.8 Q	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	2700 B	--	--	--	--	--	--	260 B	--	--	--	--	130 B	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	2100 B	--	--	--	--	--	--	5.0 BJ	--	--	--	--	400 B	--	--
Dioxin TEQs - TEF WHO	22	NSL	pg/g	--	--	**37.018**	--	--	--	--	--	--	0.4033	--	--	--	--	6.945	--	--
Metals (SW6020A)																				
Aluminum	100000	NSL	mg/kg	12000	5300	--	7300	6500	13000	2700	2300	2800	--	9300	2900	9300	14000	--	8000	9600
Antimony	41	NSL	mg/kg	0.40 J	0.37	--	1.1	0.97	3.0	0.33	0.32	0.30	--	0.22	0.27	0.41 F1	0.62 J	--	0.44	0.13 J
Arsenic	3.6	3.6	mg/kg	1.5 J	**3.4**	--	2.2	**3.1**	1.8	2.3	**3.0**	**4.3**	--	2.3	2.1	**5.1 F1**	3.1 J	--	**5.0**	1.9 J
Barium	20000	NSL	mg/kg	39 J	58	--	67	58	83	20	18	13	--	32	33	50	130	--	32	98
Beryllium	200	NSL	mg/kg	1.5 U	0.47	--	0.91	0.81	0.56	1.0	0.90	1.2	--	0.23	0.90	0.51	2.2	--	0.45	1.9 J
Cadmium	51	NSL	mg/kg	0.22 J	1.1	--	4.8	3.9	1.4	0.14	0.12	0.15	--	0.23	0.35	0.38	0.90 J	--	0.13	4.5
Calcium	NSL	NSL	mg/kg	230000	4100	--	14000	11000	94000	4500	1000	360	--	470	200	42000 F2	23000	--	8600	15000
Chromium	310	28	mg/kg	140	130	--	**360**	**250**	**34**	**33**	**54**	**38**	--	27	**35**	**55 F1**	**1500**	--	**29**	**2900**
Cobalt	NSL	NSL	mg/kg	6.8	4.7	--	7.3	6.4	5.1	3.0	1.3	3.0	--	3.4	2.3	8.9	35	--	4.3	4.1
Copper	4100	NSL	mg/kg	2.2 J	17	--	14	15	24	14	4.2	14	--	9.5	12	47 F1	16	--	200	8.1
Iron	72000	NSL	mg/kg	6900	15000	--	32000	29000	12000	16000	29000	27000	--	15000	27000	17000	**120000**	--	16000	**100000**
Lead	1000	NSL	mg/kg	0.62 J	53	--	30	17	53	5.0	0.4	4.6	--	4.5	4.6	28	67	--	20	43
Magnesium	NSL	NSL	mg/kg	910	1100	--	5000	4900	14000	200	140	170	--	120	98	8500 F1	6300	--	2000	12000
Manganese	2000	NSL	mg/kg	320 B	1400 B	--	**2900 B**	**2300 B**	540 B	68 B	9.6 B	31 B	--	35 B	14 B	410	**20000**	--	200	**17000**
Nickel	2000	NSL	mg/kg	2.1	18	--	40	41	13	13	3.8	12	--	4.8	7.6	24	220	--	11	200
Potassium	NSL	NSL	mg/kg	750 U	300	--	330	320	1500	330	290	290	--	160	120	1000	9300 U	--	830	1000 U
Selenium	510	NSL	mg/kg	2.5 U	0.15 J	--	0.25 J	0.33 J	0.060 J	0.060 J	0.080 J	0.080 J	--	0.55 U	0.10 J	0.52 J	0.90 J	--	0.43 J	10 U
Silver	510	NSL	mg/kg	1.5 U	0.28	--	0.58	0.77	0.060 J	0.032 J	0.021 J	0.029 J	--	0.060 J	0.020 J	0.11 J	1.8 J	--	0.22	9.6
Sodium	NSL	NSL	mg/kg	180 J	11 J	--	120	93	530	26 J	18 J	19 J	--	25 J	12 J	100 B	410 B	--	68 B	560 B
Thallium	7.2	4.9	mg/kg	1.5 U	0.004 J	--	0.068 J	0.070 J	0.038 J	0.020 J	0.040 J	0.046 J	--	0.037 J	0.028 J	0.075 J	0.077 J	--	0.070 J	2.0 U
Vanadium	140	NSL	mg/kg	**310**	**300**	--	**850**	**690**	34	79	**130**	80	--	65	**110**	93 F1	**4900**	--	33	**7600**
Zinc	31000	NSL	mg/kg	16 J	34	--	41	41	120	19	5.3	20	--	7.1	6.7	58 F2 F1	190	--	51	84
Mercury (SW7471B)																				
Mercury	30	NSL	mg/kg	0.053 U	0.18	--	0.25	0.28	0.29	0.043 U	0.038 U	0.036 U	--	0.035 U	0.035 U	0.041 U	0.064 U	--	0.067	0.027 J
DRO/GRO (SW8015C)																				
Diesel Range Organics	620	NSL	mg/kg	580	--	--	170	80	--	89	46	--	--	--	6.8 J	--	330	--	--	45
Gasoline Range Organics	620000	NSL	ug/kg	160 U	--	--	150	130 U	--	99 J	330	--	--	--	120 U	--	190	--	--	110 J

Table D-4
Cristal USA Facility
Landfill Areas

Location ID:				LF-01	LF-01	LF Area 1	LF-02	LF-02	LF-02	LF-03	LF-03	LF-03	LF Area 2	LF-04	LF-04	LF-05	LF-05	LF Area 3	LF-06	LF-06
Sample Name:				LF-01 18-20	LF-01 2-4	LF-01-02	DUP-LF-02	LF-02 16-18	LF-02 2-4	DUP-LF-01	LF-03 13-15	LF-03 2-4	LF-03-04	LF-04 0-2	LF-04 14-16	LF-05 0-2	LF-05 42-44	LF-05-07	LF-06 0-2	LF-06 46-48
Date Sampled:				4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 13 2015	4 13 2015	4 13 2015	4 13 2015	4 13 2015
Parent Sample ID:							LF-02 16-18			LF-03 13-15										
Depth Interval (ft):				18-20	2-4	-	16-18	16-18	2-4	13-15	13-15	2-4	-	0-2	14-16	0-2	42-44	-	0-2	46-48
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit																	
PCBS (SW8082A)																				
Aroclor 1016	41	NSL	mg/kg	0.0013 U	0.0071 U	--	0.0011 U	0.0011 U	0.0046 U	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.0051 U	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1221	1.4	NSL	mg/kg	0.0013 U	0.0071 U	--	0.0011 U	0.0011 U	0.0046 U	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.0051 U	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1232	1.4	NSL	mg/kg	0.0013 U	0.0071 U	--	0.0011 U	0.0011 U	0.0046 U	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.0051 U	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1242	1.4	NSL	mg/kg	0.0013 U	0.0071 U	--	0.056	0.043	0.093	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.0051 U	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1248	1.4	NSL	mg/kg	0.0013 U	0.0071 U	--	0.0011 U	0.0011 U	0.0046 U	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.0051 U	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1254	1.4	NSL	mg/kg	0.0013 U	0.0062 J	--	0.0011 U	0.0011 U	0.0046 U	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.033	0.0080 U	--	0.0046 U	0.0088 U
Aroclor 1260	1.4	NSL	mg/kg	0.0013 U	0.0056	--	0.015	0.02	0.068	0.0053 U	0.0049 J	0.0048 U	--	0.0025 J	0.0048 U	0.019	0.0028 J	--	0.0080	0.0088 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.0013 U	0.012	--	0.071	0.063	0.15	0.0053 U	0.0048 U	0.0048 U	--	0.0048 U	0.0048 U	0.051	0.0080 U	--	0.0080	0.0088 U
VOCS (SW8260C)																				
1,1,1-trichloroethane	200000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,1,2,2-tetrachloroethane	13	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,1,2-trichloroethane	56	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,1-dichloroethane	26000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,1-dichloroethene	5100	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0011 J	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,2-dibromoethane	1.4	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,2-dichloroethane	33	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,2-dichloroethene	920	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
1,2-dichloropropane	42	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
2-hetanone	61000	NSL	mg/kg	0.0099 U	0.0035 J	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	0.0099 U	0.0076 J	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Acetone	92000	NSL	mg/kg	0.04 U	0.0096 J	--	0.028 U	0.022 U	0.023 U	0.022 U	0.033 U	0.022 U	--	0.018 U	0.018 U	0.023 U	0.043 U	--	0.018 U	0.056 U
Benzene	53	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Bromodichloromethane	46	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Bromoform	360	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Bromomethane	140	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Carbon disulfide	10000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Carbon tetrachloride	52	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Chlorobenzene	2600	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Chloroethane	990	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Chloroform	1000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.0028 J	--	0.0045 U	0.014 U
Chloromethane	NSL	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
cis-1,2-dichloroethene	1000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
cis-1,3-dichloropropene	29	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Dibromochloromethane	34	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Ethylbenzene	10000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0016 J	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Isopropylbenzene	10000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Methyl tert-butyl ether	720	NSL	mg/kg	0.0099 U	0.0076 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Methylene Chloride	980	NSL	mg/kg	0.0067 JB	0.0027 JB	--	0.0032 JB	0.0025 JB	0.0026 JB	0.0021 JB	0.0026 JB	0.0021 JB	--	0.0022 JB	0.0018 JB	0.0019 JB	0.0044 JB	--	0.0015 JB	0.0033 JB
Styrene	20000	NSL	mg/kg	0.0099 U	0.0012 J	--	0.0069 U	0.0055 U	0.14	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Tetrachloroethene	5.3	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Toluene	8200	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
trans-1,2-dichloroethene	2000	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
trans-1,3-dichloropropene	29	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Trichloroethene	7.2	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U
Vinyl chloride	4	NSL	mg/kg	0.0099 U	0.0070 U	--	0.0069 U	0.0055 U	0.0057 U	0.0055 U	0.0082 U	0.0055 U	--	0.0046 U	0.0044 U	0.0057 U	0.011 U	--	0.0045 U	0.014 U

Table D-4
Cristal USA Facility
Landfill Areas

Location ID:				LF-01	LF-01	LF Area 1	LF-02	LF-02	LF-02	LF-03	LF-03	LF-03	LF Area 2	LF-04	LF-04	LF-05	LF-05	LF Area 3	LF-06	LF-06
Sample Name:				LF-01 18-20	LF-01 2-4	LF-01-02	DUP-LF-02	LF-02 16-18	LF-02 2-4	DUP-LF-01	LF-03 13-15	LF-03 2-4	LF-03-04	LF-04 0-2	LF-04 14-16	LF-05 0-2	LF-05 42-44	LF-05-07	LF-06 0-2	LF-06 46-48
Date Sampled:				4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-9-2015	4-13-2015	4-13-2015	4-13-2015	4-13-2015	4-13-2015
Parent Sample ID:							LF-02 16-18			LF-03 13-15										
Depth Interval (ft):				18-20	2-4	-	16-18	16-18	2-4	13-15	13-15	2-4	-	0-2	14-16	0-2	42-44	-	0-2	46-48
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit																	
Xylenes, Total	20000	NSL	mg/kg	0.033 U	0.021 U	--	0.021 U	0.016 U	0.017 U	0.017 U	0.024 U	0.017 U	--	0.014 U	0.013 U	0.017 U	0.032 U	--	0.014 U	0.032 U
SVOCS (SW8270D)																				
1,2,4-trichlorobenzene	1000	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
1,2-dichlorobenzene	9200	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
1,3-dichlorobenzene	340	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	0.01 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg	0.01 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	0.271 U	--	--	--	--	--	0.211 U	0.2 U	--	--	--	--	--	0.331 U	--	--	--
2,4-dinitrotoluene	200	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2,6-dinitrotoluene	100	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	0.01 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
2-chlorophenol	530	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
2-methylnaphthalene	310	NSL	mg/kg	0.0643 J	0.0093 J	--	0.083	0.062	7.5	0.0839 J	0.0059 J	0.0077 U	--	0.0049 J	0.0045 J	0.063 U	0.0089 J	--	0.074 U	0.0027 J
2-methylphenol	5200	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
3,3-dichlorobenzidine	6.4	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
4-chloroaniline	430	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
4-methylphenol	520	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Acenaphthene	6100	NSL	mg/kg	0.013 U	0.0043 U	--	0.15	0.34	15	0.0084 U	0.0078 U	0.0077 U	--	0.0078 U	0.0078 U	0.016 J	0.013 U	--	0.074 U	0.014 U
Acenaphthylene	6100	NSL	mg/kg	0.013 U	0.0043 U	--	0.0039 J	0.029 J	1.7	0.0084 U	0.0078 U	0.0077 U	--	0.0078 U	0.0078 U	0.095	0.013 U	--	0.074 U	0.014 U
Anthracene	31000	NSL	mg/kg	0.013 U	0.011 J	--	0.31	0.29	20	0.0084 U	0.0017 J	0.0077 U	--	0.00069 J	0.0078 U	0.13	0.013 U	--	0.023 J	0.014 U
Benz[a]anthracene	3.9	NSL	mg/kg	0.013 U	0.035 J	--	0.6	0.66	33	0.0084 U	0.0063 J	0.0077 U	--	0.0025 J	0.0078 U	0.32	0.013 U	--	0.092	0.014 U
Benzo[a]pyrene	0.39	NSL	mg/kg	0.013 U	0.04 J	--	0.43	0.5	24	0.0084 U	0.0051 J	0.0077 U	--	0.0039 J	0.0078 U	0.4	0.013 U	--	0.085	0.014 U
Benzo[b]fluoranthene	3.9	NSL	mg/kg	0.013 U	0.052	--	0.54	0.61	27	0.0084 U	0.0079	0.0077 U	--	0.0058 J	0.0078 U	0.49	0.013 U	--	0.14	0.014 U
Benzo[g,h,i]perylene	31000	NSL	mg/kg	0.013 U	0.043 J	--	0.34	0.45	18	0.0084 U	0.0043 J	0.0077 U	--	0.0042 J	0.0078 U	0.42	0.013 U	--	0.085	0.014 U
Benzo[k]fluoranthene	39	NSL	mg/kg	0.013 U	0.023 J	--	0.21	0.24	11	0.0084 U	0.0024 J	0.0077 U	--	0.0021 J	0.0078 U	0.16	0.013 U	--	0.059 J	0.014 U
Bis(2-chloroethyl)ether	2.6	NSL	mg/kg	0.013 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	0.058 J	--	--	--	--	--	0.56	0.91	--	--	--	--	--	0.21	--	--	--
Carbazole	340	NSL	mg/kg	0.013 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
Chrysene	390	NSL	mg/kg	0.013 U	0.046	--	0.55	0.62	30	0.0084 U	0.0063 J	0.0077 U	--	0.0036 J	0.0078 U	0.39	0.013 U	--	0.1	0.014 U
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.013 U	0.043 U	--	0.11	0.11	5.2	0.0084 U	0.0078 U	0.0077 U	--	0.0078 U	0.0078 U	0.077 J	0.013 U	--	0.074 U	0.014 U
Dibenzofuran	130	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.015 J	--	--	--
Fluoranthene	4100	NSL	mg/kg	0.0032 J	0.07	--	1.2	1.3	82	0.0039 J	0.011	0.0064 J	--	0.0080	0.0078 U	0.36	0.0050 J	--	0.13	0.0052 J
Fluorene	4100	NSL	mg/kg	0.013 U	0.043 U	--	0.23	0.19	18	0.0084 U	0.0078 U	0.0077 U	--	0.0078 U	0.0078 U	0.083 U	0.013 U	--	0.074 U	0.014 U
Hexachloro-1,3-butadiene	37	NSL	mg/kg	0.013 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	0.031	--	--	--	--	--	0.0084 U	0.034	--	--	--	--	--	0.12	--	--	--

Table D-4
Cristal USA Facility
Landfill Areas

				Location ID:	LF-01	LF-01	LF Area 1	LF-02	LF-02	LF-02	LF-03	LF-03	LF-03	LF Area 2	LF-04	LF-04	LF-05	LF-05	LF Area 3	LF-06	LF-06
				Sample Name:	LF-01 18-20	LF-01 2-4	LF-01-02	DUP-LF-02	LF-02 16-18	LF-02 2-4	DUP-LF-01	LF-03 13-15	LF-03 2-4	LF-03-04	LF-04 0-2	LF-04 14-16	LF-05 0-2	LF-05 42-44	LF-05-07	LF-06 0-2	LF-06 46-48
				Date Sampled:	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 9 2015	4 13 2015	4 13 2015	4 13 2015	4 13 2015	4 13 2015
				Parent Sample ID:				LF-02 16-18			LF-03 13-15										
				Depth Interval (ft):	18-20	2-4	-	16-18	16-18	2-4	13-15	13-15	2-4	-	0-2	14-16	0-2	42-44	-	0-2	46-48
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit																		
Hexachlorocyclopentadiene	630	NSL	mg/kg		0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Hexachloroethane	260	NSL	mg/kg		0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Indeno(1,2,3-c,d)pyrene	3.9	NSL	mg/kg		0.01 U	0.038 J	--	0.31	0.31	16	0.0084 U	0.0038 J	0.0077 U	--	0.0028 J	0.0078 U	0.25	0.013 U	--	0.07 J	0.014 U
Isophorone	5081	NSL	mg/kg		0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Naphthalene	2000	NSL	mg/kg		0.013	0.021 J	--	0.17	0.12	19	0.01	0.013	0.0077 U	--	0.017	0.014	0.084 U	0.0061 J	--	0.074 U	0.0029 J
Nitrobenzene	51	NSL	mg/kg		0.13 U	--	--	--	--	--	0.084 U	0.077 U	--	--	--	--	--	0.13 U	--	--	--
N-nitroso-di-n-propylamine	0.41	NSL	mg/kg		0.01 U	--	--	--	--	--	0.0084 U	0.0078 U	--	--	--	--	--	0.013 U	--	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg		0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Pentachlorophenol	22	NSL	mg/kg		0.052 U	--	--	--	--	--	0.042 U	0.038 U	--	--	--	--	--	0.064 U	--	--	--
Phenanthrene	11000	NSL	mg/kg		0.0044 J	0.042 J	--	1	1.1	82	0.0041 J	0.0087	0.0053 J	--	0.0053 J	0.0078 U	0.12	0.0079 J	--	0.053 J	0.0041 J
Phenol	33000	NSL	mg/kg		0.015	--	--	--	--	--	0.0072 J	0.011	--	--	--	--	--	0.013 U	--	--	--
Pyrene	3100	NSL	mg/kg		0.0029 J	0.062	--	0.94	1	55	0.0028 J	0.01	0.0047 J	--	0.0025 J	0.0078 U	0.25	0.0048 J	--	0.13	0.0049 J
pH (SW 9045D)																					
pH	NSL	NSL	pH units		7.14 H	7.55 H	--	7.92 H	7.95 H	10.5 H	6.27 H	5.92 H	4.96 H	--	5.48 H	4.40 H	8.05 H	8.09 H	--	8.21 H	7.93 H

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup

ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

[1] USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded values exceed ATC Eastern

pg/g = picogram per gram

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

B= Compound was found in the blank and sample

J Result is less than the RL but greater than or equal to the MDL and the concentration is

* ISTD response or retention time outside applicable limits

E = Result exceeds calibration range

F1 MS and/or MSD Recovery is outside acceptance limits

Q One or more quality control criteria failed

HF = Field parameter with a holding time of 15 minutes

U= Not Detected

Table D-4
Cristal USA Facility
Landfill Areas

				Location ID:	LF-07	LF-07	LF-08	LF-08	LF-09	LF-09	LF-10	LF-10	LF Area 4
				Sample Name:	LF-07 0-2	LF-07 65-67	LF-08 0-2	LF-08 65-67	LF-09 0-2	LF-09 44-46	LF 10 0-2	LF10 73-75	LF-AREA 4
				Date Sampled:	4/7/2015	4/8/2015	4/6/2015	4/6/2015	4/7/2015	4/7/2015	4/3/2015	4/3/2015	4/7/2015
				Parent Sample ID:									
				Depth Interval (ft):	0-2	65-67	0-2	65-67	0-2	44-46	0-2	73-75	-
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit										
Dioxin/Furan (SW8613B)													
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	5.7 QB
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	16 B
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	2.2 QJ
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	3.0 QBJ
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.33 J
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	2.0 QBJ
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.69 QBJ
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	8.5 Q
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.75 J
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	1.6 J
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.48 QJ
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.47 QBJ
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.95 QJ
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.91 U
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	0.55 QJ
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	600 B
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	110 QB
Dioxin TEQs - TEF_WHO	22	NSL	pg/g	--	--	--	--	--	--	--	--	--	2.7 U
Metals (SW6020A)													
Aluminum	100000	NSL	mg/kg	4400	2600 B	2400	1300 F2	8900	10000	3400	2400	--	
Antimony	41	NSL	mg/kg	0.20 BJ	0.29	0.12 J	0.19 JF1B	0.27 J	1.2 J	0.28 JB	1.0 JB	--	
Arsenic	3.6	5.5	mg/kg	**3.1**	**4.3**	**3.1**	**3.4 F1B**	**3.6**	0.82 J	**3.9**	**6.7**	--	
Barium	20000	NSL	mg/kg	17	13	7.5	9.0	26	110 B	12	26	--	
Beryllium	200	NSL	mg/kg	0.30	1.5	0.18	0.11	0.39	2.2	0.21 J	0.11 J	--	
Cadmium	51	NSL	mg/kg	0.044 J	0.14	0.035 J	0.038 J	0.070 J	1.8 JB	0.054 JB	0.10 JB	--	
Calcium	NSL	NSL	mg/kg	2600	360	310	160	10000	41000	440 B	270 B	--	
Chromium	430	28	mg/kg	25	**37**	13 B	26 F1B	18	**1800**	25	**78**	--	
Cobalt	NSL	NSL	mg/kg	1.9	3.7	0.72	1.6	2.7	16	1.9 B	1.1 B	--	
Copper	4100	NSL	mg/kg	13	17	6.7	15 J-1	18	12	15	23	--	
Iron	72000	NSL	mg/kg	14000	25000	13000	7500 F2	11000	**99000**	14000 B	13000 B	--	
Lead	1000	NSL	mg/kg	12	5.2 B	2.6	3.1 F1B	14	92 B	4.7	10	--	
Magnesium	NSL	NSL	mg/kg	800 B	1900 B	150	69	1400 B	16000	630 B	2000 B	--	
Manganese	2000	NSL	mg/kg	60	42	18	13	91	**15000**	33 B	74 B	--	
Nickel	2000	NSL	mg/kg	4.3	13 B	1.8 B	5.0 B	6.4	360	5.8 B	4.0 B	--	
Potassium	NSL	NSL	mg/kg	330	330	180	140 B	560	1100 B	320 B	220 B	--	
Selenium	510	NSL	mg/kg	0.35 J	0.090 J	0.21 J	0.22 J	0.31 J	4.1 JB	2.7 U	2.7 U	--	
Silver	510	NSL	mg/kg	0.048 J	0.22	0.0071 J	0.048 J	0.16 J	2.4	0.052 J	0.29 J	--	
Sodium	NSL	NSL	mg/kg	20 J	29 JB	14 J	10 J	110	1100	17 J	12 J	--	
Thallium	7.2	3.9	mg/kg	0.057 J	0.047 J	0.036 JB	0.027 JB	0.044 J	2.2 U	0.020 J	0.029 J	--	
Vanadium	580	NSL	mg/kg	5.8 B	60	29	22 F2	28 B	**4100**	51	56	--	
Zinc	41000	NSL	mg/kg	30	17 B	4.0	7.6	26	53	11	26	--	
Mercury (SW7471B)													
Mercury	10	NSL	mg/kg	0.080	0.038 U	0.037 U	0.044 J	0.034 J	0.067 U	0.0070 J	0.045	--	
DRO/GRO (SW8015C)													
Diesel Range Organics	620	NSL	mg/kg	--	6.9 JB	--	13 JB	--	170 B	5.9 J	33	--	
Gasoline Range Organics	620000	NSL	mg/kg	--	110 U	--	370 U	--	2200 U	110 U	130 U	--	

Table D-4
Cristal USA Facility
Landfill Areas

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID:	LF-07	LF-07	LF-08	LF-08	LF-09	LF-09	LF-10	LF-10	LF Area 4
				Sample Name:	LF-07 0-2	LF-07 65-67	LF-0810-2	LF-08 65-67	LF-09 0-2	LF-09 44-46	LF10 0-2	LF10 73-75	LF-AREA 4
				Date Sampled:	4 7 2015	4 8 2015	4 6 2015	4 6 2015	4 7 2015	4 7 2015	4 8 2015	4 8 2015	4 7 2015
				Parent Sample ID:									
				Depth Interval (ft):	0-2	65-67	0-2	65-67	0-2	44-46	0-2	73-75	-
PCBs (SW8082A)													
Aroclor 1016	43	NSL	mg/kg		0 0049 U	0 0047 U	0 0047 U	0 0045 U	0 0048 U	0 0091 U	0 0023 U	0 0024 U	--
Aroclor 1221	1.4	NSL	mg/kg		0 0049 U	0 0047 U	0 0047 U	0 0045 U	0 0048 U	0 0091 U	0 0023 U	0 0024 U	--
Aroclor 1232	1.4	NSL	mg/kg		0 0049 U	0 0047 U	0 0047 U	0 0045 U	0 0048 U	0 0091 U	0 0023 U	0 0024 U	--
Aroclor 1242	1.4	NSL	mg/kg		0 0049 U	0 0047 U	0 0047 U	0 0045 U	0 0048 U	0 0091 U	0 0023 U	0 0024 U	--
Aroclor 1248	1.4	NSL	mg/kg		0 0049 U	0 0047 U	0 0047 U	0 0045 U	0 0048 U	0 0091 U	0 0023 U	0 0024 U	--
Aroclor 1254	1.4	NSL	mg/kg		0 0077 P	0 0047 U	0 0047 U	0 0045 U	0 018 P	0 0091 U	0 0023 U	0 0069	--
Aroclor 1260	1.4	NSL	mg/kg		0 0086	0 0047 U	0 0047 U	0 0035 J	0 018	0 0091 U	0 00095 J	0 0048	--
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg		0 016 P	0 0047 U	0 00 7 U	0 0035 J	0 036 P	0 0091 U	0 00095 J	0 012	--
VOCS (SW8260C)													
1,1,1-trichloroethane	200000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,1,2,2-tetrachloroethane	14	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,1,2-trichloroethane	50	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,1-dichloroethane	28000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,1-dichloroethene	5300	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,2-dibromoethane	1.4	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,2-dichloroethane	31	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,2-dichloroethene	920	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
1,2-dichloropropane	42	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
2-butanone	61000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
4-methyl-2-pentanone	NSL	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Acetone	92000	NSL	mg/kg		0 02 U	0 021 U	0 022 U	0 018 U	0 0088 J	0 049 U	0 015 U	0 015 U	--
Benzene	52	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Bromodichloromethane	46	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Bromoform	360	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Bromomethane	140	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Carbon disulfide	10000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Carbon tetrachloride	22	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Chlorobenzene	2000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Chloroethane	990	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Chloroform	1000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Chloromethane	NSL	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
cis-1,2-dichloroethene	1000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
cis-1,3-dichloropropene	29	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Dibromochloromethane	34	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Ethylbenzene	10000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Isopropylbenzene	10000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Methyl tert-butyl ether	728	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Methylene Chloride	388	NSL	mg/kg		0.0021 JB	0 0047 JB	0 0024 JB	0 0019 JB	0.0021 JB	0 0051 JB	0 0017 JB	0 0016 JB	--
Styrene	20000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Tetrachloroethene	5.3	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Toluene	8200	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
trans-1,2-dichloroethene	2000	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
trans-1,3-dichloropropene	29	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Trichloroethene	7.2	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--
Vinyl chloride	4	NSL	mg/kg		0 0049 U	0 0052 U	0 0055 U	0 0046 U	0 0046 U	0 012 U	0 0038 U	0 0038 U	--

Table D-4
Cristal USA Facility
Landfill Areas

			Location ID:	LF-07	LF-07	LF-08	LF-08	LF-09	LF-09	LF-10	LF-10	LF Area 4
			Sample Name:	LF-07 0-2	LF-07 65-67	LF-08 0-2	LF-08 65-67	LF-09 0-2	LF-09 44-46	LF10 0-2	LF10 73-75	LF-AREA 4
			Date Sampled:	4 7 2015	4 8 2015	4 6 2015	4 6 2015	4 7 2015	4 7 2015	4 3 2015	4 3 2015	4 7 2015
			Parent Sample ID:									
			Depth Interval (ft):	0-2	65-67	0-2	65-67	0-2	44-46	0-2	73-75	-
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit									
Xylenes, Total	20000	NSL	mg/kg	0.015 U	0.016 U	0.017 U	0.034 U	0.014 U	0.017 U	0.011 U	0.012 U	--
SVOCS (SW827DD)												
1,2,4-trichlorobenzene	1000	NSL	mg/kg	--	--	--	0.0363 U	--	--	--	--	--
1,2-dichlorobenzene	9200	NSL	mg/kg	--	--	--	0.0363 U	--	--	--	--	--
1,3-dichlorobenzene	330	NSL	mg/kg	--	--	--	0.0363 U	--	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	--	--	0.0363 U	--	--	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2,4-dichlorophenol	330	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	--	--	--	0.185 U	--	--	--	--	--
2,4-dinitrotoluene	200	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2,6-dinitrotoluene	100	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
2-chlorophenol	530	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg	0.12 U	0.013 J	0.0075 U	0.0073 U	0.11	0.013 U	0.0037 U	0.0038 J	--
2-methylphenol	5300	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
3,3-dichlorobenzidine	6.4	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
3-chloroaniline	430	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
3-methylphenol	530	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
Acenaphthene	6100	NSL	mg/kg	0.12 U	0.0076 U	0.0075 U	0.0073 U	0.036 J	0.013 U	0.0037 U	0.0038 U	--
Acenaphthylene	6100	NSL	mg/kg	0.12 U	0.0076 U	0.0075 U	0.0074 U	0.076	0.013 U	0.0037 U	0.0038 U	--
Anthracene	41000	NSL	mg/kg	0.038 J	0.00089 J	0.0075 U	0.0073 U	0.11	0.0023 J	0.00081 J	0.0010 J	--
Benzo[a]anthracene	3.9	NSL	mg/kg	0.15	0.0027 J	0.0075 U	0.0073 U	0.22	0.0123	0.0029 J	0.0039 J	--
Benzo[a]pyrene	0.39	NSL	mg/kg	0.17	0.0076 U	0.0075 U	0.0073 U	0.22	0.0091 J	0.0029 J	0.0043 J	--
Benzo[b]fluoranthene	3.9	NSL	mg/kg	0.22	0.0076 U	0.0025 U	0.0073 U	0.26	0.011 J	0.0042	0.0029 J	--
Benzo[g,h,i]perylene	3100	NSL	mg/kg	0.13	0.0076 U	0.0075 U	0.0073 U	0.27	0.013	0.0033 J	0.0038 U	--
Benzo[k]fluoranthene	39	NSL	mg/kg	0.052 J	0.0076 U	0.0075 U	0.0073 U	0.074	0.0042 J	0.0015 J	0.0038 U	--
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	--	--	0.06 J	--	--	--	--	--
Carbazole	140	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
Chrysene	390	NSL	mg/kg	0.17	0.0052 J	0.0075 U	0.0073 U	0.25	0.013 J	0.0028 J	0.0026 J	--
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	0.12 U	0.0076 U	0.0075 U	0.0073 U	0.068	0.013 U	0.0037 U	0.0038 U	--
Dibenzofuran	100	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	--	0.013 J	--	--	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--
Fluoranthene	4300	NSL	mg/kg	0.24	0.0054 J	0.0075 U	0.0073 U	0.41	0.025	0.0051	0.0038	--
Fluorene	4300	NSL	mg/kg	0.12 U	0.0076 U	0.0075 U	0.0073 U	0.068	0.013 U	0.0037 U	0.0038 U	--
Hexachloro-1,3-butadiene	37	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	--	--	0.0074 U	--	--	--	--	--

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Cristal USA Facility
Landfill Areas

				Location ID:	LF-07	LF-07	LF-08	LF-08	LF-09	LF-09	LF-10	LF-10	LF Area 4
				Sample Name:	LF-07 0-2	LF-07 65-67	LF-08 0-2	LF-08 65-67	LF-09 0-2	LF-09 44-46	LF10 0-2	LF10 73-75	LF-AREA 4
				Date Sampled:	4 7 2015	4 8 2015	4 6 2015	4 6 2015	4 7 2015	4 7 2015	4 3 2015	4 3 2015	4 7 2015
				Parent Sample ID:									
				Depth Interval (ft):	0-2	65-67	0-2	65-67	0-2	44-46	0-2	73-75	-
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit										
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--	--
Hexachloroethane	200	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	3.9	NSL	mg/kg	0.12	0.0076 U	0.0075 U	0.0073 U	0.2	0.0071 J	0.0027 J	0.0038 U	--	--
Isophorone	4690	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--	--
Naphthalene	2000	NSL	mg/kg	0.12 U	0.0076 U	0.0075 U	0.0073 U	0.13	0.014 U	0.0037 U	0.0038 U	--	--
Nitrobenzene	51	NSL	mg/kg	--	--	--	0.072 U	--	--	--	--	--	--
N-nitroso-di-n-propylamine	0.41	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--	--
Pentachlorophenol	24	NSL	mg/kg	--	--	--	0.036 U	--	--	--	--	--	--
Phenanthrene	31000	NSL	mg/kg	0.14	0.0041 J	0.0075 U	0.0073 U	0.28	0.016	0.0027 J	0.0032 J	--	--
Phenol	31000	NSL	mg/kg	--	--	--	0.0073 U	--	--	--	--	--	--
Pyrene	3100	NSL	mg/kg	0.22	0.0058 J	0.0075 U	0.0073 U	0.36	0.018	0.0040	0.0028 J	--	--
pH (SW9045D)													
pH	NSL	NSL	pH units	7.42	5.20 H	5.26 H	4.17 H	7.46	7.25	7.13 H	7.49 H	--	--

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup

ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury Value

NSL = USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Grey shaded values exceed ATC Eastern

pg/g = picogram per gram

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

B = Compound was found in the blank and sample.

J = Result is less than the RL but greater than or equal to the MDL and the concentration

* = %RD response or retention time outside applicable limits

E = Result exceeds calibration range

F1 = MS and or MSD Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF = Field parameter with a holding time of 15 minutes

U = Not Detected

Table D-5
Cristal USA Facility
Middle Settling Basin

				Location ID:	MB-01 to MB-05	MB-01	MB-02	MB-03	MB-04	MB-05	MB-05
				Sample Name:	MB 01-05	MB-01	MB-02	MB-03	MB-04	FD-3	MB-05
				Date Sampled:	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015
				Parent Sample ID:						MB-05	
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**								
Dioxin/Furan (SW1613B)											
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	1100 B	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	65 QB	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	1300 B	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	2800 B	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	< 56 U	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	570 B	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	< 56 U	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	410 Q	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	5.1 QBJ	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	2000 B	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	3.9 QBJ	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	57	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	410	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	pg/g	< 1.1 U	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	1000 BQ	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-4-dioxin)	NSL	NSL	pg/g	180 B	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	11000 B	--	--	--	--	--	--	--
Dioxin TEQs (TEF, WHO)	22 [1]	NSL	pg/g	**699.114**	--	--	--	--	--	--	--
Metals (SW6020A)											
Aluminum	100000	NSL	mg/kg	--	22000	22000 B	27000	25000	17000 B	17000 B	
Antimony	41	NSL	mg/kg	--	0.36 JB	0.37 JB	0.77 JB	0.44 JB	1.5 JB	0.33 JB	
Arsenic	3.0	3.6	mg/kg	--	1.1 J	2.3 J	**3.6**	**3.1**	1.8	1.8	
Barium	20000	NSL	mg/kg	--	130	170	190	200	190	120	
Beryllium	200	NSL	mg/kg	--	3.0	3.7 B	4.8	4.9	2.9 B	2.9 B	
Cadmium	51	NSL	mg/kg	--	2.3 B	2.0 JB	2.4 JB	2.5 B	1.5 B	1.6 JB	
Calcium	NSL	NSL	mg/kg	--	140000 B	12000	62000 B	62000 B	52000	42000	
Chromium	310	28	mg/kg	--	**2500**	**2900**	**3200**	**3200**	**1900**	**2200**	
Cobalt	NSL	NSL	mg/kg	--	10 B	29 B	27 B	23 B	40 B	16 B	
Copper	4100	NSL	mg/kg	--	23	36	43	37	25	22	
Iron	72000	NSL	mg/kg	--	**160000 B**	**130000 B**	**160000 B**	**150000 B**	**170000 B**	**110000 B**	
Lead	1600	NSL	mg/kg	--	6.6	10 B	9.9	8.2	11 B	7.1 B	
Magnesium	NSL	NSL	mg/kg	--	9100 B	7000 B	8900 B	10000 B	16000 B	4100 B	
Manganese	2000	NSL	mg/kg	--	**34000 B**	**23000 B**	**28000 B**	**31000 B**	**23000 B**	**24000 B**	
Nickel	2000	NSL	mg/kg	--	210 B	200	230 B	230 B	290	160	
Potassium	NSL	NSL	mg/kg	--	120 JB	< 240 U	< 260 U	< 220 U	< 140 U	67 JB	
Selenium	510	NSL	mg/kg	--	< 9.2 U	2.7 JB	2.2 J	5.9 J	3.8 JB	2.4 JB	
Silver	510	NSL	mg/kg	--	3.7	4.0	4.3	4.1	2.8	3.1	
Sodium	NSL	NSL	mg/kg	--	130 J	170 JB	160 J	230	720 B	79 JB	
Thallium	7.2	3.9	mg/kg	--	< 1.8 U	0.068 JB	0.14 J	0.17 J	0.048 JB	0.037 JB	
Vanadium	100	NSL	mg/kg	--	**6200**	**5500 B**	**6600**	**6200**	**3900 B**	**4700 B**	
Zinc	31000	NSL	mg/kg	--	42	43	48	43	32	33	

Table D-5
Cristal USA Facility
Middle Settling Basin

Mercury (SW7471B)					--	--	--		--	--
Mercury	10	NSL	mg/kg	--	0.13	0.040 J	< 0.089 U	0.035 J	0.65	0.073
PCBS (SW8082A)										
Aroclor 1016	41	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1221	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1232	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1242	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1248	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1254	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Aroclor 1260	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	--	< 0.0078 U	< 0.01 U	< 0.011 U	< 0.0094 U	< 0.0058 U	< 0.0075 U
SVOCS (SW8270D)										
2-methylnaphthalene	410	NSL	mg/kg	--	< 0.013 U	0.0016 J	< 0.018 U	< 0.015 U	< 0.0094 U	0.0012 J
Acenaphthene	6300	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Acenaphthylene	6100	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Anthracene	31000	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Benzo[a]anthracene	3.9	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	0.0022 J	0.0030 J
Benzo[a]pyrene	0.39	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Benzo[b]fluoranthene	3.9	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Benzo[g,h,i]perylene	3100	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Benzo[k]fluoranthene	39	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Chrysene	390	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	0.0027 J	0.0048 J
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Fluoranthene	4100	NSL	mg/kg	--	0.0051 J	0.0098 J	0.006 J	0.0021 J	0.0050 J	0.0092 J
Fluorene	4100	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Indeno[1,2,3-c,d]pyrene	39	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	< 0.012 U
Naphthalene	2000	NSL	mg/kg	--	< 0.013 U	< 0.016 U	< 0.018 U	< 0.015 U	< 0.0094 U	0.0013 J
Phenanthrene	31000	NSL	mg/kg	--	0.0057 J	0.0087 J	0.0067 J	< 0.015 U	0.0057 J	0.0078 J
Pyrene	3100	NSL	mg/kg	--	0.0044 J	0.0085 J	0.0079 J	0.0033 J	0.0058 J	0.0073 J
pH (SW9045D)										
pH	NSL	NSL	pH units	--	7.94 H	7.87 H	7.93 H	7.95 H	8.06 H	7.76 H

Notes

MDE Non-Residential Soil Maryland Dept of Environment June 2008 non-residential cleanup

ATC Eastern Maryland Dept of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded values exceed ATC Eastern

pg/g = picogram per gram

mg/kg = milligrams per kilogram

B= Compound was found in the blank and sample

J= Result is less than the RL but greater than or equal to the MDL and the concentration is an

*=ISTD response or retention time outside applicable limits

E= Result exceeds calibration range

F1=MS and/or MDS Recovery is outside acceptance limits

Q = One or more quality control criteria failed

H= Field parameter with a holding time of 15 minutes

U= Not Detected

Table D-6
Cristal USA Facility
Oil/Water Separator

			Location ID:	OWS-01	OWS-01	OWS-02	OWS-02	OWS-03	OWS-03	OWS-03	OWS-04	OWS-04
			Sample Name:	OWS-01 0-2	OWS-01 13-15	OWS-02 0-2	OWS-02 11-13	DUP-03	OWS-03 0-2	OWS-03 13-15	OWS-04 0-2	OWS-04 13-15
			Date Sampled:	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015
			Parent Sample ID:					OWS-04 13-15				
			Depth Interval (ft):	0-2	13-15	0-2	11-13	13-15	0-2	13-15	0-2	13-15
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**									
Metals (SW6020A)												
Aluminum	100000	NSL	mg/kg	2500 B	3700 B	1800 B	1200 B	1200 B	2700 B	2800 B	2400 B	1100 B
Antimony	41	NSL	mg/kg	3.7	0.050 J	0.15 J	0.063 J	0.025 J	0.32	0.29	0.17 J	0.050 J
Arsenic	3.0	3.6	mg/kg	**3.3**	4.29	**17**	**4.6**	9.79	**4.3**	**6.7**	2.0	0.91
Barium	20000	NSL	mg/kg	15	18	14	5.5	6.2	9.6	12	7.8	6.5
Beryllium	200	NSL	mg/kg	0.49	1.34	0.12	0.11	0.103	0.50	0.62	0.39	0.088 J
Cadmium	51	NSL	mg/kg	0.025 JB	0.021 JB	0.024 JB	0.033 JB	0.021 JB	0.019 JB	0.015 JB	0.016 JB	0.022 JB
Calcium	NSL	NSL	mg/kg	530	156	380	56	65	1600	110	410	58
Chromium	310	28	mg/kg	**34**	5.9	4.1	6.0	7.5	**50**	**38**	**34**	7.3
Cobalt	NSL	NSL	mg/kg	0.96	1.1	0.37	4.3	6.9	0.69	0.83	0.85	7.6
Copper	4100	NSL	mg/kg	13	1.4	7.2	2.2	3.3	11	5.8	8.8	5.5
Iron	72000	NSL	mg/kg	30000	2500	42000	1300	250	41000	35000	20000	360
Lead	1000	NSL	mg/kg	4.2	3.6	1.7	1.7	2.0	5.3	6.7	2.5	2.4
Magnesium	NSL	NSL	mg/kg	330	110	350	27	40	210	76	100	38
Manganese	2000	NSL	mg/kg	10 B	6.1 B	2.4 B	1.3 B	2.0 B	8.8 B	4.5 B	6.8 B	1.9 B
Nickel	2000	NSL	mg/kg	4.0 B	4.5 B	1.7 B	17 B	14 B	2.9 B	4.0 B	3.7 B	25 B
Potassium	NSL	NSL	mg/kg	220	120	290	130	240	270	340	120	300
Selenium	510	NSL	mg/kg	0.23 J	0.13 J	0.49 J	0.19 J	0.12 J	0.19 J	0.32 J	0.14 J	0.18 J
Silver	510	NSL	mg/kg	0.022 J	0.0092 J	0.026 J	0.0083 J	0.011 J	0.020 J	0.022 J	0.020 J	0.0050 J
Sodium	NSL	NSL	mg/kg	21 B	27 B	41 B	24 B	23 B	27 B	27 B	28 B	18 B
Thallium	7.2	3.9	mg/kg	0.041 J	0.023 J	0.047 J	0.029 J	0.041 J	0.044 J	0.063 J	0.038 J	0.042 J
Vanadium	100	NSL	mg/kg	69	6.1	6.5	14	12	**120**	84	72	12
Zinc	31000	NSL	mg/kg	12 B	2.3 B	2.3 B	1.9 B	9.8 B	16 B	5.5 B	17 B	17 B
Mercury (SW7471B)												
Mercury	10	NSL	mg/kg	< 0.037 U	< 0.036 U	< 0.037 U	< 0.037 U	< 0.040 U	< 0.036 U	< 0.042 U	< 0.034 U	< 0.039 U
DRO/GRO (SW8015C)												
Diesel Range Organics	620	NSL	mg/kg	37 J	5.9 J	< 19 U	< 19 U	< 21 U	**2400**	< 23 U	150	< 21 U
Gasoline Range Organics	620000	NSL	µg/kg	71 JB	< 110 U	< 120 U	< 110 U	64 JB	< 120 U	< 140 U	58 JB	80 JB
PCBS (SW8082A)												
Aroclor 1016	41	NSL	mg/kg	< 0.0048 U	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Aroclor 1221	1.4	NSL	mg/kg	< 0.0048 U	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Aroclor 1232	1.4	NSL	mg/kg	< 0.0048 U	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Aroclor 1242	1.4	NSL	mg/kg	< 0.0048 U	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Aroclor 1248	1.4	NSL	mg/kg	< 0.0048 U	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Aroclor 1254	1.4	NSL	mg/kg	0.0045 J	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	0.0032 J	< 0.0052 U
Aroclor 1260	1.4	NSL	mg/kg	0.0036 J	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	< 0.0048 U	< 0.0052 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.0081	< 0.0048 U	< 0.0048 U	< 0.0047 U	< 0.0053 U	< 0.0049 U	< 0.0056 U	0.0032 J	< 0.0052 U
VOCS (SW8260C)												
1,1,1-trichloroethane	200000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,1,2-trichloroethane	50	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U

Table D-6
Cristal USA Facility
Oil/Water Separator

			Location ID:	OWS-01	OWS-01	OWS-02	OWS-02	OWS-03	OWS-03	OWS-03	OWS-04	OWS-04
			Sample Name:	OWS-01 0-2	OWS-01 13-15	OWS-02 0-2	OWS-02 11-13	DUP-03	OWS-03 0-2	OWS-03 13-15	OWS-04 0-2	OWS-04 13-15
			Date Sampled:	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015
			Parent Sample ID:					OWS-04 13-15				
			Depth Interval (ft):	0-2	13-15	0-2	11-13	13-15	0-2	13-15	0-2	13-15
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**									
1,1-dichloroethane	20000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,1-dichloroethene	5100	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,2-dibromoethane	1.4	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,2-dichloroethane	31	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,2-dichloroethene	920	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
1,2-dichloropropane	42	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
2-butanone	61000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Acetone	92000	NSL	mg/kg	< 0.017 U	< 0.017 U	< 0.018 U	< 0.019 U	< 0.02 U	< 0.016 U	< 0.018 U	< 0.017 U	< 0.022 U
Benzene	52	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Bromodichloromethane	46	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Bromoform	360	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Bromomethane	140	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Carbon disulfide	10000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Carbon tetrachloride	22	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Chlorobenzene	2000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Chloroethane	990	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Chloroform	1000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Chloromethane	NSL	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
cis-1,2-dichloroethene	1000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
cis-1,3-dichloropropene	29	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Dibromochloromethane	34	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Ethylbenzene	10000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Isopropylbenzene	10000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Methyl tert-butyl ether	720	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Methylene Chloride	380	NSL	mg/kg	0.0014 JB	0.0023 JB	0.0028 JB	0.0026 JB	0.0022 JB	0.0022 JB	< 0.0045 U	0.0021 JB	0.0028 JB
Styrene	20000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Tetrachloroethene	53	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	0.00056 J	< 0.0045 U	< 0.0042 U	< 0.0055 U
Toluene	8200	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
trans-1,2-dichloroethene	2000	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
trans-1,3-dichloropropene	29	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Trichloroethene	7.2	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Vinyl chloride	4	NSL	mg/kg	< 0.0042 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0050 U	< 0.0039 U	< 0.0045 U	< 0.0042 U	< 0.0055 U
Xylenes, Total	20000	NSL	mg/kg	< 0.013 U	< 0.013 U	< 0.013 U	< 0.014 U	< 0.015 U	< 0.012 U	< 0.014 U	< 0.013 U	< 0.016 U
SVOCS (SW8270D)												
2-methylnaphthalene	410	NSL	mg/kg	0.0027 J	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.033	< 0.0092 U	< 0.0077 U	< 0.0085 U
Acenaphthene	6100	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Acenaphthylene	6100	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Anthracene	31000	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Benzo[a]anthracene	3.9	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U

Table D-6
Cristal USA Facility
Oil/Water Separator

			Location ID:	OWS-01	OWS-01	OWS-02	OWS-02	OWS-03	OWS-03	OWS-03	OWS-04	OWS-04
			Sample Name:	OWS-01 0-2	OWS-01 13-15	OWS-02 0-2	OWS-02 11-13	DUP-03	OWS-03 0-2	OWS-03 13-15	OWS-04 0-2	OWS-04 13-15
			Date Sampled:	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015
			Parent Sample ID:					(OWS-04 13-15				
			Depth Interval (ft):	0-2	13-15	0-2	11-13	13-15	0-2	13-15	0-2	13-15
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**									
Benzo[a]pyrene	0.39	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Benzo[b]fluoranthene	3.9	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Benzo[g,h,i]perylene	3100	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Benzo[k]fluoranthene	39	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Chrysene	390	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Fluoranthene	3100	NSL	mg/kg	0.0027 J	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.0080	< 0.0092 U	< 0.0077 U	< 0.0085 U
Fluorene	3100	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.023	< 0.0092 U	< 0.0077 U	< 0.0085 U
Indeno[1,2,3-c,d]pyrene	3.9	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	< 0.0078 U	< 0.0092 U	< 0.0077 U	< 0.0085 U
Naphthalene	2900	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.0055 J	< 0.0092 U	< 0.0077 U	< 0.0085 U
Phenanthrene	31000	NSL	mg/kg	0.0056 J	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.046	< 0.0092 U	< 0.0077 U	< 0.0085 U
Pyrene	3100	NSL	mg/kg	< 0.0077 U	< 0.0078 U	< 0.0077 U	< 0.0076 U	< 0.0085 U	0.013	< 0.0092 U	< 0.0077 U	< 0.0085 U
pH (SW9045D)												
pH	NSL	NSL	pH units	6.33	5.26	5.55	4.70	5.21	6.99	5.13	5.99	5.25

Notes

MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 non-residential

ATC Eastern - Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

[1] USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded values exceed ATC Eastern

pg/g= picogram per gram

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

B= Compound was found in the blank and sample

J= Result is less than the RL but greater than or equal to the MDL and the

*=ISTD response or retention time outside applicable limits

E= Result exceeds calibration range

F1=MS and/or MDS Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF= Field parameter with a holding time of 15 minutes

U= Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID: SB-01 / Sample Name: SB-01 0-2 / Date Sampled: 3/31/2015 / Parent Sample ID: / Depth Interval (ft): 0-2	SB-01 13-15 / 3/31/2015 / 13-15	SB-02 / SB-02 1-3 / 3/31/2015 / SB-02 1-3 / 1-3	SB-02 / SB-02 1-3 / 3/31/2015 / 1-3	SB-02 13-15 / 3/31/2015 / 13-15	SB-03 / SB-03 1-3 / 4/2/2015 / 1-3	SB-03 / SB-03 1-3 / 4/2/2015 / 1-3	SB-03 13-15 / 4/2/2015 / 13-15	SB-04 / SB-04 1-3 / 4/2/2015 / 1-3	SB-04 13-15 / 4/2/2015 / 13-15	SB-05 / SB-05 0-2 / 4/2/2015 / 0-2	SB-05 13-15 / 4/2/2015 / 13-15	SB-06 / SB-06 0-2 / 4/2/2015 / 0-2	SB-06 13-15 / 4/2/2015 / 13-15	SB-07 / SB-07 0-2 / 4/7/2015 / 0-2	SB-07 13-15 / 4/7/2015 / 13-15	SB-08 / SB-08 0-2 / 4/7/2015 / SB-08 0-2 / 0-2	SB-08 / SB-08 0-2 / 4/7/2015 / 0-2	SB-08 / SB-08 1-3 / 4/7/2015 / 1-3	SB-09 / SB-09 0-2 / 4/7/2015 / 0-2	SB-09 / SB-09 1-3 / 4/7/2015 / 1-3
Rad (E901.1)																									
Actinium-227	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW1613B)																									
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran (1,2,3,7,8,9-HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF: WHO	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																									
Aluminum	77400	NSL	mg/kg	15900	18900	35000	27500	40800	13600	12900	22000	24000	35000	19600	23000	34200	29600	22000	21000	30300	18600	19000	19000	27000	27000
Antimony	31	NSL	mg/kg	0.48	0.19 J	0.29 J	0.27 J	0.27 J	0.078 J	0.065 J	0.13 J	0.23	0.22	0.21	0.18 J	0.24 J	0.22 J	0.55	0.48	0.14 JB	0.21 J	0.072 JB	0.23 J	0.043 JB	
Arsenic	3.6	3.6	mg/kg	2.7	3.1	4.6	4.6	9.8 F2	0.70	0.81	2.1 F2	4.3	4.6	8.9	7.1	4.0	3.5	8.1	5.8	3.9	2.8	1.1	4.3	7.8	
Barium	20000	NSL	mg/kg	20	15	15	14	8.7	9.2 B	16 B	11	11	16	31	17	35	26	47	43	26	21 B	12	29	17	
Beryllium	200	NSL	mg/kg	0.69	1.1	0.85	1.0	0.43 F2	0.45	0.42	0.85	0.85	1.9	1.2	0.75	0.99	0.80	1.6	1.4	0.49 J	0.45 J	0.23 J	0.85 J	0.87	0.85 J
Cadmium	91	NSL	mg/kg	0.022 JB	0.020 JB	0.013 JB	0.021 JB	0.013 JB	0.015 J	0.022 J	0.063	0.13 J	0.13 J	0.13 J	0.13 J	0.083 J	0.13 J	0.060 J	0.051 J	0.11 J	0.22 JB	0.022 JB	0.047 J	0.045 J	
Calcium	NSL	NSL	mg/kg	4400	500	680	490	1900 F2	1300	1200 B	1900 B	910	840	1500	910	930	500	3000	970	91000	31000	400	490	13000	
Chromium	300	25	mg/kg	17	20	29	29	21 F1	8.7	8.2	25	43	39	25	19	15	15	14	36	19	12	5.9	23	20	
Cobalt	NSL	NSL	mg/kg	5.2	3.5	7.7	7.0	9.5	3.4	3.2 B	6.7 B	6.4	10	11	5.4	7.2	5.2	12	7.4	3.8	4.2	1.9 J	11	6.8	
Copper	4700	NSL	mg/kg	28	13	9.8	20	27 F1	14	16	20 F2	24	22	20	14	17	12	25	15	17	13	4.2	17	16	
Iron	72000	NSL	mg/kg	18000	24000	34000	33000	120000 F2	20000	22000 B	100000 F2	30000	38000	33000	24000	32000	27000	19000	19000	18000	19000	19000	20000	19000	
Lead	2000	NSL	mg/kg	36	6.5	9.4	8.2	8.6 F2	2.9	2.7 B	2.5 F2	8.6	9.3	6.2	5.2	7.5	5.4	26	8.1	2.1	2.9 J	1.1 J	15	7.2	
Magnesium	NSL	NSL	mg/kg	6600	7900	4700	4200	13000 F1	4.0	4.0 B	2.9 B	180	3000	52	2200	4400	4400	15000	3000	3500 B	4700	2700 B	1800 B	4400 B	
Manganese	2000	NSL	mg/kg	240	83 E	160 E	96 E	410 E	68	70 E	39 E	77	74	91	130	75	80	260	75	130	130	58	250	78	
Nickel	2000	NSL	mg/kg	17 B	8.3 B	8.9 B	9.2 B	10 B	3.3	4.1	11	7.4	9.9	8.3	7.0	7.6	5.7	15	7.4	4.9	4.7	2.1	8.9	7.7	
Potassium	NSL	NSL	mg/kg	2600	450	2500	2500	4400	1500	1800 B	5000 B	2600	6600	3500	2200	3200	3200	4500 E	4500 E	2600	2400 B	2100	3600	2400 B	
Selenium	510	NSL	mg/kg	0.29 J	0.29 J	0.32 J	0.34 J	0.27 J	0.18 J	0.16 J	0.43 J	0.51 J	0.29 J	0.35 J	0.68 J	0.28 J	0.42 J	0.47 J	0.50 J	0.32 J	0.4 JB	0.19 J	0.30 J	0.30 J	
Silver	510	NSL	mg/kg	0.054 J	0.053 J	0.059 J	0.058 J	0.22 J	0.011 J	0.018 J	0.029 J	0.025 J	0.038 J	0.011 J	0.013 J	0.022 J	0.013 J	0.013 J	0.045 J	0.13 J	0.024 J	0.014 J	0.0096 J		
Sodium	NSL	NSL	mg/kg	61 B	24 B	130 B	120 B	120 B	100 B	78 B	240 B	160 B	180 B	200 B	100 B	92 B	100 B	180	130	400 J	97	59	120		
Thallium	7.2	3.6	mg/kg	0.048 J	0.037 J	0.060 J	0.052 J	0.073 J	0.050 J	0.051 JB	0.053 JB	0.053 J	0.075 J	0.073 J	0.041 J	0.023 J	0.053 J	0.12	0.053 J	0.050 J	0.12 JB	0.053 J	0.11	0.062 J	
Vanadium	100	NSL	mg/kg	34	44	46	75	91	27	25	52	110	52	40	47	57	36	51 B	49 B	33 B	19	9.2 B	42 B	45 B	
Zinc	31000	NSL	mg/kg	46 B	27 B	32 B	24 B	73 F1 B	20	18 B	62 F2 B	77	80	55	45	65	53 B	58	52 B	57	61	25	54	54	
Mercury (SW7471B)																									
Mercury	10	NSL	mg/kg	0.0053 J	0.0053 U	0.0056 U	0.0057 U	0.0056 U	0.0053 U	0.0054 U	0.0055 U	0.0054 U	0.0054 U	0.0055 U F2 F1	0.0056 U	0.0053 U	0.0052 U	0.0056 U	0.0053 U	0.0053 U	0.0057 U	0.0052 U	0.0053 U	0.0056 U	

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-01	SB-01	SB-02	SB-02	SB-02	SB-03	SB-03	SB-03	SB-04	SB-04	SB-05	SB-05	SB-06	SB-06	SB-07	SB-07	SB-08	SB-08	SB-08	SB-09	SB-09
			Sample Name:	SB-01 0-2	SB-01 13-15	DUP-02	SB-02 1-3	SB-02 13-15	DUP-08	SB-03 1-3	SB-03 15-16	SB-04 1-3	SB-04 13-15	SB-05 0-2	SB-05 13-15	SB-06 0-2	SB-06 13-15	SB-07 0-2	SB-07 13-15	DUP-14	SB-08 0-2	SB-08 6-8	SB-09 0-2	SB-09 8-10
			Date Sampled:	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015
			Parent Sample ID:			SB-02 1-3			SB-03 1-3											SB-08 0-2				
			Depth Interval (ft):	0-2	13-15	1-3	1-3	13-15	1-3	1-3	15-16	1-3	13-15	0-2	13-15	0-2	13-15	0-2	13-15	0-2	0-2	6-8	0-2	8-10
Analyte	**MDE Non Residential Soil**	**ATC Eastern**	**Unit**																					
DRO/GRO (SW8015C)																								
Diesel Range Organics	620	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	71.3	12.8	--	--	--	--	--	--	--
Gasoline Range Organics	620000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	13.0 J	55.2	--	--	--	--	--	--	--
PCBS (SW8082A)																								
Aroclor 1016	41	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1221	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1232	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1242	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1248	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1254	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	<0.0055 U	<0.0096 U	<0.0048 U	<0.0049 U	--	--	--	--	--
Aroclor 1260	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	0.13	<0.0096 U	0.0038 Jp	<0.0049 U	--	--	--	--	--
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	--	--	--	--	--	<0.0016 U	<0.0025 U	<0.0024 U	--	--	<0.0085 U	<0.0085 U	0.13	<0.0096 U	0.0038 Jp	<0.0049 U	--	--	--	--	--
VOCS (SW8260C)																								
1,1,1-trichloroethane	230000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,1,2,2-tetrachloroethane	3.0	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,1,2-trichloroethane	5.0	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,1-dichloroethane	2000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,1-dichloroethene	5100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,2-dibromo-3-chloropropane	5.x	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,2-dibromoethane	1.6	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,2-dichloroethane	4.	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,2-dichloroethene	92	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
1,2-dichloropropane	47	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
2-butanone	19000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
4-methyl-2-pentanone	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Acetone	92000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.018 U	<0.016 U	--	--	--	--	--	--	--
Benzene	52	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Bromodichloromethane	4	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Bromoform	300	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Bromomethane	14	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Carbon disulfide	35000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Carbon tetrachloride	22	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Chlorobenzene	280	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Chloroethane	5??	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Chloroform	1500	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Chloromethane	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
cis-1,2-dichloroethene	2000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
cis-1,3-dichloropropene	29	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Dibromochloromethane	33	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Ethylbenzene	19000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Isopropylbenzene	10000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Methyl tert-butyl ether	220	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Methylene Chloride	380	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	0.0012 JB	0.0038 JB	--	--	--	--	--	--	--
Styrene	35000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Tetrachloroethene	3.3	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Toluene	82000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
trans-1,2-dichloroethene	2000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
trans-1,3-dichloropropene	29	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Trichloroethene	2.2	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Vinyl chloride	4	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.0045 U	<0.0040 U	--	--	--	--	--	--	--
Xylenes, Total	25000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.014 U	<0.012 U	--	--	--	--	--	--	--
SVOCS (SW8270D)																								
1,2,4-trichlorobenzene	1100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
1,2-dichlorobenzene	9200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
1,3-dichlorobenzene	330	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.44 U	--	--	--	--	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.44 U	--	--	--	--	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<0.22 U	--	--	--	--	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	<1.1 U	--	--	--	--	--	--	--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-01	SB-01	SB-02	SB-02	SB-02	SB-03	SB-03	SB-03	SB-04	SB-04	SB-05	SB-05	SB-06	SB-06	SB-07	SB-07	SB-08	SB-08	SB-08	SB-09	SB-09
			Sample Name:	SB-01 0-2	SB-01 13-15	DUP-02	SB-02 1-3	SB-02 13-15	DUP-06	SB-03 1-3	SB-03 13-15	SB-04 3-5	SB-04 13-15	SB-05 0-2	SB-05 13-15	SB-06 0-2	SB-06 13-15	SB-07 0-2	SB-07 13-15	DUP-14	SB-08 0-2	SB-08 6-8	SB-09 0-2	SB-09 8-10
			Date Sampled:	3/31/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015
			Parent Sample ID:			SB-02 1-3			SB-03 1-3											SB-08 0-2				
			Depth Interval (ft):	0-2	13-15	1-3	1-3	13-15	1-3	1-3	13-15	3-5	13-15	0-2	13-15	0-2	13-15	0-2	13-15	0-2	0-2	6-8	0-2	8-10
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																					
2,4-dinitrotoluene	250	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
2,6-dinitrotoluene	360	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
2-chlorophenol	510	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg	0.0059 J	< 0.0078 U	< 0.0078 U	0.0069 J	< 0.0080 U	< 0.0080 U	< 0.0041 U	< 0.0039 U	0.21	< 0.0080 U	13	0.0068 J	0.045	< 0.0077 U	< 0.039 U	< 0.0078 U	0.0081 J	0.0073 J	0.016 J	< 0.0076 U	< 0.0073 U
2-methylphenol	5300	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	5.1	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
4-chloroaniline	430	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
4-methylphenol	530	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Acenaphthene	4500	NSL	mg/kg	0.01	< 0.0078 U	< 0.0078 U	< 0.0078 U	< 0.0080 U	< 0.0080 U	< 0.0040 U	< 0.0039 U	0.033 J	< 0.0080 U	0.54	< 0.0077 U	0.014 J	< 0.0077 U	< 0.039 U	< 0.0078 U	0.0081 J	< 0.0073 U	0.0013 J	< 0.0078 U	< 0.0073 U
Acenaphthylene	4500	NSL	mg/kg	0.0013 J	< 0.0078 U	< 0.0078 U	0.0078 J	< 0.0080 U	< 0.0080 U	< 0.0040 U	< 0.0039 U	< 0.039 U	< 0.0080 U	1.1	< 0.0077 U	0.044 J	< 0.0077 U	0.048	< 0.0078 U	0.0081 U	< 0.0073 U	< 0.0077 U	< 0.0078 U	< 0.0073 U
Anthracene	23000	NSL	mg/kg	0.036	< 0.0078 U	< 0.0078 U	< 0.0052 J	< 0.0080 U	< 0.0080 U	< 0.0040 U	< 0.0039 U	< 0.039 U	< 0.0080 U	1.4	< 0.0077 U	< 0.044 U	0.0077 U	0.044	< 0.0078 U	0.0081 U	< 0.0073 U	0.0022 J	< 0.0078 U	0.0073 U
Benzo(a)anthracene	2.9	NSL	mg/kg	0.036	< 0.0078 U	0.0022 J	0.025	0.0080 U	0.0080 U	< 0.0040 U	0.0039 U	< 0.039 U	< 0.0080 U	0.59	< 0.0077 U	< 0.044 U	< 0.0077 U	0.097	< 0.0078 U	0.0055 J	0.024	0.0024 J	0.029 J	< 0.0073 U
Benzo(a)pyrene	0.29	NSL	mg/kg	0.029	< 0.0078 U	0.0018 J	0.025	0.0080 U	< 0.0080 U	0.0040 U	< 0.0039 U	< 0.039 U	< 0.0080 U	0.46	< 0.0077 U	0.017 J	0.0077 U	0.091	0.0078 U	0.0025 J	0.013	0.0077 U	< 0.0078 U	< 0.0073 U
Benzo(b)fluoranthene	2.9	NSL	mg/kg	0.037	0.0078 U	0.0023 J	0.026	< 0.0080 U	< 0.0080 U	0.0040 U	< 0.0039 U	< 0.039 U	< 0.0080 U	0.48	< 0.0077 U	0.021 J	0.0077 U	0.1	0.0078 U	0.011	0.014	0.0077 U	< 0.0078 U	< 0.0073 U
Benzo(g,h,i)perylene	3100	NSL	mg/kg	0.022	0.0078 J	< 0.0078 U	0.015	0.0080 U	0.0080 U	0.0040 U	< 0.0039 U	< 0.039 U	0.0080 U	0.38	< 0.0077 U	0.015 J	0.0077 U	0.11	0.0078 U	0.0091	0.011	0.0077 U	0.028 U	0.0073 U
Benzo(k)fluoranthene	29	NSL	mg/kg	0.013	0.0078 U	0.0037 J	0.01	< 0.0080 U	< 0.0080 U	0.0040 U	< 0.0039 U	0.039 U	0.0080 U	0.18	< 0.0077 U	< 0.044 U	0.0077 U	0.052	0.0078 U	0.0044 J	0.0069 J	0.0077 U	< 0.0078 U	0.0073 U
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.44 U	--	--	--	--	--	--	--	--
Carbazole	140	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
Chrysene	290	NSL	mg/kg	0.037	0.0078 J	0.0024 J	0.024	< 0.0080 U	0.0080 U	0.0040 U	< 0.0039 U	0.039 U	0.0080 U	0.66	< 0.0077 U	0.044 U	0.0077 U	0.1	0.0078 U	0.0096	0.015	0.0064 J	0.053 J	0.0073 U
Dibenz(a,h)anthracene	0.29	NSL	mg/kg	0.0095 J	0.0078 U	0.0078 U	0.0055 J	< 0.0080 U	< 0.0080 U	0.0040 U	< 0.0039 U	0.039 J	0.0080 U	0.081	0.0077 U	0.044 U	0.0077 U	0.023 J	0.0078 U	0.0081 U	0.0073 J	0.0077 U	< 0.0078 U	0.0073 U
Dibenzofuran	380	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	0.053 J	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Fluoranthene	3100	NSL	mg/kg	0.068	0.0078 J	0.0052 J	0.056	< 0.0080 U	0.0022 J	0.0013 J	0.0039 U	0.077	0.0080 U	1.2	< 0.0077 U	0.044	0.0077 U	0.14	0.0078 J	0.016	0.022	0.0091	0.089	0.0073 U
Fluorene	4500	NSL	mg/kg	0.0064 J	< 0.0078 U	0.0078 U	0.0017 J	< 0.0080 U	0.0080 U	0.0040 U	< 0.0039 U	0.058	0.0080 U	0.55	0.0077 U	0.022 J	0.0077 U	< 0.039 U	0.0078 U	< 0.0081 U	0.0073 U	0.0077 U	< 0.0078 U	0.0073 U
Hexachloro-1,3-butadiene	53	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
Hexachlorobenzene	1.1	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Hexachloroethane	200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	2.9	NSL	mg/kg	0.022	0.0078 U	0.0078 U	0.015	< 0.0080 U	< 0.0080 U	< 0.0040 U	< 0.0039 U	< 0.039 U	0.0080 U	0.033	< 0.0077 U	0.014 J	< 0.0077 U	0.083	0.0078 U	0.0076 J	0.01	0.0077 U	< 0.0078 U	0.0073 U
Isophorone	2400	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Naphthalene	2000	NSL	mg/kg	0.0024 J	0.0078 U	< 0.0078 U	0.0078 J	0.0080 U	0.0080 U	0.0040 U	0.0039 U	< 0.039 U	0.0080 U	2.2	< 0.0077 U	< 0.044 U	0.0077 U	< 0.039 U	0.0078 U	0.0081 U	< 0.0073 U	0.0064 J	< 0.0078 U	< 0.0073 U
Nitrobenzene	51	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.44 U	--	--	--	--	--	--	--	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	330	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Pentachlorophenol	24	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.22 U	--	--	--	--	--	--	--	--
Phenanthrene	23000	NSL	mg/kg	0.051	0.0078 J	< 0.0035 J	0.019	< 0.0080 U	0.0024 J	< 0.0040 U	0.0039 U	0.12	0.0080 U	2.5	< 0.0077 U	0.059	0.0077 U	0.094	< 0.0078 U	0.0036 J	0.0097	0.0073 J	0.062 J	< 0.0073 U
Phenol	25000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	< 0.044 U	--	--	--	--	--	--	--	--
Pyrene	2300	NSL	mg/kg	0.053	0.0078 J	0.0045 J	0.028	0.0080 U	0.0080 U	< 0.0041 U	0.0039 U	0.011 J	0.0080 U	1.5	< 0.0077 U	0.024 J	0.0077 U	0.15	0.0078 U	0.013	0.017	0.0069 J	0.068 J	0.0073 U
pH (SW9045D)																								
pH	NSL	NSL	pH units	8.38	8.45	7.32	8.48	4.48	7.15 H	7.65 H	5.19 H	6.38 H	5.65 H	8.02 H	6.94 H	7.18 H	8.97 H	8.35	4.92	7.64	7.27	7.41	7.37	7.78

Notes:
MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury Value
USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Gray shaded values exceed ATC Eastern
pg/g = picograms per gram
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
B = Compound was found in the blank and sample
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an
* = ISTD response or retention time outside applicable limits
E = Result exceeds calibration range
F1 = MS and/or MSD Recovery is outside acceptance limits
Q = One or more quality control criteria failed
HF = Field parameter with a holding time of 15 minutes
U = Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit																				
			Location ID:	SB-10	SB-10	SB-11	SB-11	SB-12	SB-12	SB-13	SB-13	SB-14	SB-14	SB-15	SB-15	SB-15	SB-16	SB-16	SB-17	SB-17	SB-18	SB-18	SB-19
			Sample Name:	SB-10-0-2	SB-10-13-15	SB-11-0-2	SB-11-13-15	SB-12-0-2	SB-12-13-15	SB-13-0-2	SB-13-13-15	SB-14-0-2	SB-14-4-6	DUP-19	SB-15-0-2	SB-15-13-15	SB-16-0-2	SB-16-7-8	SB-17-0-2	SB-17-7-9	SB-18-0-2	SB-18-13-15	SB-19-0-2
			Date Sampled:	3/30/2015	3/30/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015
			Parent Sample ID:											SB-15-13-15									
			Depth Interval (ft):	0-2	13-15	0-2	13-15	0-2	13-15	0-2	13-15	0-2	4-6	13-15	0-2	13-15	0-2	7-8	0-2	7-9	0-2	13-15	0-2
Rad (E901.1)																							
Actinium-228	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW1613B)																							
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.921 QB	--	--	--	0.71 QB	--	--	--	--	--	--	--	0.36 QB
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	1.16 QB	--	--	--	2.4 B	--	--	--	--	--	--	--	9.1 B
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	< 4.83	--	--	--	4.81	--	--	--	--	--	--	--	0.12 Q
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.0313 Q	--	--	--	0.26 Q	--	--	--	--	--	--	--	0.189 QB
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	< 4.81	--	--	--	4.81	--	--	--	--	--	--	--	0.10 Q
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	4.81	--	--	--	0.065 Q	--	--	--	--	--	--	--	0.062 QB
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.089 Q	--	--	--	0.056 Q	--	--	--	--	--	--	--	0.24 Q
1,2,3,7,8,9-hexachlorodibenzo-furan (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	< 4.81	--	--	--	4.81	--	--	--	--	--	--	--	0.095 Q
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.012 Q	--	--	--	0.14 Q	--	--	--	--	--	--	--	0.55 Q
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	4.83	--	--	--	4.83	--	--	--	--	--	--	--	0.054 Q
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.12 QB	--	--	--	0.048 B	--	--	--	--	--	--	--	0.086 QB
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	< 4.83	--	--	--	0.046 Q	--	--	--	--	--	--	--	0.056 QB
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.027 QB	--	--	--	4.81	--	--	--	--	--	--	--	0.069 Q
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.971	--	--	--	0.961	--	--	--	--	--	--	--	< 0.96
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.971	--	--	--	0.961	--	--	--	--	--	--	--	0.097 B
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	4.1 B	--	--	--	12 B	--	--	--	--	--	--	--	88 B
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	0.22 QB	--	--	--	1.8 B	--	--	--	--	--	--	--	1.1 QB
Dioxin TEQs - TEF WHO	22	NSL	pg/g	--	--	--	--	--	--	--	0	--	--	--	0.168	--	--	--	--	--	--	--	1.53
Metals (SW6020A)																							
Aluminum	110000	NSL	mg/kg	6800 B	5300 B	3100	2400 B	2200 B	4100	15000	2300	5000	11000	2200	2500	2400	9600	140	12000	620	5400 B	2400 B	7300 B
Antimony	47	NSL	mg/kg	0.54	0.52	0.46	0.22	0.10 J	0.20	0.15	0.18 J	0.17 J	0.30	0.26	0.21 J	0.15 J	0.82 B	0.056 B	0.40 B	0.07 B	1.5	0.08 J	2.2
Arsenic	3.0	3.6	mg/kg	**5.8**	**6.6**	**5.8**	2.0	**5.4**	2.6	2.2	2.5	1.1	**8.0**	**4.6**	**5.2**	2.3	**15**	3.0	**19**	**18**	**4.5**	2.4	**3.9**
Barium	22000	NSL	mg/kg	60	8.7	17	12	52	12	170	52	56	46	70	52	43	44	0.86	80	33	37	9.7	22
Beryllium	230	NSL	mg/kg	1.5	1.8	2.5	4.2	2.2	2.5	1.9	2.5	0.42	0.80	1.4	0.50	1.4	0.61	0.11 J	1.2	0.064 J	0.65	0.21	0.31
Cadmium	98	NSL	mg/kg	0.029 J	0.044 J	0.075 JB	0.028 JB	0.015 JB	0.038 JB	0.15	0.090 J	0.14	0.034 J	0.034 J	0.035 J	0.0094 J	0.036	0.11 J	0.34	0.021 J	0.043 J	0.021 J	0.080 J
Calcium	NSL	NSL	mg/kg	1900	120	250	360	370	240	54000	88	62000	510	230	240	230	5300	76	21000	85000	1700	84	35000
Chromium	350	28	mg/kg	**37 B**	**54 B**	24	**41**	22	22	16	28	12	19	**42**	**34**	24	22	0.4	19	16	**42 B**	8.5 B	18 B
Cobalt	NSL	NSL	mg/kg	1.2 B	1.7 B	9.4	11	1.5	2.5	2.6	3.6	2.3	4.7	2.7	1.3	2.6	3.4	0.61	4.0	2.1	0.42 B	4.7 B	5.7 B
Copper	4700	NSL	mg/kg	53	20	15	20	70	15	15	13	17	23	73	16	4.7	98	20	14	30	65	3.5	24
Iron	82000	NSL	mg/kg	40000 B	**81000 B**	26000	51000	17000	23000	16000 B	29000 B	24000 B	29000 B	30000 B	15000 B	25000 B	29000	1100	16000	22000	35000 B	34000 B	13000 B
Lead	1000	NSL	mg/kg	2.5 B	5.4 B	12	9.3	6.7	7.8	12	2.6	15	25	9.6	8.5	6.5	17	0.64	5.6	2.3	8.7 B	3.3 B	7.1 B
Magnesium	NSL	NSL	mg/kg	4800	92	2100	200	230	23	15000	340	7800	1200	190	240	230	2800 B	20 JB	5500 B	4100 B	3200	47	1500
Manganese	2600	NSL	mg/kg	150 B	68 B	86 B	150 B	36 B	28 B	1500 B	170 B	280 B	56 B	21 B	455	36 B	140	28	110	460	240 B	29 B	32 B
Nickel	2200	NSL	mg/kg	5.6	12	15.8	10 B	0.78	11.8	7.4	12	7.5	8.2	8.1	3.0	8.4	7.0	0.87	4.5	3.5	2.2	26	32
Potassium	NSL	NSL	mg/kg	300 B	90 B	50	450	210	550	800 B	380 B	2200 B	450 B	150 B	150 B	140 B	730	24.7	190	120	800 B	330 B	600 B
Selenium	580	NSL	mg/kg	0.65	0.42 J	0.55 J	0.64	0.28 J	0.37 J	0.72	0.25 J	0.38	0.45	0.29 J	0.25 J	0.14 J	0.44 J	0.12 J	0.86	0.61	0.72	0.25 J	0.48 J
Silver	580	NSL	mg/kg	0.021 J	0.025 J	0.021 J	0.029 J	0.018 J	0.021 J	0.046 J	0.0095 J	0.012 J	0.090	0.015 J	0.015 J	0.0086 J	0.035 J	0.011	0.0057 J	0.018 J	0.026 J	0.012 J	0.046 J
Sodium	NSL	NSL	mg/kg	56	18	44 B	30 B	64 B	36 B	850	63	120	350	110	350	130	550	21.7	250	420	110	18	76
Thallium	1.2	5.5	mg/kg	0.054 J	0.043 J	0.062 J	0.096 J	0.056 J	0.068 J	0.12 JB	0.064 JB	0.051 JB	0.27 B	0.035 JB	0.044 JB	0.021 JB	0.15	0.0056 J	0.37	0.013 J	0.099 J	0.059 J	0.33
Vanadium	100	NSL	mg/kg	83 B	**180 B**	57	24	57	47	42	46	13	29	79	42	42	36 B	2.9 B	36 B	15 B	78 B	22 B	34 B
Zinc	35000	NSL	mg/kg	12 B	32 B	110 B	15 B	15 B	18 B	80	26	70	45	30	3	12	25	2.5	32	3.7	13 B	2.4 B	20 B
Mercury (SW7471B)																							
Mercury	10	NSL	mg/kg	0.035 J	0.058 J	0.031 J	0.037 J	0.058 J	0.030 J	0.018 J	0.054 J	0.026 J	0.014 J	0.037 J	0.044 J	0.035 J	0.084	0.035 J	0.15	0.054 J	0.037 J	0.041 J	0.024 J

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Location ID:				SB-10	SB-10	SB-11	SB-11	SB-12	SB-12	SB-13	SB-13	SB-14	SB-14	SB-15	SB-15	SB-15	SB-16	SB-16	SB-17	SB-17	SB-18	SB-18	SB-19
Sample Name:				SB-10 0-2	SB-10 13-15	SB-11 0-2	SB-11 13-15	SB-12 0-2	SB-12 13-15	SB-13 0-2	SB-13 13-15	SB-14 0-2	SB-14 4-6	DUP-10	SB-15 0-2	SB-15 13-15	SB-16 0-2	SB-16 7-9	SB-17 0-2	SB-17 7-9	SB-18 0-2	SB-18 13-15	SB-19 0-2
Date Sampled				3/30/2015	3/30/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	4/1/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015
Parent Sample ID:														SB-15 13-15									
Depth Interval (ft):				0-2	13-15	0-2	13-15	0-2	13-15	0-2	13-15	0-2	4-6	13-15	0-2	13-15	0-2	7-9	0-2	7-9	0-2	13-15	0-2
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																				
DRO/GRO (SW8015C)																							
Diesel Range Organics	620	NSL	mg/kg	13.3	< 20 U	37.3	19 U	6.3 J	20 U	60 B	34 JB	69 B	11 JB	7.7 JB	30 JB	12 JB	--	--	--	--	< 21 U	< 19 U	**1200**
Gasoline Range Organics	620000	NSL	µg/kg	< 120 U	< 120 U	< 120 U	120 J	56 JB	74 JB	< 120 U	< 120 U	< 150 U	< 120 U	120 J	< 120 U	< 120 U	--	--	--	--	128 J	< 120 U	< 120 U
PCBs (SW8082A)																							
Aroclor 1016	41	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0047 U	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1221	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0047 U	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1232	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0047 U	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1242	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0047 U	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1248	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0047 U	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1254	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	< 0.00098 U	< 0.00098 U	< 0.00093 U	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	< 0.0057	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Aroclor 1260	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	0.025	< 0.00098 U	0.039	< 0.0010 U	< 0.0049 U	0.0035 J	< 0.00097 U	--	--	0.0062	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	< 0.0048 U	< 0.0049 U	< 0.0048 U	< 0.0049 U	< 0.0050 U	< 0.0049 U	0.025	< 0.00098 U	0.039	< 0.0010 U	< 0.0049 U	< 0.0010 U	< 0.00097 U	--	--	0.035	< 0.0046 U	< 0.0052 U	< 0.0048 U	< 0.0049 U
VOCs (SW8260C)																							
1,1,1-trichloroethane	290000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,1,2-trichloroethane	50	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,1-dichloroethane	23000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,1-dichloroethene	5100	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,2-dibromo-3-chloropropane	0.6	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,2-dibromoethane	1.2	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,2-dichloroethane	33	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,2-dichloroethene	920	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
1,2-dichloropropane	42	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
2-butanone	44000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Acetone	92000	NSL	mg/kg	< 0.017 U	< 0.017 U	< 0.017 U	< 0.03 U	< 0.019 U	< 0.018 U	< 0.017 U	< 0.019 U	< 0.019 U	< 0.02 U	< 0.018 U	< 0.02 U	< 0.019 U	--	--	--	--	< 0.025 U	< 0.018 U	< 0.023 U
Benzene	52	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Bromodichloromethane	40	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Bromoform	360	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Bromomethane	140	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Carbon disulfide	34000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Carbon tetrachloride	22	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Chlorobenzene	2800	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Chloroethane	990	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Chloroform	26	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Chloromethane	NSL	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
cis-1,2-dichloroethene	2000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
cis-1,3-dichloropropene	29	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Dibromochloromethane	36	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Ethylbenzene	1000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Isopropylbenzene	20000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Methyl tert-butyl ether	320	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Methylene Chloride	380	NSL	mg/kg	0.0014 JB	0.0019 JB	0.0021 JB	0.0057 JB	0.0016 JB	0.0021 JB	0.0019 JB	0.0025 JB	0.0022 JB	0.0026 JB	0.0025 JB	0.0023 JB	0.0029 JB	--	--	--	--	0.0029 JB	0.0019 JB	0.0025 JB
Styrene	36000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Tetrachloroethene	53	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Toluene	92000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	0.00089 JB	0.00097 JB	0.00092 JB	0.0016 JB	0.00086 JB	0.0011 JB	0.0016 JB	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
trans-1,2-dichloroethene	2000	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
trans-1,3-dichloropropene	29	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Trichloroethene	5.2	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Vinyl chloride	2	NSL	mg/kg	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0075 U	< 0.0047 U	< 0.0045 U	< 0.0043 U	< 0.0048 U	< 0.0047 U	< 0.0051 U	< 0.0045 U	< 0.0049 U	< 0.0048 U	--	--	--	--	< 0.0064 U	< 0.0044 U	< 0.0056 U
Xylenes, Total	25000	NSL	mg/kg	< 0.013 U	< 0.013 U	< 0.012 U	< 0.023 U	< 0.014 U	< 0.014 U	< 0.013 U	< 0.014 U	< 0.014 U	< 0.015 U	< 0.013 U	< 0.015 U	< 0.014 U	--	--	--	--	< 0.019 U	< 0.013 U	< 0.017 U
SVOCs (SW8270D)																							
1,2,4-trichlorobenzene	1000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
1,2-dichlorobenzene	9300	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
1,3-dichlorobenzene	310	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.082 U	--	--	--	--	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.082 U	--	--	--	--	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 0.41 U	--	--	--	--	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	< 2.1 U	--	--	--	--	--	--	--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Location ID:				SB-10	SB-10	SB-11	SB-11	SB-12	SB-12	SB-13	SB-13	SB-14	SB-14	SB-15	SB-15	SB-15	SB-16	SB-16	SB-17	SB-17	SB-18	SB-18	SB-19
Sample Name:				SB-10-0-2	SB-10-13-15	SB-11-0-2	SB-11-13-15	SB-12-0-2	SB-12-13-15	SB-13-0-2	SB-13-13-15	SB-14-0-2	SB-14-4-6	DUP-01	SB-15-0-2	SB-15-13-15	SB-16-0-2	SB-16-7-9	SB-17-0-2	SB-17-7-9	SB-18-0-2	SB-18-13-15	SB-19-0-2
Date Sampled:				3/30/2015	3/30/2015	3/31/2015	3/31/2015	3/31/2015	3/31/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	4/10/2015	3/30/2015
Parent Sample ID:														SB-15-13-15									
Depth Interval (ft):				0-2	13-15	0-2	13-15	0-2	13-15	0-2	13-15	0-2	4-6	13-15	0-2	13-15	0-2	7-9	0-2	7-9	0-2	13-15	0-2
Analyte	MDE Non Residential Soil	ATC Eastern	Unit																				
2,4-dinitrotoluene	238	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
2,6-dinitrotoluene	310	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
2-chlorophenol	510	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-methylphenol	5100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	5.1	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
4-chloroaniline	43	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
4-methylphenol	510	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Acenaphthene	5100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthylene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Anthracene	33000	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]anthracene	15	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]pyrene	0.36	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[b]fluoranthene	15	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[g,h,i]perylene	3100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[k]fluoranthene	150	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	260	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Carbazole	140	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Chrysene	1500	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz[a,h]anthracene	0.36	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenzofuran	100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Fluoranthene	4100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	4100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloro-1,3-butadiene	33	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Hexachloroethane	20	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Indeno[1,2,3-c,d]pyrene	15	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Isophorone	3200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Naphthalene	20	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrobenzene	51	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Pentachlorophenol	24	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Phenanthrene	1100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenol	11000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--
Pyrene	3100	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
pH (SW 9045D)																							
pH	NSL	NSL	pH units	7.04	4.52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes:
MDE Non-Residential Soil – Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern – Maryland Dept. of the Environment Anticipated Typical Concentrations
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
* - USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Gray shaded values exceed ATC Eastern
pg/g – picogram per gram
mg/kg – milligrams per kilogram
µg/kg – micrograms per kilogram
B – Compound was found in the blank and sample
J – Result is less than the RL but greater than or equal to the MDL and the concentration is an
* – ISTD response or retention time outside applicable limits
E – Result exceeds calibration range
F1 – MS and/or MSD Recovery is outside acceptance limits
Q – One or more quality control criteria failed
HF – Field parameter with a holding time of 15 minutes
U – Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID	SB-19	SB-20	SB-20	SB-21	SB-21	SB-22	SB-22	SB-23	SB-23	SB-24	SB-24	SB-25	SB-25	SB-26	SB-26	SB-27	SB-27	SB-28	SB-28	SB-29	SB-29
			Sample Name	SB-19 10-12	SB-20 0-2	SB-20 9-11	SB-21 0-2	SB-21 13-15	SB-22 0-2	SB-22 9-11	SB-23 1-3	SB-23 4-6	SB-24 0-2	SB-24 8-10	SB-25 0-2	SB-25 13-15	SB-26 0-2	SB-26 13-15	SB-27 0-2	SB-27 6-8	SB-28 0-2	SB-28 2.5-4.55	SB-29 0-2	SB-29 8-10
			Date Sampled	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	4/7/2015	4/3/2015	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	3/30/2015	3/30/2015
			Parent Sample ID																					
			Depth Interval (ft)	10-12	0-2	9-11	0-2	13-15	0-2	9-11	1-3	4-6	0-2	8-10	0-2	13-15	0-2	13-15	0-2	6-8	0-2	2.5-4.55	0-2	8-10
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																					
Rad (E901.1)																								
Actinium-228	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW8290B)																								
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF WHO	22 [1]	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																								
Aluminum	110000	NSL	mg/kg	3200 B	1800 B	12000 B	5700 B	42000 B	24000	5600	2500	4200	2600	360	14000 B	21000 B	5800 B	1600 B	5200 B	6800 B	3400	2200	4700 B	1900 B
Antimony	47	NSL	mg/kg	0.079 J	0.36	0.047 J	0.33 J	0.45	2.8	12	3.3 B	0.76 B	0.55 B	0.061 JB	13	0.080 J	0.53	0.053 J	4.6	7.6	7.5 B	7.9 B	0.087 J	0.071 J
Arsenic	3.0	3.6	mg/kg	**14**	**4.3**	2.5	2.3	**7.8**	3.8	2.1	**4.5**	2.7	**4.2**	1.1	2.9	0.71	**4.8**	1.74	2.5	2.5	1.9	0.42 J	2.2	3.6
Barium	22000	NSL	mg/kg	24	85	76	35	93	270	22	12	29	34	2.7	13	26	25	11	35	120	47	44	24	7.3
Beryllium	230	NSL	mg/kg	0.52	0.30	0.13	0.21	0.73	5.9	0.24	0.16 J	0.55 J	0.32	0.035 J	0.07	0.29	3.6	0.24	0.82	1.5	0.25 J	0.17 J	0.38	0.13
Cadmium	98	NSL	mg/kg	0.060 J	0.084 J	0.088 J	0.077 J	0.11 J	0.060 J	0.12 J	<0.52 U	0.16 JB	0.14	0.039 J	0.058 J	0.056 J	0.057 J	0.054 J	0.17 B	5.2 B	0.33 JB	0.46 JB	0.32	0.025 J
Calcium	NSL	NSL	mg/kg	160	530	130	67000	180	140000	130000	8400 B	33000 B	12000	190	450	58	3600	62	96000	11000	140000 B	140000 B	140000	92
Chromium	310	28	mg/kg	31 B	**55 B**	6.4 B	20 B	**53 B**	**46**	**658**	20	29	28	3.7	**33 B**	8.5 B	**45 B**	12 B	**120**	**1700**	**120**	**150**	16 B	13 B
Cobalt	NSL	NSL	mg/kg	22 B	0.72 B	0.49 B	3.7 B	11 B	0.43	1.2	2.7 B	2.6 B	0.94	0.66	2.1 B	0.80 B	5.3 B	1.4 B	3.9	6.4	2.3 B	3.5 B	3.8 B	0.49 B
Copper	4700	NSL	mg/kg	29	4.2	2.4	20	14	4.5	48	11	11	14	2.8	17	16	52	12	31	15	29	35	16	9.9
Iron	82000	NSL	mg/kg	24000 B	38000 B	11000 B	12000 B	37000 B	4800	21000	16000 B	12000 B	18000	1400	34000 B	7600 B	50000 B	5800 B	15000	43000	34000 B	68000 B	10000 B	8300 B
Lead	1000	NSL	mg/kg	32 B	6.7 B	2.0 B	7.4 B	9.8 B	3.8 B	11 B	16	14	15	1.4	5.2 B	1.7 B	13 B	1.9 B	33	45	55	190	12 B	1.3 B
Magnesium	NSL	NSL	mg/kg	140	180	54	4100	120	47000	55	1500 B	2500 B	1400 B	37 B	140	63	400	38	6600	7200	4600 B	14000 B	56000	51
Manganese	2600	NSL	mg/kg	5.5 B	3.3 B	1.6 B	20 B	9.2 B	170 B	35 B	56 B	130 B	45	6.5	27 B	5.4 B	66 B	2.2 B	330 B	**5300 B**	310 B	170 B	130 B	3.3 B
Nickel	2200	NSL	mg/kg	20	2.8	2.6	15	18	1.4	4.3	3.1 B	14 B	5.2	0.99	6.6	6.4	16	2.5	19 B	24 B	13 B	17 B	9.5	2.2
Potassium	NSL	NSL	mg/kg	820 B	95 B	300 B	840 B	120 B	1400 B	62 B	360 B	520 B	280	46 J	280 B	150 B	450 B	31 B	520	45	450 B	440 B	1600 B	360 B
Selenium	510	NSL	mg/kg	0.41	0.39 J	0.25 J	0.47 J	0.49 J	3.1	0.18 J	<2.8 U	<2.9 U	0.36 J	0.086 J	0.33 J	0.31 J	0.45 J	0.45 J	0.25 J	0.80 J	2.8 U	0.47 J	0.35 J	0.27 J
Silver	510	NSL	mg/kg	0.041 J	0.016 J	0.0088 J	0.034 J	0.015 J	0.051 J	0.092 J	<0.53 U	0.024 J	0.046 J	<0.12 U	0.025 J	0.049 J	0.059 J	0.024 J	0.38	16	0.16 J	0.29 J	0.054 J	0.0097 J
Sodium	NSL	NSL	mg/kg	24	22	24	180	53	970	180	430	1200	56	22 J	38	22	41	20	320 B	190 B	530	560	180	27
Thallium	1.2	[illegible]	mg/kg	0.52	0.037 J	0.045 J	0.084 J	0.039 J	0.025 JB	0.019 JB	<0.53 U	0.033 J	0.089 J	0.014 J	0.089 J	0.071 J	0.086 J	0.14	0.062 J	0.16 J	0.086 J	0.066 J	0.053 J	0.039 J
Vanadium	580	NSL	mg/kg	7.1 B	**130 B**	13 B	24 B	**140 B**	53	**880**	28	27	58 B	4.4 B	76 B	14 B	58 B	24 B	**320**	**6000**	**220**	**560**	24 B	24 B
Zinc	35000	NSL	mg/kg	63 B	4.2 B	3.1 B	32 B	25 B	21 B	220 B	18	22	16	6.0	33 B	2.9 B	74 B	4.0 B	66 B	40 B	52	31	32 B	3.3 B
Mercury (SW7471B)																								
Mercury	35	NSL	mg/kg	0.039	0.035 J	<0.036 J	0.036	0.084 U	0.027 U	0.037 U	0.024	0.093 J	0.34	<0.032 U	0.033 J	0.086 U	0.069	0.037 J	<0.032 J	0.22	0.25	0.069	0.012 J	<0.033 U

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID	SB-19	SB-20	SB-20	SB-21	SB-21	SB-22	SB-22	SB-23	SB-23	SB-24	SB-24	SB-25	SB-25	SB-26	SB-26	SB-27	SB-27	SB-28	SB-28	SB-29	SB-29
			Sample Name	SB-19-10-12	SB-20-0-2	SB-20-9-11	SB-21-0-2	SB-21-13-15	SB-22-0-2	SB-22-9-11	SB-23-1-3	SB-23-4-6	SB-24-0-2	SB-24-8-10	SB-25-0-2	SB-25-13-15	SB-26-0-2	SB-26-13-15	SB-27-0-2	SB-27-6-8	SB-28-0-2	SB-28-2.5-4.5	SB-29-0-2	SB-29-8-10
			Date Sampled:	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	3/30/2015	3/30/2015
			Parent Sample ID																					
			Depth Interval (ft):	10-12	0-2	9-11	0-2	13-15	0-2	9-11	1-3	4-6	0-2	8-10	0-2	13-15	0-2	13-15	0-2	6-8	0-2	2.5-4.5	0-2	8-10
Analyte	**MDE Non Residential Soil**	**ATC Eastern**	**Unit**																					
DRO/GRO (SW8015C)																								
Diesel Range Organics	620	NSL	mg/kg	25	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Gasoline Range Organics	620000	NSL	ug/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
PCBS (SW8082A)																								
Aroclor 1016	41	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1221	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1232	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1242	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1248	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1254	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Aroclor 1260	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]
VOCS (SW8260C)																								
1,1,1-trichloroethane	36000	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,1,2-trichloroethane	5	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,1-dichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,1-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,2-dibromo-3-chloropropane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,2-dibromoethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,2-dichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
1,2-dichloropropane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
2-butanone	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
4-methyl-2-pentanone	NSL	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Acetone	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Benzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Bromodichloromethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Bromoform	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Bromomethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Carbon disulfide	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Carbon tetrachloride	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Chlorobenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Chloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Chloroform	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Chloromethane	NSL	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
cis-1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
cis-1,3-dichloropropene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Dibromochloromethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Ethylbenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Isopropylbenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Methyl tert-butyl ether	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Methylene Chloride	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Styrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Tetrachloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Toluene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
trans-1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
trans-1,3-dichloropropene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Trichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Vinyl chloride	4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
Xylenes, Total	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	--
SVOCS (SW8270D)																								
1,2,4-trichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
1,2-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
1,3-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,2-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,4,5-trichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,4,6-trichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,4-dichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,4-dimethylphenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--
2,4-dinitrophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Location ID:				SB-19	SB-20	SB-20	SB-21	SB-21	SB-22	SB-22	SB-23	SB-23	SB-24	SB-24	SB-25	SB-25	SB-26	SB-26	SB-27	SB-27	SB-28	SB-28	SB-29	SB-29
Sample Name:				SB-19 10-12	SB-20 0-2	SB-20 9-11	SB-21 0-2	SB-21 13-15	SB-22 0-2	SB-22 9-11	SB-23 3-5	SB-23 4-6	SB-24 0-2	SB-24 8-10	SB-25 0-2	SB-25 13-15	SB-26 0-2	SB-26 13-15	SB-27 0-2	SB-27 6-8	SB-28 0-2	SB-28 2.5-4.5	SB-29 0-2	SB-29 8-10
Date Sampled:				3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	4/7/2015	4/7/2015	3/31/2015	3/30/2015	3/30/2015	3/30/2015	3/31/2015	3/31/2015	4/3/2015	4/3/2015	3/30/2015	3/30/2015
Parent Sample ID:																								
Depth Interval (ft):				10-12	0-2	9-11	0-2	13-15	0-2	9-11	3-5	4-6	0-2	8-10	0-2	13-15	0-2	13-15	0-2	6-8	0-2	2.5-4.5	0-2	8-10
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																					
2,4-dinitrotoluene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
2,6-dinitrotoluene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
2-chlorophenol	510	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.023 J	< 0.0081 U	0.0059 J	0.0056 J	0.029	0.04	0.049 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	< 0.0084 U	< 0.0078 U	0.0071 J	0.0097 J	0.18	0.047	0.011 J	< 0.0078 U
2-methylphenol	5100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
3,3-dichlorobenzidine	3.4	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
4-chloroaniline	410	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
4-methylphenol	510	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	6100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.033 J	< 0.0081 U	0.0054 J	< 0.011 U	0.026	0.086	< 0.039 U	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0084 J	< 0.0078 U	0.0083 J	0.0026 J	0.06	0.26	0.028 J	< 0.0078 U
Acenaphthylene	6100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.21	< 0.0081 U	0.0066 J	< 0.011 U	0.0031 J	0.0062 J	< 0.039 U	< 0.0085 U	< 0.0079 U	< 0.0075 U	< 0.0084 U	< 0.0078 U	0.0083 J	< 0.017 U	0.019 J	0.013	0.0063 J	< 0.0078 U
Anthracene	31000	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.19	< 0.0081 U	0.0045 J	< 0.011 U	0.027	0.021	0.0098 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0033 J	< 0.0078 U	0.0052 J	< 0.017 U	0.99	0.42	0.055 J	< 0.0078 U
Benzo(a)anthracene	5.0	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	1.2	< 0.0081 U	0.019	< 0.011 U	0.038	0.025	0.085 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.01	< 0.0078 U	0.013 J	0.0047 J	2.4	3.1	1.3	< 0.0078 U
Benzo(a)pyrene	0.29	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	1.2 *	< 0.0081 U	0.013	< 0.011 U	0.029	0.035 J	0.032 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0092	< 0.0078 U	0.033 J	< 0.017 U	**1.9**	**0.96**	0.098 *	< 0.0078 U
Benzo(b)fluoranthene	2.9	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0078 U	0.12 *	< 0.0081 U	0.05	< 0.011 U	0.045	0.02	0.044	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.011	< 0.0078 U	0.046	< 0.017 U	2.5	1.2	0.11 *	< 0.0078 U
Benzo(g,h,i)perylene	3100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.26 *	< 0.0081 U	0.014	< 0.011 U	0.024	0.02	0.03 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0092	< 0.0078 U	0.033 J	< 0.017 U	1.5	0.68	0.092 *	< 0.0078 U
Benzo(k)fluoranthene	29	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.082 J*	< 0.0081 U	0.0078	< 0.011 U	0.013 J	0.011 J	0.02 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0059 J	< 0.0078 U	0.0063 J	< 0.017 U	0.98	0.49	0.047 J*	< 0.0078 U
Bis(2-chloroethyl) ether	1.0	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	160	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.39 U	--	--	--	--	--	--	--	--	--	--	--
Carbazole	140	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
Chrysene	290	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	1.2	< 0.0081 U	0.02	< 0.011 U	0.043	0.025	0.047	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.011	< 0.0078 U	0.037 J	0.0094 J	2.4	1.2	0.12	< 0.0078 U
Dibenz(a,h)anthracene	0.29	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.043 J*	< 0.0081 U	0.0053 J	< 0.011 U	0.0082 J	0.021	< 0.039 U	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0064 J	< 0.0078 U	< 0.0083 U	< 0.017 U	**0.45**	0.16	0.0076 J*	< 0.0078 U
Dibenzofuran	100	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	8200	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	4100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	1.3	< 0.0081 U	0.038	0.0082 J	0.12	0.05	0.026	< 0.0085 U	0.0031 J	< 0.0075 U	0.021	< 0.0078 U	0.045	0.0092 J	3.3	3.2	0.33	< 0.0078 U
Fluorene	4100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.035 J	< 0.0081 U	0.0012 J	0.012 J	0.04	0.036	< 0.039 U	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0019 J	< 0.0078 U	< 0.0083 U	0.0022 J	0.44	0.26	0.023 J	< 0.0078 U
Hexachloro-1,3-butadiene	17	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	0.49	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	20	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	2.9	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.27 *	< 0.0081 U	0.012	< 0.011 U	0.02	0.014 J	0.026 J	< 0.0085 U	< 0.0079 U	< 0.0075 U	0.0083 J	< 0.0078 U	0.029 J	< 0.017 U	1.4	0.62	0.072 J*	< 0.0078 U
Isophorone	3000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	20	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.023 J	< 0.0081 U	0.0027 J	< 0.011 U	0.13	0.024	< 0.039 U	< 0.0085 U	< 0.0079 U	< 0.0075 U	< 0.0084 U	< 0.0078 U	< 0.0083 U	0.042 J	0.3	0.065	< 0.0076 U	< 0.0078 U
Nitrobenzene	51	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.39 U	--	--	--	--	--	--	--	--	--	--	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.039 U	--	--	--	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	560	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	22	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.19 U	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	31000	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.19	< 0.0081 U	0.015	< 0.011 U	0.15	0.15	0.19 J	< 0.0085 U	0.0025 J	< 0.0075 U	0.015	< 0.0078 U	0.022 J	0.0079 J	4.4	1.8	0.12	< 0.0078 U
Phenol	31000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	< 0.39 U	--	--	--	--	--	--	--	--	--	--	--
Pyrene	3100	NSL	mg/kg	< 0.0079 U	< 0.0076 U	< 0.0079 U	0.24	< 0.0081 U	0.048	0.0093 J	0.07	0.049	0.058	< 0.0085 U	0.0018 J	< 0.0075 U	0.012	< 0.0078 U	0.047	0.0063 J	4.7	1.7	0.21	< 0.0078 U
pH (SW9045D)																								
pH	NSL	NSL	pH units	4.98	5.91	4.53	7.96	4.46	5.14	7.81	7.18 H	7.68 H	7.46	7.63	5.06	5.29	5.78	4.46	7.74	7.22	5.02 H	6.95 H	8.24	4.34

Notes:
MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
? = EPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Gray shaded values exceed ATC Eastern
pg/g = picogram per gram
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
B = Compound was found in the blank and sample
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an
* = ISTD response or retention time outside applicable limits
E = Result exceeds calibration range
F1 = MS and/or MSD Recovery is outside acceptance limits
Q = One or more quality control criteria failed
HF = Field parameter with a holding time of 15 minutes
U = Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Location ID:				SB-30	SB-30	SB-31	SB-31	SB-32	SB-32	SB-32	SB-33	SB-33	SB-34
Sample Name				SB-30-0-2	SB-30-9-11	SB-31-0-2	SB-31-13-15	DUP-08	SB-32-0-2	SB-32-2-4	SB-33-0-2	SB-33-13-15	DUP-13
Date Sampled				4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/7/2015
Parent Sample ID:								SB-32-0-2					SB-34-12-14
Depth Interval (ft)				0-2	9-11	0-2	13-15	0-2	0-2	4-6	0-2	13-15	12-14
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**										
Rad (E901.1)													
Actinium-228	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW1613B)													
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ - ND=1/2 WHO	22	NSL	pg/g	--	--	--	--	--	--	--	--	--	--
Metals (SW6010A)													
Aluminum	110000	NSL	mg/kg	3200	9200	5200	1000	3700 J	4000	26000 J	3500	2800	5600
Antimony	47	NSL	mg/kg	2.1 J	4.7 J	[illegible]	[illegible]	1.6 J	2.5 J	7.2 J	0.18 J	0.11 J	0.12
Arsenic	3	3.6	mg/kg	**3.4**	**3.8**	**4.7**	2.3	**5.4**	**8.9**	**6.9 FJ**	2.5	1.2	**58**
Barium	22000	NSL	mg/kg	17	31	22	18	45	56	34	15	30	24
Beryllium	230	NSL	mg/kg	0.51	0.74	0.32	0.96	0.51 J	0.56	0.062	0.26	0.46	0.39
Cadmium	98	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Calcium	NSL	NSL	mg/kg	8400 J	2200 J	1000	1800 J	15000	13000 J	150000 J	2000 J	170 J	780
Chromium	330	25	mg/kg	26 J	25 J	22	**320**	**2700**	**100**	**50 FJ**	**35**	18	27
Cobalt	NSL	NSL	mg/kg	3.7	4.7	[illegible]	5.5	25 J	5.5 J	3.0 J	1.6 J	0.72 J	4.1
Copper	4700	NSL	mg/kg	21	62	11	8.6	120	59	15	7.8	5.6	12
Iron	72000	NSL	mg/kg	23000	26000	17000	33000	37000 J	25000 J	**86000 FJ**	21000 J	13000 J	14000
Lead	800	NSL	mg/kg	7.5	12	4.2	3.5	53 J	88	45	15	12	32
Magnesium	NSL	NSL	mg/kg	1600 J	5200 J	2700 J	610 J	25000 J	17000 J	420 J	170 J	120 J	650
Manganese	2600	NSL	mg/kg	46	37	110	92	460 J	350 J	120 FJ	34 J	53 J	72
Nickel	2200	NSL	mg/kg	7.7	11	2.6	14	130	16 J	6.3 J	2.4 J	2.9 J	4.2
Potassium	NSL	NSL	mg/kg	340	520	450	290	3100 J	2100 J	740 J	310 J	150 J	310 J
Selenium	580	NSL	mg/kg	[illegible]	0.31	0.17	0.12	2.0	[illegible]	3.4 FJ	2.8	2.9	[illegible]
Silver	580	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sodium	NSL	NSL	mg/kg	45 J	82 J	31 J	76 J	370 J	45	660	65	25	48
Thallium	1.2	3.9	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vanadium	100	NSL	mg/kg	58 J	41	22 J	9.3 J	**140 B**	**250**	98 FJ	94	38	20 J
Zinc	35000	NSL	mg/kg	16	26	7.3	13	100	130	36	45	11	23
Mercury (SW7471B)													
Mercury	3.5	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Location ID:	SB-34	SB-34	SB-35	SB-35	SB-35	SB-36	SB-36	SB-36	SB-37	SB-37	SB-38
Sample Name	SB-34-0-2	SB-34-12-14	DUP-12	SB-35-0-2	SB-35-9-11	DUP-1	SB-36-0-2	SB-36-9-11	SB-37-0-2	SB-37-13-15	SB-38-0-2
Date Sampled	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015	4/1/2015	4/1/2015	4/1/2015
Parent Sample ID:			SB-35-0-2			SB-36-9-11					
Depth Interval (ft)	0-2	12-14	0-2	0-2	9-11	9-11	0-2	9-11	0-2	13-15	0-2
Analyte											
Rad (E901.1)											
Actinium-228	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	--	--	--	--	--	--	--	--	--	--	--
Lead-212	--	--	--	--	--	--	--	--	--	--	--
Lead-214	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW1613B)											
1,2,3,4,6,7,8-heptachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ - ND=1/2 WHO	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6010A)											
Aluminum	3300	4600	3800	5800	7600	2500 J	6800 J	2500 J	2100	1100	1200
Antimony	15	0.98	12	30	1.2 J	0.062	[illegible]	[illegible]	1.9 J	0.29 J	0.43 J
Arsenic	**17**	**41**	**32**	**43**	**16 FJ**	0.55	2.1	0.44	2.3	**9.3**	**4.9**
Barium	35 J	33	61	43	37	17	26	15	16	[illegible]	[illegible]
Beryllium	0.34	0.40	0.50	0.56	0.51 FJ	0.10	0.66	0.35	0.29	0.37	0.32
Cadmium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Calcium	15000	6800	8700	11000	2400 J	150	9700	140	12000 J	310 J	4600 J
Chromium	**81**	22	**29**	**37**	31 FJ	8.2 J	15 J	7.1 J	**34 J**	19 J	**40 FJ**
Cobalt	1.2	1.7	2.7	2.6	3.5	0.22 J	5.7 J	0.25 J	1.5	0.62 J	0.57
Copper	16	19	28	29	32	2.7	18	3.2	1.4	1.5	7.2
Iron	6500	25000	21000	40000	14000	6400 J	9900 J	5500 J	2100	34000	41000
Lead	22 J	16	17	15	37 FJ	1.3 J	10 J	1.1 J	[illegible]	4.0	8.2
Magnesium	3700	3300	2100	2200	1400	64	2000 J	61	1500 J	45	130 J
Manganese	93	220	130	140	170 FJ	3.7 J	150 J	5.3 J	[illegible]	4.5 J	14
Nickel	3.2	3.1	6.5	6.6	6.3	1.2	59	1.2	[illegible]	2.5 J	1.8
Potassium	330 J	200 J	570 J	460 J	360 J	43 J	2400 J	280 J	360	270 J	140
Selenium	2.0 J	[illegible]	1.2	0.56	[illegible]	0.20	0.38	1.4	0.57	0.24 J	0.16
Silver	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sodium	220	370	340	330	630	26	[illegible]	22	27 J	16	30 J
Thallium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vanadium	**270**	40 J	**130 B**	**530 B**	27 J	14 J	20 J	32 J	62 J	35	83 J
Zinc	17	13	45	29	25	3.5 J	66 J	2.6 J	5.5	3.4 J	5.4
Mercury (SW7471B)											
Mercury	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-30	SB-30	SB-31	SB-31	SB-32	SB-32	SB-32	SB-33	SB-33	SB-34	SB-34	SB-34	SB-35	SB-35	SB-35	SB-36	SB-36	SB-36	SB-37	SB-37	SB-38
			Sample Name:	SB-30 0-2	SB-30 9-11	SB-31 0-2	SB-31 13-15	DUP-08	SB-32 0-2	SB-32 2-4	SB-33 0-2	SB-33 13-15	DUP-15	SB-34 0-2	SB-34 12-14	DUP-12	SB-35 0-2	SB-35 9-11	DUP-01	SB-36 0-2	SB-36 9-11	SB-37 0-2	SB-37 13-15	SB-38 0-2
			Date Sampled:	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015	4/1/2015	4/1/2015	4/1/2015
			Parent Sample ID:					SB-32 0-2					SB-34 12-14			SB-35 0-2			SB-36 9-11					
			Depth Interval (ft):	0-2	9-11	0-2	13-15	0-2	0-2	2-4	0-2	13-15	12-14	0-2	12-14	0-2	0-2	9-11	9-11	0-2	9-11	0-2	13-15	0-2
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																					
DRO/GRO (SW8015C)																								
Diesel Range Organics	620	NSL	mg/kg	25	9.5 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11 J
Gasoline Range Organics	620000	NSL	ug/kg	12 U	69 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12 U
PCBS (SW8082A)																								
Aroclor 1016	41	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	0.028	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1221	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	<0.0046 U	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1232	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	<0.0046 U	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1242	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	<0.0046 U	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1248	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	<0.0046 U	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1254	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	<0.0053 U	<0.0049 U	--	--	--	<0.0046 U	<0.0046 U	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
Aroclor 1260	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	0.053 J	0.029 J	--	--	--	<0.0046 U	0.036	<0.0046 U	0.0097 J	<0.0050 U	<0.0049 U
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	<0.0048 U	<0.0054 U	<0.0055 U	<0.0048 U	--	--	--	<0.0024 U	<0.0024 U	<0.0047 U	0.048 J	0.029 J	--	--	--	<0.0046 U	0.028	<0.0046 U	<0.0050 U	<0.0050 U	<0.0049 U
VOCS (SW8260C)																								
1,1,1-trichloroethane	200000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,1,2-trichloroethane	50	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,1-dichloroethane	20000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,1-dichloroethene	5100	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,2-dibromoethane	1.4	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,2-dichloroethane	31	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,2-dichloroethene	920	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
1,2-dichloropropane	42	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
2-butanone	61000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Acetone	920000	NSL	mg/kg	<0.016 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.017 U
Benzene	52	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Bromodichloromethane	46	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Bromoform	690	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Bromomethane	140	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Carbon disulfide	10000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Carbon tetrachloride	22	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Chlorobenzene	2000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Chloroethane	990	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Chloroform	1600	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Chloromethane	NSL	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
cis-1,2-dichloroethene	1000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
cis-1,3-dichloropropene	28	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Dibromochloromethane	64	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Ethylbenzene	10000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Isopropylbenzene	10000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Methyl tert-butyl ether	720	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Methylene Chloride	300	NSL	mg/kg	0.0022 JB	0.0026 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0019 JB
Styrene	20000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Tetrachloroethene	53	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Toluene	8200	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
trans-1,2-dichloroethene	2000	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
trans-1,3-dichloropropene	29	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Trichloroethene	72	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Vinyl chloride	4	NSL	mg/kg	<0.0041 U	<0.0053 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0044 U
Xylenes, Total	2000	NSL	mg/kg	<0.012 U	<0.016 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.013 U
SVOCS (SW8270D)																								
1,2,4-trichlorobenzene	1000	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
1,2-dichlorobenzene	9300	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
1,3-dichlorobenzene	310	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	<0.0079 U	<0.0085 U	--	--	--	--	--	--	--	--	0.25 U	--	--	--	--	--	--	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg	<0.0079 U	<0.0085 U	--	--	--	--	--	--	--	--	4.2 U	--	--	--	--	--	--	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg	<0.39 U	<0.42 U	--	--	--	--	--	--	--	--	3.5 U	--	--	--	--	--	--	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg	<2 U	<2.2 U	--	--	--	--	--	--	--	--	6.4 U	--	--	--	--	--	--	--	--	--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Location ID:				SB-30	SB-30	SB-31	SB-31	SB-32	SB-32	SB-32	SB-33	SB-33	SB-34	SB-34	SB-34	SB-35	SB-35	SB-35	SB-36	SB-36	SB-36	SB-37	SB-37	SB-38
Sample Name:				SB-30 0-2	SB-30 9-11	SB-31 0-2	SB-31 13-15	[illegible]	SB-32 0-2	SB-32 2-4	SB-33 0-2	SB-33 13-15	DUP-13	SB-34 0-2	SB-34 12-14	[illegible]	SB-35 0-2	SB-35 9-11	DUP-1	SB-36 0-2	SB-36 9-11	SB-37 0-2	SB-37 13-15	SB-38 0-2
Date Sampled:				4/3/2015	4/3/2015	4/1/2015	4/1/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	4/7/2015	3/30/2015	3/30/2015	3/30/2015	4/1/2015	4/3/2015	4/3/2015
Parent Sample ID:								SB-32 0-2					SB-34 12-14			SB-35 0-2			SB-36 9-11					
Depth Interval (ft):				0-2	9-11	0-2	13-15	0-2	0-2	4-Feb	0-2	13-15	12-14	0-2	12-14	0-2	0-2	9-11	9-11	0-2	9-11	0-2	13-15	0-2
Analyte	**MDE Non Residential Soil**	**ATC Eastern**	**Unit**																					
2,4-dinitrotoluene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
2,6-dinitrotoluene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	0.25 U	--	--	--	--	--	--	--	--	--	--
2-chlorophenol	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
2-methylnaphthalene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.25 U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-methylphenol	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
4-chloroaniline	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	1.3 U	--	--	--	--	--	--	--	--	--	--
4-methylphenol	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Acenaphthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthylene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[b]fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[g,h,i]perylene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[k]fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-chloroethyl) ether	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Carbazole	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Chrysene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz[a,h]anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenzofuran	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloro-1,3-butadiene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Indeno[1,2,3-c,d]pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Isophorone	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Naphthalene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrobenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
N-nitrosodi-n-propylamine	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Phenanthrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenol	[illegible]	NSL	mg/kg	[illegible]	[illegible]	--	--	--	--	--	--	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--
Pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
pH (SW9045D)																								
pH	NS	NSL	pH units	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes:
MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern - Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
* - USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Grey shaded values exceed ATC Eastern
pg/g - picogram per gram
mg/kg - milligrams per kilogram
μg/kg - micrograms per kilogram
B - Compound was found in the blank and sample
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an
* - ISTD response or retention time outside applicable limits
E - Result exceeds calibration range
F1 - MS and/or MSD Recovery is outside acceptance limits
Q - One or more quality control criteria failed
HF - Field parameter with a holding time of 15 minutes
U - Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID / Sample Name / Date Sampled / Parent Sample ID / Depth Interval (ft)																				
				SB-38 SB-38-13-15 4/1/2015 13-15	SB-39 SB-39-0-2 4/1/2015 0-2	SB-39 SB-39-13-15 4/1/2015 13-15	SB-40 SB-40-0-2 4/3/2015 0-2	SB-40 SB-40-8-10 4/3/2015 8-10	SB-41 SB-41-0-2 4/3/2015 0-2	SB-41 SB-41-13-15 4/3/2015 13-15	SB-42 SB-42-0-2 4/3/2015 0-2	SB-42 SB-42-0-2 4/3/2015 0-2	SB-43 SB-43-0-2 4/3/2015 0-2	SB-43 SB-43-6-8 4/3/2015 6-8	SB-43 SB-43-0-2 4/3/2015 0-2	SB-43 SB-43-4-6 4/3/2015 4-6	SB-44 SB-44-0-2 4/3/2015 0-2	SB-44 SB-44-8-10 4/3/2015 8-10	SB-45 SB-45-0-2 4/3/2015 0-2	SB-45 SB-45-2-4 4/3/2015 2-4	SB-46 SB-46-0-2 4/3/2015 0-2	SB-46 SB-46-8-10 4/3/2015 8-10	SB-47 SB-47-0-2 4/7/2015 0-2	SB-47 SB-47-7-9 4/7/2015 7-9	SB-48 SB-48-0-2 4/3/2015 0-2
Rad (EPA 1.3)																								
Actinium-228	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW1613B)																								
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran (Qlw TDL)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF WHO	27	NSL	pg/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																								
Aluminum	1000000	NSL	mg/kg	3930	5430	2980	6980 B	2160 B	2660 B	2500 B	3560 B	5760 B	5800 B	7600 B	4840 B	5240 F2 B	3900 B	9800	7000	15000	10900	8400	2700	6100
Antimony	41	NSL	mg/kg	0.17 JB	0.99 B	0.36 B	1.0 B	0.44 B	0.36 JB	0.29 JB	2.5 B	0.40 JB	110 B	0.11 B	180 B	25 F2 B	2.4 B	110	55	4.9 B	9.3 B	580	1.8	7.0
Arsenic	3.0	3.0	mg/kg	2.0	25	4.3	3.4	3.7	1.1	1.9	31	8.6	7.3	11	3.0	2.3 B	3.5	3.9	5.8	2.5 B	30	3.9	2.5	5.9
Barium	200000	NSL	mg/kg	12	12	11	7.0	15	10	7.2	60	53	430	83	320	140 F2	13	110 B	82	26	66	190 B	9.0	140 B
Beryllium	200	NSL	mg/kg	0.35	0.26	0.26	0.16 JB	0.13 JB	0.13 JB	0.15 JB	0.51 JB	0.25 JB	0.61 B	0.63 B	0.54 JB	0.36 JB	0.32 JB	2.9	1.5	0.42	0.32 B	0.32 B	0.12 B	0.52
Cadmium	93	NSL	mg/kg	0.013 J	0.014 J	0.018 J	0.20 JB	0.24 JB	0.14 BJ	0.18 J	0.18 JB	0.067 JB	0.26 JB	0.21 JB	0.16 JB	0.49 JB	0.026 JB	0.42 JB	0.69 J	1.2	0.027 J	0.38 JB	0.027 J	11
Calcium	NSL	NSL	mg/kg	530 J	220 B	310 B	240000	150000	960	150	840	400	34000	1700	8600	11000	580	40000	7400	4900 B	36	7400	110	40000
Chromium	3160	25	mg/kg	29 B	100 B	49 B	9.0	11	13	24	18	16	18	18	14	47	15	25	34	230	20	23	22	180
Cobalt	NSL	NSL	mg/kg	0.80	0.45	1.5	3.1 B	0.78 B	0.46 B	0.44 B	4.3 B	2.3 B	2.7 B	3.2 B	2.9 B	1.6 B	3.6 B	7.9	3.8	3.6	2.0	1.0	0.43	0.8
Copper	41000	NSL	mg/kg	9.2	61	7.0	3.7	2.5	2.5	6.1	82	17	23	27	26	76	12	180	23	52	35	25	2.5	35
Iron	820000	NSL	mg/kg	2800	56000	4000	6200 B	3000 B	3800 B	12000 B	16000 B	14000 B	14000 B	16000 B	14000 B	9600 B	19000 B	27000	26000	20000	18000	32000	5000	110000
Lead	1000	NSL	mg/kg	2.5	14	2.5	3.8 B	6.6 B	2.9 B	2.3 B	150 B	69 B	49 B	45 B	68 B	120 B	2.9 B	150 B	42	2.3	5.8	250 B	2.3	15
Magnesium	NSL	NSL	mg/kg	830 B	1400 B	970 B	21000 B	2300 B	1400 B	1600 B	1100 B	900 B	2300 B	2500 B	1100 B	3000 B	2800 B	7800	4500	10000 F1	4.2	900	450	9000
Manganese	2000	NSL	mg/kg	9.6	7.5	2.0	24 B	43 B	6.6 B	38 B	45 B	16 B	180 B	240 B	160 B	240 B	72 B	630	120	310 B F2	7.4 B	31	3.5	1800 B
Nickel	2000	NSL	mg/kg	3.7	3.6	3.9	23	2.5	1.2	3.9	8.4	4	7.4	9.5	4.8	7.2	3.9	13	6.8	24	4.8	7.4	2.4	9.2
Potassium	NSL	NSL	mg/kg	380	340	82	410 B	410 B	390 B	360 B	450 B	320 B	420 B	390 B	400 B	360 B	260 B	470 B	250 B	1900 BJ	250	190 B	360 B	560
Selenium	510	NSL	mg/kg	0.13 J	0.30	0.26 J	0.30 JB	0.17 JB	0.11 B	0.31 JB	0.73 JB	0.32 JB	0.42 JB	0.42 JB	0.33 JB	0.33 JB	0.21 JB	2.0 JB	0.26 J	0.053 BJ	0.13 J	0.23 JB	0.18 J	0.71
Silver	510	NSL	mg/kg	0.020 J	0.054 J	0.027 J	0.55 J	0.14 J	0.05 J	0.18 J	0.43 J	0.12 J	0.94 J	0.56 J	0.085 J	0.35 J	0.58 J	2.1 J	0.82 J	0.25 J	0.052 J	0.16 J	0.042 J	2.1 J
Sodium	NSL	NSL	mg/kg	56 B	52 B	51 B	53 B	220 B	50 BJ	45 B	43 JB	28 JB	300 B	300 B	550 B	520 B	90 JB	1000	390	140	52 J	2200	160	52 J
Thallium	7.1	7.1	mg/kg	0.040 J	0.042 J	0.024 J	0.21 JB	0.082 JB	0.060 JB	0.063 JB	0.30 JB	0.14 JB	0.15 JB	0.16 JB	0.15 JB	0.085 JB	0.042 JB	0.35 JB	0.16 B	0.052 J	0.03 J	0.26 JB	0.043 J	0.052 J
Vanadium	180	NSL	mg/kg	6.5	72 B	9.9	12 B	14 B	5.0 B	4.9 B	23 B	20 B	45 B	47 B	23 B	120 F1 B	25 B	52	29 B	250	35	38	17 B	130
Zinc	41000	NSL	mg/kg	23	35	13	25	15	25	9.1	130	33	75	84	52	260	19	150	48	2000 J	5.4	76	4.6	87
Mercury (SW7471B)																								
Mercury	35	NSL	mg/kg	0.0039 J	0.0067 J	0.0047 J	0.0020 J	0.0051 J	0.0023 J	0.0012 J	0.01 J	0.008 J	0.016 J	0.013 J	0.006 J	0.2 J	0.0012 J	0.0070 J	0.0028 J	0.0028 J	0.0028 J	0.23 J	0.20 J	0.0029 J

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-38	SB-39	SB-39	SB-40	SB-40	SB-41	SB-41	SB-42	SB-42	SB-43	SB-43	SB-43	SB-44	SB-44	SB-45	SB-45	SB-46	SB-46	SB-47	SB-47	SB-48
			Sample Name:	SB-38 13-15	SB-39 0-2	SB-39 13-15	SB-40 0-2	SB-40 8-10	SB-41 0-2	SB-41 23-25	SB-42 0-2	SB-42 5-7	[illegible]	SB-43 0-2	SB-43 4-6	SB-44 0-2	SB-44 8-10	SB-45 0-2	SB-45 2-4	SB-46 0-2	SB-46 8-10	SB-47 0-2	SB-47 7-9	SB-48 0-2
			Date Sampled:	4/1/2015	4/1/2015	4/1/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/7/2015	4/7/2015	4/8/2015	4/8/2015	4/7/2015	4/7/2015	4/8/2015
			Parent Sample ID:										SB-43 4-6											
			Depth Interval (ft):	13-15	0-2	13-15	0-2	8-10	0-2	23-25	0-2	5-7	4-6	0-2	4-6	0-2	8-10	0-2	2-4	0-2	8-10	0-2	7-9	0-2
Analyte	MDE Non Residential Soil	ATC Eastern	Unit																					
DRO/GRO (SW8015C)																								
Diesel Range Organics	620	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	900	[illegible]	[illegible]	[illegible]	--	--	--	--	--
Gasoline Range Organics	620000	NSL	µg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--
PCBS (SW8082A)																								
Aroclor 1016	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1221	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1232	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1242	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1248	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1254	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Aroclor 1260	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]
VOCS (SW8260C)																								
1,1,1-trichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,1,2,2-tetrachloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,1,2-trichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,1-dichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,1-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,2-Dibromo-3-chloropropane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,2-dibromoethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,2-dichloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
1,2-dichloropropane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
2-butanone	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
4-methyl-2-pentanone	NSL	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Acetone	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Benzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Bromodichloromethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Bromoform	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Bromomethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Carbon disulfide	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Carbon tetrachloride	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Chlorobenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Chloroethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Chloroform	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Chloromethane	NSL	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
cis-1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
cis-1,3-dichloropropene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Dibromochloromethane	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Ethylbenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Isopropylbenzene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Methyl tert-butyl ether	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Methylene Chloride	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Styrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Tetrachloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Toluene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
trans-1,2-dichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
trans-1,3-dichloropropene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Trichloroethene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Vinyl chloride	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
Xylenes, Total	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	[illegible]	--	--	--	--	--
SVOCS (SW8270D)																								
1,2,4-trichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
1,2-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
1,3-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
1,4-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,2-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,4,5-trichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,4,6-trichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,4-dichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,4-dimethylphenol	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]
2,4-dinitrophenol	[illegible]	NSL	mg/kg	--	--	--	--	[illegible]	--	--	[illegible]	--	--	--	--	--	--	--	--	--	--	[illegible]	--	[illegible]

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	SB-38 / SB-38 13-15 / 4/1/2015 / 13-15	SB-39 / SB-39 0-2 / 4/1/2015 / 0-2	SB-39 / SB-39 13-15 / 4/1/2015 / 13-15	SB-40 / SB-40 0-2 / 4/3/2015 / 0-2	SB-40 / SB-40 8-10 / 4/3/2015 / 8-10	SB-41 / SB-41 0-2 / 4/3/2015 / 0-2	SB-41 / SB-41 13-15 / 4/3/2015 / 13-15
2,4-dinitrotoluene	200	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
2,6-dinitrotoluene	100	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
2-chlorophenol	510	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
2-methylnaphthalene	410	NSL*	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.025	0.085	0.0096	<0.0039 U
2-methylphenol	5100	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
3,3'-dichlorobenzidine	5.4	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
4-chloroaniline	430	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
4-methylphenol	530	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Acenaphthene	6100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.0026 J	0.021 J	0.0056 J	<0.0039 U
Acenaphthylene	6100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	<0.0017 U	<0.0033 U	0.0045 J	<0.0039 U
Anthracene	31000	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.0046 J	0.023 J	0.0097 J	<0.0039 U
Benzo(a)anthracene	3.9	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.013 J	0.029 J	0.0082 J	<0.0039 U
Benzo(a)pyrene	0.39	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.013 J	0.019 J	0.0026 J	<0.0039 U
Benzo(b)fluoranthene	3.9	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.017 J	0.023 J	0.0040 J	<0.0039 U
Benzo(g,h,i)perylene	3100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.012 J	0.017 J	0.0018 J	<0.0039 U
Benzo(k)fluoranthene	39	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.0056 J	0.012 J	0.0012 J	<0.0039 U
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	--	--	--	0.13 J	--	--
Carbazole	140	NSL	mg/kg	--	--	--	--	0.033 J	--	--
Chrysene	390	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.014 J	0.036	0.0046 J	<0.0039 U
Dibenz(a,h)anthracene	0.39	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	<0.0017 U	0.0035 J	<0.0045 U	<0.0039 U
Dibenzofuran	200	NSL	mg/kg	--	--	--	--	0.033 J	--	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	--	--	0.027 J	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Fluoranthene	4100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.021	0.061	0.0046	<0.0039 U
Fluorene	4100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.0040 J	0.022 J	0.0043 U	<0.0039 U
Hexachloro-1,3-butadiene	37	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Hexachloroethane	200	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Indeno(1,2,3-cd)pyrene	3.9	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.0039 J	0.022 J	0.0016 J	<0.0039 U
Isophorone	3000	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Naphthalene	2000	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.014 J	0.050	0.0064	<0.0039 U
Nitrobenzene	57	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	--	--	--	<0.033 U	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Pentachlorophenol	24	NSL	mg/kg	--	--	--	--	<0.16 U	--	--
Phenanthrene	31000	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.022	0.26	0.0070	<0.0039 U
Phenol	31000	NSL	mg/kg	--	--	--	--	<0.034 J	--	--
Pyrene	3100	NSL	mg/kg	<0.0088 U	<0.0077 U	<0.0087 U	0.018	0.062	0.0036 J	<0.0039 U
pH (SW9045D)										
pH	NSL	NSL	pH units	5.12	4.27	4.46	7.65 H	5.24 H	7.43 H	5.18 H

Analyte	SB-42 / SB-42 0-2 / 4/3/2015 / 0-2	SB-42 / SB-42 5-7 / 4/3/2015 / 5-7	SB-43 / DUP-04 / 4/3/2015 / SB-43 4-6 / 4-6	SB-43 / SB-43 0-2 / 4/3/2015 / 0-2	SB-43 / SB-43 4-6 / 4/3/2015 / 4-6	SB-44 / SB-44 0-2 / 4/3/2015 / 0-2	SB-44 / SB-44 8-10 / 4/3/2015 / 8-10
2,4-dinitrotoluene	<0.019 U	--	--	--	--	--	--
2,6-dinitrotoluene	<0.019 U	--	--	--	--	--	--
2-chloronaphthalene	<0.0039 U	--	--	--	--	--	--
2-chlorophenol	<0.019 U	--	--	--	--	--	--
2-methylnaphthalene	0.0025 J	0.00068 J	0.027	<0.0019 U	0.036	0.36	0.0054 J
2-methylphenol	<0.019 U	--	--	--	--	--	--
3,3'-dichlorobenzidine	<0.019 U	--	--	--	--	--	--
4-chloroaniline	<0.019 U	--	--	--	--	--	--
4-methylphenol	<0.019 U	--	--	--	--	--	--
Acenaphthene	0.0037 J	0.00062 J	0.022	0.044	0.031	9.2	0.0019 J
Acenaphthylene	0.0039 J	0.0015 J	0.0051 J	0.064	0.0093 J	0.14	<0.0039 U
Anthracene	0.0091	0.0019 J	0.011 J	0.044	0.021	11	0.0015 J
Benzo(a)anthracene	0.025	0.0052	0.03	0.22	0.042	**24**	0.0016 J
Benzo(a)pyrene	0.02	0.0049	0.027	0.3	0.038	**19**	<0.0039 U
Benzo(b)fluoranthene	0.05	0.0064	0.033	0.35	0.046	**45**	<0.0039 U
Benzo(g,h,i)perylene	0.017	0.0046	0.0093 J	0.098	0.022	17	0.0039 J
Benzo(k)fluoranthene	0.0086	0.0035 J	0.013 J	0.056	0.018 J	19	<0.0039 U
Bis(2-chloroethyl) ether	<0.0039 U	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	0.0041 J	--	--	--	--	--	--
Carbazole	0.0035 J	--	--	--	--	--	--
Chrysene	0.026	0.0054	0.031	0.24	0.045	22	0.0054 J
Dibenz(a,h)anthracene	0.0053	<0.0039 U	0.0050 J	0.021	<0.012 U	**3.9**	<0.0039 U
Dibenzofuran	<0.0039 U	--	--	--	--	--	--
Diethyl phthalate	0.0053 J	--	--	--	--	--	--
Di-n-butyl phthalate	<0.019 U	--	--	--	--	--	--
Fluoranthene	0.047	0.01	0.063	0.18	0.091	88	0.0054 J
Fluorene	0.0026 J	0.00067 J	0.013 J	0.025	0.017 J	5.2	0.0026 J
Hexachloro-1,3-butadiene	<0.0038 U	--	--	--	--	--	--
Hexachlorobenzene	<0.0038 U	--	--	--	--	--	--
Hexachlorocyclopentadiene	<0.019 U	--	--	--	--	--	--
Hexachloroethane	<0.019 U	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	0.014	0.0036 J	0.016 J	0.083	0.023	**12**	0.0059 J
Isophorone	<0.019 U	--	--	--	--	--	--
Naphthalene	0.0026 J	0.00082 J	0.027	0.028	0.037	1.2	0.0011 J
Nitrobenzene	<0.0038 U	--	--	--	--	--	--
N-nitrosodi-n-propylamine	<0.0038 U	--	--	--	--	--	--
N-nitrosodiphenylamine	<0.019 U	--	--	--	--	--	--
Pentachlorophenol	<0.019 U	--	--	--	--	--	--
Phenanthrene	0.028	0.0053	0.047	0.11	0.47	70	0.0045
Phenol	<0.0038 U	--	--	--	--	--	--
Pyrene	0.05	0.0076	0.042	0.15	0.056	68	0.0023 J
pH (SW9045D)							
pH	5.67 H	5.54 H	7.35 H	7.53 H	7.41 H	7.65 H	5.35 H

Analyte	SB-45 / SB-45 0-2 / 4/7/2015 / 0-2	SB-45 / SB-45 2-4 / 4/7/2015 / 2-4	SB-46 / SB-46 0-2 / 4/8/2015 / 0-2	SB-46 / SB-46 8-10 / 4/8/2015 / 8-10	SB-47 / SB-47 0-2 / 4/7/2015 / 0-2	SB-47 / SB-47 7-9 / 4/7/2015 / 7-9	SB-48 / SB-48 0-2 / 4/8/2015 / 0-2
2,4-dinitrotoluene	--	--	--	--	<0.038 U	--	<0.038 U
2,6-dinitrotoluene	--	--	--	--	<0.038 U	--	<0.038 U
2-chloronaphthalene	--	--	--	--	<0.0078 U	--	<0.0077 U
2-chlorophenol	--	--	--	--	<0.038 U	--	<0.038 U
2-methylnaphthalene	<0.0077 U	0.0063	0.023	0.0072 J	0.0064	0.0086 U	0.019
2-methylphenol	--	--	--	--	<0.038 U	--	<0.038 U
3,3'-dichlorobenzidine	--	--	--	--	<0.038 U	--	<0.038 U
4-chloroaniline	--	--	--	--	<0.038 U	--	<0.038 U
4-methylphenol	--	--	--	--	<0.038 U	--	<0.038 U
Acenaphthene	<0.0077 U	0.0050 J	0.0055 J	<0.0082 U	<0.0078 U	0.0086 U	0.0055 J
Acenaphthylene	<0.0077 U	0.016 U	0.0072 J	<0.0082 U	<0.0078 U	0.0086 U	0.0053 J
Anthracene	<0.0077 U	0.0092 J	0.018 J	<0.0082 U	<0.0078 U	0.0086 U	0.038
Benzo(a)anthracene	<0.0077 U	0.025	0.16	<0.0082 U	0.035	0.0086 U	0.054
Benzo(a)pyrene	<0.0077 U	0.024	0.16	<0.0082 U	0.029	0.0086 U	0.051
Benzo(b)fluoranthene	<0.0077 U	0.05	0.19	<0.0082 U	0.04	0.0086 U	0.056
Benzo(g,h,i)perylene	<0.0077 U	0.018	0.16	<0.0082 U	0.023	0.0086 U	0.033 F1
Benzo(k)fluoranthene	<0.0077 U	0.02	0.092	<0.0082 U	0.016	0.0086 U	0.015
Bis(2-chloroethyl) ether	--	--	--	--	<0.0078 U	--	<0.0077 U
Bis(2-ethylhexyl) phthalate	--	--	--	--	0.081	--	0.13
Carbazole	--	--	--	--	<0.0078 U	--	0.0052 J
Chrysene	<0.0077 U	0.028	0.15	<0.0082 U	0.042	<0.0086 U	0.096
Dibenz(a,h)anthracene	<0.0077 U	0.016 U	0.051	<0.0082 U	0.0074 J	0.0086 U	0.0082
Dibenzofuran	--	--	--	--	<0.038 U	--	0.038 U
Diethyl phthalate	--	--	--	--	0.038 U	--	0.079 J
Di-n-butyl phthalate	--	--	--	--	0.038 U	--	0.055 J
Fluoranthene	0.037 J	0.047	0.12	<0.0082 U	0.072	0.0086 U	0.086
Fluorene	0.077 U	0.0041 J	0.035 U	0.0082 U	<0.0078 U	0.0086 U	0.044 J
Hexachloro-1,3-butadiene	--	--	--	--	<0.0078 U	--	0.0077 U
Hexachlorobenzene	--	--	--	--	<0.0078 U	--	0.011
Hexachlorocyclopentadiene	--	--	--	--	0.038 U	--	0.038 U Q
Hexachloroethane	--	--	--	--	<0.038 U	--	0.038 U
Indeno(1,2,3-cd)pyrene	0.077 U	0.023	0.14	0.0082 U	0.018	0.0086 U	0.027
Isophorone	--	--	--	--	<0.038 U	--	0.038 U
Naphthalene	0.077 U	<0.016 U	0.059	0.016	0.0062 J	<0.0086 U	0.065
Nitrobenzene	--	--	--	--	0.038 U	--	0.038 U
N-nitrosodi-n-propylamine	--	--	--	--	<0.0078 U	--	0.0077 U
N-nitrosodiphenylamine	--	--	--	--	0.038 U	--	0.038 U
Pentachlorophenol	--	--	--	--	0.038 U	--	0.038 F1 F2
Phenanthrene	0.077 U	0.025	0.046	0.0082 U	0.052	<0.0086 U	0.053
Phenol	--	--	--	--	<0.0078 U	--	0.013
Pyrene	0.041 J	0.058	0.35	0.0082 U	0.052	<0.0086 U	0.043
pH (SW9045D)							
pH	7.56	7.45	7.64 H	7.76 H	5.25	3.12	3.21 H

Notes:
MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup
ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentrations
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
* USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Gray shaded values exceed ATC Eastern
pg/g = picogram per gram
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
B = Compound was found in the blank and sample
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
* = ISTD response or retention time outside applicable limits
E = Result exceeds calibration range
F1 = MS and/or MSD Recovery is outside acceptance limits
Q = One or more quality control criteria failed
HF = Field parameter with a holding time of 15 minutes
U = Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID:	SB-49	SB-49	SB-49	SB-50	SB-50	SB-51	SB-51	SB-52	SB-52	SB-53	SB-53	SB-53	SB-54	SB-54	SB-55	SB-55	SB-56	SB-56	SB-57	SB-57	SB-58
				Sample Name	SB-49 13-15	SB-49-0-2	SB-49-4-6	SB-50-0-2	SB-50-4-6	SB-51-0-2	SB-51-4-6	SB-52-0-2	SB-52 13-15	SB-53-0-2	SB-53-4-6	SB-53-17-19	SB-54-0-2	SB-54 13-15	SB-55-0-2	SB-55-6-8	SB-56-0-2	SB-56-18-20	SB-57-0-2	SB-57-4-6	SB-58-0-2
				Date Sampled	4/8/2015	4/8/2015	4/8/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/8/2015	4/8/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/8/2015	4/8/2015	4/9/2015	4/9/2015	4/9/2015
				Parent Sample ID												SB-53 17-19									
				Depth Interval (ft):	13-15	0-2	4-6	0-2	4-6	0-2	4-6	0-2	13-15	0-2	4-6	17-19	0-2	13-15	0-2	6-8	0-2	18-20	0-2	4-6	0-2
Radium (EPA 9315)																									
Actinium-227	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-210	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead-214	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin/Furan (SW 8413B)																									
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
1,2,3,7,8,9-hexachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--																					
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--																					
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--																					
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--																					
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
Octachlorodibenzofuran	NSL	NSL	pg/g	--																					
Octachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--																					
Dioxin TEQs, TEF, WHO	0.1	NSL	pg/g	--																					
Metals (SW 6020A)																									
Aluminum	200000	NSL	mg/kg	1960	2430	4060	4300	10000	5030	9990	22000	4210	2060 J+	24000	23000	2360	2400	1700	1800	7290	3800	400	1600	1100	2400
Antimony	82	NSL	mg/kg	0.15 J	0.27 J	0.5	0.62 J	0.55 J	2U	0.23 J	2U	0.28 J	0.31 J	2U	2U	2U	0.25 J	0.15 J	0.17 J	0.27 J	0.23 J	0.95	0.18 J	0.19 J	0.28 J
Arsenic	3.0	4.1	mg/kg	0.95 J	1.1 J	0.97 J	3.3	1.6 J	0.66 J+	0.82 J	3.4	2.1 J	1.1 J	2.8	3.3	1.2 J	1.2 J	1.7 J	1.4 J	2.6	0.98 J+	0.96 J+	1.1 J	0.76 J+	2.7
Barium	20000	NSL	mg/kg	11	14	13	6.7	19	2U	2U	130 B	13	12	11	15	11	7.7	16	9U	25 B	2U	2U	3.3	2U	2U
Beryllium	200	NSL	mg/kg	0.14 J	1.9	2.3	0.22	1.1	0.05	0.18 J	0.21	0.23	0.17 J	0.15	0.12	0.09 J	0.03 J	0.07 J	0.04 J	0.17	0.07 J	0.03 J	0.04 J	0.03 J	0.11
Cadmium	71	NSL	mg/kg	0.13 J	0.042 J	46	2U	2U	0.33	1.2	0.29 B	0.05 J	0.12	0.088 J	0.13	0.29	0.13	0.16 J	4.5	0.084 JB	0.035 J	0.05 J	0.027 J	0.013
Calcium	NSL	NSL	mg/kg	1100	2000	130000	2200	12000	5200	22000	12000	110	300	1600	920	2600	430	220	43000	120000	290	1500	990	120
Chromium	120	28	mg/kg	5.2	6.5	1900	730	2900	350	280	28	12	38	2400	24	41	25	16	2600	26	12	15	21	38
Cobalt	NSL	NSL	mg/kg	2.2	1.5	4.9	3.1	3.3	2.8	4.7	1.5	0.76 J	1.5	4.3	4.1	4.5	2.3	1.5	2.4	2.2	0.73 J	0.61	1.36	1.7
Copper	4100	NSL	mg/kg	9.3	6.9	3.4	2.7	27	2U	1.4 J	1.5	1.5	12	3.7	3.5	5.9	2U	2U	2.6	4.7	2.2	2.6	2.6	2.2
Iron	72000	NSL	mg/kg	9700	7500	7800	24000 B	44000 B	27000 B	40000 B	9000	13000	8600	28000	16000	8000	3400	12000	16000	6800	12000	4600	4000	11000
Lead	1000	NSL	mg/kg	10.3	9.5	45	18	2U	2U	18 B	2.6	4.6 B	3.7 B	3.6	2.8	3.1	2.4	2.7	5.4	2.7	2.2	2.6	2.4	2.3
Magnesium	NSL	NSL	mg/kg	961	1600	2000	1400	2300	1400	1800	2500	1300 B	2100 B	2400	930	1600	860	2700	17000	1500	82	850	98	1500
Manganese	2000	NSL	mg/kg	0.17 B	200 B	3800 B	2400 B	7300 B	2600 B	2600 B	230	35	90	5.1	13	47	12	28	7200	230	42	52	32	47
Nickel	2000	NSL	mg/kg	3.6	6.5	10	3.3	9.8	2U	3.3	2.2	1.7 J	2.3 B	9.1	5.2	9.1	4.3	3.7	9.2	4.3	1.5	0.95	1.5	3.1
Potassium	NSL	NSL	mg/kg	200 J	200 J	46	150 J	1400 J	160 J	430 JB	1200 B	200 B	190	180	280	230	160	120	760	2600 B	450 B	120	120	180
Selenium	510	NSL	mg/kg	0.63 J	0.85 J	0.22 J	0.42 J	0.83 J	0.45 J	2.2 J	0.28 J	0.21 J	0.41 J	0.58 J	0.083 J	0.63 J	0.46 J	0.65 J	1.5 J	1.2 JB	0.22 J	0.57 J	0.54 J	0.47 J
Silver	510	NSL	mg/kg	0.13 U	0.058 J	1.7	0.2	0.3	0.05 U	0.21	0.13 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	12	0.05 U	0.05 U	0.05 U	0.05 U
Sodium	NSL	NSL	mg/kg	65 J	250 J	240	58 J	210 J	160 J	320 J	130 J	120	230 B	57 J	57 J	74	4 J	58	6200	13	110 B	28	29	84
Thallium	7.2	5.6	mg/kg	0.052 J	0.13 J	0.076 J	0.041 JB	0.2 J	0.04 JB	0.21 J	0.058 JB	0.04 J	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.03 JB	0.023 J	0.03 JB
Vanadium	500	NSL	mg/kg	6.6	9.8	10	4300	1700	6600	540	640	21	45 B	52	57	52	8.2	4	38	6200	13	110 B	28	29	84
Zinc	31000	NSL	mg/kg	30	31	36	28	67	15	120	57	30	30	28 B	23 B	27	16	17	36	17	9.6	6.4	9.6	7.7	14
Mercury (SW 7471B)																									
Mercury	46	NSL	mg/kg	0.013 J	0.014 J	0.33	0.18	0.15	0.12	0.047 J	0.025 J	0.019 J	0.020 J	0.020 J	0.018 J	0.020 J	0.018 J	0.019 J	0.017 J	0.16	0.020 J	0.018 J	0.020 J	0.020 J	0.020 J

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-48	SB-49	SB-49	SB-50	SB-50	SB-51	SB-51	SB-52	SB-52	SB-53	SB-53	SB-54	SB-54	SB-54	SB-55	SB-55	SB-56	SB-56	SB-57	SB-57	SB-58
			Sample Name:	SB-48 13-15	SB-49 0-2	SB-49 4-6	SB-50 0-2	SB-50 4-6	SB-51 0-2	SB-51 3-5	SB-52 0-2	SB-52 13-15	SB-53 0-2	SB-53 5-7	DUP-17	SB-54 0-2	SB-54 11-13	SB-55 0-2	SB-55 6-8	SB-56 0-2	SB-56 18	SB-57 0-2	SB-57 4-6	SB-58 0-2
			Date Sampled:	4/8/2015	4/8/2015	4/8/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/8/2015	4/8/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/7/2015	4/7/2015	4/9/2015	4/9/2015	4/9/2015
			Parent Sample ID:												SB-54 11-13									
			Depth Interval (ft):	13-15	0-2	4-6	0-2	4-6	0-2	3-5	0-2	13-15	0-2	5-7	11-13	0-2	11-13	0-2	6-8	0-2	-	0-2	4-6	0-2
Analyte	MDE Non Residential Soil	ATC Eastern	Unit																					
DRO/GRO (SW8015C)																								
Diesel Range Organics	620	NSL	mg/kg	--	--	--	170 B	410 B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gasoline Range Organics	620	NSL	mg/kg	--	--	--	140 U	370	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBS (SW8082A)																								
Aroclor 1016	41	NSL	mg/kg	<0.0047 U	<0.0049 U	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0046 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Aroclor 1221	1.4	NSL	mg/kg	<0.0047 U	<0.0049 U	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0046 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Aroclor 1232	1.4	NSL	mg/kg	<0.0047 U	<0.0049 U	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0046 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Aroclor 1242	4	NSL	mg/kg	<0.0047 U	<0.0049 U	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0046 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	0.05	<0.0047 U	--
Aroclor 1248	1.4	NSL	mg/kg	<0.0047 U	<0.0049 U	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0045 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Aroclor 1254	1.4	NSL	mg/kg	<0.0047 U	0.0060	<0.0098 U	<0.0059 U	<0.011 U	<0.0053 U	<0.0062 U	<0.0045 U	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Aroclor 1260	1.4	NSL	mg/kg	<0.0047 U	0.0084	<0.0098 U	<0.0059 U	<0.011 U	0.072	<0.0062 U	0.023	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	<0.0047 U	<0.0047 U	--
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	<0.0047 U	0.014	<0.0098 U	<0.0059 U	<0.011 U	0.072	<0.0062 U	0.023	<0.0049 U	<0.0050 U	<0.0050 U	--	--	--	--	--	--	--	0.05	<0.0047 U	--
VOCS (SW8260C)																								
1,1,1-trichloroethane	280000	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-tetrachloroethane	8	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-trichloroethane	50	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-dichloroethane	2000	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-dichloroethene	1100	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dibromo-3-chloropropane	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dibromoethane	1.4	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dichloroethane	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dichloroethene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-dichloropropane	42	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-hexanone	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-methyl-2-pentanone	NSL	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	[illegible]	NSL	mg/kg	--	--	--	<0.022 U	<0.083 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	52	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	46	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	0.0078 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	22	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	NSL	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-dichloroethene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-dichloropropene	29	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	34	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-butyl ether	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	[illegible]	NSL	mg/kg	--	--	--	0.0033 JB	0.011 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	8200	NSL	mg/kg	--	--	--	0.0012 JB	0.0065 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-dichloroethene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-dichloropropene	29	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	[illegible]	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	2	NSL	mg/kg	--	--	--	<0.0056 U	<0.021 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	[illegible]	NSL	mg/kg	--	--	--	<0.017 U	<0.063 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCS (SW8270D)																								
1,2,4-trichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
1,2-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
1,3-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
1,4-dichlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
2,2-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0076 U	--	--
2,4,5-trichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
2,4-dichlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0076 U	--	--
2,4-dimethylphenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.057 U	--	--
2,4-dinitrophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.19 U	--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

			Location ID:	SB-48	SB-49	SB-49	SB-50	SB-50	SB-51	SB-51	SB-52	SB-52	SB-53	SB-53	SB-54	SB-54	SB-54	SB-55	SB-55	SB-56	SB-56	SB-57	SB-57	SB-58
			Sample Name:	SB-48 13-15	SB-49 0-2	SB-49 4-6	SB-50 0-2	SB-50 4-6	SB-51 0-2	SB-51 3-5	SB-52 0-2	SB-52 13-15	SB-53 0-2	SB-53 5-7	DUP-17	SB-54 0-2	SB-54 11-13	SB-55 0-2	SB-55 6-8	SB-56 0-2	SB-56 18	SB-57 0-2	SB-57 4-6	SB-58 0-2
			Date Sampled:	4/8/2015	4/8/2015	4/8/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/7/2015	4/7/2015	4/8/2015	4/8/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/9/2015	4/7/2015	4/7/2015	4/9/2015	4/9/2015	4/9/2015
			Parent Sample ID:												SB-54 11-13									
			Depth Interval (ft):	13-15	0-2	4-6	0-2	4-6	0-2	3-5	0-2	13-15	0-2	5-7	11-13	0-2	11-13	0-2	6-8	0-2	-	0-2	4-6	0-2
Analyte	**MDE Non Residential Soil**	**ATC Eastern**	**Unit**																					
2,4-dinitrotoluene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
2,6-dinitrotoluene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
2-chloronaphthalene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
2-chlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
2-methylnaphthalene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-methylphenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
3,3'-dichlorobenzidine	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
4-chloroaniline	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
4-methylphenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Acenaphthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthylene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[b]fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[g,h,i]perylene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[k]fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-chloroethyl) ether	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Bis(2-ethylhexyl) phthalate	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Carbazole	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Chrysene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz[a,h]anthracene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenzofuran	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Diethyl phthalate	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Di-n-butyl phthalate	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Fluoranthene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloro-1,3-butadiene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Hexachlorobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Hexachlorocyclopentadiene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Hexachloroethane	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Indeno[1,2,3-cd]pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Isophorone	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Naphthalene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrobenzene	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
N-nitroso-di-n-propylamine	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
N-nitrosodiphenylamine	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Pentachlorophenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Phenanthrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenol	[illegible]	NSL	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	[illegible]	--	--
Pyrene	[illegible]	NSL	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
pH (SW 9045D)																								
pH	NSL	NSL	pH units	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes:
MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 non-residential cleanup [illegible]
ATC Eastern - Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
* USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded values exceed MDE Non-Res
Grey shaded values exceed ATC Eastern
µg/g - micrograms per gram
mg/kg - milligrams per kilogram
ng/kg - nanograms per kilogram
B - Compound was found in the blank and sample
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an
* - ISTD response or retention time outside applicable limits
E - Result exceeds calibration range
F1 - MS and/or MSD Recovery is outside acceptance limits
Q - One or more quality control criteria failed
HF - Field parameter with a holding time of 15 minutes
U - Not Detected

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID: SB-58 Sample Name: SB-58 11-13 Date Sampled: 4/9/2015 Parent Sample ID: Depth Interval (ft): 11-13	SB-59 SB-59 0-2 4/9/2015 0-2	SB-59 SB-59 4-6 4/9/2015 4-6	SB-60 DUP-20 4/10/2015 SB-60 0-2 0-2	SB-60 SB-60 0-2 4/10/2015 0-2	SB-60 SB-60 12-14 4/10/2015 12-14	SB-61 SB-61 0-2 4/9/2015 0-2	SB-61 SB-61 4-6 4/9/2015 4-6
Rad (E901.1)											
Actinium-228	NSL	NSL	pCi/g	--	1.42	--	0.909	0.824	--	--	--
Bismuth-212	NSL	NSL	pCi/g	--	--	--	--	1.46	--	--	--
Bismuth-214	NSL	NSL	pCi/g	--	1.14	--	0.259	0.281	--	--	--
Cesium-137	NSL	NSL	pCi/g	--	0.0261	--	0.0261	0.0261	--	--	--
Potassium-40	NSL	NSL	pCi/g	--	4.49	--	1.82	--	--	--	--
Lead-212	NSL	NSL	pCi/g	--	1.5	--	0.356	0.503	--	--	--
Lead-214	NSL	NSL	pCi/g	--	1.1	--	0.256	--	--	--	--
Thallium-208	NSL	NSL	pCi/g	--	0.574	--	0.174	0.145	--	--	--
Dioxin/Furan (SW6413B)											
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin (HxCDD)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran (PeCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-octachlorodibenzofuran (OCDF)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin (OCDD)	NSL	NSL	pg/g	--	--	--	--	--	--	--	--
Dioxin TEQs, TEF WHO	---	NSL	pg/g	--	--	--	--	--	--	--	--
Metals (SW6020A)											
Aluminum	77000+	NSL	mg/kg	7200	25000	19000	24000	3200	37000	4200	25000
Antimony	47	NSL	mg/kg	0.23 J	0.33 J	0.19 J	0.062 J	0.026 J	1.6 J[F1]	37 B	**43 B**
Arsenic	3.8	5.6	mg/kg	2.9	5.1	2.5	3	2.6	**8.0 F1[2]**	**16**	**14**
Barium	22000+	NSL	mg/kg	7.9	11	17	7.9	7.4	6.7	68	67
Beryllium	230+	NSL	mg/kg	1.2	0.76	0.58	0.053 J	0.053 J	0.22	0.59 J	0.85 J
Cadmium	93	NSL	mg/kg	0.13	0.13	0.12	0.021 J	0.03	0.17 J	0.46 JB	0.21 JB
Calcium	NSL	NSL	mg/kg	990	290	240	3500	3600	55	9800 B	9800 B
Chromium	230+	26	mg/kg	12	42	30	9.9	1.9	24 F1	100	230
Cobalt	1400+	NSL	mg/kg	1.5	6.8e	4.5e	0.56	1.52	1.9	2.7 B	5.2 B
Copper	8100+	NSL	mg/kg	5.6	13	11	4.9	2.2	11 F1[F]	64	56
Iron	72000+	NSL	mg/kg	16000	28000	24000	2200 B	2400 B	36000 B	46000 B	45000 B
Lead	1000+	NSL	mg/kg	4.1	4.8	3.3	1.2	3.6	2.8 F1	120	120
Magnesium	NSL	NSL	mg/kg	1600	1200	1000	920	300	340	5600 B	4100 B
Manganese	2400+	NSL	mg/kg	46	55	32	27 B	23 B	11 B	580 B	580 B
Nickel	2600+	NSL	mg/kg	4.6	18	12	2.4	1.9	10 F1	37 B	45 B
Potassium	NSL	NSL	mg/kg	2400	1800	1600	1200 B	1500 B	2100 B	4800 B	3800 B
Selenium	310+	NSL	mg/kg	0.53 J	0.53 J	0.38 J	0.09 J	0.2 J	0.13 J	0.32 J	0.41 J
Silver	310+	NSL	mg/kg	0.063 J	0.083 J	0.026 J	0.051 J	0.13 J	0.047 J	0.38 J	0.26 J
Sodium	NSL	NSL	mg/kg	120	210	90	54 J	17 J	17 J	820	1000
Thallium	5.2+	2.6	mg/kg	0.041 J	0.042 J	0.035 J	0.029 JB	0.015 JB	0.042 JB	0.23 J	0.19 J
Vanadium	1100+	NSL	mg/kg	20	62	47	3.1	2.1	5	370	540
Zinc	47000+	NSL	mg/kg	13	69	53	3.6	3.2	9.1	93	60
Mercury (SW7471B)											
Mercury	35	NSL	mg/kg	0.0059	0.0063	0.0057	0.0021	0.0022 J	0.0029	0.24	0.19

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non-Residential Soil	ATC_Eastern	Unit	Location ID	SB-58	SB-59	SB-60	SB-61	SB-62	SB-63	SB-64	SB-65	SB-66
				Sample Name	SB-58-11-13	SB-59-6-8	SB-60-4-6	SB-61-10-12	SB-62-12-14	SB-63-10-12	SB-64-10-12	SB-65-4-6	SB-66-4-6
				Date Sampled	4/8/2015	4/9/2015	4/9/2015	4/10/2015	4/10/2015	4/9/2015	4/10/2015	4/8/2015	4/8/2015
				Parent Sample ID				SB-60-4-6					
				Depth Interval (ft)	11-13	6-8	4-6	10-12	12-14	10-12	10-12	4-6	4-6
ORGOGRO (SW8015C)													
Diesel Range Organics	820	NS	mg/kg			--						320	280
Gasoline Range Organics	6,200	NS	ug/kg			--						1,250 J	330 J
PCBS (SW8082 A)													
Aroclor 1016	41	NS	mg/kg			0.0356 U	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1221	1.4	NS	mg/kg			0.0356 U	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1232	1.4	NS	mg/kg			0.0356 U	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1242	2.4	NS	mg/kg			0.0356 J [D]	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1248	2.4	NS	mg/kg			0.0356 U	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1254	1.4	NS	mg/kg			0.0356 U	0.0407 U	0.0425 U	0.0382 U	0.0403 U	0.0382 U	0.0382 U	0.0377 U
Aroclor 1260	1.4	NS	mg/kg			0.0712	0.0814	0.0849 U	0.0765 U	0.0806 U	0.0765 U	0.0765 U	0.0755 U
Total Polychlorinated Biphenols	1.4	NS	mg/kg			0.0712 J [D]	0.0814 U	0.0849 U	0.0765 U	0.0806 U	0.0765 U	0.0765 U	0.0755 U
VOCS (SW8260C)													
1,1,1,2-Tetrachloroethane	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,1,1-Trichloroethane	14	NS	mg/kg									0.00423 U	0.00421 U
1,1,2,2-Tetrachloroethane	5.6	NS	mg/kg									0.00423 U	0.00421 U
1,1,2-Trichloroethane	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,1-Dichloroethane	5,600	NS	mg/kg									0.00423 U	0.00421 U
1,1-Dichloroethene	14	NS	mg/kg									0.00423 U	0.00421 U
1,1-Dichloropropene	37	NS	mg/kg									0.00423 U	0.00421 U
1,2,3-Trichlorobenzene	820	NS	mg/kg									0.00423 U	0.00421 U
1,2,3-Trichloropropane	42	NS	mg/kg									0.00423 U	0.00421 U
1,2,4-Trichlorobenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,2,4-Trimethylbenzene	NS	NS	mg/kg									0.00423 U	0.00421 U
1,2-Dibromo-3-chloropropane	2.9	NS	mg/kg									0.00423 U	0.00421 U
1,2-Dibromoethane	0.36	NS	mg/kg									0.00423 U	0.00421 U
1,2-Dichlorobenzene	9,200	NS	mg/kg									0.00423 U	0.00421 U
1,2-Dichloroethane	2.1	NS	mg/kg									0.00423 U	0.00421 U
1,2-Dichloropropane	5.2	NS	mg/kg									0.00423 U	0.00421 U
1,3,5-Trimethylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,3-Dichlorobenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,3-Dichloropropane	2,900	NS	mg/kg									0.00423 U	0.00421 U
1,4-Dichlorobenzene	2.6	NS	mg/kg									0.00423 U	0.00421 U
2,2-Dichloropropane	NS	NS	mg/kg									0.00423 U	0.00421 U
2-Butanone	23,000	NS	mg/kg									0.00423 U	0.00421 U
2-Chlorotoluene	2,900	NS	mg/kg									0.00423 U	0.00421 U
2-Hexanone	200	NS	mg/kg									0.00423 U	0.00421 U
4-Chlorotoluene	2,900	NS	mg/kg									0.00423 U	0.00421 U
4-Isopropyltoluene	NS	NS	mg/kg									0.00423 U	0.00421 U
4-Methyl-2-pentanone	5,600	NS	mg/kg									0.00423 U	0.00421 U
Acetone	92,000	NS	mg/kg									0.0127 J	0.0126 J
Benzene	4.5	NS	mg/kg									0.00423 U	0.00421 U
Bromochloromethane	46	NS	mg/kg									0.00423 U	0.00421 U
Bromoform	360	NS	mg/kg									0.00423 U	0.00421 U
Bromomethane	130	NS	mg/kg									0.00423 U	0.00421 U
Carbon disulfide	1,000	NS	mg/kg									0.00423 U	0.00421 U
Carbon tetrachloride	3.1	NS	mg/kg									0.00423 U	0.00421 U
Chlorobenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
Chloroethane	NS	NS	mg/kg									0.00423 U	0.00421 U
Chloroform	2,900	NS	mg/kg									0.00423 U	0.00421 U
Chloromethane	NS	NS	mg/kg									0.00423 U	0.00421 U
cis-1,2-dichloroethene	570	NS	mg/kg									0.00423 U	0.00421 U
cis-1,3-dichloropropene	20	NS	mg/kg									0.00423 U	0.00421 U
Dibromochloromethane	56	NS	mg/kg									0.00423 U	0.00421 U
Dibromomethane	1,000	NS	mg/kg									0.00423 U	0.00421 U
Dichlorodifluoromethane	18,000	NS	mg/kg									0.00423 U	0.00421 U
Diethyl ether (ethyl ether)	370	NS	mg/kg									0.00423 U	0.00421 U
Ethylene dibromide	NS	NS	mg/kg									0.00423 U	0.00421 U
Hexane	2,000	NS	mg/kg									0.00423 U	0.00421 U
Isopropylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
Methyl tert-butyl ether	820	NS	mg/kg									0.00423 U	0.00421 U
Methylene chloride	90	NS	mg/kg									0.00423 U	0.00421 U
Naphthalene	2,900	NS	mg/kg									0.00423 U	0.00421 U
n-Butylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
n-Propylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
sec-Butylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
Styrene	20,000	NS	mg/kg									0.00423 U	0.00421 U
tert-Butylbenzene	2,900	NS	mg/kg									0.00423 U	0.00421 U
Tetrachloroethene	37	NS	mg/kg									0.00423 U	0.00421 U
Toluene	820	NS	mg/kg									0.00423 U	0.00421 U
trans-1,2-dichloroethene	700	NS	mg/kg									0.00423 U	0.00421 U
trans-1,3-dichloropropene	20	NS	mg/kg									0.00423 U	0.00421 U
Trichloroethene	7.2	NS	mg/kg									0.00423 U	0.00421 U
Trichlorofluoromethane	4	NS	mg/kg									0.00423 U	0.00421 U
Xylenes, Total	20,000	NS	mg/kg									0.00635 U	0.00632 U
SVOCS (SW8270D)													
1,2-dichlorobenzene	2,900	NS	mg/kg									--	--
1,3-dichlorobenzene	820	NS	mg/kg									--	--
1,4-dichlorobenzene	3.1	NS	mg/kg									--	--
2,4,5-trichlorophenol	100,000	NS	mg/kg									--	--
2,4,6-trichlorophenol	2,900	NS	mg/kg									--	--
2,4-dichlorophenol	820	NS	mg/kg									--	--
2,4-dimethylphenol	2,900	NS	mg/kg									--	--
2,4-dinitrophenol	2,900	NS	mg/kg									--	--

Table D-7
Cristal USA Facility
Site-Wide Sampling Grid

Analyte	MDE Non Residential Soil	ATC Eastern	Unit	Location ID:	SB-58	SB-59	SB-59	SB-60	SB-60	SB-60	SB-60	SB-61	SB-61
				Sample Name:	SB-58-11-13	SB-59-0-2	SB-59-4-6	DUP-201	SB-60-0-2	SB-60-12-14	SB-60-4-6	SB-61-0-2	SB-61-4-6
				Date Sampled:	4/9/2015	4/9/2015	4/9/2015	4/10/2015	4/10/2015	4/10/2015	4/13/2015	4/13/2015	4/13/2015
				Parent Sample ID:				SB-60-0-2					
				Depth Interval (ft):	11-13	0-2	4-6	0-2	0-2	12-14	4-6	0-2	4-6
1-methylnaphthalene	2700	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2-chloronaphthalene	5100	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2-chlorophenol	210	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg		0.0192	0.0192	0.0189 J	0.0192 U	0.0192 U	0.0189 U	0.0276	0.0192	0.0192
2-methylphenol	5100	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2,3,4,6-tetrachlorophenol	4	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2,4-dichlorophenol	210	NSL	mg/kg		--	--	--	--	--	--	--	--	--
2,4-dimethylphenol	1200	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Acenaphthene	3600	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 J	0.0192 U	0.0192 U	0.0189 U	0.033	0.0192 U	0.0192 U
Acenaphthylene	3600	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0192 U	0.0192 U	0.0189 U	0.0276 U	0.0192 U	0.0192 U
Anthracene	18000	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0192 U	0.0192 U	0.0189 U	0.0661	0.0192 U	0.0192 U
Benzo[a]anthracene	5.8	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0204 J	0.0192 U	0.0189 U	0.12	0.0192 U	0.0192 U
Benzo[a]pyrene	0.58	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0204 J	0.0192 U	0.0189 U	0.12	0.0192 U	0.0192 U
Benzo[b]fluoranthene	5.8	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0255 J	0.0192 U	0.0189 U	0.12	0.0192 U	0.0192 U
Benzo[g,h,i]perylene	1800	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0242 J	0.0192 U	0.0189 U	0.07	0.0192 U	0.0192 U
Benzo[k]fluoranthene	58	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0153 J	0.0192 U	0.0189 U	0.0827	0.0192 U	0.0192 U
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	390	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Carbazole	140	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Chrysene	580	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 J	0.0229 J	0.0192 U	0.0189 U	0.125	0.0192 U	0.0192 U
Dibenz[a,h]anthracene	0.58	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0192 U	0.0192 U	0.0189 U	0.0331 J	0.0192 U	0.0192 U
Dibenzofuran	78	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Diethyl phthalate	52000	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	26000	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Fluoranthene	2400	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 J	0.0242 J	0.0192 U	0.0189 U	0.23	0.0192 U	0.0192 U
Fluorene	2400	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.0192 U	0.0192 U	0.0189 U	0.0241	0.0192 U	0.0192 U
Hexachloro-1,3-butadiene	37	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Hexachlorobenzene	2.9	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	410	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Hexachloroethane	180	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	5.8	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 U	0.025 J	0.0192 U	0.0189 U	0.0962	0.0192 U	0.0192 U
Isophorone	8600	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Naphthalene	3000	NSL	mg/kg		0.024	0.0192 U	0.0189 U	0.0192 U	0.0192 U	0.0189 U	0.0248	0.0192 U	0.0192 U
Nitrobenzene	51	NSL	mg/kg		--	--	--	--	--	--	--	--	--
N-nitroso-di-n-propylamine	0.37	NSL	mg/kg		--	--	--	--	--	--	--	--	--
N-nitrosodiphenylamine	780	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Pentachlorophenol	2.9	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Phenanthrene	18000	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 J	0.0192 U	0.0192 U	0.0189 U	0.24	0.0192 U	0.0192 U
Phenol	31000	NSL	mg/kg		--	--	--	--	--	--	--	--	--
Pyrene	1800	NSL	mg/kg		0.0192 U	0.0192 U	0.0189 J	0.0229 J	0.0192 U	0.0189 U	0.176	0.0192 U	0.0192 U
pH (SW-9045D)													
pH	NSL	NSL	pH units		4.49 H	4.04 H	4.04 H	7.64 H	7.76 H	8.33 H	7.01 H	7.99 H	

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup

ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil cleanup level for Mercury is the Methyl Mercury value

USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Grey shaded values exceed ATC Eastern

pg/g = picograms per gram

mg/kg = milligrams per kilogram

ng/kg = nanograms per kilogram

J= Compound was found in the blank and sample

J = Result is less than the RL, but greater than or equal to the MDL and the concentration is an

* = LCS/D response or retention time outside applicable limits

R = Result exceeds calibration range

H = Mdl and/or MDL Recovery is outside acceptance limits

Q = One or more quality control criteria failed

H = Field parameter with a holding time of 15 minutes

U = Not Detected

Table D-8
Cristal USA Facility
Spent Solvent Storage Area

			Location ID:	SS-01	SS-01 to SS-06	SS-01	SS-01	SS-02	SS-02	SS-03	SS-03	SS-04	SS-04	SS-05	SS-05	SS-06	SS-06
			Sample Name:	DUP-07	SS 01-06	SS-01 0-2	SS-01 6-8	SS-02 0-2	SS-02 13-15	SS-03 0-2	SS-03 4-6	SS-04 0-2	SS-04 13-15	SS-05 1-3	SS-05 6-8	SS-06 1-3	SS-06 5-7
			Date Sampled:	4/2/2015	4/10/2015	4/2/2015	4/2/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015
			Parent Sample ID:	SS-01 6-8													
			Depth Interval (ft):	6-8	-	0-2	6-8	0-2	13-15	0-2	4-6	0-2	13-15	1-3	6-8	1-3	5-7
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**														
Dioxin/Furan (SW1613B)																	
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g	--	51 B	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	33 B	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g	--	2.6 BJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	1.3 CJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	0.30 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	0.71 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	2.5 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g	--	0.36 QJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	2.4 CJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	0.31 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	0.27 QBJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g	--	0.56 QJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g	--	< 4.8 U	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	NSL	pg/g	--	0.14 QJ	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g	--	0.054 QJ	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-p-dioxin)	NSL	NSL	pg/g	--	3700 B	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g	--	52 B	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF WHO	22	NSL	pg/g	--	2.4e-16	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																	
Aluminum	100000	NSL	mg/kg	5000	--	12000	6000	8700	2200	630	2600	2300	3100	8500	1400	2500	2300
Antimony	41	NSL	mg/kg	0.17 BFJ	--	0.13 J	0.35	0.11 J	0.29	0.48	0.065 J	0.85	0.36 J	0.28 B	0.060 J	1.4	0.28
Arsenic	3.9	3.6	mg/kg	**3.7 FJ**	--	**4.6**	**6.9**	**3.4**	**3.7**	0.93	**3.1**	2.2	**11**	**4.7**	2.0	**3.7**	**8.9**
Barium	20000	NSL	mg/kg	17	--	28	21	36	13	5.8	19	28	18	58	15	26	15
Beryllium	200	NSL	mg/kg	0.36	--	0.29	0.67	0.49	1.1	0.022 J	0.084 J	0.29	0.92 J	0.70	0.041 J	0.030 J	0.050 J
Cadmium	51	NSL	mg/kg	0.034 J	--	0.026 J	0.068 J	0.027 J	0.0080 J	0.041 J	0.0084 J	0.150	< 1.2 U	0.11	0.015 J	0.012 J	0.033 J
Calcium	NSL	NSL	mg/kg	9500	--	1400	5800	2100	170	14000	420	24000	570 J	14000	520	490	370
Chromium	510	28	mg/kg	23	--	**35**	**38**	14	**53**	4.2	11	27	**61**	18	6.6	16	**29**
Cobalt	NSL	NSL	mg/kg	5.5	--	3.9	3.7	3.5	1.8	0.34	0.75	3.9	1.3	2.9	0.27	0.69	0.75
Copper	4100	NSL	mg/kg	18	--	15	20	10	8.3	4.6	3.5	31	15	15	4.2	10	10
Iron	72000	NSL	mg/kg	15000	--	23000	33000	11000 B	36000 B	2300 B	9500 B	18000 B	**87000 B**	13000	1500	17000	23000
Lead	1000	NSL	mg/kg	9.9	--	9.8	16	11	11	5.9	6.8	23	17	22	4.4	**4300**	130
Magnesium	NSL	NSL	mg/kg	370	--	350	450	1400	220	4300	210	1200	240 J	2700 B	130	89	93
Manganese	2000	NSL	mg/kg	36	--	24	35	43 B	27 B	30 B	17 B	150 B	34 B	500	4.7	7.5	8.1
Nickel	2000	NSL	mg/kg	8.0	--	8.7	9.0	6.7	4.1	1.3	2.0	8.2	3.8	5.9 B	0.99	2.1	1.9
Potassium	NSL	NSL	mg/kg	280	--	410	310	450 B	110 B	130 B	300 B	250 B	240 BJ	530 B	250	1900	1800
Selenium	510	NSL	mg/kg	0.24 BFJ	--	0.20 J	0.24 J	0.28 J	0.25 J	0.067 J	0.13 J	0.38 J	< 5.8 U	0.89	0.095 J	0.12 J	0.31 J
Silver	510	NSL	mg/kg	0.0055 J	--	0.011 J	0.013 J	0.022 J	0.0077 J	< 0.12 U	0.0050 J	0.030 J	< 1.2 U	0.089 J	0.0065 J	0.085 J	0.019 J
Sodium	NSL	NSL	mg/kg	120 B	--	400 B	96 B	140	160	33 J	110	230	560	220	27 B	110 B	160 B
Thallium	7.2	3.9	mg/kg	0.048 J	--	0.10 J	0.057 J	0.10 BJ	0.026 BJ	0.0060 BJ	0.068 BJ	0.030 BJ	0.025 BJ	0.16 J	0.038 J	0.027 J	0.031 J
Vanadium	100	NSL	mg/kg	47	--	67	74	24	83	8.3	20	45	**110**	31 B	6.9	28	44
Zinc	31000	NSL	mg/kg	51	--	44	40	23	4.6	33	5.2	190	6.6	29	3.5	5.9	4.9
Mercury (SW7471B)																	

Table D-8
Cristal USA Facility
Spent Solvent Storage Area

Location ID:				SS-01	SS-01 to SS-06	SS-01	SS-01	SS-02	SS-02	SS-03	SS-03	SS-04	SS-04	SS-05	SS-05	SS-06	SS-06
Sample Name:				DUP-07	SS 01-06	SS-01 0-2	SS-01 6-8	SS-02 0-2	SS-02 13-15	SS-03 0-2	SS-03 4-6	SS-04 0-2	SS-04 13-15	SS-05 1-3	SS-05 6-8	SS-06 1-3	SS-06 5-7
Date Sampled:				4/2/2015	4/10/2015	4/2/2015	4/2/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015
Parent Sample ID:				SS-01 6-8	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth Interval (ft):				6-8	-	0-2	6-8	0-2	13-15	0-2	4-6	0-2	13-15	1-3	6-8	1-3	5-7
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**														
Mercury	10	NSL	mg/kg	0.018 J	--	0.10	0.022 J	< 0.037 U	< 0.037 U	< 0.039 U	< 0.036 U	< 0.038 U	< 0.039 U	0.024 J	< 0.036 U	1.7	0.34
DRO/GRO (SW8015C)																	
Diesel Range Organics	620	NSL	mg/kg	**3400 B**	--	**1000 B**	**3600 B**	--	--	--	--	--	--	190 B	16 JB	120 B	13 JB
Gasoline Range Organics	620000	NSL	µg/kg	81 J	--	< 1200 U	57 J	--	--	--	--	--	--	< 1200 U	< 1200 U	66 J	< 1200 U
PCBS (SW8082A)																	
Aroclor 1016	41	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1221	1.4	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1232	1.4	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1242	1.4	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1248	1.4	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1254	1.4	NSL	mg/kg	--	--	--	--	--	--	< 0.00098 U	< 0.00096 U	--	--	--	--	--	--
Aroclor 1260	1.4	NSL	mg/kg	--	--	--	--	--	--	0.0021	< 0.00096 U	--	--	--	--	--	--
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	--	--	--	--	--	--	0.0021	< 0.00096 U	--	--	--	--	--	--
VOCS (SW8260C)																	
1,1,1-trichloroethane	200000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,1,2,2-tetrachloroethane	14	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,1,2-trichloroethane	50	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,1-dichloroethane	20000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,1-dichloroethene	5100	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,2-Dibromo-3-chloropropane	3.6	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U*	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,2-dibromoethane	1.4	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,2-dichloroethane	31	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,2-dichloroethene	920	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
1,2-dichloropropane	42	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
2-butanone	61000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
4-methyl-2-pentanone	NSL	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Acetone	92000	NSL	mg/kg	< 0.016 U	--	< 0.016 U	< 0.017 U	< 0.017 U	< 0.019 U	< 0.024 U	< 0.019 U	< 0.022 U	< 0.018 U	< 0.021 U	< 0.017 U	< 0.016 U	< 0.017 U
Benzene	52	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	0.00061 J	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Bromodichloromethane	46	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Bromoform	360	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Bromomethane	140	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Carbon disulfide	10000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	0.0013 J	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Carbon tetrachloride	22	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Chlorobenzene	2000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Chloroethane	990	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Chloroform	1000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Chloromethane	NSL	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
cis-1,2-dichloroethene	1000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
cis-1,3-dichloropropene	29	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Dibromochloromethane	34	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Ethylbenzene	10000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	0.0013 J	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Isopropylbenzene	16000	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Methyl tert-butyl ether	720	NSL	mg/kg	< 0.0040 U	--	< 0.0039 U	< 0.0043 U	< 0.0044 U	< 0.0048 U	< 0.0060 U	< 0.0048 U	< 0.0054 U	< 0.0045 U	< 0.0052 U	< 0.0044 U	< 0.0041 U	< 0.0042 U
Methylene Chloride	380	NSL	mg/kg	0.0027 JB	--	0.0018 JB	0.0024 JB	0.0025 JB	0.0023 JB	0.0030 JB	0.0022 JB	0.0034 JB	0.0024 JB	0.0011 JB	0.0018 JB	0.0017 JB	0.0018 JB

Table D-8
Cristal USA Facility
Spent Solvent Storage Area

			Location ID:	SS-01	SS-01 to SS-06	SS-01	SS-01	SS-02	SS-02	SS-03	SS-03	SS-04	SS-04	SS-05	SS-05	SS-06	SS-06
			Sample Name:	DUP-07	SS 01-06	SS-01 0-2	SS-01 6-8	SS-02 0-2	SS-02 13-15	SS-03 0-2	SS-03 4-6	SS-04 0-2	SS-04 13-15	SS-05 1-3	SS-05 6-8	SS-06 1-3	SS-06 5-7
			Date Sampled:	4/2/2015	4/10/2015	4/2/2015	4/2/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015
			Parent Sample ID:	SS-01 6-8													
			Depth Interval (ft):	6-8	-	0-2	6-8	0-2	13-15	0-2	4-6	0-2	13-15	1-3	6-8	1-3	5-7
Analyte	MDE Non-Residential Soil	ATC Eastern	Unit														
Styrene	20000	NSL	mg/kg	< 0.0040 UJ	--	< 0.0039 UJ	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
Tetrachloroethene	5.2	NSL	mg/kg	0.0021 J	--	0.004	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
Toluene	8200	NSL	mg/kg	< 0.0040 UJ	--	< 0.0039 UJ	0.0015 J	0.00893 JB	0.00898 JB	0.0013 JB	0.0013 JB	0.0011 JB	0.00096 JB	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
trans-1,2-dichloroethene	2000	NSL	mg/kg	< 0.0040 UJ	--	< 0.0039 UJ	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
trans-1,3-dichloropropene	29	NSL	mg/kg	< 0.0040 UJ	--	< 0.0039 UJ	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
Trichloroethene	7.2	NSL	mg/kg	0.00053 J	--	0.0014 J	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
Vinyl chloride	4	NSL	mg/kg	< 0.0040 UJ	--	< 0.0039 UJ	< 0.0043 UJ	< 0.0044 UJ	< 0.0048 UJ	< 0.0060 UJ	< 0.0048 UJ	< 0.0054 UJ	< 0.0045 UJ	< 0.0052 UJ	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 UJ
Xylenes, Total	20000	NSL	mg/kg	< 0.012 UJ	--	< 0.012 UJ	0.0066 J	< 0.013 UJ	< 0.014 UJ	< 0.018 UJ	< 0.014 UJ	< 0.016 UJ	< 0.014 UJ	< 0.015 UJ	< 0.013 UJ	< 0.012 UJ	< 0.013 UJ
SVOCS (SW8270D)																	
1,2,4-trichlorobenzene	1000	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
1,2-dichlorobenzene	9200	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
1,3-dichlorobenzene	310	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
1,4-dichlorobenzene	120	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2,2-oxybis(1-chloropropane)	NSL	NSL	mg/kg	--	--	< 0.0077 UJ	--	--	--	--	--	--	--	--	--	< 0.0070 UJ	--
2,4,5-trichlorophenol	39000	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2,4,6-trichlorophenol	260	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2,4-dichlorophenol	310	NSL	mg/kg	--	--	< 0.0077 UJ	--	--	--	--	--	--	--	--	--	< 0.0070 UJ	--
2,4-dimethylphenol	2000	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2,4-dinitrophenol	200	NSL	mg/kg	--	--	< 0.2 UJ	--	--	--	--	--	--	--	--	--	< 0.18 UJ	--
2,4-dinitrotoluene	290	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2,6-dinitrotoluene	190	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2-chloronaphthalene	8200	NSL	mg/kg	--	--	< 0.0077 UJ	--	--	--	--	--	--	--	--	--	< 0.0070 UJ	--
2-chlorophenol	510	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
2-methylnaphthalene	410	NSL	mg/kg	0.016 J	--	0.021 J	0.015 J	0.043	< 0.0077 UJ	0.22	< 0.0079 UJ	0.03 J	< 0.0079 UJ	< 0.079 UJ	< 0.0078 UJ	< 0.0070 UJ	< 0.0079 UJ
2-methylphenol	5100	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
3,3-dichlorobenzidine	6.4	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
4-chloroaniline	410	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
4-methylphenol	510	NSL	mg/kg	--	--	< 0.038 UJ	--	--	--	--	--	--	--	--	--	< 0.035 UJ	--
Acenaphthene	6100	NSL	mg/kg	0.11	--	0.0017 J	0.14	0.19	< 0.0077 UJ	< 0.039 UJ	< 0.0079 UJ	0.0053 J	< 0.0079 UJ	< 0.079 UJ	< 0.0078 UJ	< 0.0070 UJ	0.0035 J
Acenaphthylene	6100	NSL	mg/kg	< 0.04 U	--	< 0.0077 UJ	< 0.04 UJ	< 0.04 UJ	< 0.0077 UJ	< 0.039 UJ	< 0.0079 UJ	0.016 J	0.0034 J	0.059 J	< 0.0078 UJ	< 0.0070 UJ	< 0.0079 UJ
Anthracene	31000	NSL	mg/kg	0.17	--	< 0.0077 UJ	0.2	0.68	< 0.0077 UJ	< 0.039 UJ	< 0.0079 UJ	0.013 J	0.0020 J	0.043 J	< 0.0078 UJ	< 0.0070 UJ	0.0056 J
Benzo[a]anthracene	3.9	NSL	mg/kg	0.44	--	< 0.0077 UJ	0.69	1.5	< 0.0077 UJ	0.37	< 0.0079 UJ	0.035 J	0.0050 J	0.13	< 0.0078 UJ	0.0036 J	0.016
Benzo[a]pyrene	0.39	NSL	mg/kg	0.35	--	< 0.0077 UJ	**0.47**	1.1	< 0.0077 UJ	0.33	< 0.0079 UJ	0.028 J	0.0027 J	0.11	< 0.0078 UJ	< 0.0070 UJ	0.014
Benzo[b]fluoranthene	3.9	NSL	mg/kg	0.46	--	< 0.0077 UJ	0.56	1.3	< 0.0077 UJ	0.43	< 0.0079 UJ	0.046	0.0025 J	0.12	< 0.0078 UJ	< 0.0070 UJ	0.017
Benzo[g,h,i]perylene	3100	NSL	mg/kg	0.26	--	< 0.0077 UJ	0.3	0.62	< 0.0077 UJ	0.21	< 0.0079 UJ	0.029 J	< 0.0079 UJ	0.095	< 0.0078 UJ	< 0.0070 UJ	0.0077 J
Benzo[k]fluoranthene	39	NSL	mg/kg	0.15	--	< 0.0077 UJ	0.17	0.39	< 0.0077 UJ	0.12	< 0.0079 UJ	0.016 J	< 0.0079 UJ	0.036 J	< 0.0078 UJ	< 0.0070 UJ	0.0054 J

Table D-8
Cristal USA Facility
Spent Solvent Storage Area

Location ID:				SS-01	SS-01 to SS-06	SS-01	SS-01	SS-02	SS-02	SS-03	SS-03	SS-04	SS-04	SS-05	SS-05	SS-06	SS-06
Sample Name:				DUP-07	SS 01-06	SS-01 0-2	SS-01 6-8	SS-02 0-2	SS-02 13-15	SS-03 0-2	SS-03 4-6	SS-04 0-2	SS-04 13-15	SS-05 1-3	SS-05 6-8	SS-06 1-3	SS-06 5-7
Date Sampled:				4/2/2015	4/10/2015	4/2/2015	4/2/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/10/2015	4/2/2015	4/2/2015	4/2/2015	4/2/2015
Parent Sample ID:				SS-01 6-8													
Depth Interval (ft):				6-8	-	0-2	6-8	0-2	13-15	0-2	4-6	0-2	13-15	1-3	6-8	1-3	5-7
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**														
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg	--	--	< 0.0077 U	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg	--	--	< 0.077 U	--	--	--	--	--	--	--	--	--	< 0.07 U	--
Carbazole	140	NSL	mg/kg	--	--	< 0.0077 U	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
Chrysene	390	NSL	mg/kg	0.39	--	< 0.0077 U	0.51	1.3	< 0.0077 U	0.36	< 0.0079 U	0.032 J	0.0040 J	0.14	< 0.0078 U	0.0065 J	0.015
Dibenz[a,h]anthracene	0.39	NSL	mg/kg	< 0.041 U	--	< 0.0077 U	0.068	0.19	< 0.0077 U	0.061	< 0.0079 U	< 0.041 U	< 0.0079 U	< 0.079 U	< 0.0078 U	< 0.0070 U	< 0.0079 U
Dibenzofuran	100	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Diethyl phthalate	82000	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Di-n-butyl phthalate	10000	NSL	mg/kg	--	--	0.018 J	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Fluoranthene	4100	NSL	mg/kg	0.91	--	0.015	1.2	2.9	< 0.0077 U	0.68	< 0.0079 U	0.071	0.0020 J	0.23	< 0.0078 U	0.0069 J	0.036
Fluorene	4100	NSL	mg/kg	0.11	--	0.0029 J	0.12	0.29	< 0.0077 U	< 0.039 U	< 0.0079 U	< 0.041 U	< 0.0079 U	< 0.079 U	< 0.0078 U	< 0.0070 U	0.0021 J
Hexachloro-1,3-butadiene	37	NSL	mg/kg	--	--	< 0.0077 U	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
Hexachlorobenzene	1.8	NSL	mg/kg	--	--	< 0.0077 U	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Hexachloroethane	200	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Indeno[1,2,3-c,d]pyrene	3.9	NSL	mg/kg	0.23	--	< 0.0077 U	0.28	0.62	< 0.0077 U	0.17	< 0.0079 U	0.025 J	< 0.0079 U	0.066 J	< 0.0078 U	< 0.0070 U	0.0070 J
Isophorone	3000	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Naphthalene	2000	NSL	mg/kg	0.017 J	--	< 0.0077 U	0.016 J	0.058	< 0.0077 U	< 0.039 U	< 0.0079 U	0.016 J	< 0.0079 U	< 0.079 U	< 0.0078 U	< 0.0070 U	< 0.0079 U
Nitrobenzene	51	NSL	mg/kg	--	--	< 0.077 U	--	--	--	--	--	--	--	--	--	< 0.07 U	--
N-nitroso-di-n-propylamine	0.41	NSL	mg/kg	--	--	< 0.0077 U	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	--	< 0.038 U	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Pentachlorophenol	24	NSL	mg/kg	--	--	0.016 J	--	--	--	--	--	--	--	--	--	< 0.035 U	--
Phenanthrene	31000	NSL	mg/kg	0.74	--	0.019	0.92	1.5	< 0.0077 U	0.26	< 0.0079 U	0.048	0.0082	0.13	< 0.0078 U	0.0050 J	0.02
Phenol	31000	NSL	mg/kg	--	--	0.015	--	--	--	--	--	--	--	--	--	< 0.0070 U	--
Pyrene	3100	NSL	mg/kg	0.61	--	0.0895	0.85	1.8	< 0.0077 U	0.74	< 0.0079 U	0.068	0.0082	0.27	< 0.0078 U	0.0039 J	0.024
pH (SW9045D)																	
pH	NSL	NSL	pH units	7.24 H	--	4.98 H	7.17 H	6.90 H	3.95 H	8.77 H	5.88 H	7.45 H	4.45 H	7.46 H	6.25 H	5.27 H	4.70 H

Notes

MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 non-residential cleanup

ATC Eastern - Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

" - USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Gray shaded values exceed ATC Eastern

pg/g= picogram per gram

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

B= Compound was found in the blank and sample.

J= Result is less than the RL but greater than or equal to the MDL and the concentration is

*=ISTD response or retention time outside applicable limits

E= Result exceeds calibration range

F1=MS and/or MDS Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF= Field parameter with a holding time of 15 minutes

U= Not Detected

Table D-9
Cristal USA Facility
Former Titanium Ore Storage Area

Location ID:				TS-01	TS-01 to TS-10	TS-02	TS-02	TS-03	TS-04	TS-04	TS-04	TS-05	TS-06	TS-06	TS-07	TS-07	TS-07	TS-08	TS-08	TS-09	TS-10
Sample Name:				TS-01 0-2	TS-01-10	TS-02 0-2	TS-02 13-15	TS-03 0-2	DUP-15	TS-04 0-2	TS-04 8-10	TS-05 0-2	TS-06 0-2	TS-06 13-15	DUP-16	TS-07 0-2	TS-07 4-6	TS-08 0-2	TS-08 13-15	TS-09 0-2	TS-10 0-2
Date Sampled:				4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015	4.8.2015
Parent Sample ID:									TS-04 8-10						TS-07 0-2						
Depth Interval (ft):				0-2 ft		0-2 ft	13-15 ft	0-2 ft	8-10 ft	0-2 ft	8-10 ft	0-2 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft	4-6 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																		
Rad (E900.1)																					
Actinium-228	NSI	NSI	pCi/g	0.935	--	1.33	--	1.03	--	1.10	--	5.69	2.58	--	1.74	1.82	--	1.24	--	9.36	--
Bismuth-212	NSI	NSI	pCi/g	--	--	1.64	--	--	--	--	--	6.46	3.11	--	2.64	--	--	1.34	--	10.2	--
Bismuth-214	NSI	NSI	pCi/g	0.784	--	1.03	--	0.443	--	1.98	--	6.39	6.11	--	0.584	0.422	--	0.786	--	1.40	0.686
Cesium-137	NSI	NSI	pCi/g	0.200 U	--	0.200 U	--	0.200 U	--	0.200 U	--	0.209 U	0.200 U	--	0.200 U	0.200 U	--	0.200 U	--	0.200 U	0.200 U
Potassium-40	NSI	NSI	pCi/g	6.66	--	4.68	--	2.99	--	2.82	--	3.66	4.78	--	--	--	--	7.84	--	--	3.93
Lead-210	NSI	NSI	pCi/g	--	--	--	--	--	--	--	--	6.26	8.30	--	--	--	--	--	--	--	--
Lead-212	NSI	NSI	pCi/g	1.07	--	1.01	--	0.627	--	0.867	--	5.63	2.34	--	1.83	1.84	--	1.22	--	8.65	0.832
Lead-214	NSI	NSI	pCi/g	0.979	--	1.31	--	0.604	--	2.02	--	6.62	6.67	--	0.628	--	--	1.09	--	1.72	0.725
Thallium-208	NSI	NSI	pCi/g	0.431	--	0.379	--	0.218	--	0.260	--	2.00	0.674	--	0.703	0.689	--	0.388	--	2.72	0.214
Dioxin/Furan (SW1613B)																					
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSI	NSI	pg/g	--	84 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSI	NSI	pg/g	--	45 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSI	NSI	pg/g	--	54 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSI	NSI	pg/g	--	50 Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg/g	--	0.78 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg/g	--	9.6 Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSI	NSI	pg/g	--	1.7 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSI	NSI	pg/g	--	4.0 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSI	NSI	pg/g	--	1.8 QJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSI	NSI	pg/g	--	17 QB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSI	NSI	pg/g	--	0.51 QBJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSI	NSI	pg/g	--	2.4 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSI	NSI	pg/g	--	3.9 QBJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSI	NSI	pg/g	--	0.093 QJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSI	NSI	pg/g	--	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDD (octachlorodibenzo-4-dioxin)	NSI	NSI	pg/g	--	4000 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCDF (octachlorodibenzofuran)	NSI	NSI	pg/g	--	2500 JB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQs - TEF WHO	22	NSI	pg/g	--	13.341	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (SW6020A)																					
Aluminum	100000	NSI	mg/kg	5600 J	--	7300 B	1400 B	3100 B	42000 B	11000 B	2800 B	4300 B	2700 B	2000 B	2300 B	40000 B	2200 B	6400 B	2800 B	3600 B	3000 B
Antimony	41	NSI	mg/kg	1.2	--	0.157	0.107	1.1	0.47	0.40	0.36	2.9	4.4	28	9.6	2.2	28	0.54	0.30	5.5	4.8
Arsenic	3.9	5.6	mg/kg	0.86	--	2.8	2.8	**5.9**	**3.7**	3.5	2.9	1.7	1.5	**7.3**	**3.9**	2.6	2.3	**4.7**	2.9	**3.7**	**3.0**
Barium	20000	NSI	mg/kg	46	--	22	6.8	9.4	38	95	12	33	39	110	14	24	14	43	13	24	11
Beryllium	200	NSI	mg/kg	0.29	--	0.56	0.15	0.17	0.80	2.0	0.62	0.28	0.21	0.14	0.23	0.27	0.23	0.40	0.93	0.31	0.26
Cadmium	51	NSI	mg/kg	0.22	--	0.078 J	0.056 J	0.052 J	0.31 J	0.20	0.13 J	0.86	1.5	0.76	0.37	0.28	0.28	0.11 J	0.10 J	0.68	0.56
Calcium	NSI	NSI	mg/kg	100000	--	820	51 J	1300	860	59000	550	12000	14000	1500	200000	100000	220000	14000	41 J	130000	180000
Chromium	410	28	mg/kg	14	--	24	13	39	**44**	30	**55**	**55**	**51**	120	**130**	**51**	150	24	**38**	290	**150**
Cobalt	NSI	NSI	mg/kg	5.2	--	2.0	0.27	0.66	0.71	1.1	0.53	1.5	1.8	2.3	4.2	4.8	3.1	2.2	1.4	9.5	2.4
Copper	4100	NSI	mg/kg	8.4	--	23	5.9	45	12	14	6.8	22	36	93	30	15	12	19	12	19	18
Iron	72000	NSI	mg/kg	8400	--	12000	4700	21000	42000	9000	39000	11000	16000	18000	28000	19000	22000	20000	56000	55000	64000
Lead	1600	NSI	mg/kg	15 B	--	8.9 B	2.5 B	3.9 B	5.7 B	2.4 B	7.7 B	110 B	64 B	610 B	21 B	16 B	31 B	12 B	2.3 B	73 B	4.6 B
Magnesium	NSI	NSI	mg/kg	22000 B	--	1200 B	490 B	580 B	140 B	15000 B	96 B	4600 B	1700 B	410 B	21000 B	4800 B	750 B	5900 B	80 JB	19000 B	7100 B
Manganese	2000	NSI	mg/kg	130	--	22	2.3	9.1	9.0	580	14	200	310	110	370	290	450	100	13	1300	740
Nickel	2000	NSI	mg/kg	5.0 B	--	6.1 B	1.2 B	1.9 B	4.0 B	2.2 B	2.8 B	12 B	15 B	12 B	18 B	25 B	3.1 B	6.3 B	6.7 B	15 B	9.5 B
Potassium	NSI	NSI	mg/kg	1500	--	530	300	230	250	890	240	230	290	160	200	170	87	680	190	410	370
Selenium	510	NSI	mg/kg	0.56 U	--	0.47 J	0.58 J	0.18 J	0.58 U	0.90	0.60 U	0.58 U	0.54 J	0.58 U	0.71 U	0.64 U	0.39 J	0.60 U	0.56 U	0.11 J	0.61 U
Silver	510	NSI	mg/kg	0.045 J	--	0.023 J	0.012 J	0.023 J	0.024 J	0.046 J	0.026 J	0.20	0.29	0.30	0.11 J	0.15	0.071 J	0.049 J	0.018 J	0.14	0.12 J

Table D-9
Cristal USA Facility
Former Titanium Ore Storage Area

Location ID:				TS-01	TS-01 to TS-10	TS-02	TS-02	TS-03	TS-04	TS-04	TS-04	TS-05	TS-06	TS-06	TS-07	TS-07	TS-07	TS-08	TS-08	TS-09	TS-10
Sample Name:				TS-01 0-2	TS-01-10	TS-02 0-2	TS-02 13-15	TS-03 0-2	DUP-15	TS-04 0-2	TS-04 8-10	TS-05 0-2	TS-06 0-2	TS-06 13-15	DUP-16	TS-07 0-2	TS-07 4-6	TS-08 0-2	TS-08 13-15	TS-09 0-2	TS-10 0-2
Date Sampled:				4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015
Parent Sample ID:									TS-04 8-10						TS-07 0-2						
Depth Interval (ft):				0-2 ft	-	0-2 ft	13-15 ft	0-2 ft	8-10 ft	0-2 ft	8-10 ft	0-2 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft	4-6 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																		
Sodium	NSL	NSL	mg/kg	150 B	--	93 B	17 B	28 B	26 B	200 B	28 B	44 B	84 B	110 B	190 B	85 B	240 B	100 B	38 B	370 B	220 B
Thallium	7.2	1.9	mg/kg	0.047 J	--	0.13	0.047 J	0.048 J	0.052 J	0.041 J	0.043 J	0.044 J	0.078 J	0.25	0.024 J	0.025 J	0.033 J	0.086 J	0.036 J	0.063 J	0.027 J
Vanadium	106	NSL	mg/kg	19	--	42	25	42	95	21	**110**	89	78	95	**390**	77	**240 J3**	49	83	**480**	**440**
Zinc	31000	NSL	mg/kg	29 B	--	15 B	3.7 B	7.7 B	7.4 B	8.3 B	7.9 B	37 B	45 B	47 B	78 B	100 B	57 HF1	15 B	10 B	110 B	14 B
Mercury (SW7471B)																					
Mercury	10	NSL	mg/kg	0.050	--	0.035 U	0.049 U	0.036 U	0.038 U	0.036 U	0.038 U	0.035 J	0.17	0.12	0.046 U	0.021 J	0.038 J	0.023 J	0.035 U	0.099	0.042 U
PCBS (SW8082A)																					
Aroclor 1016	41	NSL	mg/kg	0.0047 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	1.4	NSL	mg/kg	0.0047 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	1.4	NSL	mg/kg	0.0047 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	1.4	NSL	mg/kg	0.19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	1.4	NSL	mg/kg	0.0047 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	1.4	NSL	mg/kg	0.0047 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	1.4	NSL	mg/kg	0.012	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg	0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCS (SW8270D)																					
1,2,4-trichlorobenzene	1000	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
1,2-dichlorobenzene	8200	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
1,3-dichlorobenzene	310	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
1,4-dichlorobenzene	120	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
2,4,5-trichlorophenol	10000	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2,4,6-trichlorophenol	260	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2,4-dichlorophenol	310	NSL	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
2,4-dimethylphenol	2000	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2,4-dinitrophenol	200	NSL	mg/kg	0.971 U	--	--	--	--	--	--	--	--	--	--	0.24 U	0.22 U	--	--	--	--	1.1 U
2,4-dinitrotoluene	200	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2,6-dinitrotoluene	100	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2-chloronaphthalene	8200	NSL	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
2-chlorophenol	510	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
2-methylnaphthalene	410	NSL	mg/kg	0.074	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.041 J	0.038 U	0.017 J	0.0083 J	0.0088 U	0.0098 U	0.055	0.0079 U	0.0491 J	0.043 U
2-methylphenol	5100	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
3,3-dichlorobenzidine	6.4	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
4-chloroaniline	410	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
4-methylphenol	510	NSL	mg/kg	0.191 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Acenaphthene	6100	NSL	mg/kg	0.31	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.042	0.011 J	0.0062 J	0.0015 J	0.0088 U	0.0098 U	0.0015 J	0.0079 U	0.019 J	0.043 U
Acenaphthylene	6100	NSL	mg/kg	0.068	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.043	0.038 U	0.041 J	0.0096 U	0.0088 U	0.0098 U	0.0014 J	0.0079 U	0.0491 J	0.043 U
Anthracene	31000	NSL	mg/kg	0.73	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.062	0.038 U	0.015 J	0.0096 U	0.0029 J	0.0098 U	0.0023 J	0.0079 U	0.024 J	0.043 U
Benzo[a]anthracene	3.9	NSL	mg/kg	1.9	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.16	0.066	0.052	0.0033 J	0.0088 U	0.0022 J	0.0063 J	0.0079 U	0.072	0.023 J
Benzo[a]pyrene	0.39	NSL	mg/kg	1.4	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.23	0.055	0.038 J	0.0096 U	0.0080 J	0.0098 U	0.0058 J	0.0079 U	0.062	0.022 J
Benzo[b]fluoranthene	3.9	NSL	mg/kg	1.8	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.16	0.068	0.064	0.0047 J	0.0078 J	0.0098 U	0.0060 J	0.0079 U	0.065	0.022 J
Benzo[g,h,i]perylene	3100	NSL	mg/kg	0.87	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.12	0.057	0.039 J	0.0096 U	0.0064 J	0.0098 U [F1]	0.0063 J	0.0079 U	0.059	0.022 J

Table D-9
Cristal USA Facility
Former Titanium Ore Storage Area

Location ID:				TS-01	TS-01 to TS-10	TS-02	TS-02	TS-03	TS-04	TS-04	TS-04	TS-05	TS-06	TS-06	TS-07	TS-07	TS-07	TS-08	TS-08	TS-09	TS-10
Sample Name:				TS-01 0-2	TS-01-10	TS-02 0-2	TS-02 13-15	TS-03 0-2	DUP-15	TS-04 0-2	TS-04 8-10	TS-05 0-2	TS-06 0-2	TS-06 13-15	DUP-16	TS-07 0-2	TS-07 4-6	TS-08 0-2	TS-08 13-15	TS-09 0-2	TS-10 0-2
Date Sampled:				4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015	4/8/2015
Parent Sample ID:										TS-04 8-10					TS-07 0-2						
Depth Interval (ft):				0-2 ft	-	0-2 ft	13-15 ft	0-2 ft	8-10 ft	0-2 ft	8-10 ft	0-2 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft	4-6 ft	0-2 ft	13-15 ft	0-2 ft	0-2 ft
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																		
Benzo(k)fluoranthene	39	NSI	mg/kg	0.66	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.05	0.027 J	0.017 J	0.0096 U	0.0047 J	0.0098 U	0.0027 J	0.0079 U	0.022 J	0.013 J
Bis(2-chloroethyl) ether	2.6	NSI	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
Bis(2-ethylhexyl) phthalate	200	NSI	mg/kg	0.23 J	--	--	--	--	--	--	--	--	--	--	0.025 J	0.056 J	--	--	--	--	0.42 U
Carbazole	140	NSI	mg/kg	0.29	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
Chrysene	390	NSI	mg/kg	1.7	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.15	0.067	0.062	0.0033 J	0.0082 J	0.0021 J	0.011	0.0079 U	0.067	0.024 J
Dibenz[a,h]anthracene	0.39	NSI	mg/kg	0.29	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.023 J	0.022 J	0.041 U	0.0096 U	0.0040 J	0.0098 U [F]	0.0080 U	0.0079 U	0.049 U	0.043 U
Dibenzofuran	160	NSI	mg/kg	0.36	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Diethyl phthalate	82000	NSI	mg/kg	0.19 U	--	--	--	--	--	--	--	--	--	--	0.011 J	0.013 J	--	--	--	--	0.034 J
Di-n-butyl phthalate	16000	NSI	mg/kg	0.19 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Fluoranthene	4100	NSI	mg/kg	3.6	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.47	0.14	0.12	0.0059 J	0.019	0.0039 J	0.01	0.0079 U	0.15	0.038 J
Fluorene	4100	NSI	mg/kg	0.39	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.043 J	0.038 U	0.016 J	0.0096 U	0.0088 U	0.0098 U	0.0034 J	0.0079 U	0.049 U	0.043 U
Hexachloro-1,3-butadiene	37	NSI	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
Hexachlorobenzene	1.8	NSI	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
Hexachlorocyclopentadiene	610	NSI	mg/kg	0.29 J	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Hexachloroethane	200	NSI	mg/kg	0.29 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Indeno[1,2,3-cd]pyrene	3.9	NSI	mg/kg	0.82	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.13	0.049	0.033 J	0.0096 U	0.0076 J	0.0098 U [F]	0.0047 J	0.0079 U	0.049	0.017 J
Isophorone	3900	NSI	mg/kg	0.19 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Naphthalene	2000	NSI	mg/kg	0.08	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.043 J	0.038 U	0.041 U	0.02	0.0088 U	0.0098 U	0.03	0.0079 U	0.049 U	0.043 U
Nitrobenzene	51	NSI	mg/kg	0.383	--	--	--	--	--	--	--	--	--	--	0.095 U	0.088 U	--	--	--	--	0.42 U
N-nitroso-di-n-propylamine	0.43	NSI	mg/kg	0.038 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
N-nitrosodiphenylamine	580	NSI	mg/kg	0.393	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Pentachlorophenol	24	NSI	mg/kg	0.29 U	--	--	--	--	--	--	--	--	--	--	0.047 U	0.043 U	--	--	--	--	0.21 U
Phenanthrene	31000	NSI	mg/kg	2.2	--	0.0078 U	0.0080 U	0.00441 J	0.0080 U	0.077 U	0.0082 U	0.25	0.073	0.069	0.0045 J	0.01	0.0098 U	0.029	0.0079 U	0.092	0.045 J
Phenol	31000	NSI	mg/kg	0.048 U	--	--	--	--	--	--	--	--	--	--	0.0096 U	0.0088 U	--	--	--	--	0.043 U
Pyrene	3100	NSI	mg/kg	2.6	--	0.0078 U	0.0080 U	0.0075 U	0.0080 U	0.077 U	0.0082 U	0.2	0.083	0.076	0.0044 J	0.011	0.0026 J	0.0066 J	0.0079 U	0.088	0.023 J
pH (SW 9045D)																					
pH	NSI	NSI	pH Units	11.9 H	--	8.42 H	4.33 H	7.24 H	5.27 H	8.62 H	5.15 H	7.94 H	7.50 H	7.37 H	9.07 H	8.88 H	7.38 H	7.87 H	4.96 H	7.28 H	7.45 H

Notes

MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 non-residential cleanup standards

ATC Eastern - Maryland Dept. of the Environment Anticipated Typical Concentration

MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value

- USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015

Bolded values exceed MDE Non-Res

Grey shaded values exceed ATC Eastern

pg/g: picogram per gram

mg/kg: milligrams per kilogram

µg/kg: micrograms per kilogram

B: Compound was found in the blank and sample

J: Result is less than the RL but greater than or equal to the MDL and the concentration is an

*: ISTD response or retention time outside applicable limits

E: Result exceeds calibration range

F1: MS and or MSD Recovery is outside acceptance limits

Q: One or more quality control criteria failed

H: Field parameter with a holding time of 15 minutes

U: Not Detected

Table D-10
Cristal USA Facility
Upper Settling Basin

Analyte	MDE Non-Residential Soil	ATC Eastern	Unit	Location ID:	UB-01	UB-01	UB-03	UB-02	UB-02	UB-03	UB-03	UB-04	UB-04	UB-05	UB-05	UB-05	UB-06 to UB-08	UB-06	UB-07	UB-08
				Sample Name:	DUP-04	UB-01 0-2	UB-03 3-7	UB-02 0-2	UB-02 3-5	UB-03 0-2	UB-03 3-5	UB-04 0-2	UB-04 2-4	DUP-05	UB-05 0-2	UB-05 13-15	UB-06-08	UB-06	UB-07	UB-08
				Date Sampled:	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015
				Parent Sample ID:	UB-01 0-2									UB-05 13-15						
				Depth Interval (ft):	0-2	0-2	5-7	0-2	3-5	0-2	3-5	0-2	2-4	13-15	0-2	13-15	-	-	-	-
Dioxin/Furan (SW1613B)																				
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	1100 B	--	--	--
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	160 B	--	--	--
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	1700 B	--	--	--
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	3600 B	--	--	--
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	1.9 QBJ	--	--	--
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	540 B	--	--	--
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	5.3 J	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	370	--	--	--
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	0.40 QBJ	--	--	--
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	1600 B	--	--	--
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	3.2 QBJ	--	--	--
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	39 J	--	--	--
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	210	--	--	--
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	0.45 QJ	--	--	--
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	570 B	--	--	--
OCDD (octachlorodibenzo-4-dioxan)	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	1200 B	--	--	--
OCDF (octachlorodibenzofuran)	NSL	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	9500 B	--	--	--
Dioxin TEQs - TEF_WHO	22	NSL	pg/g		--	--	--	--	--	--	--	--	--	--	--	--	**600.23**	--	--	--
Metals (SW6020A)																				
Aluminum	100000	NSL	mg/kg		3900	3800	4700	4800	2000	5500	18000	1900	1800	2000	3800	3100	--	9800	7100	13000
Antimony	41	NSL	mg/kg		11 B	9.0 B	**45 B**	6.3 B	8.7 B	3.9 B	0.59 B	0.35 BF1	0.21 JB	0.21 JB	0.25 B	0.21 JB	--	0.74	2.3	1.1
Arsenic	3.0	3.6	mg/kg		2.9	**3.4**	**6.3 FJF2**	**4.4**	1.1	3.5	2.6	**3.0 F1**	2.8	**6.6**	**7.8**	**5.2**	--	0.77	1.3	3.5
Barium	20000	NSL	mg/kg		15	17	32	17	18	51	64	12	11	9.2	9.2	16	--	44	49	85
Beryllium	200	NSL	mg/kg		0.19	0.23	0.38	0.67	0.25	0.93	2.5	0.81	0.28	0.38	0.24	0.49	--	1.6	0.63	1.7
Cadmium	51	NSL	mg/kg		0.081 J	0.11 J	0.38	0.069 J	0.72	0.64	0.88	0.057 J	0.013 J	0.014 J	0.030 J	0.11 J	--	1.1	0.79	1.9
Calcium	NSL	NSL	mg/kg		120000 B	120000 B	94000 B	24000 B	31000 B	52000 B	7100 B	980 BF1	260 B	66 B	12000 B	58 B	--	17000	5400	12000
Chromium	310	28	mg/kg		**320 B**	**340 B**	**300 B**	**31 B**	**460 B**	**410 B**	**2400 B**	**73 BF1**	**39 B**	**33 B**	**37 B**	**34 B**	--	**610**	**350**	**1400**
Cobalt	NSL	NSL	mg/kg		1.5	1.9	2.5	3.8	2.1	6.0	17	3.0 B	0.48 B	0.63	0.63	0.58	--	11	7.8	12
Copper	4100	NSL	mg/kg		32	15	34 F1	14	7.5	13	18	34 F1	11	8.5	16	34	--	22	28	47
Iron	72000	NSL	mg/kg		11000	11000	19000	21000	9500	29000	**160000**	20000 F2	16000	20000	21000	23000	--	57000	**76000**	**91000**
Lead	1000	NSL	mg/kg		18	19	37 F2	7.8	17	13	6.1	3.9 F1	3.3	5.3	4.2	6.3	--	11	12	9.2
Magnesium	NSL	NSL	mg/kg		550 B	400 B	1300 B	15000 B	240 B	5800 B	666 B	300 F1	500	85 B	100 B	86 B	--	2600	2400	5200
Manganese	2000	NSL	mg/kg		310	220	360	500	460	**2500**	**8200**	420 BF2	31 B	82	93	82	--	**9200**	1900	**9500**
Nickel	2000	NSL	mg/kg		4.8	6.7	11 F1	32	15	35	140	14 BF1	2.3 B	2.4	3.5	2.6	--	97 B	63 B	190 B
Potassium	NSL	NSL	mg/kg		180	110	180 F1	230	43	120	66	150 B	180 B	99	180	100	--	190 B	220 B	170 B
Selenium	510	NSL	mg/kg		0.090 J	0.18 J	0.21 JF1	0.25 J	0.11 J	0.37 J	1.8	0.37 JBF1	0.26 JB	0.19 J	0.21 J	0.21 J	--	0.49 J	0.46 J	1.3
Silver	510	NSL	mg/kg		0.17	0.19	0.76	0.039 J	1.6	1.3	2.8	0.056 J	0.022 J	0.020 J	0.029 J	0.013 J	--	1.4	0.90	2.8
Sodium	NSL	NSL	mg/kg		180 B	190 B	300 B	200 B	430 B	100 B	52 B	36	77	73 B	42 B	70 B	--	240 B	1000 B	680 B
Thallium	5.2	1.9	mg/kg		0.080 J	0.063 J	0.13 J	0.069 J	0.015 J	0.062 J	0.065 J	0.043 J	0.050 J	0.047 J	0.055 J	0.043 J	--	0.036 J	0.048 J	0.049 J
Vanadium	100	NSL	mg/kg		**400 B**	**570 B**	**740 B**	70 B	**1000 B**	**930 B**	**3800 B**	**130 F1**	63	76 B	62 B	100 B	--	**1400**	**620**	**2700**
Zinc	31000	NSL	mg/kg		20	19	61 F1F2	48	38	27	86	13 BF1	2.8 B	2.1	2.5	1.9	--	180	120	110
Mercury (SW7473B)																				
Mercury	10	NSL	mg/kg		0.017 J	0.042 J	0.051 F1	0.035 J	0.22 J	0.23 J	0.18 J	0.037 J	0.039 J	0.036 J	0.012 J	0.037 J	--	0.092 J	0.12	0.059 J

Table D-10
Cristal USA Facility
Upper Settling Basin

Analyte	MDE Non-Residential Soil	AIC Eastern	Unit	Location ID:	UB-01	UB-01	UB-01	UB-02	UB-02	UB-03	UB-03	UB-04	UB-04	UB-05	UB-05	UB-05	UB-06 to UB-08	UB-06	UB-07	UB-08
				Sample Name:	DUP-04	UB-01 0-2	UB-01 5-7	UB-02 0-2	UB-02 3-5	UB-03 0-2	UB-03 3-5	UB-04 0-2	UB-04 2-4	DUP-05	UB-05 0-2	UB-05 13-15	UB-06-08	UB-06	UB-07	UB-08
				Date Sampled:	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015
				Parent Sample ID:	UB-01 0-2									UB-05 13-15						
				Depth Interval (ft):	0-2	0-2	5-7	0-2	3-5	0-2	3-5	0-2	2-4	13-15	0-2	13-15	-	-	-	-
PCBS (SW8082A)																				
Aroclor 1016	41	NSL	mg/kg		0.0056 U	0.0057 U	0.0056 U	0.0048 U	0.0056 U	0.0056 U	0.011 U	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.0063 U	0.0077 U	0.0099 U
Aroclor 1221	1.4	NSL	mg/kg		0.0056 U	0.0057 U	0.0056 U	0.0048 U	0.0056 U	0.0056 U	0.011 U	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.0063 U	0.0077 U	0.0099 U
Aroclor 1232	1.4	NSL	mg/kg		0.0056 U	0.0057 U	0.0056 U	0.0048 U	0.0056 U	0.0056 U	0.011 U	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.0063 U	0.0077 U	0.0099 U
Aroclor 1242	1.4	NSL	mg/kg		0.0056 U	0.0057 U	0.0056 U	0.0048 U	0.0056 U	0.0056 U	0.011 U	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.0063 U	0.0077 U	0.0099 U
Aroclor 1248	1.4	NSL	mg/kg		0.0056 U	0.0057 U	0.0056 U	0.0048 U	0.0056 U	0.0056 U	0.011 U	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.0063 U	0.0077 U	0.0099 U
Aroclor 1254	1.4	NSL	mg/kg		0.0099	0.017	0.024	0.0034 J	0.014 P	0.05	0.055	0.0010 U	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.025	0.0077 U	0.063
Aroclor 1260	1.4	NSL	mg/kg		0.012	0.0089	0.017	0.0048 U	0.018	0.014 P	0.0060 Jp	0.00038 J	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.023	0.011	0.012 P
Total Polychlorinated Biphenyls	1.4	NSL	mg/kg		0.022	0.026	0.041	0.0048 U	0.032 P	0.064	0.031	0.00038 J	0.00099 U	0.0050 U	0.0048 U	0.0050 U	--	0.048	0.011	0.095
SVOCS (SW8270D)																				
1,2,4-trichlorobenzene	1900	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
1,2-dichlorobenzene	9200	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
1,3-dichlorobenzene	310	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
1,4-dichlorobenzene	120	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2,2'-oxybis(1-chloropropane)	NSL	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
2,4,5-trichlorophenol	10000	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2,4,6-trichlorophenol	260	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2,4-dichlorophenol	310	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
2,4-dimethylphenol	2000	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2,4-dinitrophenol	200	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.21 U	--	0.21 U	--	--	--	--
2,4-dinitrotoluene	200	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2,6-dinitrotoluene	100	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2-chloronaphthalene	8200	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
2-chlorophenol	530	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
2-methylnaphthalene	410	NSL	mg/kg		0.0061 J	0.0015 J	0.045 U	0.0078 U	0.0022 J	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.0093 J	0.0068 J	0.08 U
2-methylphenol	5100	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
3,3-dichlorobenzidine	6.3	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
4-chloroaniline	410	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
4-methylphenol	510	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
Acenaphthene	6100	NSL	mg/kg		0.018	0.00094 J	0.0072 J	0.0078 U	0.00094 J	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.014 J	0.062 U	0.08 U
Acenaphthylene	6100	NSL	mg/kg		0.0034 J	0.0014 J	0.065 U	0.0078 U	0.0093 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.13	0.0076 J	0.08 U
Anthracene	31000	NSL	mg/kg		0.03 J	0.0029 J	0.011 J	0.0078 U	0.0093 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.036 J	0.018 J	0.08 U
Benzo[a]anthracene	1.9	NSL	mg/kg		0.11	0.018	0.041 J	0.0035 J	0.0093 U	0.024 J	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.11	0.049 J	0.02 J
Benzo[a]pyrene	0.19	NSL	mg/kg		0.13	0.018	0.051 J	0.0026 J	0.0093 U	0.027 J	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.12	0.047 J	0.039 J
Benzo[b]fluoranthene	1.9	NSL	mg/kg		0.14	0.028	0.053	0.0033 J	0.0093 U	0.032 J	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.17	0.066	0.025 J
Benzo[g,h,i]perylene	3100	NSL	mg/kg		0.082	0.015	0.027 J	0.0020 J	0.0093 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.11	0.042 J	0.015 J
Benzo[k]fluoranthene	19	NSL	mg/kg		0.065	0.0083 J	0.02 J	0.0027 J	0.0093 U	0.013 J	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.083 J	0.037 J	0.016 J
Bis(2-chloroethyl) ether	2.6	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
Bis(2-ethylhexyl) phthalate	200	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.079 U	--	0.015	--	--	--	--
Carbazole	140	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
Chrysene	490	NSL	mg/kg		0.14	0.022	0.046	0.0035 J	0.0064 J	0.029 J	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.16	0.059 J	0.025 J
Dibenz[a,h]anthracene	0.19	NSL	mg/kg		0.02	0.0092 J	0.045 U	0.0078 U	0.0093 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.13	0.062 U	0.08 U
Dibenzofuran	100	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
Diethyl phthalate	82000	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.014 J	--	0.014 J	--	--	--	--
Di-n-butyl phthalate	10000	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--
Fluoranthene	4100	NSL	mg/kg		0.26	0.035	0.076	0.0032 J	0.0073 J	0.048	0.0049 J	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.26	0.097	0.047 J
Fluorene	4100	NSL	mg/kg		0.024	0.0013 J	0.0063 J	0.0078 U	0.0014 J	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.015 J	0.062 U	0.08 U
Hexachloro-1,3-butadiene	37	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--
Hexachlorobenzene	1.8	NSL	mg/kg		--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--

Table D-10
Cristal USA Facility
Upper Settling Basin

				Location ID:	UB-01	UB-01	UB-01	UB-02	UB-02	UB-03	UB-03	UB-04	UB-04	UB-05	UB-05	UB-05	UB-06 to UB-08	UB-06	UB-07	UB-08
				Sample Name:	DUP-04	UB-01 0-2	UB-01 5-7	UB-02 0-2	UB-02 3-5	UB-03 0-2	UB-03 3-5	UB-04 0-2	UB-04 2-4	DUP-05	UB-05 0-2	UB-05 13-15	UB-06-08	UB-06	UB-07	UB-08
				Date Sampled:	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015	4 1 2015
				Parent Sample ID:	UB-01 0-2									UB-05 13-15						
				Depth Interval (ft):	0-2	0-2	5-7	0-2	3-5	0-2	3-5	0-2	2-4	13-15	0-2	13-15	-	-	-	-
Analyte	**MDE Non-Residential Soil**	**ATC Eastern**	**Unit**																	
Hexachlorocyclopentadiene	610	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--	--
Hexachloroethane	290	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	3.9	NSL	mg/kg	0.072	0.012	0.0223	0.0035 J	0.0091 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.083 J	0.037 J	0.013 J	
Isophorone	9000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--	--
Naphthalene	2000	NSL	mg/kg	0.012	0.0023 J	0.045 U	0.0078 U	0.0091 U	0.045 U	0.018 U	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.11	0.062 U	0.08 U	
Nitrobenzene	51	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.079 U	--	0.079 U	--	--	--	--	--
N-nitrosodi-n-propylamine	0.41	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.0080 U	--	0.0080 U	--	--	--	--	--
N-nitrosodiphenylamine	580	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--	--
Pentachlorophenol	24	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.039 U	--	0.039 U	--	--	--	--	--
Phenanthrene	31000	NSL	mg/kg	0.2	0.015	0.045	0.0019 J	0.0062 J	0.026 J	0.0083 J	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.11	0.041 J	0.08 U	
Phenol	31000	NSL	mg/kg	--	--	--	--	--	--	--	--	--	0.0920 J	--	0.0080 U	--	--	--	--	--
Pyrene	3100	NSL	mg/kg	0.21	0.031	0.069	0.0028 J	0.0064 J	0.041 J	0.0055 J	0.0081 U	0.0080 U	0.0080 U	0.0078 U	0.0080 U	--	0.19	0.059 J	0.034 J	
pH (SW9045D)																				
pH	NSL	NSL	pH units	7.26	7.39	7.46	6.12	7.02	7.34	6.08	4.19	4.49	4.76	6.76	4.80	--	7.14	6.51	7.05	

Notes
MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup standards
ATC Eastern = Maryland Dept. of the Environment Anticipated Typical Concentration
MDE Non-Residential Soil screening level for Mercury is the Methyl Mercury value
* = USEPA Regional Screening Level for Non-Residential Soil Screening Criteria January 2015
Bolded Values exceed MDE Non-Res
Grey shaded values exceed ATC Eastern
pg/g = picogram per gram
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
B = Compound was found in the blank and sample
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an
* = ISTD response or retention time outside applicable limits
E = Result exceeds calibration range
J1 = MS and or MDS Recovery is outside acceptance limits
Q = One or more quality control criteria failed
HF = Field parameter with a holding time of 15 minutes
U = Not Detected

Table D-11
Cristal USA Facility
Toxicity characteristic leaching procedure

			Location ID:	AN-06	MB-04	SB-32	SB-55	SS-06	TS-06	UB-03
			Sample Name:	AN-06 0-2	MB-04	DUP-08	SB-55 6-8	SS-06 1-3	TS-06 13-15	UB-03 3-5
			Date Sampled:	4/6/2015	4/3/2015	4/3/2015	4/9/2015	4/2/2015	4/8/2015	4/1/2015
			Parent Sample ID:			SB-32 0-2				
			Depth Interval (ft):	0-2 ft		0-2 ft	6-8 ft	1-3 ft	13-15 ft	3-5 ft
Analyte	**RCRA TCLP**	**Unit**								
TCLP Metals (SW6010C)										
Arsenic	5	mg/l	0.034 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	
Barium	100	mg/l	0.14 JB	0.22 JB	0.069 JB	0.10 JB	0.042 JB	1.7 JB	0.073 JB	
Cadmium	1	mg/l	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	0.0045 J	0.0022 J	
Chromium	5	mg/l	< 0.50 U	0.052 J	< 0.50 U	0.022 J	< 0.50 U	0.024 J	0.025 J	
Lead	5	mg/l	**48**	< 0.50 U	< 0.50 U	< 0.50 U	4.5	**91**	0.015 J	
Selenium	1	mg/l	0.044 J	< 0.50 U	< 0.50 U	0.019 J	< 0.50 U	< 0.50 U	< 0.50 U	
Silver	5	mg/l	< 0.50 U	< 0.50 U	0.0030 JB	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	
TCLP Mercury (SW7470A)										
Mercury	0.2	mg/l	--	< 0.00020 U	< 0.00020 U	< 0.00020 U	0.00015 J	< 0.00020 U	< 0.00020 U	

Notes

RCRA TCLP. October 2009. http://www.epa.gov/osw/hazard/wastetypes/characteristic.htm

mg/l=milligrams per liter

B= Compound was found in the blank and sample

J= Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

U= Not Detected

Bolded values exceed RCRA TCLP

Table D-12
Cristal USA Facility
Chromium Speciation Results

		Location ID:	BB-07	LB-07	MB-04	SB-32	SB-55	TS-06	UB-03
		Sample Name:	BB-07	LB-07	MB-04	DUP-08	SB-55 6-8	TS-06 13-15	UB-03 3-5
		Date Sampled:	4/2/2015	4/2/2015	4/3/2015	4/3/2015	4/9/2015	4/8/2015	4/1/2015
		Parent Sample ID:				SB-32 0-2			
		Depth Interval (ft):	0-2	-	-	0-2	6-8	13-15	3-5
Analyte	**MDE Non-Residential Soil**	**Unit**							
Chromium (SW7196A)									
Chromium (hexavalent)	310	mg/kg	68	23	170	1.7	1.7	0.28 J	40
Chromium (III)	150000	mg/kg	2300	2100	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U

Notes

MDE Non-Residential Soil = Maryland Dept. of Environment June 2008 non-residential cleanup

mg/kg = milligrams per kilogram

J= Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

Bolded values exceed MDE Non-Res

U= Not Detected

Table D-13
Cristal USA Facility
Groundwater Results

		Location ID	AN-04	AN-13	SB-19	SB-20	SB-24	SB-28	SB-30	SB-38	SB-40
		Sample Name	AN-04	AN-13	SB-19	SB-20	SB-24	SB-28	SB-30	SB-38	SB-40
		Date Sampled	4/14/2015	4/14/2015	4/8/2015	4/3/2015	4/15/2015	4/14/2015	4/3/2015	4/15/2015	4/13/2015
		Parent Sample ID									
Analyte	**MDE GW**	**Unit**									
Dioxin/Furan (SW1613B)											
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	pg/l	< 53 U	50 U	0.77 JB	4.8 QB	4.1 B	< 46 U	0.73 J	47 U	< 49 U
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	pg/l	< 53 U	50 U	47 U	17 B	31 SB	3.2 Q	1.7 QB	1.2 QB	49 U
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	pg/l	< 53 U	< 50 U	0.68 QB	49 U	< 53 U	< 46 U	47 U	0.34 QB	49 U
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	pg/l	53 U	50 U	47 U	1.3 Q	0.41 QB	46 U	< 47 U	< 47 U	49 U
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	pg/l	53 U	< 50 U	47 U	0.68 Q	0.35 QB	46 U	< 47 U	47 U	< 49 U
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	pg/l	53 U	50 U	47 U	49 U	0.72 QB	< 46 U	47 U	0.29 QB	< 49 U
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	pg/l	53 U	50 U	47 U	< 49 U	0.57 QB	< 46 U	47 U	0.47 Q	49 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	pg/l	< 53 U	< 50 U	< 47 U	< 49 U	0.20 QB	< 46 U	47 U	< 47 U	49 U
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	pg/l	53 U	50 U	47 U	0.85 QB	0.49 QB	< 46 U	< 47 U	47 U	49 U
1,2,3,7,8-pentachlorodibenzofuran	NSL	pg/l	< 53 U	< 50 U	47 U	0.59	0.18 B	46 U	47 U	< 47 U	49 U
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	pg/l	53 U	< 50 U	47 U	49 U	< 53 U	46 U	47 U	< 47 U	49 U
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	pg/l	53 U	50 U	47 U	< 49 U	0.25 QB	46 U	47 U	0.11 QB	49 U
2,3,4,7,8-pentachlorodibenzofuran	NSL	pg/l	53 U	< 50 U	47 U	0.90 Q	0.13 QB	46 U	47 U	47 U	49 U
2,3,7,8-tetrachlorodibenzo-p-dioxin	NSL	pg/l	11 U	10 U	9.4 U	9.7 U	0.26 Q	9.2 U	9.4 U	9.3 U	9.8 U
2,3,7,8-tetrachlorodibenzofuran	NSL	pg/l	11 U	10 U	9.4 U	9.7 U	0.22 Q	< 9.2 U	9.4 U	9.3 U	9.8 U
OCDD (octachlorodibenzo-p-dioxin)	NSL	pg/l	[illegible]	30 B	67 B	170 B	260 B	320 B	43 B	54 B	4.1 QB
OCDF (octachlorodibenzofuran)	NSL	pg/l	[illegible]	3.5 Q	3.2 QB	21 B	24 QB	6.8 Q	1.5 QB	0.87 QB	5.5 Q
Dioxin TEQs - TEF WHO	[illegible]	pg/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Metals (SW6020A)											
Aluminum	50	ug/l	340	35	2200	3300	[illegible]	12000 B	6600	810 B	17 B
Antimony	6	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	450	[illegible]	[illegible]	[illegible]
Arsenic	10	ug/l	< 1.0 U	47	[illegible]	2.3	1.0 U	37	1.4	10 U	1.0 U
Barium	2000	ug/l	40	12	560	32	[illegible]	240 B	22	38 B	26 B
Beryllium	4	ug/l	0.078 J	1.0 U	8.9	[illegible]	1.0 U	4.5	52	3.0	1.0 U
Cadmium	5	ug/l	1.0 U	1.0 U	[illegible]	1.3	1.0 U	1.0	1.2	< 1.0 U	1.0 U
Calcium	NSL	ug/l	65000 B	350000 B	2800	56000	210	180000	92000	340000	82000
Chromium	100	ug/l	1.2	2.0 U	22	16	24	45	6.5	20	[illegible]
Cobalt	NSL	ug/l	2.5	1.6	42	3.7	[illegible]	66	38	33	35
Copper	1300	ug/l	1.6	4.1	[illegible]	31	3.5	890	190	1.9	1.1
Iron	300	ug/l	54	21000	120000	6400	1500 B	360000 B	53000	280000 B	150000 B
Lead	15	ug/l	1.0 U	[illegible]	[illegible]	1.0	[illegible]	260	2.0	0.78 J	[illegible]
Magnesium	NSL	ug/l	24000 B	6800 B	74000	7400 B	74 B	42000 B	28000	31000 B	63000 J
Manganese	50	ug/l	85 B	77 B	1400	78	42 B	7900 B	2000	5900 B	2200 B
Nickel	73	ug/l	3.7	2.5	110	17	2.9	170	290	15	140
Potassium	NSL	ug/l	9600 B	14000 B	2600	5600	22 B	6900 B	2000	6100 B	37000 J
Selenium	50	ug/l	[illegible]	2.8 J	[illegible]	[illegible]	5.0 U	5.0 U	[illegible]	5.0 U	5.0 U
Silver	100	ug/l	1.0 U	1.0 U	[illegible]	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sodium	NSL	ug/l	29000 J	27000 B	120000 B	22000 B	200	21000	120000 B	98000	42000
Thallium	2	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	< 1.0 U	[illegible]
Vanadium	3.7	ug/l	1.2	0.72 J	5.2	18	1.0 U	92	9.2	15	1.0 U
Zinc	5000	ug/l	12	34	210	84	[illegible]	360	430	35	32
Mercury (SW7470A)											
Mercury	0.37	ug/l	< 0.20 U	0.20 U	0.20 U	< 0.20 U	0.20 U	0.20 U	0.20 U	[illegible]	0.20 U
PCBS (SW8082A)											
Aroclor 1016	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1221	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1232	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1242	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1248	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1254	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1260	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Polychlorinated biphenyls	[illegible]	ug/l	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VOCS (SW8260C)											
1,1,1-trichloroethane	200	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U
1,1,2,2-tetrachloroethane	0.053	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-trichloroethane	5	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U
1,1-dichloroethane	90	ug/l	1.0 U	1.0 U	1.0 U	1.0	[illegible]	1.0 U	0.18 J	1.0 U	1.0 U
1,1-dichloroethene	7	ug/l	1.0 U	1.0 U	1.0 U	1.1	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U
1,2-dibromo-3-chloropropane	NSL	ug/l	< 1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-dibromoethane	0.05	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-dichloroethane	5	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
1,2-dichloroethene	55	ug/l	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table D-13
Cristal USA Facility
Groundwater Results

		Location ID	AN-12	AN-13	SB-19	SB-20	SB-24	SB-25	SB-30	SB-35	SB-40
		Sample Name	AN-04	AN-13	SB-19	SB-20	SB-24	SB-25	SB-30	SB-35	SB-40
		Date Sampled	4/14/2015	4/14/2015	4/8/2015	4/8/2015	4/15/2015	4/15/2015	4/8/2015	4/15/2015	4/13/2015
		Parent Sample ID									
Analyte	**MDEGW**	**Unit**									
1,1-dichloroethane	7	µg/l	1.0U	1.0U	1.0U	0.43J	1.0U	1.0U	1.0U	0.35J	1.0U
2-Butanone	300	µg/l	5.0U	5.0U	5.0U	5.0U	5.0U	1.9J	5.0U	5.0U	5.0U
Cis-1,2-dichloroethene	0.54	µg/l	5.0U	5.0U	5.0U	5.0U	5.0U	0.78J	5.0U	1.3J	5.0U
Acetone	700	µg/l	5.0U*	4.7J	5.0U	4.1J	5.0U	25	5.0U*	5.0U	5.0U
Benzene	5	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.9	1.0U	100	1.0U
Bromodichloromethane	80	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Bromoform	80	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Bromomethane	10	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U*	1.0U	1.0U	1.0U	1.0U
Carbon disulfide	700	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Carbon tetrachloride	5	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Chlorobenzene	100	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Chloroethane	5.6	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	13.0	1.0U
Chloroform	80	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	0.41J	1.0U	1.0U	1.0U
Chloromethane	15	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Cis-1,2-dichloroethene	70	µg/l	1.0U	1.0U	1.0U	1.0U	0.58J	1.0U	1.0U	1.0U	1.0U
cis-1,3-dichloropropene	0.44	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Dibromochloromethane	80	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Ethylbenzene	700	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	0.57J	1.0U	2.1	1.0U
Isopropylbenzene	70	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	0.13J	1.0U	0.67J	1.0U
Methyl tert-butyl ether	20	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Methylene Chloride	5	µg/l	0.15JB	0.18JB	0.17J	0.16JB	0.23JB	1.0U	1.0U	1.0U	0.15JB
Styrene	100	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Tetrachloroethene	5	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Toluene	1000	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	0.55J	1.0U	0.23J	1.0U
trans-1,2-dichloroethene	100	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
trans-1,3-dichloropropene	0.44	µg/l	1.0U*	1.0U	1.0U	1.0U	1.0U	1.0U*	1.0U	1.0U	1.0U
Trichloroethene	5	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	0.17J	1.0U	1.0U
Vinyl chloride	2	µg/l	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Xylenes, Total	10000	µg/l	3.0U	3.0U	3.0U	3.0U	3.0U	3.0	3.0U	8.7	3.0U
SVOCS (SW8270D)											
1,2,4-trichlorobenzene	70	µg/l	1.0U	1.0U	0.95J	1.0U	1.1U	0.98J	1.0U	1.1U	1.0U
1,2-dichlorobenzene	600	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
1,3-dichlorobenzene	1.5	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
1,4-dichlorobenzene	75	µg/l	1.0U	1.0U	0.95J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2,2'-oxybis(1-chloropropane)	0.82	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.98J	1.0U	1.1U	1.0U
2,4,5-trichlorophenol	700	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2,4,6-trichlorophenol	2.5	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2,4-dichlorophenol	21	µg/l	1.0U	1.0U	0.95J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2,4-dimethylphenol	140	µg/l	1.0U	5.2J	4.2J	5.0J	4.4J	4.8J	5.0	5.4J	5.0U
2,4-dinitrophenol	14	µg/l	5.0U	5.0U	4.8J	5.0U	5.4U	4.8U	5.0U	5.4U	5.0U
2,4-dinitrotoluene	0.2	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2,6-dinitrotoluene	0.2	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2-chloronaphthalene	490	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2-chlorophenol	35	µg/l	1.0U	1.0U	0.98J	1.0U	1.1U	0.96J	1.0U	1.1U	1.0U
2-methylnaphthalene	3.5	µg/l	0.20J	0.21J	0.15J	0.20J	0.22J	0.19J	0.20J	4.4	0.20J

Table D-13
Cristal USA Facility
Groundwater Results

Location ID			AS-04A	AS-13	SB-3	SB-20	SB-21	SB-22	SB-26	SB-30	SB-35	SB-40
Sample Name			AS-04A	AS-13	SB-13	SB-20	SB-21	SB-22	SB-26	SB-30	SB-35	SB-40
Date Sampled			4/14/2015	4/24/2015	4/8/2015	4/13/2015	4/13/2015	4/13/2015	4/13/2015	4/8/2015	4/15/2015	4/13/2015
Parent Sample ID												
Analyte	**MDE GW**	**Unit**										
2-methylphenol	180	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
2,4-dichlorobenzidine	0.14	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
3-chloroaniline	25	µg/L	2.1 U	2.1 U	1.9 U	2.1 U	2.1 U	1.9 U	2.1 U	1.9 U	2.1 U	2.1 U
3-methylphenol	18	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
3,3-dichlorobenzidine	2.8	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
4-chloroaniline	180	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
4-methylphenol	18	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Acenaphthene	270	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
Acetophenone	370	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
Aniline	180	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
Anthracene	1800	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
Benzo(a)anthracene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	0.21 U	0.21 U
Benzo(a)pyrene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	3.3	0.21 U
Benzo(b)fluoranthene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	**4.9**	0.21 U
Benzo(g,h,i)perylene	180	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	4.5	0.21 U
Benzo(k)fluoranthene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	**6.8**	0.21 U
Bis(2-chloroethoxy)ether	0.0046	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Bis(2-ethylhexyl)phthalate	6	µg/L	1.1 U	0.27 J	0.93 U	2.1 U	2.1 U	0.96 U	1.1 U	**8.6**	**7.4**	1.1 U
Carbazole	8.6	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Chrysene	20	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	**5.1**	0.21 U
Dibenz(a,h)anthracene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	**5.1**	0.21 U
Dibenzofuran	2.9	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Diethylphthalate	2900	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	2.4 J	1.1 U
Dimethylphthalate	730	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Fluoranthene	150	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	1.1	0.21 U
Fluorene	270	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	1.4	0.21 U
Hexachloro-1,3-butadiene	0.86	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Hexachlorobenzene	1	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Hexachlorocyclopentadiene	50	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Hexachloroethane	4.8	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Indeno(1,2,3-cd)pyrene	0.2	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	**4.8**	0.21 U	0.21 U
Isophorone	73	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
Naphthalene	1.7	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	**110**	0.21 U	0.21 U
Nitrobenzene	0.35	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
N-nitrosodi-n-propylamine	0.0096	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
N-nitrosodiphenylamine	28	µg/L	2.1 U	2.1 U	1.9 U	2.1 U	2.1 U	1.9 U	2.1 U	1.9 U	2.1 U	2.1 U
Pentachlorophenol	1	µg/L	2.1 U	2.1 U	1.9 U	2.1 U	2.1 U	1.9 U	2.1 U	1.9 U	2.1 U	2.1 U
Phenanthrene	180	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	1.1	0.21 U
Pyrene	180	µg/L	0.21 U	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.19 U	1.1	0.21 U
Pyridine	37	µg/L	1.1 U	1.1 U	0.93 U	1.1 U	1.1 U	0.96 U	1.1 U	0.94 U	1.1 U	1.1 U
pH (SW9040C)												
pH	6.5 - 8.5	pH units	6.64 JH	7.47 JH	5.75 JH	6.64 JF	6.89 JH	6.81 JH	6.81 JH	4.57 JH	6.89 JH	6.66 JH

Note:

Maryland Dept. of Environment, June 2008 cleanup standards for GW: Type I and II aquifer.

* = MDE's Maximum Contaminant Level (MCL) - January 2011

µg/L = microgram/liter

pg/L = picogram per liter

B = Compound was found in the blank and sample

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

* = RPD, response or retention time outside applicable limits

E = Result exceeds calibration range

H = Holding time expired, analysis performed outside recommended holding time

M = MS and/or MSD recovery is outside acceptance limits.

Q = One or more quality control criteria failed.

JH = Field parameter with a holding time of 15 minutes.

U = Not detected

Values exceeding the MDE Groundwater criteria are bolded

Table D-13
Cristal USA Facility
Groundwater Results

		Location ID:	SB-42	SB-47	SB-50	SB-53	SB-54 SB-DUP-1 SB-56	SB-56	SB-57	SB-58	SB-59	SB-60	SB-65	SB-66
		Sample Name:	SB-42	SB-47	SB-50	SB-53	4/14/2015 SB-56	4/14/2015	4/15/2015	4/16/2015	4/15/2015	4/15/2015	4/14/2015	4/9/2015
		Date Sampled:	4/15/2015	4/15/2015	4/17/2015	4/17/2015								
		Parent Sample ID:												
Analyte	SDE GW	Unit												
Dioxin/Furan (SW1613B)														
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSE	pg/L	4.13	93	--	760 B	5.51 J	471	3.5 BGJ	2500 B	16 QBJ	7.1	5.8 BJ	
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSE	pg/L	1.36	2.82	--	30 QBJ	2.51 J	471	0.87 QBJ	45 BJ	0.6 BJ	42	2.6 BJ	
1,2,3,4,7,8-hexachlorodibenzofuran	NSE	pg/L	0.67	19.3	--	200 B	1.51 J	471	3.5 QBJ	2000 B	2.51 J	42.7	3.9 QBJ	
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSE	pg/L	1.37	56	--	240 B	3.51 J	471	3.6 QBJ	2600 B	0.42 QBJ	54.7	4.3 J	
1,2,3,6,7,8-hexachlorodibenzofuran	NSE	pg/L	0.461	3.1 QJ	--	7 QBJ	0.51 J	471	0.47 J	33 QBJ	0.41 J	42.7	0.52 J	
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSE	pg/L	1.43 J	6.8 QJ	--	39 B	0.51 J	471	0.61 QBJ	320 BJ	0.26 QBJ	54.7	0.51 J	
1,2,3,7,8,9-hexachlorodibenzofuran	NSE	pg/L	0.32 J	1.8 J	--	3 QBJ	0.51 J	471	0.47 J	33 QBJ	0.31 QJ	54.7	0.51 J	
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSE	pg/L	0.63 J	4.1 QJ	--	10 B	0.51 J	471	0.71 J	100 QB	0.39 QBJ	54.7	0.51 J	
1,2,3,4,6,7,8-Heptachlorodibenzofurans (HpCDFs)	NSE	pg/L	5.8 J	112	--	940 B	7.51 J	471	4.3 BJ	3100 B	19 QBJ	54.7	7.3 BJ	
1,2,3,4,7,8,9-heptachlorodibenzo-p-dioxin	NSE	pg/L	1.7 QJ	7.5 QJ	--	2.8 QBJ	0.51 J	471	0.61 QJ	41 BJ	0.51 J	54.7	0.51 J	
1,2,3,7,8-pentachlorodibenzofuran	NSE	pg/L	0.503 J	2.8 QJ	--	2.5 QBJ	0.51 J	471	0.47 J	2.9 QBJ	0.31 J	54.7	0.51 J	
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSE	pg/L	0.503 J	2.2 QJ	--	4.4 QBJ	0.51 J	471	0.53 QBJ	4.2 QBJ	0.51 J	54.7	0.51 J	
1,2,3,4,7,8-hexachlorodibenzofuran	NSE	pg/L	0.61 J	4.9 J	--	5.2 QBJ	0.51 J	471	0.53 QBJ	5.2 QBJ	0.49 QBJ	54.7	0.51 J	
1,2,3,4,7,8-pentachlorodibenzofuran	NSE	pg/L	0.503 J	3.5 J	--	9.9 QBJ	0.51 J	471	0.61 QBJ	14 QBJ	0.51 J	54.7	0.52 J	
2,3,7,8-tetrachlorodibenzodioxin	NSE	pg/L	0.101 J	0.91 J	--	0.64 QJ	0.101 J	94.1	0.41 J	2.5 J	0.21 J	10.7	0.12 J	
2,3,7,8-tetrachlorodibenzofuran	NSE	pg/L	0.101 J	1.7 J	--	1.6 QJ	0.101 J	94.1	0.41 J	2.5 J	0.21 J	10.7	0.12 J	
OCDD (octachlorodibenzo-p-dioxin)	NSE	pg/L	2000 B	6900 B	--	520 B	2.4 QBJ	1.4 QBJ	85 BJ	360 B	8.4 BJ	1000 B	280 B	
OCDF (octachlorodibenzofuran)	NSE	pg/L	4.8 QJ	169	--	42 B	1.6 J	94.1	39 BJ	330 BJ	2.4 QBJ	210 B	14 BJ	
Dioxin TEQs, TEF WHO	0.07	pg/L	0.606544	35.421	--	**718.226**	0		0.0177	**470.104**	0.026	47.09	1.1	
Metals (SW6020A)														
Aluminum	--	µg/L	**7100 B**	**16000 B**	**1400**	**24000**	**1100**	**1100**	**1100**	**7500 B**	**2500 B**	**7200**	**610**	
Antimony	6	µg/L	0.763 J	**34**	2.5 J	20 J	0.15 J	0.75 J	1 J	2.5 J	0.688 J	1.55 J	0.31 J	
Arsenic	10	µg/L	3.3	3.2	10 J	19 J	1.4	1.9 J	3.3	5.2	0.66 J	16	1.6	
Barium	2000	µg/L	67 B	53 B	37 J	150	12	15	23	72 B	32 B	93	23	
Beryllium	4	µg/L	0.2	0.4	1 U	1 J	0.31 J	0.25 J	1 U	1 J	0.14 J	2.2	0.11 J	
Iron/Diem	--	µg/L	8300 B	21000 B	1200 B	38000 B	1300 B	1300 B	1400 B	9200 B	3000 B	11000 B	1100 B	
Cadmium	5	µg/L	0.106 J	0.267 J	1 U	0.5 J	0.107 J	0.125 J	0.1 U	**14**	0.061 J	0.1 U	0.1 U	
Calcium	NSE	µg/L	70000 B	110000 B	28000 B	160000 B	76000 B	42000 B	34000 B	92000 B	52000 B	76000 B	22000 B	
Chromium	100	µg/L	15	32	**400**	**3800**	1.8 J	1.9 J	3.2	**370**	5.2	25	2.7	
Cobalt	NSE	µg/L	3.1	6.2	1.8 J	46	0.5 J	0.6 J	0.6 J	11	0.5 J	4.4	0.5 J	
Copper	1300	µg/L	5.1	7.6	5 J	42	1.3 J	2 J	3 J	13	2 J	7.6	1.1 J	
Iron	300	µg/L	**74000 B**	**120000 B**	**9300**	**190000**	**2000**	**2100**	**29000**	**110000 B**	**1400 B**	**47000**	**38000**	
Lead	15	µg/L	**290**	**185**	1.1 J	37	0.29 J	0.35 J	1 J	**42**	0.69 J	**23**	**4.9**	
Magnesium	NSE	µg/L	36000 B	42000 B	55000 B	26000 B	18000 B	16000 B	52000 B	28000 B	20000 B	36000 B	16000	
Manganese	50	µg/L	**1300 B**	**8200 B**	**7600**	**40000**	**1300 B**	**1400 B**	**1400**	**7800 B**	**190 B**	**210 B**	**650 B**	
Nickel	73	µg/L	22	**150**	30	**150**	0.6	0.9	3.1	50	0.5	7.9	2.2	
Potassium	NSE	µg/L	3000 B	10000 B	25000 B	9000 B	8500 B	9800 B	24000 B	15000 B	26000 B	26000 B	12000	
Selenium	50	µg/L	0.417 J	0.427 J	5 U	5 U	0.26 J	0.24 J	5 U	5 U	0.2 J	5 U	5 U	
Silver	100	µg/L	0.107 J	0.231 J	1 U	1 U	0.1 U	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	
Sodium	NSE	µg/L	73000	25000	370000 B	26000 B	70000 B	70000 B	240000 B	250000	73000	160000 B	31000	
Thallium	2	µg/L	0.261 J	0.0921 J	1 U	0.5 J	0.0821 J	0.084 J	0.041 J	1 U	0.055 J	0.23 J	0.1 U	
Vanadium	5.2	µg/L	**28**	**47**	**1600**	**8100**	1.8 J	2 J	**5.4**	**1900**	1.6 J	**56**	2.6 J	
Zinc	1600	µg/L	150	190	70	150	40	45	21	75	150	45	10 J	
Mercury (SW7470A)														
Mercury	0.15	µg/L	0.11	0.181 J	0.0217 J	**0.66**	0.0217 J	0.0217 J	0.0217 J	0.0217 J	0.0217 J	0.0217 J	0.0217 J	
PCBS (SW8082A)														
Aroclor 1016	0.96	µg/L	0.00961 U	0.00981 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1221	0.96	µg/L	0.00961 U	0.00981 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1232	0.96	µg/L	0.00961 U	0.00981 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1242	0.96	µg/L	0.00961 U	0.00981 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1248	0.96	µg/L	0.00961 U	0.00981 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1254	0.96	µg/L	0.00961 U	0.0098 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Aroclor 1260	0.96	µg/L	0.00961 U	0.0098 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
Total Polychlorinated Biphenyls	0.5	µg/L	0.00961 U	0.0098 U	--	0.0125 U	0.00943 U	0.00951 U	0.00964 U	0.0127 U	0.00917 U	0.00917 U	0.00961 U	
VOCS (SW8260C)														
1,1,1-trichloroethane	200	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,1,2,2-tetrachloroethane	0.093	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,1,2-trichloroethane	5	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,1-dichloroethane	681	µg/L	1 U	1 U	0.6 J	1 U	0.4 J	0.4 J	1 U	5 U	1 U	1 U	2.8 J	
1,1-dichloroethene	7	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,2-dibromo-3-chloropropane	NSE	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,2-dibromoethane	0.05	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,2-dichloroethane	5	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	
1,2-dichloropropane	5	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	12	

Table D-13
Cristal USA Facility
Groundwater Results

		Location ID	SB-42	SB-47	SB-56	SB-57	SB-58 GW-DUP-1	SB-66	SB-67	SB-68	SB-69	SB-70	SB-71
		Sample Name	SB-42	SB-47	SB-56	SB-57	GW-DUP-1	SB-66	SB-67	SB-68	SB-69	SB-70	SB-71
		Date Sampled	4/13/2015	4/13/2015	4/27/2015	4/17/2015	4/14/2015	4/14/2015	4/17/2015	4/16/2015	4/15/2015	4/14/2015	4/9/2015
		Parent Sample ID					SB-58A						
Analyte	MDEQ GV	Unit											
1,1-dichloropropene	-	µg/L	2.0 U	2.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	730	µg/L	< 5.0 U	< 5.0 U	11 J+	5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
4-methyl-2-pentanone	640	µg/L	< 5.0 U	< 5.0 U	< 5.0 U	5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Acetone	550	µg/L	< 5.0 U	8.0	8.0	5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	4.5	< 5.0 U	2.6 J	1.5 J
Benzene	5	µg/L	2.0 U	1.0	< 1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U
Bromodichloromethane	80	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	80	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	0.84	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	130	µg/L	1.0 U	1.0 U	< 0.68 J	1.0 U	1.0 U	1.0 U	1.0 U	< 0.52 J	1.0 U	1.0 U	1.0 UJ*
Carbon tetrachloride	5	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	100	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	3.6	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	80	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	3.6	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-dichloroethene	70	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-dichloropropene	0.44	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	80	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
EDB Dibromide	200	µg/L	0.020 U	0.020 U	< 0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	< 0.020 U	0.020 U	0.020 U	0.020 U
Dichlorodifluoromethane	200	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	20	µg/L	1.0 U	0.42 J	< 1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	5	µg/L	1.0 U	2.0 U	< 0.26 J	< 0.26 J	1.0 U	1.0 U	1.0 U	< 0.18 J	0.27 J	2.0 U	< 0.18 J
Styrene	100	µg/L	2.0 U	2.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	< 1.0 U
Tetrachloroethene	5	µg/L	1.0 U	1.0 U	1.0	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	< 0.26 J
Toluene	1000	µg/L	2.0 U	< 0.26 J	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	< 1.0 U
trans-1,2-dichloroethene	100	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	2.2
trans-1,3-dichloropropene	0.44	µg/L	2.0 U*	2.0 U*	< 1.0 U	1.0 U	< 1.0 U*	2.0 U*	1.0 U	< 1.0 U*	1.0 U*	1.0 U*	1.0 U
Trichloroethene	5	µg/L	2.0 U	2.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	2.3
Vinyl chloride	2	µg/L	2.0 U	2.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U
Xylenes, Total	10000	µg/L	4.0 U	4.0	< 1.0 U	3.0 U	3.0 U	4.0 U	3.0 U	< 3.0 U	3.0 U	3.0 U	3.0 U
SEMIVOLATILES													
1,2,4-trichlorobenzene	70	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
1,2-dichlorobenzene	600	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
1,3-dichlorobenzene	1.8	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
1,4-dichlorobenzene	75	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,2'-oxybis(1-chloropropane)	NS	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,4,5-trichlorophenol	320	µg/L	1.0 U	0.20 J	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,4,6-trichlorophenol	6.1	µg/L	1.0 U	0.20 J	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,4-dichlorophenol	11	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,4-dimethylphenol	73	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2,4-dinitrotoluene	7.3	µg/L	5.0 U	5.0 U	< 5.0 U	5.0 U	5.0 U	5.0 U	4.8 J	< 5.0 U	5.0 U	5.0 U	4.8 J
2,6-dinitrotoluene	3.7	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2-chloronaphthalene	580	µg/L	1.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	1.0 U	0.96 J	< 1.0 U	1.0 U	1.0 U	0.96 J
2-chlorophenol	29	µg/L	0.21 J	0.21 J	< 0.20 J	0.23 J	0.23 J	0.20 J	0.24 J	< 0.21 J	0.23 J	0.21 J	< 0.19 J
2-Methylphenol	73	µg/L	2.0 U	2.0 U	< 1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	< 1.0 U	1.0 U	1.0 U	0.96 J
2-methylnaphthalene	2.4	µg/L	0.21 J	4.7	< 0.20 J	< 0.19 J	0.20 J	< 0.20 J	0.96 J	< 0.21 J	0.22 J	0.20 J	< 0.19 J

Table D-13
Cristal USA Facility
Groundwater Results

		Location ID	SB-42	SB-47	SB-50	SB-53	SB-56	SB-56	SB-57	SB-58	SB-60	SB-61	SB-65
		Sample Name	SB-42	SB-47	SB-50	SB-53	SB-56-R1	SB-56	SB-57	SB-58	SB-60	SB-61	SB-65
		Date Sampled	4/13/2015	4/14/2015	4/17/2015	4/17/2015	4/14/2015	4/14/2015	4/13/2015	4/16/2015	4/15/2015	4/14/2015	4/9/2015
		Parent Sample ID					SB-56R1						
Analyte	**MDE GW**	**Unit**											
2-methylphenol	180	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
3,3'-dichlorobenzidine	0.15	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
4-Chloroaniline	33	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
4-methylphenol	18	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Acenaphthene	20	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	< 0.22 U	< 0.21 U	< 0.19 U
Acenaphthylene	83	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	0.084 J	< 0.22 U	< 0.21 U	< 0.19 U
Anthracene	183	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	0.10 J	< 0.21 U	< 0.19 U
Benzaldehyde	0.2	µg/L	< 0.21 U	0.23	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	1.5	< 0.21 U	< 0.19 U
Benzo(a)anthracene	0.2	µg/L	< 0.21 U	0.25	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	1.4	< 0.21 U	0.023 J
Benzo(a)pyrene	0.2	µg/L	< 0.21 U	0.25	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	2.2	< 0.21 U	0.021 J
Benzo(g,h,i)perylene	18	µg/L	< 0.21 U	0.17 J	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	1.5	< 0.21 U	< 0.19 U
Benzo(k)fluoranthene	2.1	µg/L	< 0.21 U	0.17 J	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	2.2	< 0.21 U	< 0.19 U
bis(2-Chloroethyl) ether	0.0096	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Bis(2-ethylhexyl) phthalate	6	µg/L	< 0.95 U	< 0.95 U	< 1.1 U	< 0.46 J	< 0.91 U	< 0.95 U	< 0.86 U	< 0.96 U	5.4	< 0.95 U	< 0.86 U
Carbazole	3.3	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Chrysene	2	µg/L	< 0.21 U	0.24	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	2.2	< 0.21 U	< 0.19 U
Dibenz(a,h)anthracene	0.2	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	2.1	< 0.21 U	< 0.19 U
Dibenzofuran	2.8	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Diethylphthalate	2800	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Di-n-butyl phthalate	350	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Diphenylether	150	µg/L	< 0.21 U	0.09 J	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	< 0.22 U	< 0.21 U	< 0.19 U
Fluorene	30	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	< 0.22 U	< 0.21 U	< 0.19 U
Hexachloro-1,3-butadiene	0.86	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Hexachlorobenzene	0.072	µg/L	< 1.0 U	< 1.0 U	< 0.79 J	< 0.85 J	< 1.0 U	< 1.0 U	< 0.96 U	< 0.84 J	< 1.1 U	< 1.0 U	< 0.96 U
Hexachlorocyclopentadiene	50	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Hexachloroethane	4.8	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Indeno(1,2,3-cd)pyrene	0.2	µg/L	< 0.21 U	0.12 J	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	2.0	< 0.21 U	< 0.19 U
Isophorone	73	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Naphthalene	150	µg/L	< 0.21 U	4.3	< 0.26 U	0.034 J	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	< 0.22 U	< 0.21 U	< 0.19 U
Nitrobenzene	3.4	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 2.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
N-nitrosodi-n-propylamine	0.0096	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
N-nitrosodiphenylamine	20	µg/L	< 1.0 U	< 1.0 U	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Pentachlorophenol	1	µg/L	< 1.0 U	63	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Phenanthrene	180	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	0.083 J	< 0.21 U	< 0.19 U
Phenol	2100	µg/L	< 1.0 U	2.0 J	< 1.5 U	< 1.0 U	< 1.0 U	< 1.0 U	< 0.96 U	< 1.1 U	< 1.1 U	< 1.0 U	< 0.96 U
Pyrene	18	µg/L	< 0.21 U	< 0.21 U	< 0.26 U	< 0.21 U	< 0.20 U	< 0.21 U	< 0.19 U	< 0.23 U	< 0.22 U	< 0.21 U	< 0.19 U
pH (SW 9040C)													
pH	NNE	pH units	5.95 HF	4.52 HF	7.01 HF	7.05 HF	7.15 HF	7.15 HF	6.50 HF	6.22 HF	4.24 HF	6.88 HF	6.07 HF

Notes:

Maryland Dept. of Environment June 2008 cleanup standards for GW: type I and II aquifers

USEPA Maximum Contaminant Level (MCL), January 2011

µg/L = micrograms/liter

pg/L = picogram per liter

ND = Compound was found in the blank and sample

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

* = ISTD response or retention time outside applicable limits

E = Result exceeds calibration range

PE = MS and or MSD Recovery is outside acceptance limits

Q = One or more quality control criteria failed

HF = Field parameter with a holding time of 15 minutes

U = Not Detected

Values exceeding the MDE Groundwater criteria are bolded

Table D-14
Cristal USA Facility
Surface Water Results

					Location ID:	BB-08	BB-08	LB-08	LB-07
					Sample Name:	BB-08	FD-2-040222015	LB-08	LB-07
					Date Sampled:	4/2/2015	4/2/2015	4/1/2015	4/1/2015
					Parent Sample ID:		BB-08		
Analyte	**MDE Eco Freshwater Acute**	**MDE Eco Freshwater Chronic**	**Health Drinking Water and Organism**	**MDE Human Health Organism**	**Unit**				
Dioxin/Furan (SW1613B)									
1,2,3,4,6,7,8-heptachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	3.0 QBJ	2.5 BJ	0.93 QBJ	2.1 BJ
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	NSL	NSL	NSL	NSL	pg/l	1.9 QJ	< 53 U	< 47 U	0.69 QJ
1,2,3,4,7,8,9-heptachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	1.4 QBJ	1.0 QBJ	0.86 QBJ	< 53 U
1,2,3,4,7,8-hexachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	1.4 BJ	0.30 QBJ	1.3 BJ	1.7 BJ
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	NSL	NSL	pg/l	< 54 U	0.32 J	0.27 QJ	< 53 U
1,2,3,6,7,8-hexachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	0.51 QJ	< 53 U	< 47 U	0.36 QJ
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	< 47 U	0.44 QJ
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NSL	NSL	NSL	NSL	pg/l	0.85 QSJ	< 53 U	< 47 U	< 53 U
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	< 47 U	0.77 QJ
1,2,3,7,8-pentachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	0.30 QBJ	0.68 QBJ
1,2,3,7,8-pentachlorodibenzo-p-dioxin	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	< 47 U	< 53 U
2,3,4,6,7,8-hexachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	< 47 U	< 53 U
2,3,4,7,8-pentachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	< 54 U	< 53 U	< 47 U	< 53 U
2,3,7,8-tetrachlorodibenzodioxin	NSL	NSL	NSL	NSL	pg/l	< 11 U	< 11 U	< 9.5 U	< 11 U
2,3,7,8-tetrachlorodibenzofuran	NSL	NSL	NSL	NSL	pg/l	< 11 U	< 11 U	< 9.5 U	0.30 QJ
OCDD (octachlorodibenzo-4-dioxin)	NSL	NSL	NSL	NSL	pg/l	20 BJ	5.8 QBJ	3.8 QBJ	15 BJ
OCDF (octachlorodibenzofuran)	NSL	NSL	NSL	NSL	pg/l	56 QBJ	28 QBJ	6.9 QBJ	15 BJ
Dioxin TEQs - TEF_WHO	30	NSL	NSL	NSL	pg/l	0.155	0.032	0	0
Metals (SW6020A)									
Aluminum	NSL	NSL	NSL	NSL	µg/l	800	800	79.2	78.1
Antimony	NSL	NSL	5.6	640	µg/l	< 20 U	5.1 J	< 20 U	< 20 U
Arsenic	340	150	0.18	1.4	µg/l	< 10 U	< 10 U	**6.0 JB**	**6.3 JB**
Barium	NSL	NSL	1000	NSL	µg/l	26 J	26 J	14 J	24 J
Beryllium	NSL	NSL	4	NSL	µg/l	< 10 U	< 10 U	0.56 J	< 10 U
Cadmium	2	0.25	5	NSL	µg/l	< 10 U	< 10 U	< 10 U	< 10 U
Calcium	NSL	NSL	NSL	NSL	µg/l	780000	760000	380000	290000
Chromium	NSL	NSL	100	NSL	µg/l	68	64	16 J	30 J
Cobalt	NSL	NSL	NSL	NSL	µg/l	2.0 J	1.8 J	1.2 J	3.0 J
Copper	13	9	1300	NSL	µg/l	6.0 J	5.3 J	4.3 J	6.2 J
Iron	NSL	NSL	NSL	NSL	µg/l	5300 F2	5100	920	13000
Lead	65	2.5	NSL	NSL	µg/l	0.94 J	0.52 J	< 10 U	< 10 U
Magnesium	NSL	NSL	NSL	NSL	µg/l	1710000 B	1600000 B	200000 B	1010000 B
Manganese	NSL	NSL	NSL	NSL	µg/l	830 F1F2	810	870	1800
Nickel	470	52	610	4600	µg/l	29	25	6.8 J	7.8 J
Potassium	NSL	NSL	NSL	NSL	µg/l	32000	31000	14000 B	9700 B
Selenium	20	5	170	4200	µg/l	< 50 U F2	< 50 U	< 50 U	< 50 U
Silver	3.2	NSL	NSL	NSL	µg/l	< 10 U	< 10 U	< 10 U	< 10 U
Sodium	NSL	NSL	NSL	NSL	µg/l	700000 B	680000 B	250000 B	89000 B
Thallium	NSL	NSL	0.24	0.47	µg/l	< 10 U	< 10 U	0.36 J	**0.25 J**
Vanadium	NSL	NSL	NSL	NSL	µg/l	160	150	6.6 J	7.6 J

Table D-14
Cristal USA Facility
Surface Water Results

					Location ID:	BB-08	BB-08	LB-08	UB-07
					Sample Name:	BB-08	FD-2-04022015	LB-08	UB-07
					Date Sampled:	4/2/2015	4/2/2015	4/1/2015	4/1/2015
					Parent Sample ID:		BB-08		
Analyte	**MDE Eco Freshwater Acute**	**MDE Eco Freshwater Chronic**	**Health Drinking Water and Organism**	**MDE Human Health Organism**	**Unit**				
Zinc	120	120	7400	26000	µg/l	36 J	< 50 U	20 J	14 J
Mercury (SW7470A)									
Mercury	1.4	0.77	NSL	0.3	µg/l	< 0.20 U	< 0.20 U	0.087 J	**0.41**
PCBS (SW8082A)									
Aroclor 1016	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1221	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1232	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1242	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1248	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1254	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Aroclor 1260	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
Polychlorinated Biphenyls	NSL	0.014	0.00064	0.00064	µg/l	< 0.0099 U	< 0.0099 U	< 0.0095 U	< 0.010 U
VOCS (SW8260C)									
1,1,1-trichloroethane	NSL	NSL	200	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	1.0
1,1,2,2-tetrachloroethane	NSL	NSL	1.7	40	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,1,2-trichloroethane	NSL	NSL	5.9	160	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,1-dichloroethane	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	0.27 J
1,1-dichloroethene	NSL	NSL	330	7100	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,2-Dibromo-3-chloropropane	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,2-dibromoethane	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,2-dichloroethane	NSL	NSL	3.8	370	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,2-dichloroethene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,2-dichloropropane	NSL	NSL	5	150	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
2-butanone	NSL	NSL	NSL	NSL	µg/l	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
4-methyl-2-pentanone	NSL	NSL	NSL	NSL	µg/l	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Acetone	NSL	NSL	NSL	NSL	µg/l	4.5 J	5.0	< 5.0 U	6.2
Benzene	NSL	NSL	22	510	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Bromodichloromethane	NSL	NSL	80 *	170	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Bromoform	NSL	NSL	80 *	140	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Bromomethane	NSL	NSL	NSL	NSL	µg/l	< 1.0 UJ	< 1.0 U	< 1.0 U	< 1.0 U
Carbon disulfide	NSL	NSL	NSL	NSL	µg/l	< 1.0 UJ	< 1.0 U	< 1.0 U	< 1.0 U
Carbon tetrachloride	NSL	NSL	2.3	16	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Chlorobenzene	NSL	NSL	130	1600	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Chloroethane	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Chloroform	NSL	NSL	80 *	4700	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Chloromethane	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
cis-1,2-dichloroethene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
cis-1,3-dichloropropene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Dibromochloromethane	NSL	NSL	80 *	130	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Ethylbenzene	NSL	NSL	530	2100	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Isopropylbenzene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U

Table D-14
Cristal USA Facility
Surface Water Results

					Location ID:	BH-08	BH-08	BH-08	BH-07
					Sample Name:	BH-08	FD-2-04022015	BH-08	BH-07
					Date Sampled:	4/2/2015	4/2/2015	4/1/2015	4/1/2015
					Parent Sample ID:		BH-08		
Analyte	**MDE Eco Freshwater Acute**	**MDE Eco Freshwater Chronic**	**Health Drinking Water and Organism**	**MDE Human Health Organism**	**Unit**				
Methyl tert-butyl ether	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Methylene Chloride	NSL	NSL	46	5900	µg/l	0.13 J	< 1.0 U	< 1.0 U	< 1.0 U
Styrene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Tetrachloroethene	NSL	NSL	6.9	22	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Toluene	NSL	NSL	1300	15000	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
trans-1,2-dichloroethene	NSL	NSL	140	10000	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
trans-1,3-dichloropropene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Trichloroethene	NSL	NSL	25	300	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Vinyl chloride	NSL	NSL	0.25	24	µg/l	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
Xylenes, Total	NSL	NSL	NSL	NSL	µg/l	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
SVOCS (SW8270D)									
1,2,4-trichlorobenzene	NSL	NSL	35	70	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
1,2-dichlorobenzene	NSL	NSL	420	1300	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
1,3-dichlorobenzene	NSL	NSL	320	960	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
1,4-dichlorobenzene	NSL	NSL	63	190	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,2'-oxybis(1-chloropropane)	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,4,5-trichlorophenol	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,4,6-trichlorophenol	NSL	NSL	14	23	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,4-dichlorophenol	NSL	NSL	77	290	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,4-dimethylphenol	NSL	NSL	380	850	µg/l	< 1.0 UF1	< 0.96 U	< 1.0 U	< 1.0 U
2,4-dinitrophenol	NSL	NSL	69	5300	µg/l	< 5.0 U	< 4.8 U	< 5.0 U	< 5.2 U
2,4-dinitrotoluene	NSL	NSL	1.1	34	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2,6-dinitrotoluene	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2-chloronaphthalene	NSL	NSL	1000	1600	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
2-chlorophenol	NSL	NSL	80	150	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
2-methylnaphthalene	NSL	NSL	NSL	NSL	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
2-methylphenol	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
3,3-dichlorobenzidine	NSL	NSL	0.21	0.28	µg/l	< 1.0 UF1	< 0.96 U	< 1.0 U	< 1.0 U
4-chloroaniline	NSL	NSL	NSL	NSL	µg/l	< 1.0 UF1	< 0.96 U	< 1.0 U	< 1.0 U
4-methylphenol	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
Acenaphthene	NSL	NSL	670	990	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Acenaphthylene	NSL	NSL	NSL	NSL	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Anthracene	NSL	NSL	8300	40000	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Benzo[a]anthracene	NSL	NSL	0.038	0.18	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Benzo[a]pyrene	NSL	NSL	0.038	0.18	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Benzo[b]fluoranthene	NSL	NSL	0.038	0.18	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Benzo[g,h,i]perylene	NSL	NSL	NSL	NSL	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Benzo[k]fluoranthene	NSL	NSL	0.038	0.18	µg/l	< 0.20 U	< 0.19 U	< 0.20 U	< 0.21 U
Bis(2-chloroethyl) ether	NSL	NSL	0.3	5.3	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U
Bis(2-ethylhexyl) phthalate	NSL	NSL	12	22	µg/l	< 2.0 U	1.4 J	0.76 J	1.6 J
Carbazole	NSL	NSL	NSL	NSL	µg/l	< 1.0 U	< 0.96 U	< 1.0 U	< 1.0 U

Table D-14
Cristal USA Facility
Surface Water Results

					Lucation ID:	BB-08	BB-08	LB-08	UB-07
					Sample Name:	BB-08	FD-2404022015	LB-08	UB-07
					Date Sampled:	4/2/2015	4/2/2015	4/1/2015	4/1/2015
					Parent Sample ID:		BB-08		
Analyte	**MDE Eco Freshwater Acute**	**MDE Eco Freshwater Chronic**	**Health Drinking Water and Organism**	**MDE Human Health Organism**	**Unit**				
Chrysene	NSL	NSL	0.038	0.18	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Dibenz[a,h]anthracene	NSL	NSL	0.038	0.18	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Dibenzofuran	NSL	NSL	NSL	NSL	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Diethyl phthalate	NSL	NSL	17000	44000	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Di-n-butyl phthalate	NSL	NSL	2000	4500	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Fluoranthene	NSL	NSL	130	140	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Fluorene	NSL	NSL	1100	5300	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Hexachloro-1,3-butadiene	NSL	NSL	NSL	NSL	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Hexachlorobenzene	NSL	NSL	0.0028	0.0029	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Hexachlorocyclopentadiene	NSL	NSL	40	1100	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Hexachloroethane	NSL	NSL	14	33	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Indeno[1,2,3-c,d]pyrene	NSL	NSL	0.038	0.18	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Isophorone	NSL	NSL	350	9600	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Naphthalene	NSL	NSL	NSL	NSL	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Nitrobenzene	NSL	NSL	17	690	µg/l	< 2.0 UJ	< 1.9 UJ	< 2.0 UJ	< 2.1 UJ
N-nitrosodi-n-propylamine	NSL	NSL	0.05	5.1	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
N-nitrosodiphenylamine	NSL	NSL	33	60	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Pentachlorophenol	19	15	2.7	30	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Phenanthrene	NSL	NSL	NSL	NSL	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
Phenol	NSL	NSL	10000	860000	µg/l	< 1.0 UJ	< 0.96 UJ	< 1.0 UJ	< 1.0 UJ
Pyrene	NSL	NSL	830	4000	µg/l	< 0.20 UJ	< 0.19 UJ	< 0.20 UJ	< 0.21 UJ
pH (SW9040C)									
pH	NSL	NSL	NSL	NSL	pH Units	7.51 H	7.64 H	7.96 H	7.02 H

Notes
MDE Numerical Criteria for Toxic Substances in Surface Waters
¹ = USEPA Maxium Contament Level (MCL), January 2015
Values exceeding MDE Human Health Drinking Water and Organism are bolded
Values MDE Human Health Organism are shaded gray
µg/l = microgram liter
pg/l= picogram per liter
B= Compound was found in the blank and sample.
J= Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
*=ISTD response or retention time outside applicable limits
E= Result exceeds calibration range
F1=MS and/or MDS Recovery is outside acceptance limits
Q = One or more quality control criteria failed
HF= Field parameter with a holding time of 15 minutes
U= Not Detected

Table D-15
Cristal USA Facility
Groundwater Field Parameters

	Well ID	SB-20	SB-19	SB-30	SS-05	SB-40	SB-42	SB-47	SB-28	AN-04	AN-13
	Date	4/3/2015	4/8/2015	4/8/2015	4/9/2015	4/13/2015	4/13/2015	4/13/2015	4/13/2015	4/14/2015	4/14/2015
	Time	1215	0825	1105	0900	0825	0940	1115	1325	0840	1005
Field Parameters	Units										
pH	pH units	6.97	4.15	5	6.26	6.61	5.95	4.5	4.62	5.83	6.06
Conductivity	uS/cm	361	1437	1339	1156	3720	67.3	1630	19787	3313	705
Temperature	°C	10.75	10.3	10.18	11.08	9.43	10.79	11.5	13.99	12.68	10.45
ORP	mV	14.4	78	154.1	-175.1	-104.9	-26.7	146	96.7	127.9	20.4
Turbitity	NTU	236	23.2	74.8	31.7	21.6	440	660	70.1	35.6	36.2
Dissolved Oxygen	mg/L	6.89	4.63	7.12	0.46	1.19	0.7	0.58	2.13	7.71	3.19

Notes
uS/cm = micosiemens per centimeter
°C= Degrees Celsius
mV= millivolts
NTU= Nephelometric Turbidity Unit
mg/L = milligrams per liter
*= Analysis Performed by laboratory
N=Not Analyzed

Table D-15
Cristal USA Facility
Groundwater Field Parameters

	SB-56	SS-03	SB-24	SB-35	SB-60	SB-59	SB-57	SB-53	SB-50
	4/14/2015	4/14/2015	4/15/2015	4/15/2015	4/15/2015	4/16/2015	4/17/2015	4/17/2015	4/17/2015
	1145	1445	0815	1035	1310	1100	0850	1330	1500
Field Parameters									
pH	4.76	6.59	6.28	4.33	4.05	6.54	6.72	8.6	NA
Conductivity	4373	1342	3461	20279	437	6880	1632	1142	11000*
Temperature	14.1	10.03	12.14	11.1	10.58	13	9.8	10.46	NA
ORP	55	-122.2	-61	49.3	246.2	90	-89.4	-49.2	190*
Turbiuty	19.6	939.2	32.3	65.6	70.2	3.7	26.8	728	NA
Dissolved Oxygen	0.3	0.33	3.4	2.23	3.49	6.35	0.38	16.46	NA

Notes
uS/cm = micosiemens per centimeter
°C= Degrees Celsius
mV= millivolts
NTU= Nephelometric Turbidity Unit
mg/L = milligrams per liter
*= Analysis Performed by laboratory
N=Not Analyzed

Table D-16
Cristal USA Facility
Analytical Services Soil Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Non-Residential Soil
RAD (pCi/g)				
E901.1	Cesium-137	10045-97-3	0.2	NSL
Dioxin/Furan (pg/g)				
SW1613B	1,2,3,4,6,7,8-heptachlorodibenzofuran	67562-39-4	2.9	NSL
SW1613B	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822-46-9	2.9	NSL
SW1613B	1,2,3,4,7,8,9-heptachlorodibenzofuran	55673-89-7	2.9	NSL
SW1613B	1,2,3,4,7,8-hexachlorodibenzofuran	70648-26-9	2.9	NSL
SW1613B	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227-28-6	2.9	NSL
SW1613B	1,2,3,6,7,8-hexachlorodibenzofuran	57117-44-9	2.9	NSL
SW1613B	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653-85-7	2.9	NSL
SW1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	2.9	NSL
SW1613B	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408-74-3	2.9	NSL
SW1613B	1,2,3,7,8-pentachlorodibenzofuran	57117-41-6	2.9	NSL
SW1613B	1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321-76-4	2.9	NSL
SW1613B	2,3,4,6,7,8-hexachlorodibenzofuran	60851-34-5	2.9	NSL
SW1613B	2,3,4,7,8-pentachlorodibenzofuran	57117-31-4	2.9	NSL
SW1613B	2,3,7,8-tetrachlorodibenzodioxin	1746-01-6	0.58	NSL
SW1613B	2,3,7,8-tetrachlorodibenzofuran	51207-31-9	0.58	NSL
SW1613B	OCDD (octachlorodibenzo-4-dioxin)	3268-87-9	5.8	NSL
SW1613B	OCDF (octachlorodibenzofuran)	39001-02-0	5.8	NSL
PPL Metals (mg/kg)				
SW6020A	Aluminum	7429-90-5	1.7	100000
SW6020A	Antimony	7440-36-0	0.11	41
SW6020A	Arsenic	7440-38-2	0.057	3.0
SW6020A	Barium	7440-39-3	0.57	20000
SW6020A	Beryllium	7440-41-7	0.057	200
SW6020A	Cadmium	7440-43-9	0.057	51
SW6020A	Calcium	7440-70-2	5.7	NSL
SW6020A	Chromium	7440-47-3	0.11	310
SW6020A	Cobalt	7440-48-4	0.028	NSL
SW6020A	Copper	7440-50-8	0.11	4100
SW6020A	Iron	7439-89-6	2.8	72000
SW6020A	Lead	7439-92-1	0.057	1000
SW6020A	Magnesium	7439-95-4	5.7	NSL
SW6020A	Manganese	7439-96-5	0.28	2000
SW6020A	Nickel	7440-02-0	0.057	2000
SW6020A	Potassium	7440-09-7	5.7	NSL
SW6020A	Selenium	7782-49-2	0.28	510
SW6020A	Silver	7440-22-4	0.057	510
SW6020A	Sodium	7440-23-5	5.7	NSL
SW6020A	Thallium	7440-28-0	0.057	7.2
SW6020A	Vanadium	7440-62-2	0.057	100
SW6020A	Zinc	7440-66-6	0.28	31000
SW7196A	Chromium (hexavalent)	18540-29-9	0.49	310

Table D-16
Cristal USA Facility
Analytical Services Soil Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Non-Residential Soil
SW7196A	Chromium (III)	16065-83-1	0.5	NSL
SW7471B	Mercury	7439-97-6	0.017	10
TPH (mg/kg)				
SW8015C	Diesel Range Organics	DRO	17	620
SW8015C	Gasoline Range Organics	GRO	0.1	620
PCBs (µg/kg)				
SW8082A	Aroclor 1016	12674-11-2	0.9	41000
SW8082A	Aroclor 1221	11104-28-2	0.9	1400
SW8082A	Aroclor 1232	11141-16-5	0.9	1400
SW8082A	Aroclor 1242	53469-21-9	0.9	1400
SW8082A	Aroclor 1248	12672-29-6	0.9	1400
SW8082A	Aroclor 1254	11097-69-1	0.9	1400
SW8082A	Aroclor 1260	11096-82-5	0.9	1400
SW8082A	Polychlorinated Biphenyls	1336-36-3	0.9	1400
VOCs (µg/kg)				
SW8260C	1,1,1-trichloroethane	71-55-6	3.8	200000000
SW8260C	1,1,2,2-tetrachloroethane	79-34-5	3.8	14000
SW8260C	1,1,2-trichloroethane	79-00-5	3.8	50000
SW8260C	1,1-dichloroethane	75-34-3	3.8	20000000
SW8260C	1,1-dichloroethene	75-35-4	3.8	5100000
SW8260C	1,2-Dibromo-3-chloropropane	96-12-8	3.8	3600
SW8260C	1,2-dibromoethane	106-93-4	3.8	1400
SW8260C	1,2-dichloroethane	107-06-2	3.8	31000
SW8260C	1,2-dichloroethene	540-59-0	3.8	920000
SW8260C	1,2-dichloropropane	78-87-5	3.8	42000
SW8260C	2-butanone	78-93-3	3.8	61000000
SW8260C	4-methyl-2-pentanone	108-10-1	3.8	NSL
SW8260C	Acetone	67-64-1	15	92000000
SW8260C	Benzene	71-43-2	3.8	52000
SW8260C	Bromodichloromethane	75-27-4	3.8	46000
SW8260C	Bromoform	75-25-2	3.8	360000
SW8260C	Bromomethane	74-83-9	3.8	140000
SW8260C	Carbon disulfide	75-15-0	3.8	10000000
SW8260C	Carbon tetrachloride	56-23-5	3.8	22000
SW8260C	Chlorobenzene	108-90-7	3.8	2000000
SW8260C	Chloroethane	75-00-3	3.8	990000
SW8260C	Chloroform	67-66-3	3.8	1000000
SW8260C	Chloromethane	74-87-3	3.8	NSL
SW8260C	cis-1,2-dichloroethene	156-59-2	3.8	1000000
SW8260C	cis-1,3-dichloropropene	10061-01-5	3.8	29000
SW8260C	Dibromochloromethane	124-48-1	3.8	34000
SW8260C	Ethylbenzene	100-41-4	3.8	10000000
SW8260C	Isopropylbenzene	98-82-8	3.8	10000000
SW8260C	Methyl tert-butyl ether	1634-04-4	3.8	720000

Table D-16
Cristal USA Facility
Analytical Services Soil Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Non-Residential Soil
SW8260C	Methylene Chloride	75-09-2	3.8	380000
SW8260C	Styrene	100-42-5	3.8	20000000
SW8260C	Tetrachloroethene	127-18-4	3.8	5300
SW8260C	Toluene	108-88-3	3.8	8200000
SW8260C	trans-1,2-dichloroethene	156-60-5	3.8	2000000
SW8260C	trans-1,3-dichloropropene	10061-02-6	3.8	29000
SW8260C	Trichloroethene	79-01-6	3.8	7200
SW8260C	Vinyl chloride	75-01-4	3.8	4000
SW8260C	Xylenes, Total	1330-20-7	11	20000000
SVOCs (µg/kg)				
SW8270D	1,2,4-trichlorobenzene	120-82-1	19	1000000
SW8270D	1,2-dichlorobenzene	95-50-1	19	9200000
SW8270D	1,3-dichlorobenzene	541-73-1	19	310000
SW8270D	1,4-dichlorobenzene	106-46-7	19	120000
SW8270D	2,2-oxybis(1-chloropropane)	108-60-1	3.8	NSL
SW8270D	2,4,5-trichlorophenol	95-95-4	19	10000000
SW8270D	2,4,6-trichlorophenol	88-06-2	19	260000
SW8270D	2,4-dichlorophenol	120-83-2	3.8	310000
SW8270D	2,4-dimethylphenol	105-67-9	19	2000000
SW8270D	2,4-dinitrophenol	51-28-5	96	200000
SW8270D	2,4-dinitrotoluene	121-14-2	19	200000
SW8270D	2,6-dinitrotoluene	606-20-2	19	100000
SW8270D	2-chloronaphthalene	91-58-7	3.8	8200000
SW8270D	2-chlorophenol	95-57-8	19	510000
SW8270D	2-methylnaphthalene	91-57-6	3.7	410000
SW8270D	2-methylphenol	95-48-7	19	5100000
SW8270D	3,3-dichlorobenzidine	91-94-1	19	6400
SW8270D	4-chloroaniline	106-47-8	19	410000
SW8270D	4-methylphenol	106-44-5	19	510000
SW8270D	Acenaphthene	83-32-9	3.7	6100000
SW8270D	Acenaphthylene	208-96-8	3.7	6100000
SW8270D	Anthracene	120-12-7	3.7	31000000
SW8270D	Benzo[a]anthracene	56-55-3	3.7	3900
SW8270D	Benzo[a]pyrene	50-32-8	3.7	390
SW8270D	Benzo[b]fluoranthene	205-99-2	3.7	3900
SW8270D	Benzo[g,h,i]perylene	191-24-2	3.7	3100000
SW8270D	Benzo[k]fluoranthene	207-08-9	3.7	39000
SW8270D	Bis(2-chloroethyl) ether	111-44-4	3.8	2600
SW8270D	Bis(2-ethylhexyl) phthalate	117-81-7	38	200000
SW8270D	Carbazole	86-74-8	3.8	140000
SW8270D	Chrysene	218-01-9	3.7	390000
SW8270D	Dibenz[a,h]anthracene	53-70-3	3.7	390
SW8270D	Dibenzofuran	132-64-9	19	100000
SW8270D	Diethyl phthalate	84-66-2	19	82000000

Table D-16
Cristal USA Facility
Analytical Services Soil Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Non-Residential Soil
SW8270D	Di-n-butyl phthalate	84-74-2	19	10000000
SW8270D	Fluoranthene	206-44-0	3.7	4100000
SW8270D	Fluorene	86-73-7	3.7	4100000
SW8270D	Hexachloro-1,3-butadiene	87-68-3	3.8	37000
SW8270D	Hexachlorobenzene	118-74-1	3.8	1800
SW8270D	Hexachlorocyclopentadiene	77-47-4	19	610000
SW8270D	Hexachloroethane	67-72-1	19	200000
SW8270D	Indeno[1,2,3-c,d]pyrene	193-39-5	3.7	3900
SW8270D	Isophorone	78-59-1	19	3000000
SW8270D	Naphthalene	91-20-3	3.7	2000000
SW8270D	Nitrobenzene	98-95-3	38	51000
SW8270D	N-nitrosodi-n-propylamine	621-64-7	3.8	410
SW8270D	N-nitrosodiphenylamine	86-30-6	19	580000
SW8270D	Pentachlorophenol	87-86-5	19	24000
SW8270D	Phenanthrene	85-01-8	3.7	31000000
SW8270D	Phenol	108-95-2	3.8	31000000
SW8270D	Pyrene	129-00-0	3.7	3100000
pH				
SW9045D	pH	PH	0.1	NSL

Notes:
MDE Non-Residential Soil - Maryland Dept. of Environment June 2008 residential cleanup standards for soil
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g= picocurie per gram
pg/g = picogram per gram
NSL = No Screening Level
PCBs -=olychlorinated Biphenyls
PPL Metals = priority pollutant list metals
SVOCs = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOCs= Volatile organic compound

Table D-17
Cristal USA Facility
Analytical Services Water Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Groundwater
Dioxin/Furans (pg/l)				
SW1613B	1,2,3,4,6,7,8-heptachlorodibenzofuran	67562-39-4	46	NSL
SW1613B	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822-46-9	46	NSL
SW1613B	1,2,3,4,7,8,9-heptachlorodibenzofuran	55673-89-7	46	NSL
SW1613B	1,2,3,4,7,8-hexachlorodibenzofuran	70648-26-9	46	NSL
SW1613B	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227-28-6	46	NSL
SW1613B	1,2,3,6,7,8-hexachlorodibenzofuran	57117-44-9	46	NSL
SW1613B	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653-85-7	46	NSL
SW1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	46	NSL
SW1613B	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408-74-3	46	NSL
SW1613B	1,2,3,7,8-pentachlorodibenzofuran	57117-41-6	46	NSL
SW1613B	1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321-76-4	46	NSL
SW1613B	2,3,4,6,7,8-hexachlorodibenzofuran	60851-34-5	46	NSL
SW1613B	2,3,4,7,8-pentachlorodibenzofuran	57117-31-4	46	NSL
SW1613B	2,3,7,8-tetrachlorodibenzodioxin	1746-01-6	9.2	NSL
SW1613B	2,3,7,8-tetrachlorodibenzofuran	51207-31-9	9.2	NSL
SW1613B	OCDD (octachlorodibenzo-4-dioxin)	3268-87-9	92	NSL
SW1613B	OCDF (octachlorodibenzofuran)	39001-02-0	92	NSL
PPL Metals (µg/l)				
SW6020A	Aluminum	7429-90-5	30	50
SW6020A	Antimony	7440-36-0	2	6
SW6020A	Arsenic	7440-38-2	1	10
SW6020A	Barium	7440-39-3	10	2000
SW6020A	Beryllium	7440-41-7	1	4
SW6020A	Cadmium	7440-43-9	1	5
SW6020A	Calcium	7440-70-2	100	NSL
SW6020A	Chromium	7440-47-3	2	100
SW6020A	Cobalt	7440-48-4	0.5	NSL
SW6020A	Copper	7440-50-8	2	1300
SW6020A	Iron	7439-89-6	50	300
SW6020A	Lead	7439-92-1	1	15
SW6020A	Magnesium	7439-95-4	100	NSL
SW6020A	Manganese	7439-96-5	5	50
SW6020A	Nickel	7440-02-0	1	73
SW6020A	Potassium	7440-09-7	100	NSL
SW6020A	Selenium	7782-49-2	5	50
SW6020A	Silver	7440-22-4	1	100
SW6020A	Sodium	7440-23-5	100	NSL
SW6020A	Thallium	7440-28-0	1	2
SW6020A	Vanadium	7440-62-2	1	3.7
SW6020A	Zinc	7440-66-6	5	5000
SW7470A	Mercury	7439-97-6	0.2	0.37
PCBs (µg/l)				
SW8082A	Aroclor 1016	12674-11-2	0.0094	0.96
SW8082A	Aroclor 1221	11104-28-2	0.0094	0.5
SW8082A	Aroclor 1232	11141-16-5	0.0094	0.5
SW8082A	Aroclor 1242	53469-21-9	0.0094	0.5
SW8082A	Aroclor 1248	12672-29-6	0.0094	0.5
SW8082A	Aroclor 1254	11097-69-1	0.0094	0.5
SW8082A	Aroclor 1260	11096-82-5	0.0094	0.5
SW8082A	Polychlorinated Biphenyls	1336-36-3	0.0094	0.5

Table D-17
Cristal USA Facility
Analytical Services Water Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Groundwater
VOCs (µg/l)				
SW8260C	1,1,1-trichloroethane	71-55-6	1	200
SW8260C	1,1,2,2-tetrachloroethane	79-34-5	1	0.053
SW8260C	1,1,2-trichloroethane	79-00-5	1	5
SW8260C	1,1-dichloroethane	75-34-3	1	90
SW8260C	1,1-dichloroethene	75-35-4	1	7
SW8260C	1,2-Dibromo-3-chloropropane	96-12-8	1	NSL
SW8260C	1,2-dibromoethane	106-93-4	1	0.05
SW8260C	1,2-dichloroethane	107-06-2	1	5
SW8260C	1,2-dichloroethene	540-59-0	1	5.5
SW8260C	1,2-dichloropropane	78-87-5	1	5
SW8260C	2-butanone	78-93-3	5	700
SW8260C	4-methyl-2-pentanone	108-10-1	5	630
SW8260C	Acetone	67-64-1	5	550
SW8260C	Benzene	71-43-2	1	5
SW8260C	Bromodichloromethane	75-27-4	1	80
SW8260C	Bromoform	75-25-2	1	80
SW8260C	Bromomethane	74-83-9	1	0.85
SW8260C	Carbon disulfide	75-15-0	1	100
SW8260C	Carbon tetrachloride	56-23-5	1	5
SW8260C	Chlorobenzene	108-90-7	1	100
SW8260C	Chloroethane	75-00-3	1	3.6
SW8260C	Chloroform	67-66-3	1	80
SW8260C	Chloromethane	74-87-3	1	19
SW8260C	cis-1,2-dichloroethene	156-59-2	1	70
SW8260C	cis-1,3-dichloropropene	10061-01-5	1	0.44
SW8260C	Dibromochloromethane	124-48-1	1	80
SW8260C	Ethylbenzene	100-41-4	1	700
SW8260C	Isopropylbenzene	98-82-8	1	66
SW8260C	Methyl tert-butyl ether	1634-04-4	1	20
SW8260C	Methylene Chloride	75-09-2	1	5
SW8260C	Styrene	100-42-5	1	100
SW8260C	Tetrachloroethene	127-18-4	1	5
SW8260C	Toluene	108-88-3	1	1000
SW8260C	trans-1,2-dichloroethene	156-60-5	1	100
SW8260C	trans-1,3-dichloropropene	10061-02-6	1	0.44
SW8260C	Trichloroethene	79-01-6	1	5
SW8260C	Vinyl chloride	75-01-4	1	2
SW8260C	Xylenes, Total	1330-20-7	3	10000
SVOCs (µg/l)				
SW8270D	1,2,4-trichlorobenzene	120-82-1	0.93	70
SW8270D	1,2-dichlorobenzene	95-50-1	0.93	600
SW8270D	1,3-dichlorobenzene	541-73-1	0.93	1.8
SW8270D	1,4-dichlorobenzene	106-46-7	0.93	75
SW8270D	2,2-oxybis(1-chloropropane)	108-60-1	0.93	NSL
SW8270D	2,4,5-trichlorophenol	95-95-4	0.93	370
SW8270D	2,4,6-trichlorophenol	88-06-2	0.93	6.1
SW8270D	2,4-dichlorophenol	120-83-2	0.93	11
SW8270D	2,4-dimethylphenol	105-67-9	0.93	73
SW8270D	2,4-dinitrophenol	51-28-5	4.6	7.3
SW8270D	2,4-dinitrotoluene	121-14-2	0.93	7.3
SW8270D	2,6-dinitrotoluene	606-20-2	0.93	3.7

Table D-17
Cristal USA Facility
Analytical Services Water Summary Table

Method	Analyte	Cas No.	Reporting Limit	MDE Groundwater
SW8270D	2-chloronaphthalene	91-58-7	0.19	49
SW8270D	2-chlorophenol	95-57-8	0.93	3
SW8270D	2-methylnaphthalene	91-57-6	0.19	2.4
SW8270D	2-methylphenol	95-48-7	0.93	180
SW8270D	3,3-dichlorobenzidine	91-94-1	0.93	0.15
SW8270D	4-chloroaniline	106-47-8	0.93	15
SW8270D	4-methylphenol	106-44-5	0.93	18
SW8270D	Acenaphthene	83-32-9	0.19	37
SW8270D	Acenaphthylene	208-96-8	0.19	37
SW8270D	Anthracene	120-12-7	0.19	180
SW8270D	Benzo[a]anthracene	56-55-3	0.19	0.2
SW8270D	Benzo[a]pyrene	50-32-8	0.19	0.2
SW8270D	Benzo[b]fluoranthene	205-99-2	0.19	0.2
SW8270D	Benzo[g,h,i]perylene	191-24-2	0.19	18
SW8270D	Benzo[k]fluoranthene	207-08-9	0.19	0.3
SW8270D	Bis(2-chloroethyl) ether	111-44-4	0.93	0.0096
SW8270D	Bis(2-ethylhexyl) phthalate	117-81-7	1.9	6
SW8270D	Carbazole	86-74-8	0.93	3.3
SW8270D	Chrysene	218-01-9	0.19	3
SW8270D	Dibenz[a,h]anthracene	53-70-3	0.19	0.2
SW8270D	Dibenzofuran	132-64-9	0.93	3.7
SW8270D	Diethyl phthalate	84-66-2	0.93	2900
SW8270D	Di-n-butyl phthalate	84-74-2	0.93	370
SW8270D	Fluoranthene	206-44-0	0.19	150
SW8270D	Fluorene	86-73-7	0.19	24
SW8270D	Hexachloro-1,3-butadiene	87-68-3	0.93	0.86
SW8270D	Hexachlorobenzene	118-74-1	0.93	1
SW8270D	Hexachlorocyclopentadiene	77-47-4	0.93	50
SW8270D	Hexachloroethane	67-72-1	0.93	4.8
SW8270D	Indeno[1,2,3-c,d]pyrene	193-39-5	0.19	0.2
SW8270D	Isophorone	78-59-1	0.93	70
SW8270D	Naphthalene	91-20-3	0.19	0.65
SW8270D	Nitrobenzene	98-95-3	1.9	0.35
SW8270D	N-nitrosodi-n-propylamine	621-64-7	0.93	0.0096
SW8270D	N-nitrosodiphenylamine	86-30-6	0.93	14
SW8270D	Pentachlorophenol	87-86-5	0.93	1
SW8270D	Phenanthrene	85-01-8	0.19	180
SW8270D	Phenol	108-95-2	0.93	1100
SW8270D	Pyrene	129-00-0	0.19	18
pH				
SW9040C	pH	PH	0.1	NSL

Notes:
CAS - Chemical Abstracts Service
MDE Groundwater ==Maryland Dept. of Environment June 2008 cleanup standards for GW, type I and II aquifers
NSL - No Screening Level
µg/l - micrograms per liter
pg/l - picogram per liter
PPL Metals - priority pollutant list metals
TPH - Total petroleum hydrocarbons
SVOCs - Semi-volatile organic compound
VOCs - Volatile organic compound

Appendix E

Analytical Results
(CD-ROM Only)

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Appendix F

Pro UCL Risk Evaluation Output Data Tables

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TABLE 5-1
SAMPLE LOCATIONS EVALUATED FOR EACH AREA IN THE RISK EVALUAITON
CRISTAL USA FACILITY

Area	Media	Sample Name	Parent Sample	Start Depth	End Depth	Depth Units	Sample Date
Batch Attack Basin							
Batch Attack Basin	Surface Soil	BB-01S		0	0.5	ft.	4/3/2015
Batch Attack Basin		BB-02S		0	0.5	ft.	4/3/2015
Batch Attack Basin		BB-03S		0	0.5	ft.	4/3/2015
Batch Attack Basin		BB-04S		0	0.5	ft.	4/3/2015
Batch Attack Basin		BB-04 0-0.5		0	0.5	ft.	4/3/2015
Batch Attack Basin		BB-05S		0	0.5	ft.	4/2/2015
Batch Attack Basin		BB-06S		0	0.5	ft.	4/2/2015
Batch Attack Basin		BB-07S		0	0.5	ft.	4/2/2015
Batch Attack Basin		BB-08S		0	0.5	ft.	4/2/2015
Batch Attack Basin		FD-1-04022015	BB-08S-04022015	0	0.5	ft.	4/2/2015
East Central							
East-Central Upland	Subsurface Soil	SB-24 8-10		8	10	ft.	4/7/2015
East-Central Upland		SB-28 2.5-4.55		2.5	4.55	ft.	4/3/2015
East-Central Upland		SB-32 2-4		2	4	ft.	4/3/2015
East-Central Upland		DUP-1	SB-36 9-11-03302015	9	11	ft.	3/30/2015
East-Central Upland		SB-33 13-15		13	15	ft.	4/3/2015
East-Central Upland		SB-34 12-14		12	14	ft.	4/7/2015
East-Central Upland		DUP-13	SB-34 12-14-04072015	12	14	ft.	4/7/2015
East-Central Upland		SB-35 9-11		9	11	ft.	4/7/2015
East-Central Upland		SB-40 8-10		8	10	ft.	4/3/2015
East-Central Upland		SB-41 13-15		13	15	ft.	4/3/2015
East-Central Upland		SB-42 5-7		5	7	ft.	4/3/2015
East-Central Upland		SB-43 4-6		4	6	ft.	4/3/2015
East-Central Upland		DUP-09-04032015	SB-43 4-6-04032015	4	6	ft.	4/3/2015
East-Central Upland		SB-44 8-10		8	10	ft.	4/3/2015
East-Central Upland		SB-45 2-4		2	4	ft.	4/7/2015
East-Central Upland		SB-47 7-9		7	9	ft.	4/7/2015
East-Central Upland		SB-52 13-15		13	15	ft.	4/7/2015
East-Central Upland		SB-61 4-6		4	6	ft.	4/3/2015
East-Central Upland	Surface Soil	SB-24 0-2		0	2	ft.	4/7/2015
East-Central Upland		SB-28 0-2		0	2	ft.	4/3/2015
East-Central Upland		DUP-08-04032015	SB-32 0-2-04032015	0	2	ft.	4/3/2015
East-Central Upland		SB-32 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-33 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-34 0-2		0	2	ft.	4/7/2015
East-Central Upland		SB-35 0-2		0	2	ft.	4/7/2015
East-Central Upland		DUP-12	SB-35 0-2-04072015	0	2	ft.	4/7/2015
East-Central Upland		SB-40 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-41 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-42 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-43 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-44 0-2		0	2	ft.	4/3/2015
East-Central Upland		SB-45 0-2		0	2	ft.	4/7/2015
East-Central Upland		SB-47 0-2		0	2	ft.	4/7/2015
East-Central Upland		SB-52 0-2		0	2	ft	4/7/2015
East-Central Upland		SB-56 18		--	--	--	4/7/2015
East-Central Upland		SB-56 0-2		0	2	ft.	4/7/2015
East-Central Upland		SB-61 0-2		0	2	ft.	4/3/2015
Lower Basin							
Lower Settling Basin	Subsurface Soil	DUP-22	LB-02 8-10-04162015	8	10	ft.	4/16/2015
Lower Settling Basin		LB-02 8-10		8	10	ft.	4/16/2015
Lower Settling Basin		LB-03 8-10		8	10	ft.	4/16/2015
Lower Settling Basin		DUP-21	LB-04 6-8-04162015	6	8	ft.	4/16/2015
Lower Settling Basin		LB-04 6-8		6	8	ft.	4/16/2015
Lower Settling Basin		LB-05 6-8		6	8	ft.	4/16/2015
Lower Settling Basin	Surface Soil	LB-02 0-2		0	2	ft.	4/9/2015
Lower Settling Basin		LB-03 0-2		0	2	ft.	4/9/2015
Lower Settling Basin		LB-04 0-2		0	2	ft.	4/9/2015
Lower Settling Basin		DUP-18	LB-05 0-2-04092015	0	2	ft.	4/9/2015
Lower Settling Basin		LB-05 0-2		0	2	ft.	4/9/2015
Lower Settling Basin		LB-06S		0	0.5	ft.	4/2/2015
Lower Settling Basin		LB-07S		0	0.5	ft.	4/2/2015
Lower Settling Basin		LB-08S		0	0.5	ft.	4/2/2015

TABLE 5-1
SAMPLE LOCATIONS EVALUATED FOR EACH AREA IN THE RISK EVALUAITON
CRISTAL USA FACILITY

Area	Media	Sample Name	Parent Sample	Start Depth	End Depth	Depth Units	Sample Date
Landfill							
Landfill		LF-04 0-2		0	2	ft.	4/9/2015
Landfill		LF-05 0-2		0	2	ft.	4/13/2015
Landfill		LF-06 0-2		0	2	ft.	4/13/2015
Landfill		LF-07 0-2		0	2	ft.	4/7/2015
Landfill		LF-08 0-2		0	2	ft.	4/6/2015
Landfill		LF-09 0-2		0	2	ft.	4/7/2015
Landfill		LF10 0-2		0	2	ft.	4/3/2015
Landfill		DUP-20	SB-60 0-2-04102015	0	2	ft.	4/10/2015
Landfill		SB-60 0-2		0	2	ft.	4/10/2015
Middle Basin							
Middle Settling Basin		MB-01S		0	0.5	ft.	4/3/2015
Middle Settling Basin		MB-02S		0	0.5	ft.	4/3/2015
Middle Settling Basin		MB-03S		0	0.5	ft.	4/3/2015
Middle Settling Basin		MB-04S		0	0.5	ft.	4/3/2015
Middle Settling Basin		FD-3-04032015	MB-05S-04032015	0	0.5	ft.	4/3/2015
Middle Settling Basin		MB-05S		0	0.5	ft.	4/3/2015
North West							
Northwest Upland	Subsurface Soil	SB-01 13-15		13	15	ft.	3/31/2015
Northwest Upland		DUP-02	SB-02 1-3-03312015	1	3	ft.	3/31/2015
Northwest Upland		SB-02 1-3		1	3	ft.	3/31/2015
Northwest Upland		SB-02 13-15		13	15	ft.	3/31/2015
Northwest Upland		DUP-06	SB-03 1-3-04022015	1	3	ft.	4/2/2015
Northwest Upland		SB-03 1-3		1	3	ft.	4/2/2015
Northwest Upland		SB-04 1-3		1	3	ft.	4/2/2015
Northwest Upland		SB-04 13-15		13	15	ft.	4/2/2015
Northwest Upland		SB-05 13-15		13	15	ft.	4/2/2015
Northwest Upland		SB-06-13-15		13	15	ft.	4/2/2015
Northwest Upland		SB-07 13-15		13	15	ft.	4/7/2015
Northwest Upland		SB-08 6-8		6	8	ft.	4/7/2015
Northwest Upland		SB-09 8-10		8	10	ft.	4/7/2015
Northwest Upland		SB-10 13-15		13	15	ft.	3/30/2015
Northwest Upland		SB-11 13-15		13	15	ft.	3/31/2015
Northwest Upland		SB-12 13-15		13	15	ft.	3/31/2015
Northwest Upland		SB-13 13-15		13	15	ft.	4/10/2015
Northwest Upland		SB-14 4-6		4	6	ft.	4/10/2015
Northwest Upland		DUP-19	SB-15 13-15-04102015	13	15	ft.	4/10/2015
Northwest Upland		SB-15 13-15		13	15	ft.	4/10/2015
Northwest Upland		SB-16 7-9		7	9	ft.	4/7/2015
Northwest Upland	Surface Soil	SB-01 0-2		0	2	ft.	3/31/2015
Northwest Upland		SB-05 0-2		0	2	ft.	4/2/2015
Northwest Upland		SB-06 0-2		0	2	ft.	4/2/2015
Northwest Upland		SB-07 0-2		0	2	ft.	4/7/2015
Northwest Upland		DUP-14	SB-08 0-2-04072015	0	2	ft.	4/7/2015
Northwest Upland		SB-08 0-2		0	2	ft.	4/7/2015
Northwest Upland		SB-09 0-2		0	2	ft.	4/7/2015
Northwest Upland		SB-10 0-2		0	2	ft.	3/30/2015
Northwest Upland		SB-11 0-2		0	2	ft.	3/31/2015
Northwest Upland		SB-12 0-2		0	2	ft.	3/31/2015
Northwest Upland		SB-13 0-2		0	2	ft.	4/10/2015
Northwest Upland		SB-14 0-2		0	2	ft.	4/10/2015
Northwest Upland		SB-15 0-2		0	2	ft.	4/10/2015
Northwest Upland		SB-16 0-2		0	2	ft.	4/7/2015
Northwest Upland		SB-17 0-2		0	2	ft.	4/7/2015

TABLE 5-1
SAMPLE LOCATIONS EVALUATED FOR EACH AREA IN THE RISK EVALUAITON
CRISTAL USA FACILITY

Area	Media	Sample Name	Parent Sample	Start Depth	End Depth	Depth Units	Sample Date
South							
South Upland	Subsurface Soil	SB-46 8-10		8	10	ft.	4/8/2015
South Upland		SB-48 13-15		13	15	ft.	4/8/2015
South Upland		SB-49 4-6		4	6	ft.	4/8/2015
South Upland		SB-50 4-6		4	6	ft.	4/10/2015
South Upland		SB-51 3-5		3	5	ft.	4/10/2015
South Upland		SB-53 5-7		5	7	ft.	4/8/2015
South Upland		DUP-17	SB-54 11-13-04092015	11	13	ft.	4/9/2015
South Upland		SB-54 11-13		11	13	ft.	4/9/2015
South Upland		SB-55 6-8		6	8	ft.	4/9/2015
South Upland		SB-57 4-6		4	6	ft.	4/9/2015
South Upland		SB-58 11-13		11	13	ft.	4/9/2015
South Upland		SB-59 4-6		4	6	ft.	4/9/2015
South Upland	Surface Soil	SB-46 0-2		0	2	ft.	4/8/2015
South Upland		SB-48 0-2		0	2	ft.	4/8/2015
South Upland		SB-49 0-2		0	2	ft.	4/8/2015
South Upland		SB-50 0-2		0	2	ft.	4/10/2015
South Upland		SB-51 0-2		0	2	ft.	4/10/2015
South Upland		SB-53 0-2		0	2	ft.	4/8/2015
South Upland		SB-54 0-2		0	2	ft.	4/9/2015
South Upland		SB-55 0-2		0	2	ft.	4/9/2015
South Upland		SB-57 0-2		0	2	ft.	4/9/2015
South Upland		SB-58 0-2		0	2	ft.	4/9/2015
South Upland		SB-59 0-2		0	2	ft.	4/9/2015
Spent Solvent Storage (Focuse Area B)							
Spent Solvent Storage	Subsurface Soil	SB-23 1-3		1	3	ft.	4/3/2015
Spent Solvent Storage		SB-23 4-6		4	6	ft.	4/3/2015
Spent Solvent Storage		DUP-07	SS-01 6-8-04022015	6	8	ft.	4/2/2015
Spent Solvent Storage		SS-01 6-8		6	8	ft.	4/2/2015
Spent Solvent Storage		SS-02 13-15		13	15	ft.	4/10/2015
Spent Solvent Storage		SS-03 4-6		4	6	ft.	4/10/2015
Spent Solvent Storage		SS-04 13-15		13	15	ft.	4/10/2015
Spent Solvent Storage		SS-05 1-3		1	3	ft.	4/2/2015
Spent Solvent Storage		SS-05 6-8		6	8	ft.	4/2/2015
Spent Solvent Storage		SS-06 1-3		1	3	ft.	4/2/2015
Spent Solvent Storage		SS-06 5-7		5	7	ft.	4/2/2015
Spent Solvent Storage		SS-01 0-2		0	2	ft.	4/2/2015
Spent Solvent Storage		SS-02 0-2		0	2	ft.	4/10/2015
Spent Solvent Storage		SS-03 0-2		0	2	ft.	4/10/2015
Spent Solvent Storage		SS-04 0-2		0	2	ft.	4/10/2015
Former Titanium Ore Storage (Focus Area A)							
Former Titanium Ore Storage	Subsurface Soil	TS-02 13-15		13	15	ft.	4/8/2015
Former Titanium Ore Storage		DUP-15	TS-04 8-10-04082015	8	10	ft.	4/8/2015
Former Titanium Ore Storage		TS-04 8-10		8	10	ft.	4/8/2015
Former Titanium Ore Storage		TS-06 13-15		13	15	ft.	4/8/2015
Former Titanium Ore Storage		TS-07 4-6		4	6	ft.	4/8/2015
Former Titanium Ore Storage		TS-08 13-15		13	15	ft.	4/8/2015
Former Titanium Ore Storage		TS-01 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-02 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-03 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-04 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-05 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-06 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		DUP-16	TS-07 0-2-04082015	0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-07 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-08 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-09 0-2		0	2	ft.	4/8/2015
Former Titanium Ore Storage		TS-10 0-2		0	2	ft.	4/8/2015

TABLE 5-1
SAMPLE LOCATIONS EVALUATED FOR EACH AREA IN THE RISK EVALUAITON
CRISTAL USA FACILITY

Area	Media	Sample Name	Parent Sample	Start Depth	End Depth	Depth Units	Sample Date
Upper Basin							
Upper Settling Basin	Subsurface Soil	UB-01 5-7		5	7	ft.	4/1/2015
Upper Settling Basin		UB-02 3-5		3	5	ft.	4/1/2015
Upper Settling Basin		UB-03 3-5		3	5	ft.	4/1/2015
Upper Settling Basin		UB-04 2-4		2	4	ft.	4/1/2015
Upper Settling Basin		UB-05 13-15		13	15	ft.	4/1/2015
Upper Settling Basin		DUP-05	UB-05 13-15-04012015	13	15	ft.	4/1/2015
Upper Settling Basin	Surface Soil	DUP-04	UB-01 0-2-04012015	0	2	ft.	4/1/2015
Upper Settling Basin		UB-01 0-2		0	2	ft.	4/1/2015
Upper Settling Basin		UB-02 0-2		0	2	ft.	4/1/2015
Upper Settling Basin		UB-03 0-2		0	2	ft.	4/1/2015
Upper Settling Basin		UB-04 0-2		0	2	ft.	4/1/2015
Upper Settling Basin		UB-05 0-2		0	2	ft.	4/1/2015
Upper Settling Basin		UB-06S		0	0.5	ft.	4/1/2015
Upper Settling Basin		UB-07S		0	0.5	ft.	4/1/2015
Upper Settling Basin		UB-08S		0	0.5	ft.	4/1/2015
Waste Acid Neutralization (Focus Area C)							
PWAN/SWAN	Subsurface Soil	AN-01 1-3		1	3	ft.	4/6/2015
PWAN/SWAN		AN-01 11-13		11	13	ft.	4/6/2015
PWAN/SWAN		DUP-10	AN-02 1.5-3.5-04062015	1.5	3.5	ft.	4/6/2015
PWAN/SWAN		AN-02 1.5-3.5		1.5	3.5	ft.	4/6/2015
PWAN/SWAN		AN-02 8-10		8	10	ft.	4/6/2015
PWAN/SWAN		AN-03 1-3		1	3	ft.	4/6/2015
PWAN/SWAN		AN-03 9-11		9	11	ft.	4/6/2015
PWAN/SWAN		AN-04 6-8		6	8	ft.	4/6/2015
PWAN/SWAN		AN-05 13-15		13	15	ft.	4/6/2015
PWAN/SWAN		AN-06 11-13		11	13	ft.	4/6/2015
PWAN/SWAN		AN-07 10-12		10	12	ft.	4/6/2015
PWAN/SWAN		AN-08 13-15		13	15	ft.	4/6/2015
PWAN/SWAN		AN-09 13-15		13	15	ft.	4/6/2015
PWAN/SWAN		DUP-11	AN-10 9-11-04062015	9	11	ft.	4/6/2015
PWAN/SWAN		AN-10 9-11		9	11	ft.	4/6/2015
PWAN/SWAN		AN-11 8-10		8	10	ft.	4/6/2015
PWAN/SWAN		AN-12 13-15		13	15	ft.	4/6/2015
PWAN/SWAN		AN-13 4-6		4	6	ft.	4/6/2015
PWAN/SWAN		AN-04 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-05 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-06 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-07 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-08 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-09 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-10 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-11 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-12 0-2		0	2	ft.	4/6/2015
PWAN/SWAN		AN-13 0-2		0	2	ft.	4/6/2015

TABLE 5-1
SAMPLE LOCATIONS EVALUATED FOR EACH AREA IN THE RISK EVALUAITON
CRISTAL USA FACILITY

Area	Media	Sample Name	Parent Sample	Start Depth	End Depth	Depth Units	Sample Date
West Central							
West-Central Upland	Subsurface Soil	OWS-01 13-15		13	15	ft.	3/31/2015
West-Central Upland		OWS-02 11-13		11	13	ft.	3/31/2015
West-Central Upland		OWS-03 13-15		13	15	ft.	3/31/2015
West-Central Upland		DUP-03	OWS-04 13-15-03312015	13	15	ft.	3/31/2015
West-Central Upland		OWS-04 13-15		13	15	ft.	3/31/2015
West-Central Upland		SB-18 13-15		13	15	ft.	3/30/2015
West-Central Upland		SB-19 10-12		10	12	ft.	3/30/2015
West-Central Upland		SB-20 9-11		9	11	ft.	3/30/2015
West-Central Upland		SB-21 13-15		13	15	ft.	3/30/2015
West-Central Upland		SB-22 9-11		9	11	ft.	3/31/2015
West-Central Upland		SB-25 13-15		13	15	ft.	3/30/2015
West-Central Upland		SB-26 13-15		13	15	ft.	3/30/2015
West-Central Upland		SB-27 6-8		6	8	ft.	3/31/2015
West-Central Upland		SB-29 8-10		8	10	ft.	3/30/2015
West-Central Upland		SB-30 9-11		9	11	ft.	4/1/2015
West-Central Upland		SB-31 13-15		13	15	ft.	4/1/2015
West-Central Upland		SB-36 9-11		9	11	ft.	3/30/2015
West-Central Upland		SB-37 13-15		13	15	ft.	4/1/2015
West-Central Upland		SB-38 13-15		13	15	ft.	4/1/2015
West-Central Upland		SB-39 13-15		13	15	ft.	4/1/2015
West-Central Upland	Surface Soil	OWS-01 0-2		0	2	ft.	3/31/2015
West-Central Upland		OWS-02 0-2		0	2	ft.	3/31/2015
West-Central Upland		OWS-03 0-2		0	2	ft.	3/31/2015
West-Central Upland		OWS-04 0-2		0	2	ft.	3/31/2015
West-Central Upland		SB-18 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-19 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-20 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-21 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-22 0-2		0	2	ft.	3/31/2015
West-Central Upland		SB-25 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-26 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-27 0-2		0	2	ft.	3/31/2015
West-Central Upland		SB-29 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-30 0-2		0	2	ft.	4/1/2015
West-Central Upland		SB-31 0-2		0	2	ft.	4/1/2015
West-Central Upland		SB-36 0-2		0	2	ft.	3/30/2015
West-Central Upland		SB-37 0-2		0	2	ft.	4/1/2015
West-Central Upland		SB-38 0-2		0	2	ft.	4/1/2015
West-Central Upland		SB-39 0-2		0	2	ft.	4/1/2015

TABLE 5-2-1
SUMMARY STATISTICS FOR FORMER TITANIUM ORE STORAGE AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	3.1	5.9	TS-03 0-2	4	1.3E-06	--
Vanadium	mg/kg	100	NC	130.9	440	TS-10 0-2	265.3	--	0.27
PAHs									
Benzo(a)pyrene	mg/kg	0.39	C	0.2	1.4	TS-01 0-2	0.5	1.2E-06	--
							Cumulative Results	**2E-06**	**0.3**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-2-2
SUMMARY STATISTICS FOR FORMER TITANIUM ORE STORAGE AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	3.7	7.3	TS-06 13-15	6.4	2.1E-06	--
Vanadium	mg/kg	100	NC	109.1	240	TS-07 4-6	184.7	--	0.18
							Cumulative Results	**2E-06**	**0.2**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.
2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-3-1
SUMMARY STATISTICS FOR SPENT SOLVENT STORAGE AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic[3]	mg/kg	3.0	C	2.8	4.6	SS-01 0-2	4.6	1.5E-06	--
PAHs									
Benzo(a)pyrene[4]	mg/kg	0.39	C	0.5	1.1	SS-02 0-2	1.1	2.8E-06	--
							Cumulative Results	**4E-06**	**0**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.
2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.
3) 95%UCLM exceeds maximum concentration, maxmimum used as 95%UCLM

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-3-2
SUMMARY STATISTICS FOR SPENT SOLVENT STORAGE AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	5	11	SS-04 13-15	6.9	2.3E-06	--
Iron	mg/kg	72,000	NC	23,900	87,000	SS-04 13-15	43,621	--	0.06
Lead	mg/kg	1,000		453.4	4,300	SS-06 1-3	NA	--	--
Vanadium	mg/kg	100	NC	43.8	110	SS-04 13-15	62.2	--	0.06
PAHs									
Benzo(a)pyrene	mg/kg	0.39	C	0.1	0.4	SS-01 6-8	0.1	3.7E-07	--
							Cumulative Results	**3E-06**	**0.1**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-4-1
SUMMARY STATISTICS FOR PWAN/SWAN AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
Metals										
Antimony	mg/kg	41	NC	165 2	740	AN-12 0-2	620 6	--	1.5	Blood
Arsenic	mg/kg	3 0	C	31 3	220	AN-06 0-2	123 5	4 1E-05	--	--
Chromium[3]	mg/kg	310	NC	119 3	810	AN-11 0-2	810	--	0 26	NA
Lead	mg/kg	1,000		805 5	7,100	AN-06 0-2	NA	--	--	NA
Vanadium	mg/kg	100	NC	292 2	2,100	AN-11 0-2	800 3	--	0 80	Hair
PAHs										
Benzo(a)anthracene	mg/kg	3 9	C	1 5	7 5	AN-10 0-2	2 4	6 2E-07	--	--
Benzo(a)pyrene	mg/kg	0 39	C	1 3	5 2	AN-10 0-2	1 8	4 6E-06	--	--
Benzo(b)fluoranthene	mg/kg	3 9	C	1 6	6 3	AN-10 0-2	2 2	5 7E-07	--	--
Dibenzo(a,h)anthracene	mg/kg	0 39	C	0 4	1 1	AN-10 0-2	0 7	1 8E-06	--	--
							Cumulative Results	**5E-05**	**3**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0 1
3) 95%UCLM exceeds maximum concentration, maximum used as 95%UCLM
4) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Blood	**2**
Total Hazard Index Hair	**0.8**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-4-2
SUMMARY STATISTICS FOR PWAN/SWAN AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
Metals										
Antimony[3]	mg/kg	41	NC	126.4	640	AN-08 13-15	640	--	1.6	Blood
Arsenic	mg/kg	3.0	C	22.2	110	AN-06 11-13	58.3	1.9E-05	--	--
Vanadium	mg/kg	100	NC	59.6	330	AN-07 10-12	102	--	0.1	Hair
							Cumulative Results	**2E-05**	**2**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{5}

2) Noncancer hazards are calculated according to the following equation. (95%UCLM/MDE Soil Standard)*0.1

3) 95%UCLM exceeds maximum concentration, maximum used as 95%UCLM

4) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Blood	**2**
Total Hazard Index Hair	**0.1**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-5
SUMMARY STATISTICS FOR LANDFILL AREA
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	3.4	5.1	LF-05 0-2	4.3	1.4E-06	--
							Cumulative Results	**1E-06**	**0**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-6-1
SUMMARY STATISTICS FOR NORTHWEST UPLAND AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	6	19	SB-17 0-2	8.7	2.9E-06	--
							Cumulative Results	**3E-06**	**0**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-6-2
SUMMARY STATISTICS FOR NORTHWEST UPLAND AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	4.4	18	SB-17 7-9	6.3	2.1E-06	--
Iron	mg/kg	72,000	NC	31689	120,000	SB-02 13-15	47,928	--	0.07
Vanadium	mg/kg	100	NC	54.7	180	SB-10 13-15	79.4	--	0.08
							Cumulative Results	**2E-06**	**0.1**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.
2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-7-1
SUMMARY STATISTICS FOR WEST-CENTRAL UPLAND AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	5.2	25	SB-39 0-2	11	3.7E-06	--
Vanadium	mg/kg	100	NC	79.3	320	SB-27 0-2	109	--	0.11
Diesel Range Organics									
DRO	mg/kg	620	NC	457.2	2,400	OWS-03 0-2	1,299	--	0.21
PAHs									
Benzo(a)pyrene	mg/kg	0.4	C	0.1	0.4	SB-36 0-2	0.1	2.3E-07	--
							Cumulative Results	**4E-06**	**0.3**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.
2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-7-2
SUMMARY STATISTICS FOR WEST-CENTRAL UPLAND AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[3]
Metals										
Arsenic	mg/kg	3.0	C	3.5	14	SB-19 10-12	5.3	1.8E-06	--	--
Chromium	mg/kg	310	NC	140.7	1,700	SB-27 6-8	1,064	--	0.34	NA
Manganese	mg/kg	2,000	NC	288.8	5,300	SB-27 6-8	3,059	--	0.15	Central Nervous System
Vanadium	mg/kg	100	NC	397.6	6,000	SB-27 6-8	3,527	--	3.5	Hair
							Cumulative Results	**2E-06**	**4**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0.1
3) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Central Nervous System **0.2**
Total Hazard Index Hair **4**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-8-1
SUMMARY STATISTICS FOR EAST-CENTRAL UPLAND AREA, SURFACE SOIL
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Antimony	mg/kg	41	NC	48.8	580	SB-47 0-2	134.5	--	0.33
Arsenic	mg/kg	3.0	C	8.7	37.5	SB-35 0-2	13.9	4.6E-06	--
Chromium	mg/kg	310	NC	123.2	1,400	SB-32 0-2	474.6	--	0.15
Vanadium	mg/kg	100	NC	116.4	370	SB-61 0-2	185.5	--	0.19
Total Petroleum Hydrocarbons									
DRO	mg/kg	620	NC	279.7	900	SB-44 0-2	553.6	--	0.09
PAHs									
Benzo(a)anthracene	mg/kg	3.9	C	1.8	24	SB-44 0-2	15.7	4.0E-06	--
Benzo(a)pyrene	mg/kg	0.39	C	1.5	19	SB-44 0-2	12.4	3.2E-05	--
Benzo(b)fluoranthene	mg/kg	3.9	C	3.3	45	SB-44 0-2	29.2	7.5E-06	--
Dibenzo(a,h)anthracene	mg/kg	0.39	C	0.5	3.9	SB-44 0-2	2.6	6.7E-06	--
Indeno(1,2,3-cd)pyrene	mg/kg	3.9	C	0.9	12	SB-44 0-2	7.9	2.0E-06	--
							Cumulative Results	**6E-05**	**0.8**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-8-2
SUMMARY STATISTICS FOR EAST-CENTRAL UPLAND AREA, SUBSURFACE SOIL
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Antimony	mg/kg	41	NC	16.7	145	SB-43 4-6	50.7	--	0.12
Arsenic	mg/kg	3.0	C	6.8	29.5	SB-34 12-14	11.9	4.0E-06	--
Iron	mg/kg	72,000	NC	23,525	86,000	SB-32 2-4	35,751	--	0.05
Vanadium	mg/kg	100	NC	99.6	540	SB-61 4-6	280.4	--	0.28
PAHs									
Benzo(a)pyrene	mg/kg	0.39	C	0.1	1.0	SB-28 2.5-4.55	0.5	1.2E-06	--
							Cumulative Results	**5E-06**	**0.5**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.

2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-9-1
SUMMARY STATISTICS FOR SOUTH UPLAND AREA, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	2.9	5.9	SB-48 0-2	3.6	1.2E-06	--
Chromium	mg/kg	310	NC	148.7	730	SB-50 0-2	433.5	--	0.14
Iron	mg/kg	72,000	NC	30,630	110,000	SB-48 0-2	52,638	--	0.07
Manganese[3]	mg/kg	2,000	NC	814.8	2,800	SB-48 0-2 / SB-51 0-2	2,800	--	0.14
Vanadium	mg/kg	100	NC	295.8	1,700	SB-50 0-2	936	--	0.9
PAHs									
Benzo(a)pyrene	mg/kg	0.4	C	0.5	1.7	SB-51 0-2	1.9	4.8E-06	--
							Cumulative Results	**6E-06**	**1**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)* 10^{-6}.
2) Noncancer hazards are calculated according to the following equation:: (95%UCLM/MDE Soil Standard)*0.1.
3) Only two detected value for Manganese, maximum value used as 95%UCLM
4) Source of Target Organ: IRIS - Integrated Risk Information System

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-9-2
SUMMARY STATISTICS FOR SOUTH UPLAND AREA, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
Metals										
Arsenic	mg/kg	3.0	C	1.6	30	SB-46 8-10	18 8	6.3E-06	--	--
Cadmium	mg/kg	51	NC	9 3	66	SB-49 4-6	61		0 12	Kidneys
Chromium	mg/kg	310	NC	744 1	2,800	SB-50 4-6	1,028	--	0.3	NA
Manganese[3]	mg/kg	2,000	NC	1,845	7,300	SB-50 4-6	7,300	--	0 37	Central Nervous System
Vanadium[3]	mg/kg	100	NC	1,789	6,600	SB-50 4-6	6,600	--	6 6	Hair
							Cumulative Results	**6E-06**	**7**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0 1
3) 95%UCLM exceeds the maximum concentration The maximum detected concentration is used
4) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Digestive System	**0.12**
Total Hazard Index Central Nervous System	**0.37**
Total Hazard Index Hair	**7**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-10
SUMMARY STATISTICS FOR BATCH ATTACK BASIN
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[3]
					Metals					
Arsenic	mg/kg	3.0	C	2.1	4	BB-01S	2.7	9.1E-07	--	--
Chromium	mg/kg	310	NC	1,027	2,400	BB-07S	1,599	--	0.52	NA
Iron	mg/kg	72,000	NC	106,744	170,000	BB-07S	133,139	--	0.18	Digestive System
Manganese	mg/kg	2,000	NC	11,466	26,000	BB-05S	18,093	--	0.90	Central Nervous System
Vanadium	mg/kg	100	NC	2,408	5,100	BB-08S / BB-07S	3,737	--	3.7	Hair
							Cumulative Results	**9E-07**	**5**	

Notes:

1) Cancer risks are calculated according to the following equation. (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation. (95%UCLM/MDE Soil Standard)*0.1
3) Source of Target Organ: IRIS - Integrated Risk Information System

Total Hazard Index Digestive System	**0.5**
Total Hazard Index Central Nervous System	**0.2**
Total Hazard Index Hair	**4**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-11-1
SUMMARY STATISTICS FOR UPPER SETTLING BASIN, SURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
					Metals					
Arsenic	mg/kg	3.0	C	2.9	7	UB-05 0-2	4.3	1.4E-06	--	--
Chromium	mg/kg	310	NC	380.1	1,400	UB-08S	993.6	--	0.32	NA
Iron	mg/kg	72,000	NC	40,750	91,000	UB-08S	60,790	--	0.08	Digestive System
Manganese[3]	mg/kg	2,000	NC	3,025	9,500	UB-08S	9,500	--	0.48	Central Nervous System
Vanadium	mg/kg	100	NC	800.3	2,700	UB-08S	1,401	--	1.4	Hair
							Cumulative Results	**1E-06**	**2**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0.1
3) 95%UCLM exceeds maximum concentration, maximum used as 95%UCLM
4) Source of Target Organ: IRIS - Integrated Risk Information System

Total Hazard Index Digestive System	**0.08**
Total Hazard Index Central Nervous System	**0.48**
Total Hazard Index Hair	**1**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-11-2
SUMMARY STATISTICS FOR UPPER SETTLING BASIN, SUBSURFACE SOIL
CRISTAL FACILITY USA

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
Metals										
Antimony[3]	mg/kg	41 0	NC	10.9	45	UB-01 5-7	45	--	0.1	Blood
Arsenic	mg/kg	3.0	C	3.7	6.3	UB-01 5-7	5 9	2 0E-06	--	--
Chromium[3]	mg/kg	310	NC	646 5	2,400	UB-03 3-5	2,400	--	0 8	NA
Iron[3]	mg/kg	72,000	NC	45200	160,000	UB-03 3-5	160,000	--	0.22	Digestive System
Manganese[3]	mg/kg	2,000	NC	1807	8,200	UB-03 3-5	8,200	--	0 4	Central Nervous System
Vanadium	mg/kg	100	NC	1138	3,800	UB-03 3-5	2,609	--	2 6	Hair
							Cumulative Results	**2E-06**	**4**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-5}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0 1
3) 95%UCLM exceeds maximum concentration, maximum used as 95%UCLM
4) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Blood	**0.1**
Total Hazard Index Digestive System	**0.2**
Total Hazard Index Central Nervous System	**0.4**
Total Hazard Index Hair	**3**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-12
SUMMARY STATISTICS FOR MIDDLE SETTLING BASIN
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]
Metals									
Arsenic	mg/kg	3.0	C	2.4	3.6	MB-03S	3.1	1.0E-06	--
Chromium[3]	mg/kg	310	NC	2,330	3,200	MB-04S / MB-03S	3,200	--	1.0
Iron[3]	mg/kg	72,000	NC	126,667	160,000	MB-01S / MB-03S	160,000	--	0.22
Manganese	mg/kg	2,000	NC	23,402	34,000	MB-01S	33,116	--	1.7
Vanadium	mg/kg	100	NC	4,842	6,600	MB-03S	5,812	--	5.8
							Cumulative Results	**1E-06**	**9**

Notes:

1) Cancer risks are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*10^{-6}.
2) Noncancer hazards are calculated according to the following equation: (95%UCLM/MDE Soil Standard)*0.1.
3) 95%UCLM exceeds maximum concentration, maximimum used as 95%UCLM
4) Source of Target Organ: IRIS - Integrated Risk Information System

Total Hazard Index Digestive System
Total Hazard Index Central Nervous System
Total Hazard Index Hair

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
C = Cancer endpoint

TABLE 5-13-1
SUMMARY STATISTICS FOR LOWER SETTLING BASIN, SURFACE SOIL
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[3]
Metals										
Arsenic	mg/kg	3 0	C	1 8	2 6	LB-04 0-2	2 1	7.0E-07	--	--
Chromium	mg/kg	310	NC	1,731	3,050	LB-05 0-2	2,527	--	0 82	NA
Iron	mg/kg	72,000	NC	110,857	175,000	LB-05 0-2	150,173	--	0.21	Digestive System
Manganese	mg/kg	2,000	NC	18,800	35,000	LB-05 0-2	28,007	--	1.4	Central Nervous System
Vanadium	mg/kg	100	NC	3,607	6,650	LB-05 0-2	5,292	--	5.3	Hair
							Cumulative Results	**7E-07**	**8**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0 1
3) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Digestive System	**0.2**
Total Hazard Index Central Nervous System	**1**
Total Hazard Index Hair	**5**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
DRO = Diesel range organics
C = Cancer endpoint
NC = Noncancer endpoint

TABLE 5-13-2
SUMMARY STATISTICS FOR LOWER SETTLING BASIN, SUBSURFACE SOIL
CRISTAL USA FACILITY

Chemical	units	MDE Non-Residential Soil Standard	C/NC	Mean Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	95%UCLM	Cancer Risks[1]	Noncancer Hazards[2]	Target Organ[4]
Metals										
Arsenic	mg/kg	3 0	C	3 6	6 9	LB-05 6-8	6 4	2 1E-06	--	--
Chromium[3]	mg/kg	310	NC	2,133	3,000	LB-03 8-10	3,000	--	0 97	NA
Iron[3]	mg/kg	72,000	NC	75,000	91,000	LB-05 6-8	91,000	--	0 13	Digestive System
Manganese[3]	mg/kg	2,000	NC	8,300	9,150	LB-02 8-10	9,150	--	0 46	Central Nervous System
Vanadium[3]	mg/kg	100	NC	5,294	7,800	LB-03 8-10	7,800	--	7 8	Hair
							Cumulative Results	**2E-06**	**9**	

Notes:

1) Cancer risks are calculated according to the following equation (95%UCLM/MDE Soil Standard)*10^{-6}
2) Noncancer hazards are calculated according to the following equation (95%UCLM/MDE Soil Standard)*0 1
3) 95%UCLM exceeds maximum concentration, maximmum used as 95%UCLM
4) Source of Target Organ IRIS - Integrated Risk Information System

Total Hazard Index Digestive System	**0.1**
Total Hazard Index Central Nervous System	**0.5**
Total Hazard Index Hair	**8**

MDE = Maryland Department of the Environment
mg/kg = milligrams per kilogram
UCLM = upper confidence limit on the mean
PCBs = Polychlorinated Biphenyls
PAHs = Polyaromatic Hydrocarbons
DRO = Diesel range organics
C = Cancer endpoint
NC = Noncancer endpoint

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Cristal USA Stockpile Characterization Report

Prepared for Maryland Department of Transportation Port Administration and
Maryland Environmental Service

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Cristal USA Stockpile Characterization Report

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FIGURES

Figure 1 Vicinity Map

Figure 2 Boring and Test Pit Locations

Figure 3 Stockpile Cross-Sections

APPENDICES

Appendix A Geotechnical Engineering Reports

Appendix B Chemical Laboratory Report

ABBREVIATIONS

ATC	Anticipated Typical Concentration
CH	fat clay
CL	lean clay
CU-TXc	Consolidated-Undrained Triaxial Compression
cy	cubic yard
DMCF	dredged material containment facility
E2CR	E2CR, Inc.
FSD	Free State Drilling, Inc.
HPP	Hawkins Point Plant
MDE	Maryland Department of the Environment
ML	silt
NCS	Nonresidential Cleanup Standard
psi	pound per square inch
SAP	*Cristal USA Stockpile Characterization Sampling and Analysis Plan*
Site	HPP landfill
SPT	standard penetration test

1 Introduction

The investigation of stockpiled clay fill at the Hawkins Point Plant (HPP) Industrial Waste Landfill at the Cristal USA facility was performed in general accordance with the *Cristal USA Stockpile Characterization Sampling and Analysis Plan* (SAP; Anchor QEA 2016). The purpose of the investigation was to delineate and characterize the stockpiled fill for potential future reuse by the Maryland Port Administration. The SAP was reviewed and approved by both Cristal USA and the Maryland Department of the Environment (MDE). The location of the HPP landfill (Site) is shown on Figure 1. The following four objectives were identified in the SAP:

- Delineate the lateral and vertical extent of the stockpile. As discussed in the SAP and in Section 4 of this report, prior topographic surveys were used for the initial delineation, which was re-evaluated based on the results of the current characterization. The extents of the stockpile will be used to determine the recoverable amount of fill and develop a plan for removing stockpiled fill not in contact with the underlying waste.
- Identify field-observable differences between the stockpiled fill and the waste that can be used as criteria for potentially identifying waste during stockpile removal. Although cut lines will be identified in the stockpile-removal plan based on the stockpile delineation, the waste-identification criteria will provide a backup to avoid disturbance of waste during removal of fill from the stockpile.
- Characterize the geotechnical properties of the stockpiled fill for potential reuse.
- Confirm the previous chemical characterization that the stockpiled fill is suitable for reuse in an industrial setting.

This report provides a summary of the field investigation in Section 2 and the results of the geotechnical and chemical analyses in Section 3. Section 4 presents an evaluation of site geotechnical conditions, a discussion of soil reuse, and an updated assessment of the volume of recoverable fill from the stockpile. Section 5 discusses the preliminary stockpile removal plan. Conclusions are summarized in Section 6.

2 Field Investigation

The field investigation program consisted of advancing 12 soil borings and 7 test pits at select locations across the stockpile. E2CR, Inc. (E2CR) of Baltimore, Maryland, was the primary subcontractor advancing soil borings, excavating test pits, and providing geotechnical services. E2CR subcontracted drilling for three borings (AQ06, AQ07, and AQ11) to Free State Drilling, Inc. (FSD) of Frederick, Maryland, to help maintain the field schedule. E2CR also performed laboratory testing of samples collected from soil borings. Bulk soil samples collected from the test pits were analyzed by GeoTesting Express of Acton, Massachusetts. Chemical analyses were performed by TestAmerica Pittsburgh of Pittsburgh, Pennsylvania. Site work was completed on March 13, 2017. Anchor QEA and E2CR mobilized to the Site on February 27, 2017. Prior to the February 27 start date, proposed subsurface explorations were cleared with Maryland's public utility locate system, Miss Utility.

Figure 2 presents the final locations of the soil borings and test pits. Soil boring locations were adjusted as needed from proposed locations outlined in the SAP (Anchor QEA 2016) to accommodate field conditions. Generally, adjustments to soil boring locations were minor, averaging approximately 4 feet from the proposed locations. As described in the SAP, test pit locations were selected based on conditions observed in the soil borings and were adjusted based on safe equipment access. The proposed and final coordinates of the soil borings and test pits are presented in Table 1.

2.1 Soil Borings

Soil borings were advanced with hollow-stem augers, using a track mounted drill rig operated by E2CR or FSD. Proposed boring locations were located by Anchor QEA using a Trimble GeoXH GPS and then field adjusted as needed to allow for safe access with equipment and personnel. The final as-built location of each soil boring was recorded with the Trimble GeoXH GPS. Table 1 presents a summary of each exploration, the proposed and actual coordinates, the termination depths, and estimated elevations. Ground surface elevations, estimated from the 2015 topographic survey performed by Applied Mapping Solutions, Inc., were used with depths measured in the borings to determine the elevations of other contacts and the bottom elevations. Figure 2 presents the location of each soil boring. Soil boring logs are provided in Appendix A.

Soil samples were collected by standard penetration test (SPT; ASTM D1586). Starting at the ground surface, samples were collected at 5-foot depth intervals. Once the boring reached a depth within approximately 10 feet of the anticipated termination depth (based on the 2008 topographic survey performed by Wings Aerial Mapping Co., Inc.) indicated in Table 1 of the SAP, soil samples were collected continuously in 24-inch increments. SPT sampling was performed using an automatic trip hammer. A 2-inch outside diameter split spoon sampler was used and driven 24 inches into the soil

or until refusal (50+ blows). The number of blows required to drive the sampler every 6 inches was recorded.

Each boring was observed by a geotechnical engineer who logged the subsurface conditions and collected representative soil samples. Soil samples were collected and stored in sealed and labeled glass jars. The jars were transported to E2CR's laboratory for further evaluation and geotechnical testing. Sample material suspected of being landfill waste was collected in a separate container and transferred to the landfill owner (Cristal USA) at the end of the field work for proper disposal.

In general accordance with the SAP, three separate aliquots were collected from different depth intervals (top, middle, and bottom depth) from each boring and then composited into a single sample for chemical analysis. One composite sample was prepared for chemical analysis from each soil boring. Samples for chemical analysis were stored in coolers until the end of the work shift and then transferred to the laboratory refrigerator at the Cox Creek dredged material containment facility (DMCF) until they were picked up for transport to the TestAmerica laboratory. Maryland Environmental Service coordinated chemical laboratory services and sample pickup with TestAmerica. The samples were submitted to the laboratory as a single sample delivery group after the final soil boring was completed.

Upon completion, each boring was sealed by pumping cement grout into the borehole. Soil cuttings were spread evenly on the ground surface and then reseeded and mulched.

2.2 Test Pits

A total of seven test pits (TP01, TP02, TP04, TP05, TP06, TP08, and TP08A) were excavated following the completion of the soil borings. Soil boring observations influenced the selected test pit locations. Test pits TP01, TP04, and TP06 were excavated within the approximate location proposed in the SAP. Test pits TP02, TP05, and TP08 were moved from their proposed SAP locations, and test pit TP08A was added. Test pit locations TP03 and TP07 were omitted since the subsurface conditions anticipated at those locations were expected to be consistent with other sampled locations. Test pit TP02 was moved from the proposed location since the equipment could not safely access the proposed location. Similarly, the proposed location of TP05 was on a slope and could not be accessed safely with the mini excavator, so the actual location was adjusted in the field to the next level area (midway between AQ09 and AQ07). Test pit locations TP08 and TP08A were selected in the vicinity of borings AQ11 and AQ12 in an attempt to collect a sample of the sandy clay material expected in that area. The soils observed and collected from test pit TP08 were similar to the soils observed in other test pit locations, so the test pit was terminated at 7.1 feet, and test pit TP08A was then excavated closer to soil boring AQ12. Of test pits TP08 and TP08A, only the sandier sample collected from TP08A was selected for analysis. The proposed and actual coordinates, termination

depths, and elevations of each test pit are presented in Table 1. The actual locations of test pit explorations are depicted in Figure 2.

A Bobcat E85 compact tracked excavator was used to dig each test pit. Test pits were generally 2 to 3 feet wide and 12 to 15 feet long. The excavation depths varied from 7 to 11 feet deep. Excavated material was stockpiled adjacent to the test pit, observed, logged, and sampled. Test pit logs are presented in Appendix A. Bulk samples representative of the material observed throughout the entire excavation (excluding topsoil) were collected from each test pit. Samples were placed into a 5-gallon plastic bucket, sealed with a lid, labeled, and shipped to GeoTesting Express. Upon completion, the excavation was backfilled, graded smooth at the surface with the excavator, reseeded, and mulched.

3 Analytical Results

Soil samples were analyzed for geotechnical properties and concentrations of metals that were selected based on the results of previous investigations, as discussed in the SAP (Anchor QEA 2016). In accordance with the SAP, samples from soil borings and test pits were analyzed for the following geotechnical properties:

- Moisture content
- Atterberg limits
- Particle size
- Organic content
- Specific gravity

Test pit samples were also analyzed for the following geotechnical properties:

- Moisture-density relationship
- Permeability of soil of samples compacted to 95% of maximum dry density
- Consolidated-Undrained Triaxial Compression (CU-TXc) with pore pressure measurements of samples compacted to 95% of maximum dry density

Composite samples from soil borings were also analyzed for moisture content and selected metals, as described in Section 3.2.

3.1 Geotechnical Testing

Geotechnical testing was performed by two different laboratories. Soil boring samples were collected and submitted to E2CR's geotechnical laboratory. Bulk soil samples collected from test pits were submitted to GeoTesting Express's laboratory. Detailed reports, prepared by the respective laboratories, are presented in Appendix B. The following sections present a summary and discussion of geotechnical testing results; the significance of the test results for potential soil reuse is discussed in Section 4.

3.1.1 Index Testing Results

A total of 154 soil samples were collected from the 12 soil borings (AQ01 through AQ12) and submitted to E2CR for further analysis. No samples were collected or submitted for analysis of recovered material that was potentially landfill waste (last sample from each boring). Samples from six of the test pits (excluding TP08) were submitted to GeoTesting Express for analysis. Table 2 presents a summary of the index testing results for both the soil borings and the six test pit samples analyzed.

Each sample submitted was analyzed for moisture content. Moisture content ranged from 6.6% to 28%, except for three samples in boring AQ05. The arithmetic mean moisture content, including all

samples, was 16.1%. The highest moisture content was observed approximately 84 to 90 feet below ground surface in boring AQ05, where samples S-21, S-22, and S-23 (elastic silt – MH) had values of 64.3%, 58.1%, and 58.9%, respectively. Moisture content higher than the optimum value can lower the strength of compacted clay fill, as discussed in Section 4.3, but these highest moisture contents were observed at depths below the bottom of the recoverable stockpile, which is discussed in Section 5.

A total of 38 soil boring samples and 6 test pit samples were selected for Atterberg testing. Atterberg limit testing refers to the liquid and plastic limits determination of cohesive soils. This test was performed to assess the plasticity and consistency at varying moisture contents. Plasticity index is the difference between the liquid and plastic limits; the greater the difference between the liquid limit and plastic limit, the greater the plasticity of the soil. Atterberg testing results also aided in soil classification. A majority of the fine-grained cohesive soils tested had a plasticity index between 9 and 27 (slight to medium plasticity). Highly plastic soils (CH) were only observed in two borings (AQ04 and AQ05).

Specific gravity determination was performed to aid in determining the unit weight and void ratio of soils. A total of 13 soil boring samples and 6 test pit samples were analyzed for specific gravity. The specific gravity of the clayey sand ranged from 2.66 to 2.67. The average specific gravity of the lean clay was 2.70.

Sieve and hydrometer tests were performed on a total of 28 soil borings samples and on 6 test pit samples. A total of eight sieve analyses without hydrometer were performed and eight No. 200 wash analyses were performed. The detailed reports can be found in Appendix B. Table 2 provides a summary of the results broken down by the percentage of gravel, sand, and fines (silt/clay) reported. The results of the grain-size characterization are discussed in Section 4.

Organic content determination was performed on 16 soil boring samples and on 6 test-pit samples. The reported organic content ranged from 0.8% to 4.5% except for one sample (S23 in boring AQ05 at 88 to 90 feet below ground surface) that had an organic content of 12.6%. The arithmetic mean of all 16 measurements of organic content was 2.4%.

3.1.2 Bulk Soil Sample Testing Results

Bulk soil samples were collected from test pits to provide sufficient sample volume to perform Standard Proctor testing, permeability testing, and consolidated undrained triaxial strength testing. These sample results are only representative of the near surface soil conditions encountered at test pit locations TP01, TP02, TP04, TP05, TP06, and TP08A. These samples were collected from the top 8 to 11 feet below the existing ground surface. Standard Proctor Testing (ASTM D698) was performed on each of the bulk samples collected from the test pits. Table 3 presents a summary of the resulting

optimum moisture content and maximum dry density reported for each of the six test pit samples. The optimum moisture content, based on the Standard Proctor Testing, ranged from 12.2% to 16.4%. The moisture content of the lean clay reported from the soil borings ranged from 9.6% to 23.8%, which suggests that some of the stockpile material had a moisture content more than 2% above optimum at the time of the investigation. The significance of these data for soil reuse is discussed in Section 4.3.

The permeability of the stockpile material was assessed by performing hydraulic conductivity tests using flexible permeameter (ASTM D4084) on the bulk samples collected from six of the test pits. Each sample was compacted prior to testing. Compaction efforts targeted 95% of the maximum dry density. The compacted sample was then analyzed. The permeability ranged from 9.10E-08 to 1.20E-06 centimeters per second, which corresponds to poorly drained or practically impervious soil. Table 4 presents a summary of the permeability and the actual percent compaction achieved. There was not a strong correlation between permeability rate and sand content, which may indicate heterogeneity of the sample or limitations of the permeability test method.

Consolidated undrained triaxial compression tests (CU-TXc) (ASTM D4767) were performed on each of the six bulk samples from the test pits. Each of the samples was compacted prior to testing, and compaction efforts targeted 95% of the maximum dry density. Table 5 presents a summary of the actual percent compaction achieved and the triaxial results for the range of selected consolidation stresses (6 pounds per square inch [psi], 12 psi, and 25 psi targeted). The design engineer will need to evaluate and interpret the CU-TXc data in relation to the anticipated fill reuse application strength requirements, as discussed in Section 4.3.

3.2 Chemical Testing

3.2.1 Review of Chemical Data

Chemical analyses were performed by TestAmerica Laboratories, Inc., of Pittsburgh, Pennsylvania. One composite sample from each boring was prepared for chemical analysis. From each boring, aliquots of soil from samples near the top (current ground surface), middle, and bottom of the stockpile were homogenized in the field and packed into sample containers for laboratory analysis. One field duplicate (from the composite for soil boring AQ11) was submitted to the laboratory for analysis. The chemical laboratory report is provided in Appendix B, and the results of the analyses are summarized in Table 6.

The chemical data were reviewed for consistency with quality assurance objectives. The laboratory reported matrix spike recoveries outside standards and detections of target analytes in method blanks and continuing calibration blanks. None of these issues is significant to the evaluation of the

data considering the nature of the issues and the magnitude of the potential discrepancies, which are summarized below.

- Copper, nickel, thallium, and zinc were detected in laboratory method blanks but at concentrations that are relatively low compared to the concentrations of these metals in the samples. The laboratory flagged copper and thallium results as estimated values, but the measured concentrations of all four of these metals are very low compared to risk-based standards, and the method blank contamination is insignificant to the evaluation.
- The matrix-spike recovery was high for arsenic, copper, chromium, and lead, which means the reported concentrations for these four metals may be biased high (i.e., actual concentrations may be lower than those reported by the laboratory). For copper, chromium, and lead, the reported concentrations are significantly lower than the risk-based standards, so the bias is insignificant to the evaluation. The high bias for the arsenic concentrations means that the actual concentrations of arsenic may be below the background level (Anticipated Typical Concentration), but the values reported by the laboratory were conservatively used at face value in the evaluation.
- The matrix-spike recovery was low for antimony and selenium, so the reported concentrations for these metals may be biased low. Based on the recoveries reported for the matrix spike and matrix spike duplicates, the concentrations for these metals may be twice as high as the values reported by the laboratory. Considering that even the most restrictive nonresidential standards are more than 100 times greater than the maximum reported concentrations of antimony and selenium, the low bias of the analytical results does not affect the evaluation.
- Beryllium and nickel were detected in the laboratory continuing calibration blanks, which means that the reported concentrations for these two metals may be biased high. The reported concentrations are significantly lower than the risk-based standards, so the bias is insignificant to the evaluation.
- The results for beryllium and lead in the target sample (AQ11) and the field duplicate (AQ11-FD) were significantly different, and the difference between the results was more than twice the reporting limits for these metals. The inconsistency in the results may be due to extreme heterogeneity of these metals in the soil, insufficient homogenization of the sample, laboratory issues, or a combination of these factors. The beryllium and lead concentrations have been flagged as estimated values based on the discrepancy between the target and field duplicate results, but this issue is insignificant to the evaluation since the reported concentrations are significantly lower than the risk-based standards.

3.2.2 Comparison to Risk-Based Standards

The results of the chemical analyses were compared to three sets of risk-based standards from the following two guidance documents:

- *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater* (MDE 2008)
- *Innovative Reuse and Beneficial Use of Dredged Material Draft Guidance Document* (MDE and MDOT 2017)

The Nonresidential Cleanup Standard (NCS) from the 2008 guidance document was used as a basis for comparison for all metals except arsenic. In conformance with Appendix 2 of the guidance, the Anticipated Typical Concentration (ATC) in soil for Eastern Maryland was used for comparison to measured concentrations of arsenic instead of the NCS, since the naturally occurring background, or ATC, is greater than the NCS. Measured concentrations were also compared to the following two sets of standards in the 2017 guidance:

- Category 2 (nonresidential restricted use soil and fill material)
- Category 3 (restricted use soil and fill material, cap required)

Table 7 provides a summary of measured concentrations (range and arithmetic mean) and the three sets of cleanup standards identified in the previous paragraph. With the exception of arsenic, the concentrations of all metals in the soil samples are well below all three of the state standards. The nature of the exceptions is as follows:

- Arsenic concentrations in 3 of the 13 samples exceed the ATC for Eastern Maryland, but the average concentration is below the ATC.
- Arsenic concentrations in 10 of the 13 samples exceed the standard for Category 2 reuse, but arsenic concentrations in all of the samples are well below the standard for Category 3 reuse.

Total chromium concentrations in all of the soil samples are well below the NCS. The concentrations are also well below the Category 2 and Category 3 standards for chromium(III). Although the measured concentrations for total chromium exceed the Category 2 and Category 3 standards for chromium(VI), the measured concentrations of total chromium are well below the standards for chromium(III), and the proportion of the measured chromium in the hexavalent form was not measured. The measured concentration of total chromium is consistent with the ATC for Eastern Maryland, so the chromium appears to be naturally occurring.

The chemical data indicate that the stockpile soil does not appear to have been affected by anthropogenic sources of these metals. Based on the comparison of the measured concentrations to the standards for nonresidential soil, the stockpile soil appears to be suitable for reuse in a nonresidential setting.

4 Site Geotechnical Conditions

4.1 Soil Conditions

The boring logs presented in Appendix B provide a detailed description of the soils encountered in the subsurface explorations (soil borings and test pits). The material encountered at each exploration is believed to be fill and has been identified as such on the logs. General descriptions of the different soils identified from the borings advanced at this Site are presented below:

Topsoil: Between 2 and 30 inches of topsoil were encountered at the ground surface in the soil borings and test pits. The topsoil was generally observed to be dark brown, moist, and loose, consisting of silty sand with mixed organic matter and roots (rootmat).

Lean Clay: Lean clay was the predominant soil type observed in all explorations. The clay generally consisted of soft to hard lean clay with sand to sandy lean clay. The color varied, but mottled reddish brown and gray was typically observed. The plasticity index for this soil unit ranged from 9 to 27 (slight to medium plasticity) with an average plasticity index of 18. Multiple layers of clay were typically found in each boring with the maximum layer thickness ranging from 10.5 to 47 feet thick.

Fat Clay: Highly plastic (fat) clay was observed at two boring locations, AQ04 and AQ05. At boring location AQ05, this material was identified as red, reddish brown, light gray, soft to stiff fat clay with trace sand. Fat clay was observed 9 feet below the surface at AQ05 and was 19.5 feet thick. A thinner, 3.5-foot-thick layer of fat clay was observed at boring AQ04. The fat clay at AQ04 was identified as reddish brown, light gray, moist, stiff fat clay with sand.

Sand: Sand was encountered in all borings. In general, sand was found at varying depths and typically interbedded between clay layers. Sand layers were generally less than 5 feet thick, except in borings AQ02 and AQ05 where sand layers were as much as 15 feet thick. Sand was the second most prevalent soil type observed in the borings. The sand observed was variable in composition and ranged from reddish brown to brown silty sand to clayey sand but was most commonly clayey sand. Sand was observed to be loose to dense with trace amounts of gravel.

Silt: Silt layers 3 to 4.5 feet thick were observed in 2 of the 12 boring locations (AQ05 and AQ08). At AQ05, the silt layer was identified as brown, moist, stiff, elastic silt. At AQ08, the 4.5-foot-thick silt layer was identified as gray, moist, stiff silt with sand.

Waste: Eight of the twelve boring locations (AQ02, AQ04, AQ06, AQ07, AQ08, AQ09, AQ11, and AQ12) were terminated in material suspected to be landfill waste. Material suspected to be landfill waste was variable in composition. At boring locations AQ07, AQ11, and AQ12, the material encountered was very dense, dark gray, black and white, gravel-like material with a strong odor that was typically sulfurous (rotten egg). At boring locations AQ02, AQ04, AQ06, AQ08, and AQ09, the

material encountered consisted of stiff to very stiff fine-grained material (silt or silty clay) with variable coloring, dark red, dark brown, black, sometimes with white or yellow fragments, and occasional odor. Boring location AQ05 did not encounter material suspected to be waste and was terminated 8 feet deeper than the anticipated termination depth listed in Table 1 of the SAP (Anchor QEA 2016). Boring locations AQ01, AQ03, and AQ10 were terminated in wet sand (see groundwater discussion in Section 4.2).

4.2 Groundwater Observations

At the time of drilling (March 2017), wet sand was observed at boring locations AQ01, AQ03, and AQ10 at elevations of 53.5, 29.1, and 79.2 feet below ground surface, respectively. At these locations, there may be perched water within the layers of more permeable soil (i.e., sand) overlying the landfill waste. At each of these locations, the boring was terminated when the wet soil was encountered to avoid the potential risk of making a hydraulic connection with underlying waste. Water was also observed at test pit location TP-04 at a depth of 7 feet below the existing ground surface. Perched water may have seeped into the open excavation through sand lenses observed at that depth. Indications of groundwater were not observed at other boring locations or in test pits. The moisture encountered in the stockpile is not necessarily indicative of groundwater hydraulically connected to formations below the landfill.

4.3 Reuse of On-Site Soils

The stockpiled fill is being considered as a potential borrow source for construction in future development (i.e., in a nonresidential setting), such as embankment fill or dike fill. The usability of the stockpiled fill will depend on several factors related to the future use, such as the height of the structure, foundation subgrade, and forces that act upon it. Considering the possibility of constructing a retaining dike, almost any type of fill may be used for such construction with the exception of very wet, fine-grained soils and soils containing a high percentage of organic matter (USACE 1987). For an earthen dike or embankment, fine-grained soils, such as clays, can be particularly desirable for low permeability applications, such as impervious zones, depending on the design. Dike stability and fill suitability will also depend on the foundation subgrade soil at the selected construction site.

The following observations and recommendations are relevant to the potential reuse of the stockpiled fill for construction of earthen dikes:

- **Surficial Topsoil and Organic Soil:** Topsoil or organic rich soils at the Site within the recoverable limits of the stockpile should be segregated during excavation. Organic rich soils are not considered suitable or desirable for fill applications. Traces of organic matter were also observed on occasion at varying depths within the explorations. The stockpile may contain organic matter or debris that was not identified during the explorations. Topsoil and

organic material could be potentially reused in nonstructural applications, such as site restoration or landscaping. Based on the observed thickness of topsoil (average 1.3 feet) in the explorations and the assumed extent of the recoverable stockpile (13 acres), there may be approximately 28,000 cubic yards (cy) of topsoil on the stockpile.

- **Fine-Grained Soil:** The fine-grained soils (50% or more passing the No. 200 sieve) observed in explorations consisted of predominately CL, ML, or CH. Based on observations from explorations, fine-grained fill represents approximately 80% of the stockpile material, excluding the topsoil. These soils observed appear to be generally suitable for reuse as dike fill in their current state, with the following considerations. Moisture content of some of the fine-grained fill was more than 2% higher than the optimum moisture content and would require some drying before compaction. Fine-grained fill compacted with a moisture content higher than optimum will typically have lower strength than compacted fill at or near the optimum moisture content. The strength parameters of compacted fine-grained fill are presented in Table 5 and should be taken into consideration during the design process to aid in the assessment of embankment stability.
- **Granular Soil:** The granular soil (more than 50% retained on the No. 200 sieve) encountered on site may be used for fill applications where permeability and seepage control are not a design consideration. The granular soils on site are expected to have a higher permeability than the fine-grained soils and should not be used as a means to control seepage within a dike or embankment. Granular soils may be used in fill applications where drainage may be desirable, such as haul roads or toe berms. Granular soil (i.e., sand) represents approximately 20% of the recoverable stockpile material samples, excluding topsoil.

The sandier fill could potentially be mixed with the fine-grained soils to create a semi-impervious soil that may be suitable for dike fill applications. Successful mixing of sand and fine-grained soils will be largely dependent upon the contractor's selected methods and effort. Small or thin discontinuous layers and pockets of sand found interbedded within the clay may potentially be mixed with clay material. Some degree of mixing will occur during the process of excavating, transporting, and placing the fill, but it is possible that large or continuous layers or pockets of sand will be encountered that may be inadequately blended with fine material by incidental mixing. Significant effort would be required to mix large volumes of sand with the clay. Segregating the sandier material encountered during excavation, particularly where it appears in thicker pockets or continuous layers, may be more practical than blending it into the fine-grained fill. Segregated sand material could be used for haul roads, toe berms, or stockpiled and left on site for the landfill owner to reuse for final grading during the landfill closure process.

Water trapped within sand layers was observed on occasion during the Site investigation. Trapped water could potentially alter the moisture content of the surrounding fine-grained fill in areas during the excavation. Fill materials with greater than optimum moisture content may require drying to

meet compaction requirements. Drying soils can be very expensive, time consuming, and highly weather dependent. Any design for future use of the fill should take into account the observed moisture content and potential compaction requirements.

Table 8 presents a generalized summary of the predominant soil types (i.e., topsoil, fine-grained or granular soils) and total thickness observed at each boring. The estimated percentage of fine-grained and granular soil is based on the observed thickness of these material types in each boring.

5 Preliminary Stockpile Removal Plan

The objectives of the stockpile characterization included delineating the extent of the stockpile, refining the estimated volume of recoverable stockpile fill, and gathering information to support the development of a stockpile-removal plan. The investigation provided information to address these objectives, as described in this section.

The extent of the stockpile is documented by surveys performed in 2008 and 2015 (TM Engineering 2010, 2016), representing the ground surface before the stockpile was placed (approximately the current bottom of the stockpile) and the current ground surface (i.e., top of the stockpile). The 2015 survey shows areas of fill to the north and west of the stockpile. The apparent truncation on the left side of Section A-A' in Figure 3 is a result of one area of this other fill. The stockpile volume estimate discussed in this section includes only the fill within the stockpile boundary shown on Figure 2.

Prior to advancing the soil borings, the elevation of the bottom of the stockpile was expected to be somewhat lower than the elevations indicated by the 2008 survey because of consolidation of the waste and underlying soil under the load of the stockpile that would have occurred since the 2008 survey was performed. This change was positively seen in three of the borings (AQ06, AQ11, and AQ12), where waste was first encountered approximately 2.5 feet lower than the elevation of the 2008 survey at these points. Since this change was not positively identified in the other borings, the topography from the 2008 survey is conservatively assumed to represent the bottom the stockpile.

To calculate the recoverable volume of stockpile material, adjustments were made to both the 2008 and 2015 surveys to reflect anticipated removal operations. These adjustments are shown as red dashed lines on the sections in Figure 3. On average, approximately 1.3 feet of topsoil was observed in the borings and test pits. Anticipating that the topsoil would be removed and stored separately for future use before removing the stockpiled fill, 1.3 feet was subtracted from the surface created from the 2015 survey. To avoid potentially removing landfilled waste, a buffer of 3 feet above the surface created from the 2008 survey is proposed. Both of the adjustments reduce the calculated recoverable volume of the stockpile as compared to simply using the surfaces from the 2008 and 2015 surveys. Using these assumptions, the volume of recoverable fill in the stockpile is approximately 913,000 cy.

The stockpile material is predominantly fine-grained soil consisting of low plasticity (lean) clay and silt with varying amounts of sand. The predominantly clay fill varies in color, including light gray, red, and brown. The predominantly sand fill in the stockpile is mostly moist in varying colors, including red, reddish brown, greenish brown, gray, and yellowish brown. In contrast to the stockpile material, the waste that was encountered was dark gray or black and had an odor at four of the borings. Representatives of Cristal USA reported that the waste material is typically either dark gray or black, as observed in this investigation, or orange.

The stockpile removal would be primarily guided by elevation based on the 2008 and 2015 surveys, as well as information from the explorations. The anticipated process is that work areas would be established and topsoil removed from an area and stockpiled for future use. Surface water controls would be established at stockpiles to control runoff and migration of soil. After topsoil is removed, clay fill would be removed from the stockpile and used immediately for construction or temporarily staged, if necessary, based on construction progress. Predominantly sand fill may be separated from the clay, if feasible, and used or stockpiled for later use. Work may progress in adjacent work areas to evenly lower the height of the stockpile until all the fill is used. The removal of the fill would progress until the bottom elevation (3 feet above the elevation of the 2008 survey) is reached unless waste material is encountered first. Waste material would be identified based on the characteristics described in this section (odor or dark gray, black, or orange color).

The elastic silt fill found near the bottom of soil boring AQ05 is deeper than the proposed depth of stockpile removal in this area. As discussed in Section 3.1.1, the fill at this depth in this soil boring has properties (high moisture content and high organic content) that are inconsistent with the properties of the fill in any of the other explorations. Since this material is below the proposed depth of stockpile removal, the characteristics of these three samples should not be representative of the recoverable fill.

As discussed in Section 4.3, approximately 80% of the stockpile, excluding the topsoil, appears to be fine-grained fill based on exploration samples. Using the volume of recoverable fill discussed in this section, the volume of fine-grained fill is estimated to be 736,000 cy, and the volume of coarser fill is estimated to be 177,000 cy.

6 Conclusions

Based on available survey data and the subsurface conditions observed during our investigation, there is an estimate of 941,000 cy of recoverable stockpile material at the Site. The volume of fill that would be left in the stockpile as the 3-foot buffer above the waste is approximately 63,000 cy. The varying soil types observed in the explorations have been simplified into three main categories for discussion purposes: topsoil, fine-grained soils, and granular soils. The estimated volumes of each soil type is as follows:

- 28,000 cy topsoil
- 736,000 cy fine-grained soil (predominantly clay)
- 177,000 cy granular soil (predominantly sand)

The fill observed in this investigation appears to be generally suitable for a variety of nonresidential construction uses with the following considerations:

- Pockets and layers of sand and sandier clay material were frequently observed. Sand and sandy clay material may not be suitable for all fill applications in constructing earthen dikes. Sand alone is not suitable for use where seepage control is required but may be used in other fill applications. Sand within the stockpile could either be segregated from the fine-grained fill or mixed with the existing fine-grained soils to create a semi-impervious soil for dike fill. Any blending or mixing of soils would require further testing and evaluation to determine if the blended soil meets the engineering design requirements for the desired application. Where the coarser fill appears in larger pockets or continuous layers, segregation of this material may be practical; blending with the fine-grained fill may be more practical for the more isolated pockets of sand.
- The strength parameters of compacted fine-grained fill are presented in Table 5 and should be taken into consideration during design to assess stability.
- The moisture content of some of the fine-grained soils at the time of the investigation were above the reported optimum value and may require some drying to meet compaction requirements for construction of certain structures, such as earthen dikes. Fine-grained soils are particularly sensitive to changes in moisture content and can be challenging to handle and compact, especially during periods of wet weather.
- Pockets of water were observed in both test pits and soil borings. Trapped or perched water within the stockpile should be anticipated during excavation of the stockpile. Excess water perched in granular layers or pockets may alter the moisture content of the surrounding soils during excavation or mixing. Wetted fill material may require some drying to meet moisture-content requirements before placement.
- Waste was not encountered at each exploration and was variable in composition. The strongest indicator of waste may be a contrast in color. Fill soils were typically reddish brown.

Waste material was typically darker in color, dark brown or gray to black, with an occasional odor (rotten eggs). When waste was encountered, it generally coincided with the anticipated elevation based on previous surveys. Allowing a 3-foot buffer above the elevation of the 2008 survey should avoid potentially encountering waste during excavation of the stockpile.

- The results of the chemical analyses of the stockpile samples confirmed previous characterization that the stockpiled fill meets state standards for reuse in a nonresidential setting.

7 Limitations and Qualifications

The explorations performed and utilized for this evaluation only represent subsurface conditions at specific selected exploration locations across the Site. Actual conditions at other locations across the Site could vary, and the extent of such variation would not become evident until construction or additional explorations are performed. If significant variations are observed, the conclusions and recommendations contained in this report may need to be modified to reflect the extent of variations and the actual Site conditions observed.

The scope of our environmental assessment is limited to the evaluation of metals, listed in Tables 6 and 7. The scope of our services did not include the assessment for the presence or absence of other hazardous or toxic materials in the soils, surface water, groundwater, or air at the Site.

8 References

Anchor QEA, 2016. *Cristal USA Stockpile Characterization Sampling and Analysis Plan*. Prepared for Maryland Department of Transportation Port Administration and Maryland Environmental Service. December 2016.

MDE (Maryland Department of the Environment), 2008. *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater*, Interim Final Guidance (Update No. 2.1), June 2008.

MDE and MDOT (Maryland Department of the Environment and Maryland Department of Transportation Port Administration), 2017. *Innovative Reuse and Beneficial Use of Dredged Material Draft Guidance Document*, March 2017.

TM Engineering (TM Engineering, Inc.), 2010. *HPP Landfill – 30 Acre Site, Clay Stockpile Relocation*. Prepared for Millennium Inorganic Chemicals, Inc. August 6, 2010.

TM Engineering, 2016. *HPP Landfill – Site Plan*. Prepared for Millennium Inorganic Chemicals, Inc.

USACE (U.S. Army Corps of Engineers), 1987. *Confined Disposal of Dredged Material*. EM 1110-2-5027. September 1987.

Tables

Table 1
Exploration Summary

Exploration ID	Proposed Easting (feet)	Proposed Northing (feet)	Actual Easting (feet)	Actual Northing (feet)	Distance from Proposed Location (feet)	Ground Surface Elevation (feet MLLW)	Termination Depth (feet)	Termination Elevation (feet)
AQ01	1,441,040.27	559,937.50	1,441,041.21	559,943.21	6	80.0	27	53.0
AQ02	1,441,228.51	559,847.44	1,441,225.03	559,848.97	4	98.9	52	46.9
AQ03	1,441,427.67	559,895.54	1,441,421.96	559,893.87	6	79.0	50	29.0
AQ04	1,441,639.31	559,776.22	1,441,639.70	559,778.15	2	79.0	35	44.0
AQ05	1,441,491.73	559,692.04	1,441,493.08	559,692.10	1	118.8	92	26.8
AQ06	1,441,685.48	559,570.16	1,441,686.09	559,571.58	2	118.0	39	79.0
AQ07	1,441,594.12	559,461.36	1,441,590.29	559,465.66	6	117.6	35	82.6
AQ08	1,441,390.69	559,460.79	1,441,390.80	559,462.61	2	144.0	67	77.0
AQ09	1,441,421.00	559,297.50	1,441,421.71	559,298.59	1	99.5	23	76.5
AQ10	1,441,207.00	559,337.41	1,441,205.99	559,351.09	14	100.0	21	79.0
AQ11	1,441,136.69	559,624.16	1,441,136.23	559,627.48	3	100.0	86	14.0
AQ12	1,440,997.55	559,760.49	1,440,999.85	559,765.42	5	80.0	39	41.0
TP01	1,441,163.92	559,796.83	1,441,172.46	559,792.52	10	121.0	10.6	110.4
TP02	1,441,352.87	559,869.10	1,441,413.51	559,837.50	68	98.4	10.5	87.9
TP04	1,441,638.54	559,636.01	1,441,630.93	559,629.54	10	116.8	11.0	105.8
TP05	1,441,568.74	559,423.21	1,441,506.23	559,362.51	87	99.3	8.8	90.5
TP06	1,441,410.21	559,543.80	1,441,411.21	559,544.15	1	142.6	11.1	131.5
TP08	1,441,209.09	559,514.24	1,441,058.00	559,656.23	207	80.8	7.1	73.7
TP08A	1,441,209.09	559,514.24	1,441,006.23	559,755.44	315	80.5	10.2	70.3

Notes:
Eastings and northings are in Maryland State Plane Coordinates, North American Datum of 1983, U.S. feet.
MLLW: mean lower low water

Table 2
Index Testing Results

Location ID	Sample ID	Sample Depth (feet)		USCS[1]	Moisture Content (%)	Atterberg Limits			Particle Size			Specific Gravity	Organic Content (%)
		Top	Bottom			Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines		
AQ01	S1	0	2	CL	14.6%								
AQ01	S2	3	5	Lean clay with sand (CL)	12.7%	37	20	17	0.0%	17.8%	82.2%		
AQ01	S3	8	10	Clayey Sand (SC)	13.9%				0.2%	54.5%	45.3%	2.67	1.7%
AQ01	S4A	13	15	Lean clay with sand (CL)	9.6%	22	13	9					
AQ01	S4B	13	15	CL	10.7%								
AQ01	S5	18	20	CL	12.5%								
AQ01	S6	23	25	Clayey sand (SC)	8.8%						24.4%		
AQ02	S1	0	2	CL	15.5%								
AQ02	S2	3	5	CL	18.3%								
AQ02	S3	8	10	CL	17.0%								
AQ02	S4	13	15	Lean clay with sand (CL)	16.5%	36	17	19	0.2%	25.3%	74.5%	2.71	1.4%
AQ02	S5	18	20	CL	18.8%								
AQ02	S6	23	25	Clayey sand (SC)	10.0%				16.0%	53.1%	30.9%		
AQ02	S7	28	30	SC	11.9%								
AQ02	S8	33	35	SC	8.1%								
AQ02	S9	38	40	Lean clay (CL)	13.8%	37	19	18					
AQ02	S10	40	42	Clayey Sand (SC)	12.1%						47.6%		
AQ02	S11	42	44	CL	14.6%								
AQ02	S12	44	46	Lean clay with sand (CL)	15.7%	38	18	20	1.3%	22.2%	76.5%		2.0%
AQ02	S13	46	48	CL	10.6%								
AQ02	S14	48	50	CL	11.7%								
AQ03	S1	0	2	CL-ML	23.8%								
AQ03	S2	3	5	Lean clay (CL)	20.5%	45	22	23	0.0%	14.9%	85.1%		
AQ03	S3	8	10	Lean clay with sand (CL)	20.6%	34	17	17					
AQ03	S4	13	15	CL	20.4%								
AQ03	S5	18	20	CL	19.1%								
AQ03	S6	23	25	Lean clay with sand (CL)	15.5%	39	18	21	0.0%	20.9%	79.1%	2.72	1.5%
AQ03	S7	28	30	CL	10.8%								
AQ03	S8	33	35	CL	14.4%								
AQ03	S9	38	40	SC-SM	14.5%								4.5%
AQ03	S10	40	42	Sandy lean Clay (CL)	14.4%	30	18	12					2.3%
AQ03	S11	42	44	CL	16.1%								
AQ03	S12	44	46	Lean clay with sand (CL)	13.5%	32	15	17	0.2%	38.7%	61.1%		
AQ03	S13	46	48	CL	13.4%								
AQ04	S1	0	2	CL-ML	15.7%								
AQ04	S2	3	5	Lean clay with sand (CL)	17.1%	35	17	18	0.0%	18.9%	81.1%		
AQ04	S3	8	10	SC	12.5%				1.1%	81.2%	17.7%		
AQ04	S4	13	15	CL	18.4%								
AQ04	S5	18	20	Lean clay (CL)	16.4%	40	20	20					

Table 2
Index Testing Results

Location ID	Sample ID	Sample Depth (feet)		USCS[1]	Moisture Content (%)	Atterberg Limits			Particle Size			Specific Gravity	Organic Content (%)
		Top	Bottom			Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines		
AQ04	S6	23	25	CL	14.7%								
AQ04	S7	25	27	CL	14.5%								
AQ04	S8	27	29	Fat clay with sand (CH)	15.7%	57	22	35	0.0%	15.3%	84.7%	2.73	
AQ04	S9	29	31	Lean clay (CL)	16.9%	42	19	23					
AQ04	S10	31	33	CL	22.0%								
AQ05	S1	0	2	CL	18.8%								
AQ05	S2	3	5	CL	20.1%								
AQ05	S3A	8	10	CL	15.2%								
AQ05	S3B	8	10	CH	17.0%								
AQ05	S4	13	15	Fat clay (CH)	17.7%	56	20	36	0.0%	9.5%	90.5%		
AQ05	S5	18	20	CH	18.2%								
AQ05	S6	23	25	CH	17.5%								
AQ05	S7	28	30	Clayey Sand (SC)	11.3%				0.0%	84.8%	15.2%	2.66	
AQ05	S8	33	35	SC	11.7%								
AQ05	S9	38	40	Clayey sand (SC)	13.6%	23	12	11	0.0%	69.4%	30.6%		1.6%
AQ05	S10	43	45	Clayey sand (SC)	12.7%				0.0%	50.6%	49.4%		
AQ05	S11	48	50	SC	12.3%								
AQ05	S12	53	55	Clayey sand (SC)	28.0%						32.8%		
AQ05	S13	58	60	CL	15.1%								
AQ05	S14	63	65	Lean clay (CL)	15.3%	39	17	22					
AQ05	S15	68	70	CL	15.1%								
AQ05	S16A	74	76	Lean clay (CL)	17.4%	24	15	9					4.2%
AQ05	S16B	74	76	CL	15.0%								
AQ05	S17	76	78	CL	12.4%								
AQ05	S18A	78	80	CL	10.5%								
AQ05	S18B	78	80	CL	14.4%								
AQ05	S19A	80	82	CL	15.1%								
AQ05	S19B	80	82	CL	12.3%								
AQ05	S20	82	84	Lean clay with sand (CL)	11.6%	32	15	17	11.1%	29.4%	59.5%		1.3%
AQ05	S21	84	86	MH	64.3%								
AQ05	S22	86	88	MH	58.1%								
AQ05	S23	88	90	Elastic Silt (MH)	58.9%	60	49	11	0.0%	0.9%	99.1%		12.6%
AQ06	S1	0	2	ML	12.7%								
AQ06	S2	3	5	Lean clay with sand (CL)	20.5%	30	17	13	0.0%	19.4%	80.6%		
AQ06	S3	8	10	CL	22.8%								
AQ06	S4	13	15	CL	17.0%								
AQ06	S5	18	20	SC	10.5%								
AQ06	S6	23	25	Lean clay (CL)	14.6%	32	16	16				2.66	
AQ06	S7A	25	26.5	CL	15.5%								

Table 2
Index Testing Results

Location ID	Sample ID	Sample Depth (feet)		USCS[1]	Moisture Content (%)	Atterberg Limits			Particle Size			Specific Gravity	Organic Content (%)
		Top	Bottom			Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines		
AQ06	S7B	26.5	27	Clayey Sand (SC)	9.9%						18.7%		
AQ06	S8	27	29	SC	12.1%								
AQ06	S9	29	31	SC	9.7%								
AQ06	S10	31	33	Poorly graded sand (SP-SC)	6.6%				0.0%	90.5%	9.5%		
AQ06	S11	33	35	SP-SC	9.2%								
AQ06	S12	35	37	Lean clay (CL)	13.0%	30	17	13					
AQ07	S1	0	2	SM	18.1%								
AQ07	S2	3	5	CL	19.8%								
AQ07	S3	8	10	Lean clay with sand (CL)	17.2%	36	18	18	0.0%	19.8%	80.2%	2.71	
AQ07	S4	13	15	CL	17.6%								
AQ07	S5	18	20	Clayey sand (SC)	12.5%				4.7%	57.5%	37.8%		2.5%
AQ07	S6	23	25	Lean clay (CL)	19.0%	39	19	20					
AQ07	S7	25	27	CL	13.8%								
AQ07	S8	27	29	CL	16.2%								
AQ07	S9	29	31	Clayey Sand (SC)	13.2%				4.2%	60.8%	35.0%		
AQ08	S1	0	2	CL	18.3%								
AQ08	S2	3	5	Lean clay (CL)	17.2%	48	22	26	0.0%	4.1%	95.9%		
AQ08	S3	8	10	CL	16.0%								
AQ08	S4	13	15	CL	19.2%								
AQ08	S5	18	20	Lean clay with sand (CL)	14.4%	33	16	17	0.0%	26.6%	73.4%	2.69	
AQ08	S6	23	25	CL	14.2%								
AQ08	S7	28	30	CL	15.4%								
AQ08	S8	33	35	Lean clay (CL)	14.6%				0.0%	27.6%	72.4%		2.0%
AQ08	S9	38	40	Silt with sand (ML)	16.7%				0.0%	15.4%	84.6%		
AQ08	S10	43	45	CL	18.2%								
AQ08	S11	48	50	CL	14.8%								
AQ08	S12	53	55	CL	15.4%								1.5%
AQ08	S13	55	57	Lean clay (CL)	11.5%	38	16	22					
AQ08	S14	57	59	CL	12.7%								
AQ08	S15	59	61	Lean clay (CL)	16.4%	40	19	21					
AQ08	S16	61	63	Silty sand (SM)	11.5%				0.5%	63.9%	35.6%		
AQ09	S1	0	2	SM	27.2%								
AQ09	S2	3	5	CL	17.9%								2.8%
AQ09	S3	8	10	Lean clay with sand (CL)	18.9%	36	18	18	0.0%	18.7%	81.3%		
AQ09	S4	13	15	CL	17.6%								2.4%
AQ09	S5	15	17	CL	13.6%								
AQ09	S6	17	19	Poorly graded sand (SP-SC)	13.1%				0.0%	88.9%	11.1%	2.66	
AQ09	S7	19	21	SP-SC	14.9%								
AQ10	S1	0	2	SM	14.6%								

Table 2
Index Testing Results

Location ID	Sample ID	Sample Depth (feet)		USCS[1]	Moisture Content (%)	Atterberg Limits			Particle Size			Specific Gravity	Organic Content (%)
		Top	Bottom			Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines		
AQ10	S2	3	5	Lean clay with sand (CL)	18.2%	39	19	20	0.2%	16.0%	83.8%		
AQ10	S3	8	10	CL	13.6%							2.7	
AQ10	S4	13	15	CL									
AQ10	S5	15	17	Silty sand (SM)	7.5%				0.0%	84.8%	15.2%		
AQ11	S1	0	2	SM	23.9%								
AQ11	S2	3	5	CL	15.3%								
AQ11	S3	8	10	Sandy lean clay (CL)	13.7%	28	15	13	0.1%	39.1%	60.8%		
AQ11	S4	13	15	CL	12.3%								
AQ11	S5	18	20	Sandy lean clay (CL)	11.9%						50.9%		
AQ11	S6	23	25	CL	19.0%								
AQ11	S7	28	30	CL	17.3%								
AQ11	S8	33	35	CL	15.0%								
AQ11	S9	38	40	Lean clay with sand (CL)	13.0%	31	15	16	0.0%	20.7%	79.3%		
AQ11	S10	43	45	CL	16.8%								
AQ11	S11	48	50	CL	13.1%								
AQ11	S12	53	55	Clayey sand (SC)	9.2%						35.9%		
AQ11	S13	58	60	CL	15.7%								
AQ11	S14	63	65	CL	13.5%								
AQ11	S15	68	70	Lean clay (CL)	19.8%	40	21	19					
AQ11	S16	70	72	CL	16.2%								
AQ11	S17	72	74	CL	13.7%								
AQ11	S18	74	76	CL	13.4%								
AQ11	S19	76	78	CL	18.0%								
AQ11	S20	78	80	CL	18.5%								
AQ11	S21	80	82	CL	16.6%								
AQ11	S22	82	84	Lean clay (CL)	15.5%	46	19	27	0.0%	8.1%	91.9%	2.69	
AQ12	S1	0	2	CL	18.0%								
AQ12	S2	3	5	Lean clay with sand (CL)	17.1%	25	11	14			67.6%	2.74	
AQ12	S3	8	10	CL	12.4%								
AQ12	S4	13	15	Clayey sand (SC)	15.2%				0.4%	59.8%	39.8%		
AQ12	S5	18	20	Lean clay with sand (CL)	19.1%						50.9%		
AQ12	S6	23	25	CL	9.9%								
AQ12	S7	25	27	Lean clay with sand (CL)	18.1%	42	21	21					
AQ12	S8	27	29	CL	14.5%								
AQ12	S9	29	31	CL	13.3%								
AQ12	S10	31	33	Clayey sand (SC)	12.0%				0.8%	57.3%	41.9%	2.67	1.5%
AQ12	S11	33	35	CL	12.1%								
AQ12	S12	35	37	Lean clay with sand (CL)	17.8%	41	20	21					
TP01	--	0	10.6	Lean clay with sand (CL)	13.7%	31	15	16	0.6%	22.9%	76.5%	2.72	1.2%

Table 2
Index Testing Results

Location ID	Sample ID	Sample Depth (feet)		USCS[1]	Moisture Content (%)	Atterberg Limits			Particle Size			Specific Gravity	Organic Content (%)
		Top	Bottom			Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines		
TP02	--	0	10.5	Lean clay with sand (CL)	16.6%	37	16	21	0.2%	16.1%	83.7%	2.73	1.4%
TP04	--	0	11	Lean clay with sand (CL)	19.1%	42	21	21	1.8%	21.7%	76.5%	2.71	1.4%
TP05	--	0	8.8	Lean clay (CL)	17.8%	38	19	19	0.6%	13.1%	86.3%	2.72	1.2%
TP06	--	0	11.1	Lean clay with sand (CL)	16.0%	39	16	23	0.0%	15.2%	84.8%	2.69	2.0%
TP08A	--	0	10.2	Sandy lean clay (CL)	13.6%	28	13	15	0.3%	43.7%	56.0%	2.66	0.8%

Notes:
Complete geotechnical reports are provided in Appendix A.
1. Soil classification is based on visual observations and, where available, supporting laboratory data.
USCS: Unified Soil Classification System

Table 3
Standard Proctor Testing Results

Location ID	Sample Depth (feet)		As Received Moisture (%)	Optimum Moisture (%)	Maximum Dry Density (pcf)
	Top	Bottom			
TP01	0	10.6	14%	13.2%	119.9
TP02	0	10.5	17%	14.9%	115
TP04	0	11	19%	13.6%	116.3
TP05	0	8.8	18%	16.4%	111.7
TP06	0	11.1	16%	14.0%	112.2
TP08A	0	10.2	14%	12.2%	120.9

Notes:
Complete geotechnical reports are provided in Appendix A.
pcf: pounds per cubic foot

Table 4
Summary of Permeability Testing Results

Location ID	Sample Depth (feet)		Specific Gravity	Initial Moisture Content w_0 (%)	Initial Dry Density (pcf)	Max Dry Density (pcf)	% Compaction	Permeability (cm/sec)[1]
	Top	Bottom						
TP01	0	10.6	2.72	13.0%	113.2	119.9	94.4%	1.20E-07
TP02	0	10.5	2.73	14.9%	108.3	115.0	94.2%	9.90E-08
TP04	0	11	2.71	13.6%	109.9	116.3	94.5%	9.10E-08
TP05	0	8.8	2.72	14.5%	105.5	111.7	94.4%	9.40E-07
TP06	0	11.1	2.69	14.5%	105.9	112.2	94.4%	1.20E-06
TP08A	0	10.2	2.66	12.1%	114.7	120.9	94.9%	4.00E-07

Notes:
Complete geotechnical reports are provided in Appendix A.
1. Permeability at 20° C with at 6 psi effective stress.
cm/sec: centimeters per second
pcf: pounds per cubic foot
psi: pounds per square inch

Table 5
Summary of Triaxial Strength Testing Results

Location ID	Initial Moisture Content (%)	Optimum Moisture (%)	Initial Dry Density (pcf)	Max Dry Density (pcf)	% Compaction	Major Principle Effective Stress at Failures (psf [σ'1f])	Minor Principle Effective Stress at Failures (psf [σ'3f])	Effective Cohesion[1] C' (psf)	Effective Friction Angle[1] φ' (deg)
TP01	13.0%	13.2%	114	119.9	95.1%	1668	663	232	18.4
	13.1%	13.2%	114	119.9	95.1%	2596	853		
	13.0%	13.2%	114	119.9	95.1%	5488	2550		
TP02	15.8%	14.9%	108	115.0	93.9%	1410	483	114	22.0
	15.8%	14.9%	108	115.0	93.9%	2742	1104		
	15.8%	14.9%	108	115.0	93.9%	5388	2298		
TP04	13.4%	13.6%	111	116.3	95.4%	1970	872	0	25.5
	13.3%	13.6%	111	116.3	95.4%	3635	1337		
	13.5%	13.6%	111	116.3	95.4%	5800	2233		
TP05	16.7%	16.4%	106	111.7	94.9%	1234	350	58	28.0
	16.4%	16.4%	106	111.7	94.9%	2572	899		
	16.7%	16.4%	106	111.7	94.9%	5083	1751		
TP06	14.9%	14.0%	106	112.2	94.5%	1356	454	170	23.8
	14.6%	14.0%	106	112.2	94.5%	2847	836		
	14.5%	14.0%	106	112.2	94.5%	5178	2032		
TP08A	15.2%	12.2%	112	120.9	92.6%	1606	689	0	27
	16.0%	12.2%	111	120.9	91.8%	2125	708		
	15.9%	12.2%	111	120.9	91.8%	4493	1567		

Notes:
Complete geotechnical reports are provided in Appendix A. Refer to Figure 4 for data plots and derivation of c' and φ' and values.
1. values for c' and φ' determined from best fit straight line as reported by testing laboratory.
deg: degrees
pcf: pounds per cubic foot
psf: pounds per square foot

Table 6
Chemical Characterization Results

	Sample Location and Date													
	AQ01	AQ02	AQ03	AQ04	AQ05	AQ06	AQ07	AQ08	AQ09	AQ10	AQ11	AQ11-FD	AQ12	Rinsate Blank
	3/9/17	3/7/17	3/8/17	3/8/17	2/28/17	3/2/17	3/2/17	3/3/17	3/6/17	3/6/17	3/2/17	3/2/17	3/9/17	3/9/17
Moisture (%)	10.4	15.7	21.0	17.8	12.5	12.8	15.5	13.9	14.2	16.0	13.7	13.2	10.2	NA
Metals (mg/kg)														
Antimony	0.30	0.13	0.71	0.099 J F	0.71	0.30	0.19	0.18	0.16	0.23	0.30	0.41	0.17	1.1 J
Arsenic	3.5	1.5	3.3	3.2 F	4.3	3.3	1.4	2.6	3.8	3.4	3.1	3.7	3.4	0.40 J
Beryllium	0.75 J	0.36 J	0.92 J	0.63 J	0.22 J	0.46 J	0.22 J	0.64 J	0.24 J	0.64 J	1.3 J	0.50 J	0.33 J	1.0 U
Cadmium	0.075	0.059 U	0.16	0.0090 J	0.14	0.026 J	0.022 J	0.022 J	0.017 J	0.051 J	0.050 J	0.062	0.037 J	1.0 U
Chromium	29	19	35	13 F	28	29	22	20	12	28	28	31	20	0.74 J
Copper	17	6.6	22	19 F	27	13	9.0	11	11	10	20	22	13	5.0 B
Lead	6.2	1.5	7.6	3.2 F	9.3	8.0	5.6	3.8	3.2	4.9	11	19	3.0	1.0 U
Nickel	6.0 B	3.1 B	5.7 B	22 B F	5.1 B	4.8 B	2.9 B	5.3 B	4.4 B	4.7 B	10 B	8.5 B	12 B	1.0 U
Selenium	0.76	0.83	1.0	2.2 F	0.42	0.78	0.50	1.1	0.74	0.86	1.1	0.89	0.59	5.0 U
Silver	0.21	0.021 J	0.45	0.014 J	0.35	0.32	0.018 J	0.015 J	0.058	0.080	0.035 J	0.089	0.034 J	1.0 U
Thallium	0.047 J	0.024 J	0.035 J	0.091 J	0.041 J	0.042 J	0.033 J	0.041 J	0.042 J	0.032 J	0.042 J	0.048 J	0.034 J	1.0 U
Zinc	20	3.2	23	4.7 F	25	13	7.1	10	7.5	10	24	30	15	5.0 B
Mercury	0.027	0.020 U	0.051	0.021 U	0.057	0.029	0.021 U	0.018 U	0.012 J	0.0070 J	0.030	0.0086 J	0.0075 J	0.20 U

Notes:
All samples were composites prepared from three intervals in the respective soil boring from the top, middle, and bottom of the boring. Refer to the soil boring logs for the specific intervals collected for chemical analysis.
Analyses were performed by TestAmerica Pittsburgh. Soil samples were analyzed using EPA method 6020A for all metals except mercury and 7471B for mercury.
The complete laboratory report is provided in Appendix B.
B: The constituent was detected in the blank as well as in the sample.
F: The matrix spike or matrix spike duplicate recovery was outside the quality assurance limits indicating potential matrix interference with the analytical result.
J: The constituent was positively detected at a concentration below the reporting limit. The concentration reported is an estimated value. The J qualifier was added to beryllium and thallium results based on inconsistencies between concentrations in the target and field duplicate samples as explained in the text of the report.
mg/kg: milligrams of constituent per kilograms of sample
NA: not applicable
U: The constituent was not detected. The reporting limit is shown.

Table 7

Chemical Concentrations in Soil Compared to State Standards

Metals	Summary of Concentrations in Soil Borings (mg/kg)			Nonresidential Cleanup Standard[1]	Nonresidential Standards[2]	
	Minimum	Maximum	Arithmetic Mean		Category 2	Category 3
Antimony	0.099	0.71	0.30	41	47	467
Arsenic	1.4	4.3	3.1	3.6*	3.0	30
Beryllium	0.22	1.3	0.54	200	230	2,290
Cadmium	0.009	0.16	0.055	51	98	982
Chromium	12	35	24	310		
Chromium(III)					180,000	1,800,000
Chromium(VI)					6.3	63.3
Copper	6.6	27	15	4,100	4,700	46,700
Lead	1.5	19	6.7	1,000	800	3,850
Nickel	2.9	22	7.4	2,000	810	8,150
Selenium	0.42	2.2	0.92	510	580	5,840
Silver	0.014	0.45	0.12	510	580	5,840
Thallium	0.024	0.091	0.042	7.2	1.2	11.7
Zinc	3.2	30	14	31,000	35,000	350,000
Mercury	0.007	0.057	0.024	31	35	350

Notes:

1. Soil cleanup standards from the *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater,* Interim Final Guidance (Update No. 2.1), June 2008.

2. Soil reuse standards from *Innovative Reuse and Beneficial Use of Dredged Material Draft Guidance Document,* March 2017.

* Per Appendix 2 of the 2008 guidance, the standard for arsenic is the Anticipated Typical Concentration (background).

mg/kg: milligrams of constituent per kilograms of sample

Table 8

Approximate Quantities of Soil Types

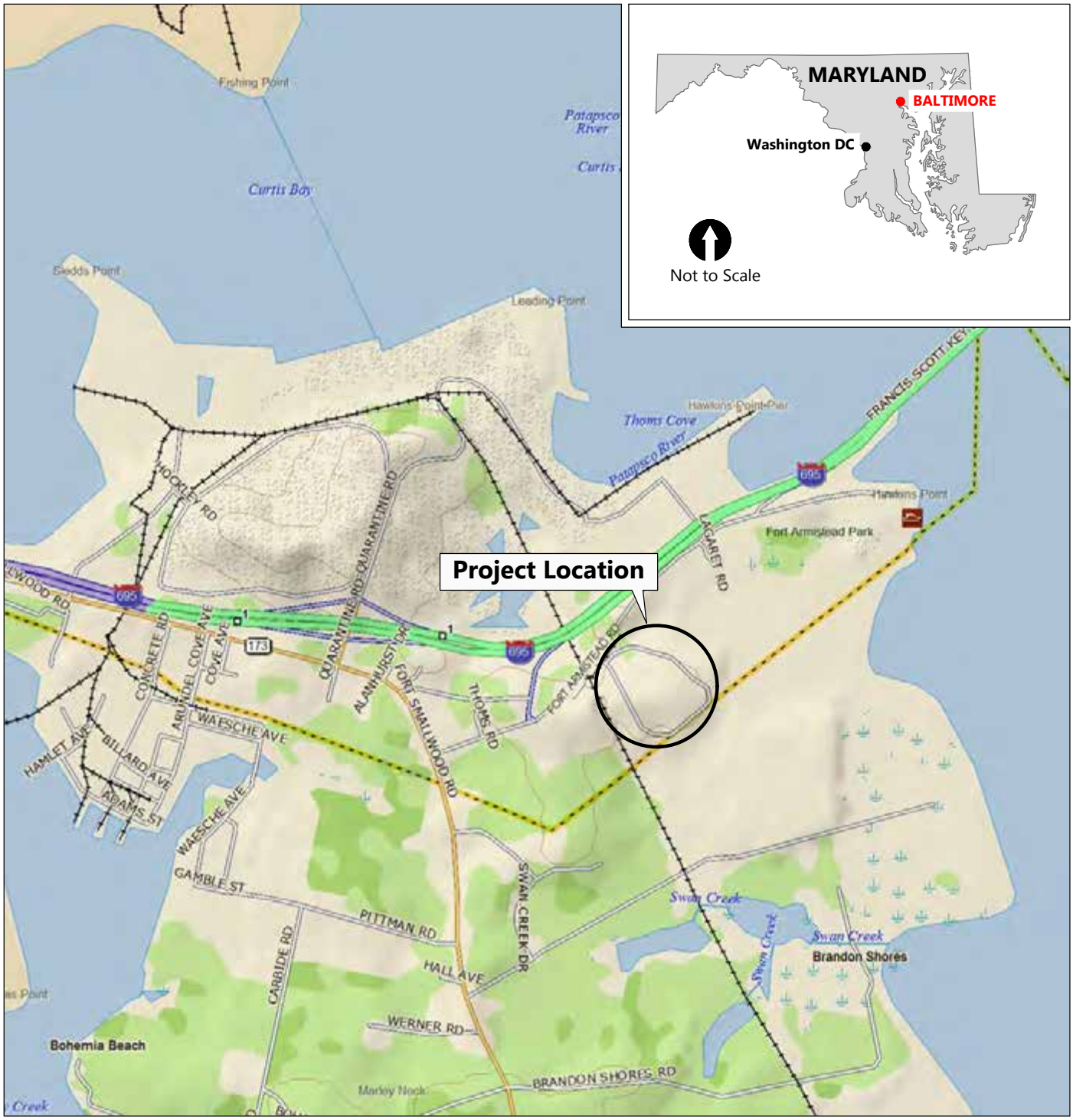
Boring	Topsoil Thickness (feet)	Thickness of Fine-Grained Soil (feet)	Thickness of Granular Soil (feet)	Total Boring Depth (feet)	% Fine-Grained Soil	% Granular Soil
AQ01	0.8	18.7	7.5	27	71%	29%
AQ02	0.8	34.7	16.5	52	68%	32%
AQ03	1.0	45.4	3.6	50	93%	7%
AQ04	0.8	32.2	2	35	94%	6%
AQ05	0.7	67.8	23.5	92	74%	26%
AQ06	2.5	25	11.5	39	68%	32%
AQ07	3.5	26	5.5	35	83%	17%
AQ08	0.4	61.6	5	67	93%	8%
AQ09	0.5	18	4.5	23	80%	20%
AQ10	1.1	14.9	5	21	75%	25%
AQ11	3.0	73	9.3	86	88%	11%
AQ12	0.3	31.2	7.5	39	81%	19%

Notes:

Fine-Grained Soil - 50% or more passes the No. 200 sieve

Granular Soils - more than 50% retained on the No. 200 sieve

Figures

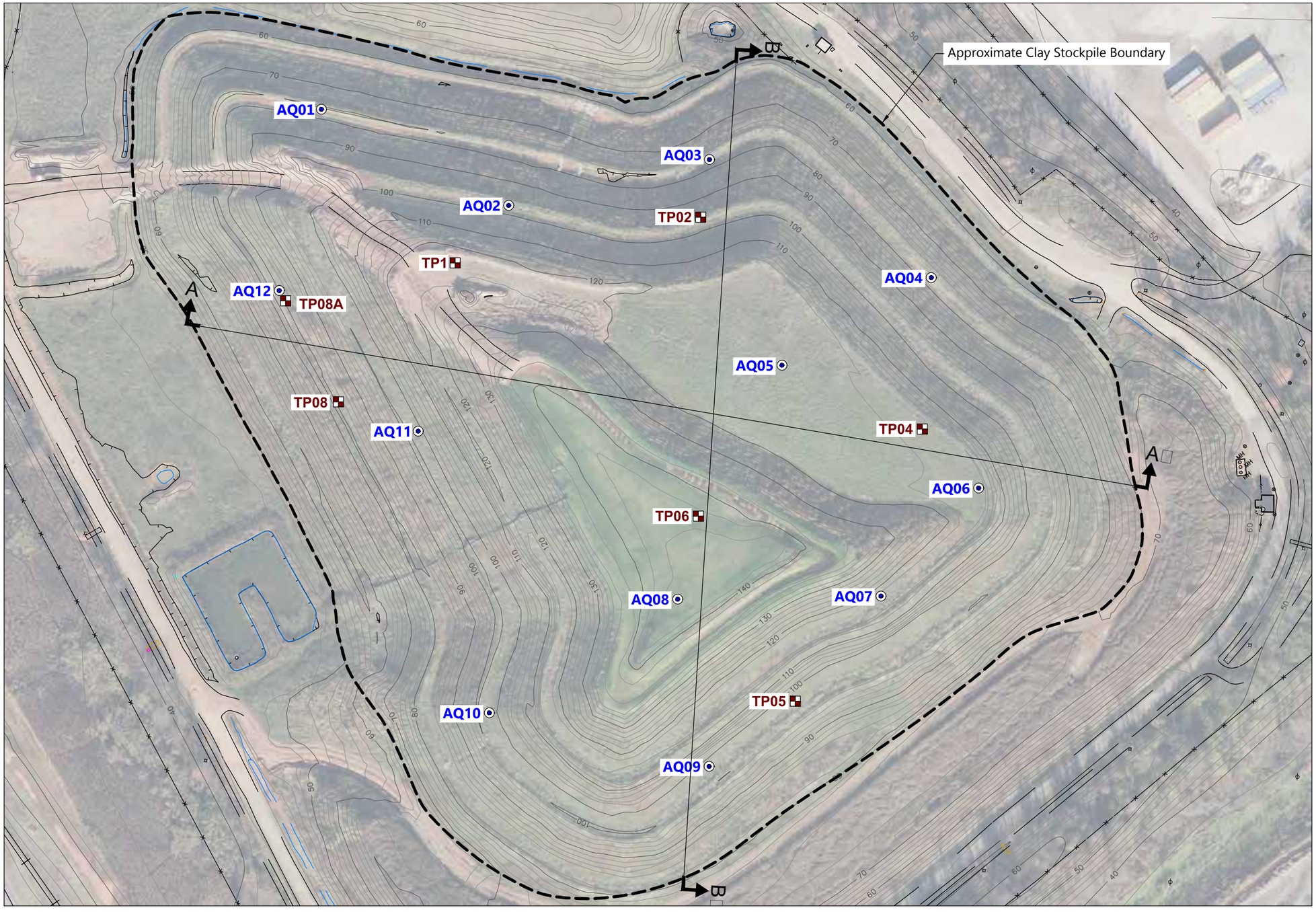


SOURCE: DeLorme Topo USA®.

Publish Date: 2017/04/26 11:02 AM | User: jbigsby
Filepath: K:\Projects\0530-Maryland Environmental Service\Cristal USA Facility Environmental Remediation_Stockpile Geotechnical Evaluation\0530-RP-003 (Vicinity Map-Report).dwg FIG1

ANCHOR QEA

Figure 1
Vicinity Map
Cristal USA Stockpile Characterization Report
Maryland Port Administration
Baltimore, Maryland



LEGEND:

AQ04 Soil Boring Location and Number

TP Test Pit Location and Number

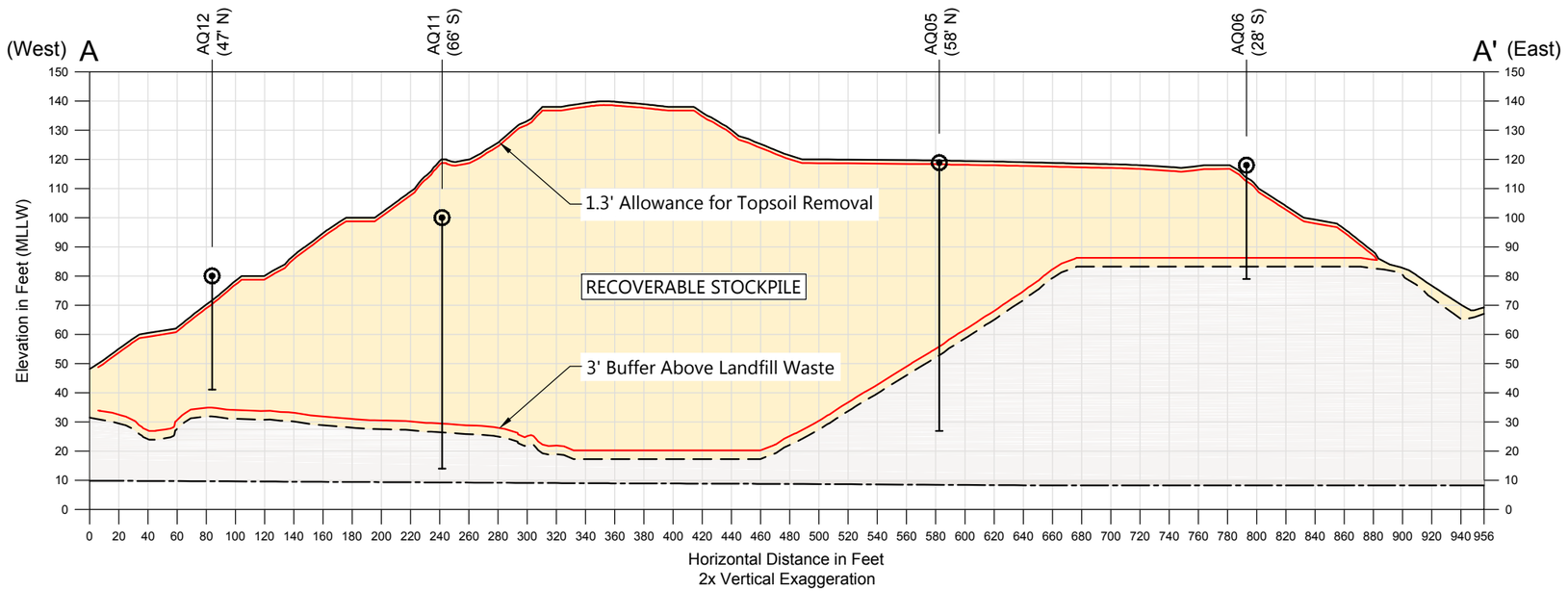
SOURCE: Photogrammetry by Applied Mapping Solutions, dated December 5, 2015 Provided by TME Engineering. Aerial image courtesy of Cristal USA, December 5, 2015.
HORIZONTAL DATUM: Maryland State Plane, NAD83, U.S. Feet.
VERTICAL DATUM: MLLW.

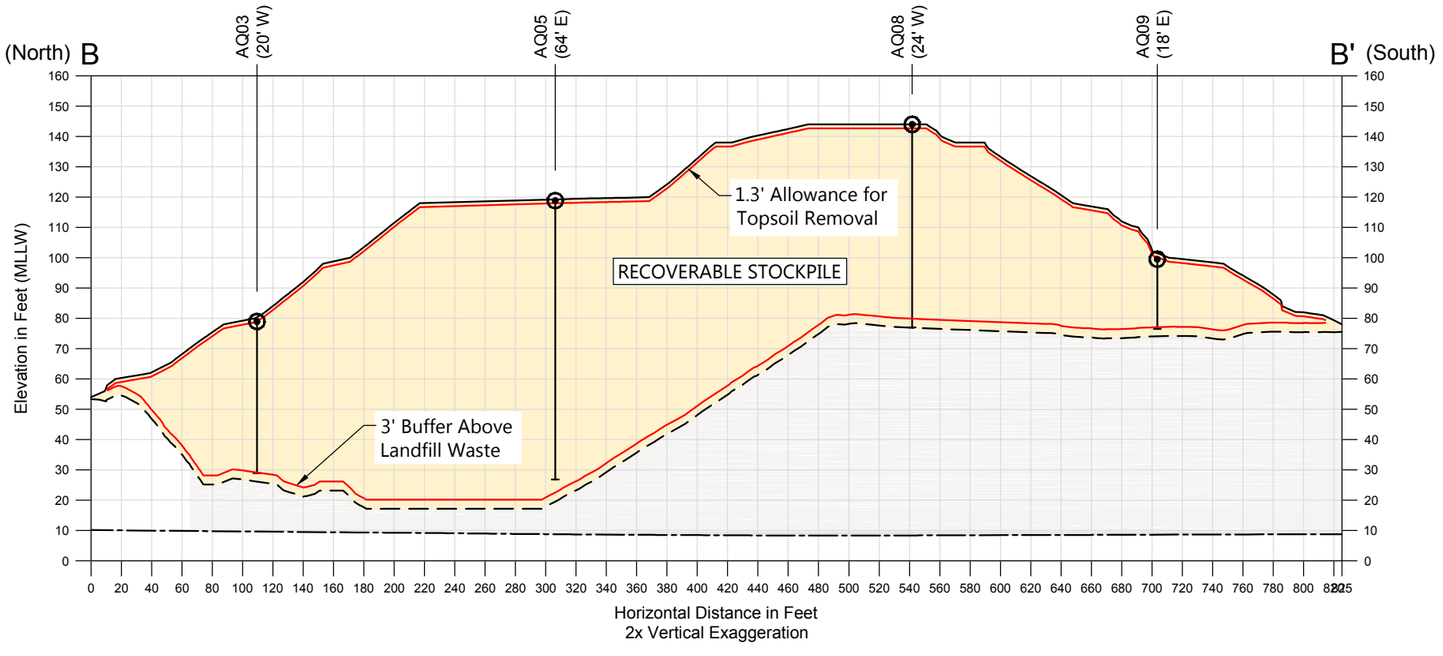
0 100
Feet

Publish Date: 2017/06/20 11:16 AM | User: jbigsby
Filepath: K:\Projects\0530-Maryland Environmental Service\Cristal USA Facility Environmental Remediation_Stockpile Geotechnical Evaluation\0530-RP-004 (Geotech Expl-Final-Report).dwg FIG2

ANCHOR QEA

Figure 2
Boring and Test Pit Locations
Cristal USA Stockpile Characterization Report
Maryland Port Administration
Baltimore, Maryland





LEGEND

- Ground Surface (Top of Stockpile)
- Bottom of Stockpile
- Clay Surface (Bottom of Landfill)

NOTES

1. Ground surface based on the HPP Landfill—Site Plan by TME Engineering, photogrammetry by Applied Mapping Solutions, Inc. (date of photography: December 5, 2015).
2. Bottom of stockpile inferred from topography on the Clay Stockpile Grading Plan by TME ngineering, photogrammtery by Wings Aerial Mapping Co., Inc. (date of photography: December 14, 2008).
3. Clay surface from the Leachate Collection System plan by Haley & Aldrich, Inc., May 4, 1992.
4. Parenthetical labels next to the boring names indicate the distance and direction of the boring from the section line.

0 100
Scale in Feet

Publish Date: 2017/06/20 11:17 AM | User: jbigsby
Filepath: K:\Projects\0530-Maryland Environmental Service\Cristal USA Facility Environmental Remediation_Stockpile Geotechnical Evaluation\0530-RP-004 (Geotech Expl-Final-Report).dwg FIG3

ANCHOR QEA

Figure 3
Stockpile Cross-Sections
Cristal USA Stockpile Characterization Report
Maryland Port Administration
Baltimore, Maryland

Appendix A
Geotechnical Engineering Reports

GEOTECHNICAL ENGINEERING DATA REPORT

FOR:

CRISTAL USA STOCKPILE CHARACTERIZATION

BALTIMORE, MARYLAND

E2CR PROJECT NO. 16559-04

Prepared for:

ANCHOR QEA, LLC
10320 Little Patuxent Parkway, Suite 1140
Columbia, Maryland 21044

Consultant to:

MARYLAND ENVIRONMENTAL SERVICE

Prepared by:

E2CR, Inc.

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MAY 5, 2017

E2CR inc.

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Email: email@e2cr.com

May 5, 2017

Mr. Walter Dinicola, P.E.
Anchor QEA, LLC
10320 Little Patuxent Parkway, Suite 1140
Columbia, MD 21044

Re: Geotechnical Investigation Data Report (Revised)
Geotechnical Investigation of the Cristal USA Stockpile Characterization
Baltimore, Maryland
E2CR Project No. 16559-04

Dear Mr. Dinicola:

E2CR, Inc. has completed the Geotechnical Investigation of the stockpile material, at Cristal USA Stockpile, Baltimore, Maryland. The investigation was performed in accordance with our proposal dated August 10, 2016. This Data Report contains a summary of our findings during the field investigation and the results of the laboratory tests. The Geotechnical Engineering Report will be prepared by others.

We wish to advise you that we will store the soil samples obtained from the soil test borings for a period of sixty (60) days from the date of this letter, after which time the samples will be discarded, unless other disposition is requested.

We appreciate the opportunity to have been of service to you on this project. If there are any questions related to the information contained within this report, please contact us.

Very truly yours,

E2CR, Inc.

Neeraj Singh, P.E.
Project Manager

Mazdak Karimpour
Geotechnical Engineer

E 2 C R inc.

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Figure 2: Aerial Photograph

Figure 3: Boring Location Plan

Appendix B: Borings Logs

Table B-1: Summary of Boring Data

Boring Logs

Appendix C: Laboratory Test Results

Table C-1: Summary of Laboratory Test Data

Laboratory Test Results

1.0 INTRODUCTION

This geotechnical investigation was conducted for the Cristal USA Stockpile Characterization project in the Hawkins Point area of Baltimore, Maryland. The investigation was conducted for ANCHOR QEA, LLC (AQ) Principal Consultants to The Maryland Environmental Service (MES). The investigation was conducted in general accordance with E2CR, Inc. (E2CR) proposal dated August 10, 2016, and was authorized by AQ.

2.0 PROJECT AND SITE DESCRIPTION

The project location is the "30-acre" Hawkins Point Plant (HPP) Industrial Waste Landfill at the Cristal USA Facility. The site is located at 3901 Fort Armistead Road in Baltimore, Maryland. In 2011, a stockpile of clay fill was stored on the landfill with the approval of the Maryland Department of the Environment (MDE). The quantity of stockpiled fill was estimated to be approximately 1,000,000 cubic yards. It is our understanding that this stockpiled fill was clean, i.e. not contaminated, and could be used for future development(s) of the site. The Site Vicinity Map and Aerial Photograph are shown on Figure 1 and Figure 2, respectively, in Appendix A.

3.0 PURPOSE AND SCOPE

The purpose of the investigation was to delineate the lateral and vertical extent of the stockpile which would be used to develop a plan for removal of stockpiled material not in contact with the underlying waste; identify differences between the stockpiled fill and the waste to avoid disturbance of waste during removal of fill from the stockpile; and characterize the properties of the stockpile material for potential use in future development of the site.

The evaluation of the stockpiled material was to be performed by subsurface exploration (i.e. soil test borings and test pits) and geotechnical laboratory testing. A qualified geotechnical engineer or geologist would characterize the stockpiled fill through direct observation of materials encountered in the borings and test pits.

Our scope of services was changed prior to start of the field investigation and is discussed in Section 4.0. Our initial scope of services, as directed by AQ, included the following:

1) Meet with AQ to discuss scope, schedule, deliverables, etc.

2) Prepare a Site Specific Health and Safety Plan

3) Prepare a Subsurface Investigation Plan for drilling borings and test pits inside the Landfill Areas 3 and 4. The plan would identify the number & location of the borings, sampling depth & intervals, drilling method, observation and field monitoring criteria, etc.

4) Conduct the Field Investigation as follows:

- The borings were to be drilled using a Track/ATV mounted Drill Rig.
- The boreholes were to be advanced with 3.25" diameter (ID) Hollow Stem Augers (HSA).
- The augers and tools were to be steam cleaned before and after mobilizing and demobilizing
- Level-D PPE was anticipated for Drill Crew, at any time.
- Drilling and samples **were not to be** monitored and/or checked for the presence of contamination and samples were not be collected for analytical testing.
- Augers and drilling tools **were not to be** decontaminated between the samples and/or borings.
- A total of 12 borings were to be drilled to an average depth of 55 feet, each.
- Subsurface Samples were to be obtained using a standard Split Spoon Sampler.
- SPT (Standard Penetration Test) Samples were to be obtained continuously with depth in the initial 2 borings and at 5 foot intervals in the remaining 10 borings to the termination depths.
- The borings were to be terminated at the elevation of the road around the perimeter of the landfill unless waste was encountered first, i.e. waste was encountered at higher elevation.
- The boreholes were to be grouted with cement-bentonite slurry. Excess spoil was to be evenly spread around the borings. If waste was encountered, the boring was to be terminated and the waste was to be containerized in drums or other suitable

containers. TCLP testing was to be performed and material was to be disposed of accordingly.

- After drilling borings, test pits were to be excavated at 8 locations adjacent to previously drilled borings to obtain bulk subsurface samples and to better define the subsurface conditions. The test pits were to be excavated using a back-hoe to depths of 10 feet to 14 feet below existing ground surface. Test pits were to be backfilled with excavated materials and tamped with back-hoe bucket to the best extent possible. E2CR would not be responsible for any future settlements of the backfill in the test pit locations.

5) Geotechnical Laboratory Tests were to be performed on selected soil samples. The tests included the following:

- Natural Moisture Content (ASTM D2216; on all samples)
- Atterberg Limits (ASTM D4318; on approximately 1/3 of the samples)
- Gradation Analysis (ASTM D422; on approximately ¼ of the samples)
- Organic Content tests
- Torvane & Pocket Penetrometer tests
- Moisture Density Relationship (ASTM D1557; on 8 bulk samples from the test pits)
- Specific Gravity tests (ASTM D854; 1 per boring)
- Permeability (on compacted bulk samples)
- Triaxial CUs with Pore Pressure (ASTM D4767; on 8 bulk samples from the test pits. Samples compacted to 95% of maximum dry density. Three separate tests each at three different confining pressures were to be completed on each of the 8 samples)
- Since E2CR did not have Triaxial testing capability, the bulk samples were to be mailed to an outside lab (to be designated by AQ) to perform the Permeability and Triaxial CU tests.

6) Prepare a Geotechnical Data Report on the sampling program. The report was to include a summary of sampling and laboratory approach, Boring Logs, Test Pit Logs and Laboratory Test Results.

Our scope did not include the following:

a) Specific Analysis, Design and/or Recommendations.
b) Ground Contamination - Sampling, testing and evaluations.
c) Defining the vertical and lateral extent and quantity estimation of clean and/or suitable materials.
d) Evaluating the properties of the waste deposit in the landfill.
e) Cost Estimation.

4.0 FIELD INVESTIGATION

The field investigation was conducted in February and March, 2017.

Our initial scope of services was to drill 12 borings to an average depth of 55 feet, each. Prior to starting the field investigation, the drilling criteria was changed. Standard penetration tests (SPT) were to be conducted and split spoon samples were to be obtained in each boring at depth intervals of 5 feet up to 10 feet above the estimated elevation of the waste; and then continuous sampling was to be performed until the waste was encountered. The borings were to be terminated after encountering 1 sample of the waste material. However, if waste was not encountered at the anticipated elevation, then the boring was to be terminated after taking a few extra samples. AQ field representative would decide when the boring should be terminated.

A total of twelve (12) borings (AQ-01 through AQ-12) were drilled and seven (7) test pits (TP-01, TP-02, TP-04, TP-05, TP-06, TP-08, TP-08A) were excavated at the locations shown on Figure 3 in Appendix A. The borings were drilled to depths of 21 feet to 92 feet and the test pits were excavated to depths of 7 feet to 11 feet below the existing ground surface. The borings and test pits were drilled and excavated at the designated location unless the boring or test pit location(s) had to be offset because of difficulty in accessing the boring or test pit location.

The borings were drilled using a track mounted drill rig and in accordance with ASTM D1452 - Standard Method of Test for Progressing Auger Borings for Geotechnical Explorations. SPT soil sampling was performed in accordance with ASTM D1586 - Standard Method of Test for Penetration Test and Split-Barrel Sampling of Soils. Sampling criteria was changed during the field investigation and is discussed above. AQ field representative decided when the boring should be terminated. All the borings except borings AQ-1, AQ-3 and AQ-10 were terminated based on the above criteria. Borings AQ-1, AQ-3 and AQ-10 were terminated at depths of 26.5 feet, 49 feet and 19 feet, respectively after encountering "wet" samples. Pocket penetrometer and torvane tests were conducted on the clay samples.

A representative portion of each SPT sample was placed in an airtight glass jar and was appropriately marked. Composite environmental samples were collected from split spoon samples near the top of the boring (i.e. ground surface), middle of the boring; and at about 10 feet above the anticipated elevation of the waste.

All the recovery from the split spoon samples of the waste or possible waste was containerized and sealed. The sealed container was handed over to the Landfill operator for disposal.

The test pits were excavated using a track back hoe and were terminated when consistent material was observed in the test pits. AQ field representative decided the termination depth of the test pits. Bulk (bucket) samples were obtained from the excavated test pits.

All jar samples were sent to our laboratory for further evaluation and testing to determine their engineering properties and characteristics. Environmental samples were handed over to AQ representative for preservation and further testing. The assigned bulk soil samples were sent to Geotesting Express, Inc for advanced geotechnical laboratory testing.

Groundwater level was monitored during drilling and after completion of drilling. Groundwater was not encountered in the borings and test pits within the depths explored. Wet samples were recovered in boring AQ-1 at a depth of 26.5 feet (i.e. sample S-7); in boring AQ-3 at a depth of 49 feet (i.e. sample S-14); and in boring AQ-10 at a depth of 19 feet (i.e. sample S-7). These borings were terminated after the wet samples were encountered.

All field operations were monitored by a geotechnical engineer from E2CR who recorded the observations on the field boring logs and test pit logs. The representative from AQ determined the termination depths of the borings and test pits. The edited logs of the borings and test pits are included in Appendix B. A summary of the boring and test pit data is included in Table 1 below and in Table B-1 in Appendix B:

Table 1: Summary of Borings

Boring No.	Elevation[1] (feet)	Depth[2] (feet)
AQ-01	80	27
AQ-02	98.9	52
AQ-03	79	50
AQ-04	79	35
AQ-05	118.8	92
AQ-06	118	39
AQ-07	117.6	35
AQ-08	144	67
AQ-09	99.5	23
AQ-10	100	21
AQ-11	100	85.3
AQ-12	80	39
TP-01	121	10.6
TP-02	98.4	10.5
TP-04	116.8	11
TP-05	99.3	8.7
TP-06	142.6	11.1
TP-08	80.8	7.1
TP-08A	80.5	10.2

1. Elevations based on drilled boring locations and excavated test pits provided by AQ
2. Measured from the existing ground surface

5.0 LABORATORY TESTING

All soil samples recovered from the soil test borings were transported to our laboratory and were visually inspected by a geotechnical engineer to corroborate and/or modify the field classification. Selected samples were subjected to various testing to determine their engineering characteristics based on assignments provided by AQ.

Laboratory tests conducted on soil samples included the following:

- Natural moisture content,
- Sieve analysis,
- Atterberg limits tests,
- Specific gravity tests
- Organic content tests,

All tests were performed in accordance with applicable AASHTO/ASTM procedures. All the assigned tests were on the existing fill.

The assigned soil bulk samples were sent to Geotesting Express, Inc for advanced geotechnical laboratory testing. Geotesting Express will submit the results of the tests performed by them directly to AQ. Geotesting Express laboratory test results are not included in this report.

The results of the laboratory tests performed by E2CR are summarized in Table C-1 in Appendix C. The laboratory results are also provided in graphical form in Appendix C.

The results of the laboratory tests performed by E2CR are summarized below.

5.1 MOISTURE CONTENT TESTS

A total of 154 moisture content tests were performed. The moisture content tests indicate that the natural moisture content of the fill varies from about 6.6% to 64.3%.

5.2 SIEVE AND HYDROMETER TESTS

A total of 36 sieve and hydrometer tests, 8 sieve analyses without hydrometer and 8 #200 wash tests were performed.

The sieve and hydrometer tests indicate that the percentage of sand and fines in the fill is as follows:

Sand Percentage ranges from 0.9% to 90.5%
Fines Percentage ranges from 9.5% to 99.1%.

5.3 ATTERBERG LIMITS TESTS

A total of 38 Atterberg Limits tests were performed.

The Atterberg Limits tests indicate that the range of Liquid Limit, Plastic Limit and Plasticity Index of the fill is as follows:

Liquid Limit: 22% to 60%
Plastic Limit: 11% to 49%
Plasticity Index: 9% to 36%

5.4 SPECIFIC GRAVITY

A total of 13 specific gravity tests were performed. The specific gravity tests indicate that the specific gravity of the fill varies from about 2.66 to 2.74.

5.5 ORGANIC CONTENT

A total of 16 organic content tests were performed. The organic content tests indicate that the organic content of the fill varies from about 1.3% to 12.6%.

5.6 POCKET PENETROMETER AND TORVANE

Pocket penetrometer tests and torvane tests were performed on the clay fill during drilling.

The actual pocket penetrometer test readings were in the range of about 1 tsf to greater than 4.5 tsf. The actual Torvane readings were in the range of about 0.25 tsf to greater than 1 tsf.

6.0 REMARKS

This data report has been prepared to aid in the evaluation of the stockpiled at Cristal USA stockpile facility in Baltimore, Maryland. It is considered that adequate findings and evaluations have been provided to serve as a basis for the project.

These findings and evaluations are based on information made available to us at the time of our investigation and the actual conditions encountered at the test boring locations at that time. General assumptions have been made that the limited exploratory test borings represent the site conditions in relation to the aerial extent and depths of the borings. It should be noted, however, that the actual subsurface conditions between the test boring locations might vary from the conditions indicated on the appended test boring logs.

Our professional services have been performed and this report has been prepared in accordance with generally accepted engineering principles and practices. E2CR, Inc. assumes no responsibility for interpretations made by others based upon our work.

APPENDICES

Appendix A: Figures

Figure 1: Site Vicinity Map

Figure 2: Aerial Photograph

Figure 3: Boring Location Plan

Appendix B: Borings Logs

Table B-1: Summary of Boring Data

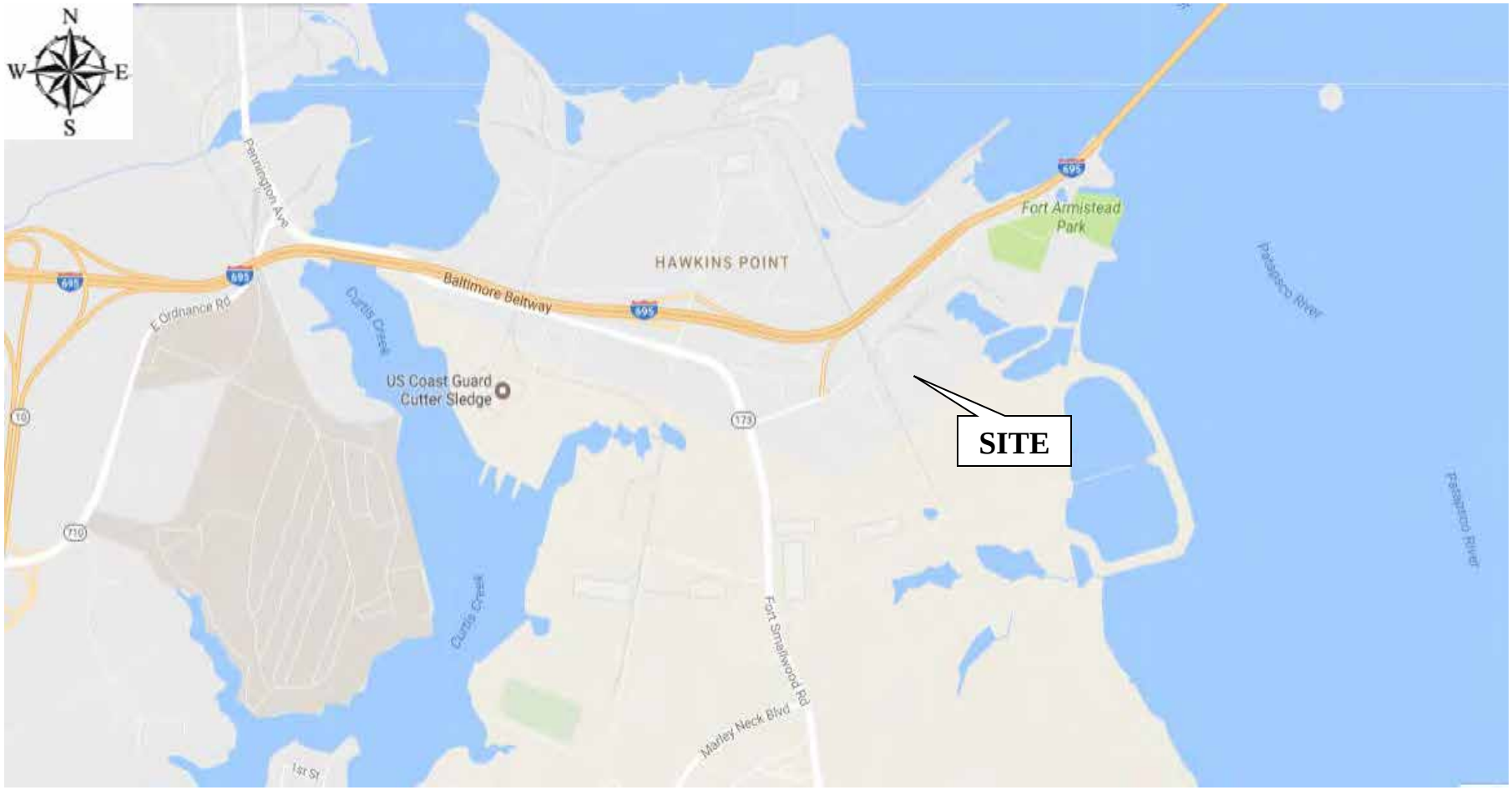
Boring Logs

Appendix C: Laboratory Test Results

Table C-1: Summary of Laboratory Test Data

Laboratory Test Results

APPENDIX A – FIGURES



E2CR, INC.	Cristal USA Stockpile Characterization Site Vicinity	FIGURE: 1	DRAWN BY: MK	CHECKED BY: NS
		DATE: APRIL 2017	JOB NO.: 16559-04	SCALE: NTS

E2CR, INC.	Cristal USA Stockpile Characterization Aerial Photograph	FIGURE: 2	DRAWN BY: MK	CHECKED BY: NS
		DATE: APRIL 2017	JOB NO.: 16559-04	SCALE: NTS

Proposed Boring Location Plan
Courtesy of ANCHOR QEA

E2CR, INC.	Cristal USA Stockpile Characterization Proposed Boring Location Plan	FIGURE: 3	DRAWN BY: MK	CHECKED BY: NS
		DATE: APRIL 2017	JOB NO.: 16527-04	SCALE: NTS

APPENDIX B – BORING LOGS

E2CR inc.

SUMMARY OF LABORATORY TEST RESULTS

CRISTAL USA STOCKPILE CHARACTERIZATION - ANCHOR QEA

E2CR Project No. 16559-04

TABLE B-1

Boring No.	Depth (ft)	Elevation (ft)	Coordinations		Top Soil Thickness (in)
			Easting (ft)	Northing (ft)	
AQ-01	27	80	1441041.211	559943.207	10
AQ-02	52	98.9	1441225.032	559848.974	9
AQ-03	50	79	1441421.964	559893.874	12
AQ-04	35	79	1441639.696	559778.145	10
AQ-05	92	118.8	1441493.079	559692.1	8
AQ-06	39	118	1441686.088	559571.582	3
AQ-07	35	117.6	1441590.292	559465.661	3
AQ-08	67	144	1441390.804	559462.609	5
AQ-09	23	99.5	1441421.71	559298.592	6
AQ-10	21	100	1441205.994	559351.086	13
AQ-11	85.3	100	1441136.229	559627.479	3
AQ-12	35	80	1440999.849	559765.42	4
TP-01	10.6	121	1441172.456	559792.52	8
TP-02	10.5	98.4	1441413.511	559837.495	17.5
TP-04	11	116.8	1441630.926	559629.544	26
TP-05	8.7	99.3	1441506.234	559362.514	15
TP-06	11.1	142.6	1441411.21	559544.151	20
TP-08	7.1	80.8	1441057.998	559656.226	11
TP-08A	10.2	80.5	1441006.23	559755.435	19

1. Elevations and coordinations based on drilled boring locations and excavated test pits provided by AQ
2. Measured from the existing ground surface

E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-01
Job # 16559-04

SAMPLER

Surf. Elev. 80 ft	**Weight of Hammer** 140 lbs	**Hole Diameter** 3.25 in	**Driller** S. Lyons
Depth Water Encountered ft	**Height of Fall** 30 in	**Depth to Rock** ft	**Logged by** A. Patel
Depth Water at End Drill ft	**Drill Make and Model** CME-55 Track	**Boring Method** Hollow Stem Auger	**Date Started** 3/9/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 27 ft	**Date Completed** 3/9/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			10" Top Soil with Rootmat	0					
			Red, brown, moist, medium stiff to stiff, Lean CLAY (CL) (Fill)	0.8	S-1	1-2-2-3 (4)	SPT	17	
			S-2: With Sand		S-2	3-3-11-16 (14)	SPT	19	
5	75								
					S-3	2-2-3-4 (5)	SPT	19	Client Requested a 3.0" spoon @ 8.0'-10.0' (Extra Sample)
10	70		Gray, red, brown, moist, loose to medium dense, Clayey SAND, trace Organics (SC) (Fill)	9					
			Olive gray, brown, moist, very stiff, Lean CLAY with Sand (CL) (Fill)	12	S-4	6-7-14-22 (21)	SPT	24	Client Requested a 3.0" spoon @ 13.0'-20.0' (Extra Sample)
15	65								
			Red, brown, moist, stiff, Lean CLAY with Sand (CL) (Fill)	17.5	S-5	5-3-8-6 (11)	SPT	22	
20	60								
			Red, gray, brown, moist, medium dense, Clayey SAND with Ironite (SC) (Fill)	22.5	S-6	5-7-12-10 (19)	SPT	10	
25	55		Layer of Ironite in S-7		S-7	4-4-10-11 (14)	SPT	23	No Jar sample for 26.5' to 27.0'
			Gray, brown, wet, medium dense, Silty SAND, trace Clay (SM) (Fill)	26.5					
			Bottom of borehole at 27.0 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-02
Job # 16559-04

SAMPLER

Surf. Elev. 98.9 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 52 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/7/2017
Date Completed 3/7/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat 9.0"	0					
			Dark gray, light gray, moist, medium stiff, Sandy Lean CLAY (CL) (Fill)	0.75	S-1	2-3-4-6 (7)	SPT	20	Top Soil 9.0"
				2					
	95		Light gray, pink, red, reddish brown, moist, stiff to very stiff, Lean CLAY, with Sand (CL) (Fill)		S-2	5-11-11-15 (22)	SPT	16	
5			Fine Sand in tip of S-2 and S-3						
	90		Trace Gravel and Organics in S-4		S-3	3-5-7-10 (12)	SPT	14	
10			Trace Gravel and Organics, lenses of Fine Sand and Clayey SAND in S-5						
	85				S-4	4-5-5-6 (10)	SPT	18	
15									
	80				S-5	4-5-6-9 (11)	SPT	21	
20									
			Red, reddish brown, moist, medium dense to dense, Clayey SAND with pieces of Ironite, lenses of Fine Sand, pockets of Clay (SC) (Fill)	22					Hard Drilling @22.0'
	75				S-6	19-12-29-25 (41)	SPT	20	
25			Fine Sand in tip of S-6						
			Sandy CLAY and Clayey SAND in spoon S-7						
	70				S-7	6-9-10-12 (19)	SPT	24	
30			Layer of Fine Sand 33.5' to 34.0', big piece of Ironite in S-8						From 28.0' to 37.0', the samples were a mixture of Sand and Clay
	65				S-8	15-11-19-15 (30)	SPT	17	

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E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-02
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Red, pink, light gray, moist, very stiff, Lean CLAY, trace Sand (CL) (Fill)	37					
	60				S-9	4-7-12-13 (19)	SPT	18	
40					S-10	4-8-13-11 (21)	SPT	16	
			Red, reddish brown, moist, medium dense, Clayey SAND, pockets of Clay, trace Gravel (SC) (Fill)	41					
			Red, reddish brown, pink, light gray, moist, very stiff, Sandy Lean CLAY, with Sand, trace Gravel (CL) (Fill)	42	S-11	8-10-13-15 (23)	SPT	18	
	55				S-12	8-9-12-13 (21)	SPT	10	
45			Gravel in tip S-12		S-13	6-9-13-15 (22)	SPT	24	
	50				S-14	10-10-13-14 (23)	SPT	24	
50			Red, reddish brown, moist, medium dense, Clayey SAND, pockets of Clay, trace Gravel, trace Organics (SC) (Fill)	49.5 50	S-15	7-12-13-15 (25)	SPT	19	No Jar sample for 51.8' to 52.0'
			Red, pink, light gray, moist, very stiff, Lean CLAY, trace Sand, trace Organics (CL) (Fill)	51.8					
			Dark brown, dark gray, moist, very stiff, SILT with yellow fragments (ML) (Fill)						
			Bottom of borehole at 52.0 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-03
Job # 16559-04

SAMPLER

Surf. Elev. 79 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 50 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/8/2017
Date Completed 3/8/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0	S-1	1-2-2-1 (4)	SPT	16	
			Red, reddish brown, pink, light gray, moist, medium stiff, Sandy Silty CLAY, trace Gravel and roots (CL-ML) (Fill)	1					
	75		Red, reddish brown, pink, light gray, moist, soft to medium stiff, Lean CLAY with Sand (CL) (Fill)	2.5	S-2	2-2-1-2 (3)	SPT	19	
5									
	70				S-3	1-2-3-3 (5)	SPT	8	
10									
			Red, reddish brown, pink, light gray, moist, stiff, Lean CLAY with lenses of Fine Sand (CL) (Fill)	11.5					
	65				S-4	3-5-5-5 (10)	SPT	22	
15									
			Red, reddish brown, pink, light gray, moist, stiff to very stiff, Lean CLAY with Sand, trace Ironite (CL) (Fill)	16.5					
	60		S-6: trace Organics		S-5	5-5-7-13 (12)	SPT	5	
20									
	55				S-6	3-5-8-9 (13)	SPT	24	
25									
	50				S-7	5-6-11-11 (17)	SPT	24	
30									
	45				S-8	5-6-9-11 (15)	SPT	23	

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-03
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Dark brown, dark gray, black, moist, medium dense, Silty Clayey SAND, with a lot of Orgnanics, pockets of Clay and Silt (SC-SM) (Fill)	36.5					
	40				S-9	7-7-6-9 (13)	SPT	24	
40			Red, reddish brown, pink, light gray, moist, very stiff, Sandy Lean CLAY, slight smell of Organics (CL) (Fill)	40	S-10	6-8-11-14 (19)	SPT	24	
					S-11	5-8-10-12 (18)	SPT	24	
	35								
45					S-12	4-7-9-13 (16)	SPT	24	
					S-13	5-7-8-10 (15)	SPT	24	
									No Jar sample for 49.9' to 50.0'
	30				S-14	4-5-7-11 (12)	SPT	24	
50			Dark brown, gray, moist to wet, medium dense, Poorly Graded Fine to Medium SAND with Clay, trace Organics (SP-SC) (Fill)	49.9					
			Bottom of borehole at 50.0 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-04
Job # 16559-04

SAMPLER

Surf. Elev. 79 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 35 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/8/2017
Date Completed 3/8/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Light gray, pink, reddish brown, medium stiff, Lean CLAY with Sand, trace Gravel (CL) (Fill)	0.8	S-1	1-1-1-3 (2)	SPT	14	
	75				S-2	2-3-4-6 (7)	SPT	12	
5									
	70				S-3	3-3-6-7 (9)	SPT	20	
10			Reddish brown, moist, loose, Clayey SAND with pockets of Clay (SC) (Fill)	9.5					
			Red, pink, light gray, moist, medium stiff to stiff, Lean CLAY (CL) (Fill)	11.5					
	65				S-4	2-3-5-8 (8)	SPT	19	
15			S-5: 6" layer of Sand in spoon (18.5'-19.0'), trace Ironite						
	60		S-6: Lenses of Fine Sand		S-5	4-3-4-7 (7)	SPT	21	
20									
	55				S-6	2-4-7-9 (11)	SPT	21	
25			Reddish brown, light gray, moist, stiff, Fat CLAY with Sand, trace Ironite, lenses of Fine Sand (CL) (Fill)	25	S-7	4-5-7-10 (12)	SPT	17	Client Requested a 3.0" spoon @ 25.0'-27.0' (Recovery 12.0") (Extra Sample)
					S-8	8-8-7-10 (15)	SPT	24	Client Requested a 3.0" spoon @ 27.0'-29.0' (Recovery 20.0") (Extra Sample)
	50		S-8: with Clayey SAND (27.5'-28.0')	28.5					
30			Red, pink, reddish brown, light gray, moist, stiff, Lean CLAY with Sand, trace Ironite (CL) (Fill)		S-9	5-6-9-10 (15)	SPT	24	
			S-10: trace broken pieces of sandstone in the tip		S-10	7-9-9-13 (18)	SPT	24	
	45				S-11	7-7-7-9 (14)	SPT	24	No Jar sample for 34.2' to 35.0'
			Reddish brown, moist, stiff, SILT with	34.2					

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-04
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			white fragments, trace Clay (ML) (Fill)						
			Bottom of borehole at 35.0 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-05
Job # 16559-04

SAMPLER

Surf. Elev. 118.8 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-75 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 92 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 2/27/2017
Date Completed 3/2/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Red, reddish brown, light gray, moist, medium stiff, Lean CLAY, trace Sand, trace Ironite (CL) (Fill)	0.7	S-1	2-2-3-4 (5)	SPT	10	
	115				S-2	1-2-4-6 (6)	SPT	16	
5			S-3 lenses of Fine Sand, dark gray, greenish brown, orange, Silty CLAY material in tip						
	110				S-3	2-2-2-3 (4)	SPT	18	S-3 two jars: S-3A top 18", S-3B bottom 6"
10			Red, reddish brown, light gray, moist, stiff, Fat CLAY, trace Sand, trace Ironite (CH) (Fill)	9					
	105		S-4: lenses of Fine Sand 13.5'-14.0': Same dark gray, greenish brown Silty CLAY material		S-4	2-2-5-6 (7)	SPT	24	
15			S-5: stiff, lenses of Fine Sand, trace Gravel, trace Silty CLAY material						
	100				S-5	4-4-5-5 (9)	SPT	19	
20			S-6: lenses of Fine Sand, trace Silty CLAY material						
	95				S-6	2-3-4-5 (7)	SPT	12	
25									
	90		Reddish brown, light gray, yellowish brown, moist, medium dense, Clayey SAND, trace SC-SM, with pockets of Clay (SC) (Fill)	28.5	S-7	6-8-7-6 (15)	SPT	24	
30									Slight chattering, Possible Gravel @ 32.0' while drilling with augers
	85				S-8	6-6-4-4 (10)	SPT	14	

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-05
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Reddish brown, red, moist, stiff, Clayey SAND, trace Gravel with lenses of Fine Sand and pockets of Clay, trace Organics (SC) (Fill)	37	S-9	5-6-9-8 (15)	SPT	18	
40	80		Reddish brown, red, moist, medium dense, Clayey SAND with layers of Clay and lenses of Fine Sand, trace Silty Clayey SAND (SC) (Fill)	42	S-10	6-5-10-12 (15)	SPT	24	
45	75		S-12: Mostly Sandy material						
50	70				S-11	13-12-12-14 (24)	SPT	24	Clay in tip of spoon S-11
55	65				S-12	12-11-12-15 (23)	SPT	24	From 28.5' the materialis a mix of Sand and Clay (sometimes more Sand and sometimes more Clay)
60	60		Reddish brown, red, moist, very stiff to hard, Lean CLAY with Sand (CL) (Fill)	57	S-13	3-8-11-17 (19)	SPT	24	
60	55				S-14	11-10-12-14 (22)	SPT	24	
65	50				S-15	12-16-20-22 (36)	SPT	24	
70	45								

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-05
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
75					S-16	11-12-17-16 (29)	SPT	24	Continous sampling from 74.0'
			Red, reddish brown, pink, light gray, moist, very stiff, Lean CLAY, trace Sand, trace Organics (CL) (Fill)	75.7	S-17	12-17-24-27 (41)	SPT	24	
	40		Red, reddish brown, moist, hard, Sandy Lean CLAY, trace Organics (CL) (Fill)	77.5	S-18	18-36-26-37 (62)	SPT	16	S-18 two jars: S-18A middle 6", S-18B bottom 6"
80			Red, reddish brown, pink, light gray, moist, hard, Lean CLAY (CL) (Fill)	79.5	S-19	5-12-15-19 (27)	SPT	18	S-19 two jars: S-19A middle 6", S-19B bottom 6"
			Dark brown, black, moist, ORGANICS (Pieces of Wood) (Fill)	81 81.5	S-20	10-18-18-16 (36)	SPT	18	
	35		Red, reddish brown, pink, light gray, moist, hard, Lean CLAY (CL) (Fill)	83.5	S-21	10-14-15-21 (29)	SPT	22	Occosional dark brown Organic material in the spoons @ 84.0' to 92.0'
85			Red, reddish brown, pink, light gray, moist, hard, Elastic SILT (MH) (Fill)		S-22	7-7-9-15 (16)	SPT	23	
	30		Brown, moist, stiff, Elastic SILT, some Organics (MH) (Fill)	88	S-23	3-4-8-4 (12)	SPT	24	
90					S-24	6-12-28-36 (40)	SPT	24	S-24: No Jar sample
			Dark brown, moist, hard, Lean CLAY (CL) (Fill)	91					
			Bottom of borehole at 92.0 feet.						

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-06
Job # 16559-04

SAMPLER

Surf. Elev. 118 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 39 ft

Driller R. Stidham
Logged by M. Karimpour
Date Started 3/2/2017
Date Completed 3/2/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Dark brown, dark gray, moist, medium stiff, Sandy SILT (ML) (Fill) (Possible Top Soil)	0.2	S-1	2-3-4-4 (7)	SPT	18	
	115		Red, reddish brown, pink, moist, medium stiff, Sandy Lean CLAY with Sand (CL) (Fill)	3.5	S-2	2-2-2-4 (4)	SPT	24	
5									
	110				S-3	2-1-3-2 (4)	SPT	8	
10									
	105				S-4	1-3-4-5 (7)	SPT	18	
15									
	100				S-5	2-7-8-7 (15)	SPT	16	
20			Dark gray, grenish brown, moist, medium desne, Clayey SAND, Pockets of Clay (SC) (Fill)	19					
	95		Red, pink, reddish brown, light gray, moist, medium stiff, Lean CLAY, lenses of Fine Sand (CL) (Fill)	22	S-6	3-3-6-8 (9)	SPT	24	
25					S-7	3-5-7-11 (12)	SPT	20	S-7 two jars: S-7A top 12" and S-7B bottom 6"
			Gray, greenish brown, moist, medium dense, Clayey SAND (SC) (Fill)	26.5					
	90		Red, pink, reddish brown, light gray, moist, loose to medium dense, Clayey SAND, pockets of Clay, lenses of Fine Sand (SC) (Fill)	27.5	S-8	3-3-6-5 (9)	SPT	20	
30					S-9	3-7-9-7 (16)	SPT	24	
					S-10	3-3-6-9 (9)	SPT	24	
	85		Red, reddish brown, moist, medium dense, Poorly Graded SAND with Clay, pockets of Clay (SP-SC) (Fill)	32.5	S-11	9-14-15-10 (29)	SPT	24	

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E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-06
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Red, reddish brown, light gray, medium stiff, Lean CLAY, lenses of Fine Sand (CL) (Fill)	35	S-12	4-4-4-5 (8)	SPT	24	
	80		Dark brown, black, moist, very stiff, SILT, trace Organics (ML) (Fill)	37.5	S-13	2-9-7-4 (16)	SPT	24	No Jar sample for 37.5' to 39.0'
			Bottom of borehole at 39.0 feet.						

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-07
Job # 16559-04

SAMPLER

Surf. Elev. 117.6 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 35 ft

Driller R. Stidham
Logged by M. Karimpour
Date Started 3/2/2017
Date Completed 3/2/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Dark brown, moist, loose, Silty Sand, trace Organics (SM) (Fill) (Possible Top Soil)	0.2	S-1	1-3-3-3 (6)	SPT	15	
	115								
			Red, pink, reddish brown, light gray, moist, medium stiff to stiff, Lean CLAY, trace Sand, lenses of Fine Sand (CL) (Fill)	3.5	S-2	3-4-4-5 (8)	SPT	24	
5									
	110				S-3	3-4-4-3 (8)	SPT	24	
			S-4 had Clayey SAND (SC) in the tip of the spoon						
10									
	105				S-4	2-4-5-6 (9)	SPT	22	
15									
	100				S-5	2-6-9-10 (15)	SPT	24	
20			Dark brown, gray, moist, medium dense, Clayey SAND, pockets of Clay, trace Gravel, trace Organics (SC) (Fill)	19.5					
	95		Red, pink, reddish brown, light gray, moist, stiff, Lean CLAY, lenses of Fine Sand (CL) (Fill)	22	S-6	3-5-6-9 (11)	SPT	24	
25			S-7 and S-8 had Clayey SAND (SC) in the tip of the spoon		S-7	4-5-9-8 (14)	SPT	24	
	90				S-8	5-7-6-9 (13)	SPT	24	
30					S-9	5-8-8-9 (16)	SPT	24	
			Dark gray, dark brown, black, moist, medium dense, Clayey SAND, strong Organic odor, lenses of Fine Sand (SC) (Fill)	30 31 32	S-10	5-8-11-12 (19)	SPT	24	No Jar sample for 34.8' to 35.0'
	85		Red, pink, reddish brown, moist, very stiff, Lean CLAY lenses of Fine Sand		S-11	5-6-7-6 (13)	SPT	18	

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-07
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			(CL) (Fill)	34.8					
			Light brown, light gray, moist, medium dense, Clayey SAND, lenses of Fine Sand, pockets of Clay, trace Organics (SC) (Fill)						
			Dark gray, black, moist, medium dense, Poorly Graded Gravel with Clay, with slight odor (GP-GC) (Fill)						
			Bottom of borehole at 35.0 feet.						

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-08
Job # 16559-04

SAMPLER

Surf. Elev. 144 ft	**Weight of Hammer** 140 lbs	**Hole Diameter** 3.25 in	**Driller** S. Lyons
Depth Water Encountered ft	**Height of Fall** 30 in	**Depth to Rock** ft	**Logged by** D. Wang
Depth Water at End Drill ft	**Drill Make and Model** CME-75 Track	**Boring Method** Hollow Stem Auger	**Date Started** 3/2/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 67 ft	**Date Completed** 3/3/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
0			Top Soil with Rootmat	0					
			Yellow, brown, red, moist, medium stiff to stiff, Lean CLAY (CL) (Fill)	0.4	S-1	1-2-5-4 (7)	SPT	12	
	140				S-2	1-4-5-6 (9)	SPT	18	
5									
	135				S-3	3-5-7-4 (12)	SPT	23	
10									
	130				S-4	5-5-5-8 (10)	SPT	24	
15									
			Gray, brown, red, moist, medium stiff to very stiff, Lean CLAY with Sand (CL) (Fill)	17					
	125				S-5	3-5-7-9 (12)	SPT	24	
20			S-8: Trace Organics						
	120				S-6	3-9-10-11 (19)	SPT	18	
25									
	115				S-7	3-2-3-5 (5)	SPT	21	
30									
	110				S-8	4-6-8-11 (14)	SPT	24	

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-08
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Gray, moist, medium dense, SILT with Sand (ML) (Fill)	37					
	105				S-9	6-6-7-9 (13)	SPT	24	
40									
			Light gray, red, moist, stiff to very stiff, Lean CLAY, with Sand (CL) (Fill)	41.5					
	100				S-10	4-6-7-10 (13)	SPT	21	
45									
			Pockets of Silt and Sand @ 54.0'						
	95				S-11	6-8-8-12 (16)	SPT	24	
50									
			S-12: Trace Organics						
	90				S-12	6-6-6-7 (12)	SPT	24	
55					S-13	4-7-9-14 (16)	SPT	24	
					S-14	8-12-15-15 (27)	SPT	24	
	85								
60					S-15	9-12-11-11 (23)	SPT	24	
			Gray to dark gray, moist, medium dense, Silty SAND (SM) (Fill)	61	S-16	6-8-10-11 (18)	SPT	24	Used 3.0" spoon instead of augers to get sample @ 65.0' because augers could not go down to 65.0'
	80				S-17	10-11-13-16 (24)	SPT	24	
65			Brown, brownish red, black, moist, medium dense to loose, Silty SAND, trace clay (SM) (Fill)	64					
					S-18	4-3-5-9 (8)	SPT	18	No Jar sample for S-18

Bottom of borehole at 67.0 feet.

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BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-09
Job # 16559-04

SAMPLER

Surf. Elev. 99.5 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 23 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/6/2017
Date Completed 3/6/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Gravel	0					
			Red, pink, reddish brown, light gray, moist, medium stiff, Lean CLAY with Sand, trace Organics (CL) (Fill)	0.5	S-1	2-1-2-2 (3)	SPT	5	
					S-2	3-2-4-4 (6)	SPT	10	
5	95		S-3: trace Gravel						
			S-4: trace Organics		S-3	2-4-4-8 (8)	SPT	20	
10	90		S-5: Sandy CLAY and Clayey SAND in spoon, Fine Sand in tip of spoon						
					S-4	2-3-3-5 (6)	SPT	14	
15	85				S-5	2-3-3-6 (6)	SPT	24	
			Light brown, light gray, moist, dense to medium dense, Poorly Graded SAND with Clay, pockets of Clay (SP-SC) (Fill)	17.5	S-6	10-14-17-22 (31)	SPT	24	
20	80				S-7	10-11-9-16 (20)	SPT	24	
			S-7: Pockets of Clay, trace Gravel		S-8	7-6-7-6 (13)	SPT	24	S-8: No Jar sample
			Dark red, black, moist, stiff, Silty CLAY with dark gray Organic material with strong odor (CL-ML) (Fill)	22					
			Bottom of borehole at 23.0 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-10
Job # 16559-04

SAMPLER

Surf. Elev. 100 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 21 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/6/2017
Date Completed 3/6/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Gravel	0	S-1	2-2-3-4 (5)	SPT	13	
			Red, pink, light gray, moist, medium stiff, Lean CLAY with Sand (CL) (Fill)	1.1					
					S-2	3-3-3-3 (6)	SPT	16	
5	95		S-3: trace Gravel, Clayey SAND in the tip of spoon						
					S-3	2-3-3-6 (6)	SPT	14	
10	90		S-4: Lenses of Fine Sand, Gravel in tip of spoon						
					S-4	4-3-3-5 (6)	SPT	4	S-4: All the spoon taken for environmental sampling, no jar samples
15	85				S-5	4-8-13-14 (21)	SPT	20	
			Light brown, light gray, moist, medium dense, Clayey SAND (SC) (Fill)	16	S-6	7-12-16-12 (28)	SPT	17	
			S-7: Wet, Trace Gravel						
20	80				S-7	5-4-9-13 (13)	SPT	20	

Bottom of borehole at 21.0 feet.

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-11
Job # 16559-04

SAMPLER

Surf. Elev. 100 ft	**Weight of Hammer** 140 lbs	**Hole Diameter** 3.25 in	**Driller** R. Stidham
Depth Water Encountered ft	**Height of Fall** 30 in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** CME-55 Track	**Boring Method** Hollow Stem Auger	**Date Started** 3/2/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 85.3 ft	**Date Completed** 3/3/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Dark brown, gray, moist, loose, Silty SAND with Roots (SM) (Fill) (Possible Top Soil)	0.25	S-1	1-4-3-4 (7)	SPT	15	
			Pink, red, reddish brown, light gray, moist, medium stiff to stiff, Sandy Lean CLAY (CL) (Fill)	3	S-2	1-2-3-4 (5)	SPT	24	
5	95				S-3	4-4-3-4 (7)	SPT	24	
10	90				S-4	3-5-4-6 (9)	SPT	18	
15	85				S-5	4-3-4-3 (7)	SPT	20	
20	80				S-6	4-4-5-7 (9)	SPT	18	
25	75		Red, reddish brown, light gray, moist, stiff to very stiff, Lean CLAY with Sand (CL) (Fill)	24	S-7	4-6-8-8 (14)	SPT	22	
30	70		Trace Ironite in S-10 Clayey SAND in tip of spoon S-11		S-8	5-7-9-9 (16)	SPT	16	

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-11
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Red, reddish brown, light gray, moist, stiff to very stiff, Lean CLAY with Sand (CL) (Fill)						
					S-9	5-6-8-9 (14)	SPT	20	
40	60		Trace Ironite in S-10						
			Clayey SAND in tip of spoon S-11 *(continued)*		S-10	4-7-8-10 (15)	SPT	20	
45	55								
					S-11	6-9-11-15 (20)	SPT	24	
50	50		Red, reddish brown, moist, medium dense, Clayey SAND, trace Organics, lenses of Fine Sand (SC) (Fill)	49.5					
					S-12	7-8-10-11 (18)	SPT	24	
55	45								
			Red, reddish brown, light gray, moist, stiff to very stiff, Lean CLAY, trace Sand, trace Ironite (CL) (Fill)	58.5	S-13	4-7-8-10 (15)	SPT	24	
60	40								
					S-14	5-7-8-14 (15)	SPT	24	
65	35								
					S-15	6-8-13-17 (21)	SPT	24	
70	30				S-16	4-10-11-17 (21)	SPT	24	
					S-17	5-9-11-14 (20)	SPT	24	

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E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-11
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
75	25		Red, reddish brown, light gray, moist, stiff to very stiff, Lean CLAY, trace Sand, trace Ironite (CL) (Fill) *(continued)*		S-18	6-9-11-15 (20)	SPT	24	
					S-19	4-5-11-16 (16)	SPT	24	
					S-20	4-8-10-13 (18)	SPT	24	
80	20				S-21	4-4-7-10 (11)	SPT	24	
					S-22	3-7-10-13 (17)	SPT	24	No Jar sample for S-23
85	15				S-23	4-6-50/4"	SPT	16	
			Dark gray, dry, very dense, Poorly graded Gravel with Clay with white and black fragments and very strong odor (GP-GC) (Fill)	85					
			Bottom of borehole at 85.3 feet.						

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-12
Job # 16559-04

SAMPLER

Surf. Elev. 80 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer 140 lbs
Height of Fall 30 in
Drill Make and Model CME-55 Track
Caved Depth ft

Hole Diameter 3.25 in
Depth to Rock ft
Boring Method Hollow Stem Auger
Depth of Boring 39 ft

Driller S. Lyons
Logged by M. Karimpour
Date Started 3/7/2017
Date Completed 3/7/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			4" Top Soil with Rootmat	0					
			Red, brown, moist, soft to medium stiff, Lean CLAY with Sand (CL) (Fill)	0.3	S-1	2-2-1-1 (3)	SPT	22	
					S-2	3-2-3-5 (5)	SPT	24	
5	75								
					S-3	2-2-5-3 (7)	SPT	17	
10	70								
			Red, brown, moist, loose, Clayey SAND (SC) (Fill)	12.5	S-4	3-4-4-4 (8)	SPT	22	
15	65								
			Red, brown, moist, medium stiff, Lean CLAY with Sand (CL) (Fill)	17.5	S-5	2-2-3-5 (5)	SPT	18	
20	60								
			Red, brown, moist, very stiff, Lean CLAY with Sand (CL) (Fill)	22.5	S-6	4-10-18-15 (28)	SPT	24	
25	55		S-8: with Silt, stiff		S-7	6-9-12-12 (21)	SPT	24	
					S-8	3-3-6-9 (9)	SPT	24	
			Red, gray, brown, moist, very stiff, Lean CLAY with Sand (CL) (Fill)	29	S-9	5-7-11-12 (18)	SPT	24	
30	50		Red, gray, brown, moist, medium dense, Clayey SAND, trace Organics (SC) (Fill)	31	S-10	4-7-12-13 (19)	SPT	24	
			Gray, red, brown, moist, stiff to very stiff, Lean CLAY with Sand (CL) (Fill)	33	S-11	3-4-10-12 (14)	SPT	24	

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E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # AQ-12
Job # 16559-04

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Gray, red, brown, moist, stiff to very stiff, Lean CLAY with Sand (CL) (Fill) *(continued)*		S-12	6-7-11-11 (18)	SPT	24	
					S-13	5-5-12-24 (17)	SPT	24	S-13: No Jar sample
			Dark gray, dry, very dense, Poorly graded Gravel with Clay with white fragments and very strong odor (GP-GC) (Fill)	38.5					
			Bottom of borehole at 39.0 feet.						

E2CR-GEO1 - E2RC.GDT - 5/4/17 14:50 - Z:\LOGS\2016 PROJECTS\16559-04 ANCHOR QEA CRISTAL CLAY.GPJ

E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-01
Job # 16559-04

SAMPLER

Surf. Elev. 121 ft	**Weight of Hammer** lbs	**Hole Diameter** in	**Driller** E. Hill
Depth Water Encountered ft	**Height of Fall** in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** Excavator	**Boring Method**	**Date Started** 3/9/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 10.6 ft	**Date Completed** 3/9/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			8" Top Soil with Rootmat	0					
	120		Red, reddish brown, moist, Lean CLAY with Sand, trace topsoil and roots (CL) (Fill)	0.75					
			Red, reddish brown, light gray, moist, Sandy Lean CLAY (CL) (Fill)	1.5					Test Pit Dimensions: 15.0' Long, 2.75' Wide, 10.6' Deep
			Red, reddish brown, moist, Lean CLAY with Sand, layers of Fine Sand (CL) (Fill)	3					
5	115								Different sizes of Gravel in the excavator bucket from 7.0' to 7.5'
									A lot of Organics, roots and Gravel in the buckets from 7.8' to 8.3'
									Trace Gravel in all the excavator buckets
10									Trace Organics from 10.3' to 10.6'

Bottom of test pit at 10.6 feet.

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-02
Job # 16559-04

SAMPLER

Surf. Elev. 98.4 ft	**Weight of Hammer** lbs	**Hole Diameter** in	**Driller** E. Hill
Depth Water Encountered ft	**Height of Fall** in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** Excavator	**Boring Method**	**Date Started** 3/9/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 10.5 ft	**Date Completed** 3/9/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			1.75' Top Soil with Rootmat	0					
	95		Red, reddish brown, Lean CLAY, with Sand (CL) (Fill)	1.75					
5			Light gray, pink, Silty CLAY, trace Sand (CL-ML) (Fill)	5					
			Red, reddish brown, moist, Lean CLAY, with Sand, trace Organics (CL) (Fill)	6					A lot of Organics from 6.5' to 7.5'
	90		Pockets of light gray CL from 8.0' to 8.5'						
10									Test Pit Dimensions: 14.0' Long, 3.0' Wide, 10.5' Deep

Bottom of test pit at 10.5 feet.

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-04
Job # 16559-04

SAMPLER

Surf. Elev. 116.8 ft	**Weight of Hammer** lbs	**Hole Diameter** in	**Driller** E. Hill
Depth Water Encountered ft	**Height of Fall** in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** Excavator	**Boring Method**	**Date Started** 3/9/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 11 ft	**Date Completed** 3/9/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat 26.0"	0					
	115		Red, reddish brown, moist, Lean CLAY (CL) (Fill)	2.2					
5			Light gray, pink, moist, Silty CLAY, trace Sand (CL-ML) (Fill)	5					All the excavator buckets from 6.0' have been moist to wet
	110		Red, reddish brown, pink, moist, Lean CLAY, with Sand, trace Organics (CL) (Fill)	6					Water/Moisture observed starting from 7.0', Lenses of Fine Sand (3.0" lense) @ 7.0'
10									Test Pit Dimensions: 15.5' Long, 3.75' Wide, 11.0' Deep

Bottom of test pit at 11.0 feet.

E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-05
Job # 16559-04

SAMPLER

Surf. Elev. 99.3 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer lbs
Height of Fall in
Drill Make and Model Excavator
Caved Depth ft

Hole Diameter in
Depth to Rock ft
Boring Method
Depth of Boring 8.7 ft

Driller E. Hill
Logged by M. Karimpour
Date Started 3/10/2017
Date Completed 3/10/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat (SC-SM)	0					
			Red, reddish brown, moist, Lean CLAY, trace Sand (CL) (Fill) wih Lenses of Silty CLAY (CL-ML) Layer of Silty SAND (SM) from 4.1' to 4.5' @8.0' the material started to get harder and losing Sand content	1.25					Test Pit Dimensions: 12.5' Long, 2.7' Wide, 8.7' Deep
	95								
5									

Bottom of test pit at 8.7 feet.

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E2CR inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-06
Job # 16559-04

SAMPLER

Surf. Elev. 142.6 ft
Depth Water Encountered ft
Depth Water at End Drill ft
Afterhrs.

Weight of Hammer lbs
Height of Fall in
Drill Make and Model Excavator
Caved Depth ft

Hole Diameter in
Depth to Rock ft
Boring Method
Depth of Boring 11.1 ft

Driller E. Hill
Logged by M. Karimpour
Date Started 3/10/2017
Date Completed 3/10/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
			Top Soil with Rootmat	0					
			Red, reddish brown, light gray, moist, Lean CLAY, trace Sand (CL) (Fill)	1.7					
	140		Light gray, pink, reddish brown, Sandy Silty CLAY (CL-ML) (Fill)	2.75					
			Red, pink, moist, Lean CLAY, with Sand, trace Orgnics (CL) (Fill)	4.2					From 3.3' to 4.5' there is a mixture of Sandy CLAY and Clayey SAND
5			The material become closer to red Clay as we go deeper						
			Red CLAY at the bottom						
	135								
10									Test Pit Dimensions: 13.5' Long, 3.1' Wide, 11.1' Deep

Bottom of test pit at 11.1 feet.

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E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-08
Job # 16559-04

SAMPLER

Surf. Elev. 80.8 ft	**Weight of Hammer** lbs	**Hole Diameter** in	**Driller** E. Hill
Depth Water Encountered ft	**Height of Fall** in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** Excavator	**Boring Method**	**Date Started** 3/10/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 7.1 ft	**Date Completed** 3/10/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
	80		Top Soil with Rootmat	0					
			Red, reddish brown, moist, Silty CLAY, trace Sand (CL-ML) (Fill)	1.9					
5	75		Gray, brown, moist, Silty Clayey SAND (SC-SM) (Fill)	4.4					Test Pit Dimensions: 14' Long, 2.6' Wide, 7.1' Deep
			Red, reddish brown, moist, Silty CLAY, trace Sand (CL-ML) (Fill)	6.4					

Bottom of test pit at 7.1 feet.

E2CR-GEO1 - E2RC.GDT - 5/4/17 14:50 - Z:\LOGS\2016 PROJECTS\16559-04 ANCHOR QEA CRISTAL CLAY.GPJ

E 2 C R inc.

BORING LOG

Contracted With Anchor QEA
Project Name Cristal USA Stockpile Characterization
Location Cristal USA Facility - 3901 Fort Armistead Road, Baltimore, MD

Boring # TP-08A
Job # 16559-04

SAMPLER

Surf. Elev. 80.5 ft	**Weight of Hammer** lbs	**Hole Diameter** in	**Driller** E. Hill
Depth Water Encountered ft	**Height of Fall** in	**Depth to Rock** ft	**Logged by** M. Karimpour
Depth Water at End Drill ft	**Drill Make and Model** Excavator	**Boring Method**	**Date Started** 3/10/2017
Afterhrs.	**Caved Depth** ft	**Depth of Boring** 10.2 ft	**Date Completed** 3/10/2017

DEPTH (ft)	Elev. (ft)	SOIL SYMBOL	SOIL DESCRIPTION Name, Symbol, Proportions, Color, Moisture, Density, Structure	STRATA DEPTH	No.	N-Value/ RQD (%)	Type	Rec. (in)	BORING & SAMPLE NOTES
	80		Top Soil with Rootmat	0					
			Red, reddish brown, pink, Silty CLAY, trace Sand (CL-ML) (Fill)	1.6					
			@8.5' material started to get harder						
			Red, pink, light brown, Sandy CLAY, lenses of Fine Sand (CL) (Fill)	3.2					
5	75								
									Test Pit Dimensions: 12' Long, 2.4' Wide, 10.2' Deep
10									

Bottom of test pit at 10.2 feet.

E2CR-GEO1 - E2RC.GDT - 5/4/17 14:50 - Z:\LOGS\2016 PROJECTS\16559-04 ANCHOR QEA CRISTAL CLAY.GPJ

APPENDIX C – LABORATORY TEST RESULTS

E2CR inc.

SUMMARY OF LABORATORY TEST RESULTS

CRISTAL USA STOCKPILE CHARACTERIZATION - ANCHOR QEA

E2CR Project No. 16559-04

TABLE C-1

Boring No.	SAMPLE					CLASSIFICATION		Moisture Content	ATTERBERG			GRAIN SIZE DIST.			Specific Gravity	Loss on Ignition
	No.	Depth (feet)			Type	USCS	AASHTO	(%)	LL	PL	PI	Gravel (%)	Sand (%)	Fines (%)		
AQ-01	S-1	0	-	2	SPT	CL		14.6%								
	S-2	3	-	5	SPT	CL	A-6(13)	12.7%	37	20	17	0.0%	17.8%	82.2%		
	S-3	8	-	10	SPT	SC		13.9%				0.2%	54.5%	45.3%	2.67	1.7%
	S-4A	13	-	15	SPT	CL		9.6%	22	13	9					
	S-4B	13	-	15	SPT	CL		10.7%								
	S-5	18	-	20	SPT	CL		12.5%								
	S-6	23	-	25	SPT	SC		8.8%						24.4%		
AQ-02	S-1	0	-	2	SPT	CL		15.5%								
	S-2	3	-	5	SPT	CL		18.3%								
	S-3	8	-	10	SPT	CL		17.0%								
	S-4	13	-	15	SPT	CL	A-6(12)	16.5%	36	17	19	0.2%	25.3%	74.5%	2.71	1.4%
	S-5	18	-	20	SPT	CL		18.8%								
	S-6	23	-	25	SPT	SC		10.0%				16.0%	53.1%	30.9%		
	S-7	28	-	30	SPT	SC		11.9%								
	S-8	33	-	35	SPT	SC		8.1%								
	S-9	38	-	40	SPT	CL		13.8%	37	19	18					
	S-10	40	-	42	SPT	SC		12.1%						47.6%		
	S-11	42	-	44	SPT	CL		14.6%								
	S-12	44	-	46	SPT	CL	A-6(14)	15.7%	38	18	20	1.3%	22.2%	76.5%		2.0%
	S-13	46	-	48	SPT	CL		10.6%								
	S-14	48	-	50	SPT	CL		11.7%								
AQ-03	S-1	0	-	2	SPT	CL-ML		23.8%								
	S-2	3	-	5	SPT	CL	A-7-6(20)	20.5%	45	22	23	0.0%	14.9%	85.1%		
	S-3	8	-	10	SPT	CL		20.6%	34	17	17					
	S-4	13	-	15	SPT	CL		20.4%								
	S-5	18	-	20	SPT	CL		19.1%								
	S-6	23	-	25	SPT	CL	A-6(16)	15.5%	39	18	21	0.0%	20.9%	79.1%	2.72	1.5%
	S-7	28	-	30	SPT	CL		10.8%								
	S-8	33	-	35	SPT	CL		14.4%								
	S-9	38	-	40	SPT	SC-SM		14.5%						48.4%		4.5%
	S-10	40	-	42	SPT	CL		14.4%	30	18	12					2.3%
	S-11	42	-	44	SPT	CL		16.1%								
	S-12	44	-	46	SPT	CL	A-6(7)	13.5%	32	15	17	0.2%	38.7%	61.1%		
	S-13	46	-	48	SPT	CL		13.4%								
AQ-04	S-1	0	-	2	SPT	CL-ML		15.7%								
	S-2	3	-	5	SPT	CL	A-6(13)	17.1%	35	17	18	0.0%	18.9%	81.1%		
	S-3	8	-	10	SPT	SC		12.5%				1.1%	81.2%	17.7%		
	S-4	13	-	15	SPT	CL		18.4%								
	S-5	18	-	20	SPT	CL		16.4%	40	20	20					
	S-6	23	-	25	SPT	CL		14.7%								
	S-7	25	-	27	SPT	CL		14.5%								
	S-8	27	-	29	SPT	CH	A-7-6(32)	15.7%	57	22	35	0.0%	15.3%	84.7%	2.73	
	S-9	29	-	31	SPT	CL		16.9%	42	19	23					
	S-10	31	-	33	SPT	CL		22.0%								

E2CR inc.

SUMMARY OF LABORATORY TEST RESULTS

CRISTAL USA STOCKPILE CHARACTERIZATION - ANCHOR QEA

E2CR Project No. 16559-04

TABLE C-1

Boring No.	SAMPLE					CLASSIFICATION		Moisture Content	ATTERBERG			GRAIN SIZE DIST.			Specific Gravity	Loss on Ignition
	No.	Depth (feet)			Type	USCS	AASHTO	(%)	LL	PL	PI	Gravel (%)	Sand (%)	Fines (%)		
AQ-05	S-1	0	-	2	SPT	CL		18.8%								
	S-2	3	-	5	SPT	CL		20.1%								
	S-3A	8	-	10	SPT	CL		15.2%								
	S-3B	8	-	10	SPT	CH		17.0%								
	S-4	13	-	15	SPT	CH	A-7-6(35)	17.7%	56	20	36	0.0%	9.5%	90.5%		
	S-5	18	-	20	SPT	CH		18.2%								
	S-6	23	-	25	SPT	CH		17.5%								
	S-7	28	-	30	SPT	SC		11.3%				0.0%	84.8%	15.2%	2.66	
	S-8	33	-	35	SPT	SC		11.7%								
	S-9	38	-	40	SPT	SC	A-2-6(0)	13.6%	23	12	11	0.0%	69.4%	30.6%		1.6%
	S-10	43	-	45	SPT	SC		12.7%				0.0%	50.6%	49.4%		
	S-11	48	-	50	SPT	SC		12.3%								
	S-12	53	-	55	SPT	SC		28.0%						32.8%		
	S-13	58	-	60	SPT	CL		15.1%								
	S-14	63	-	65	SPT	CL		15.3%	39	17	22					
	S-15	68	-	70	SPT	CL		15.1%								
	S-16A	74	-	76	SPT	CL		17.4%	24	15	9					4.2%
	S-16B	74	-	76	SPT	CL		15.0%								
	S-17	76	-	78	SPT	CL		12.4%								
	S-18A	78	-	80	SPT	CL		10.5%								
	S-18B	78	-	80	SPT	CL		14.4%								
	S-19A	80	-	82	SPT	CL		15.1%								
	S-19B	80	-	82	SPT	CL		12.3%								
	S-20	82	-	84	SPT	CL	A-6(7)	11.6%	32	15	17	11.1%	29.4%	59.5%		1.3%
	S-21	84	-	86	SPT	MH		64.3%								
	S-22	86	-	88	SPT	MH		58.1%								
	S-23	88	-	90	SPT	MH	A-7-5(20)	58.9%	60	49	11	0.0%	0.9%	99.1%		12.6%
AQ-06	S-1	0	-	2	SPT	ML		12.7%								
	S-2	3	-	5	SPT	CL	A-6(9)	20.5%	30	17	13	0.00%	19.40%	80.6%		
	S-3	8	-	10	SPT	CL		22.8%								
	S-4	13	-	15	SPT	CL		17.0%								
	S-5	18	-	20	SPT	SC		10.5%								
	S-6	23	-	25	SPT	CL		14.6%	32	16	16				2.66	
	S-7A	25	-	26.5	SPT	CL		15.5%								
	S-7B	26.5	-	27	SPT	SC		9.9%						18.7%		
	S-8	27	-	29	SPT	SC		12.1%								
	S-9	29	-	31	SPT	SC		9.7%								
	S-10	31	-	33	SPT	SP-SC		6.6%				0.00%	90.50%	9.5%		
	S-11	33	-	35	SPT	SP-SC		9.2%								
	S-12	35	-	37	SPT	CL		13.0%	30	17	13					
AQ-07	S-1	0	-	2	SPT	SM		18.1%								
	S-2	3	-	5	SPT	CL		19.8%								
	S-3	8	-	10	SPT	CL	A-6(13)	17.2%	36	18	18	0.00%	19.80%	80.2%	2.71	
	S-4	13	-	15	SPT	CL		17.6%								
	S-5	18	-	20	SPT	SC		12.5%				4.70%	57.50%	37.8%		2.5%
	S-6	23	-	25	SPT	CL		19.0%	39	19	20					
	S-7	25	-	27	SPT	CL		13.8%								
	S-8	27	-	29	SPT	CL		16.2%								
	S-9	29	-	31	SPT	SC		13.2%				4.20%	60.80%	35.0%		

E2CR inc.

SUMMARY OF LABORATORY TEST RESULTS

CRISTAL USA STOCKPILE CHARACTERIZATION - ANCHOR QEA

E2CR Project No. 16559-04

TABLE C-1

Boring No.	SAMPLE					CLASSIFICATION		Moisture Content	ATTERBERG			GRAIN SIZE DIST.			Specific Gravity	Loss on Ignition
	No.	Depth (feet)			Type	USCS	AASHTO	(%)	LL	PL	PI	Gravel (%)	Sand (%)	Fines (%)		
AQ-08	S-1	0	-	2	SPT	CL		18.3%								
	S-2	3	-	5	SPT	CL	A-7-6(28)	17.2%	48	22	26	0.0%	4.1%	95.9%		
	S-3	8	-	10	SPT	CL		16.0%								
	S-4	13	-	15	SPT	CL		19.2%								
	S-5	18	-	20	SPT	CL	A-6(10)	14.4%	33	16	17	0.0%	26.6%	73.4%	2.69	
	S-6	23	-	25	SPT	CL		14.2%								
	S-7	28	-	30	SPT	CL		15.4%								
	S-8	33	-	35	SPT	ML		14.6%				0.0%	27.6%	72.4%		2.0%
	S-9	38	-	40	SPT	ML		16.7%				0.0%	15.4%	84.6%		
	S-10	43	-	45	SPT	CL		18.2%								
	S-11	48	-	50	SPT	CL		14.8%								
	S-12	53	-	55	SPT	CL		15.4%								1.5%
	S-13	55	-	57	SPT	CL		11.5%	38	16	22					
	S-14	57	-	59	SPT	CL		12.7%								
	S-15	59	-	61	SPT	CL		16.4%	40	19	21					
	S-16	61	-	63	SPT	SM		11.5%				0.5%	63.9%	35.6%		
AQ-09	S-1	0	-	2	SPT	SM		27.2%								
	S-2	3	-	5	SPT	CL		17.9%								2.8%
	S-3	8	-	10	SPT	CL	A-6(14)	18.9%	36	18	18	0.0%	18.7%	81.3%		
	S-4	13	-	15	SPT	CL		17.6%								2.4%
	S-5	15	-	17	SPT	CL		13.6%								
	S-6	17	-	19	SPT	SP-SC		13.1%				0.0%	88.9%	11.1%	2.66	
	S-7	19	-	21	SPT	SP-SC		14.9%								
AQ-10	S-1	0	-	2	SPT	SM		14.6%								
	S-2	3	-	5	SPT	CL	A-6(16)	18.2%	39	19	20	0.2%	16.0%	83.8%		
	S-3	8	-	10	SPT	CL		13.6%							2.70	
	S-5	15	-	17	SPT	SC		7.5%				0.0%	84.8%	15.2%		
AQ-11	S-1	0	-	2	SPT	SM		23.9%								
	S-2	3	-	5	SPT	CL		15.3%								
	S-3	8	-	10	SPT	CL	A-6(5)	13.7%	28	15	13	0.1%	39.1%	60.8%		
	S-4	13	-	15	SPT	CL		12.3%								
	S-5	18	-	20	SPT	CL		11.9%						50.9%		
	S-6	23	-	25	SPT	CL		19.0%								
	S-7	28	-	30	SPT	CL		17.3%								
	S-8	33	-	35	SPT	CL		15.0%								
	S-9	38	-	40	SPT	CL	A-6(11)	13.0%	31	15	16	0.0%	20.7%	79.3%		
	S-10	43	-	45	SPT	CL		16.8%								
	S-11	48	-	50	SPT	CL		13.1%								
	S-12	53	-	55	SPT	SC		9.2%						35.9%		
	S-13	58	-	60	SPT	CL		15.7%								
	S-14	63	-	65	SPT	CL		13.5%								
	S-15	68	-	70	SPT	CL		19.8%	40	21	19					
	S-16	70	-	72	SPT	CL		16.2%								
	S-17	72	-	74	SPT	CL		13.7%								
	S-18	74	-	76	SPT	CL		13.4%								
	S-19	76	-	78	SPT	CL		18.0%								
	S-20	78	-	80	SPT	CL		18.5%								
	S-21	80	-	82	SPT	CL		16.6%								
	S-22	82	-	84	SPT	CL	A-7-6(26)	15.5%	46	19	27	0.0%	8.1%	91.9%	2.69	

E2CR inc.

SUMMARY OF LABORATORY TEST RESULTS

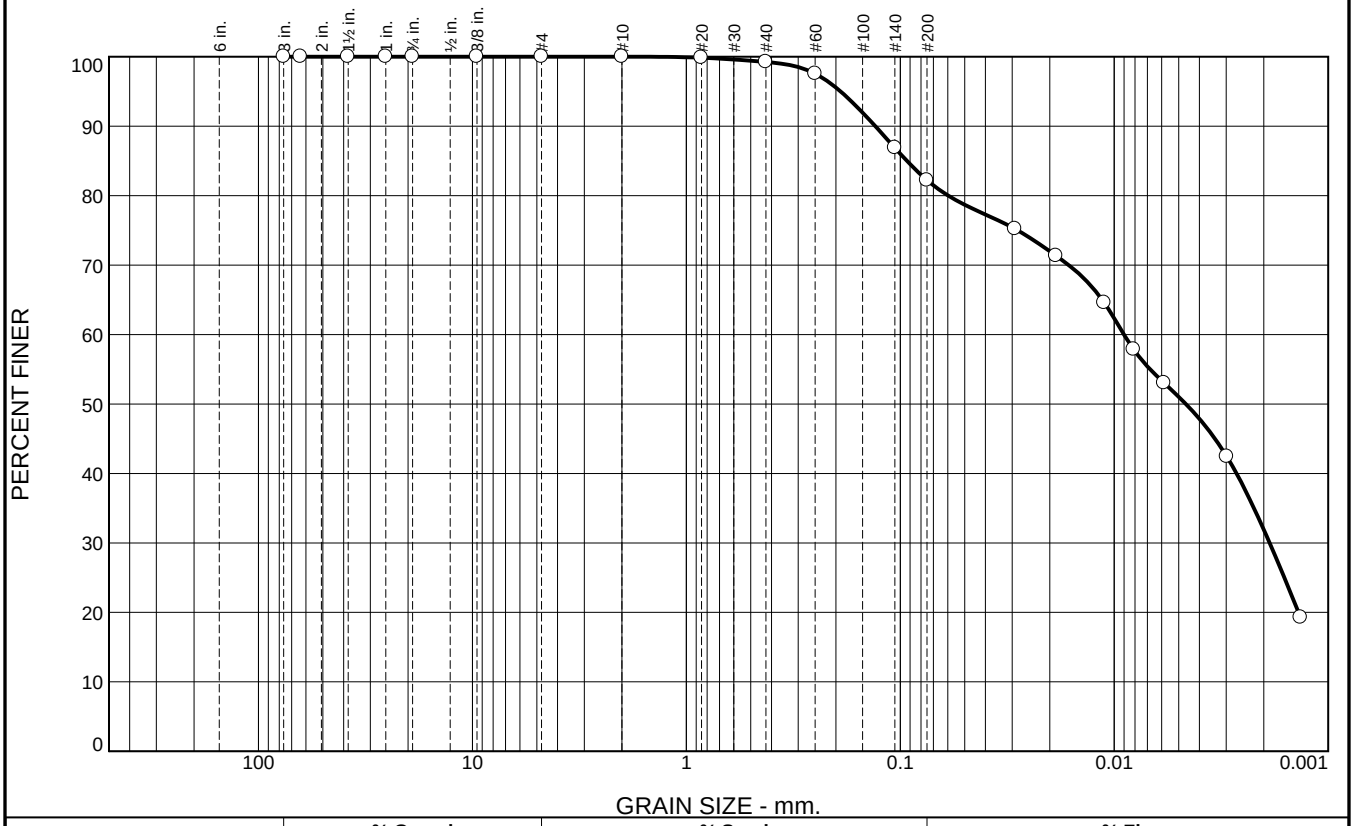
CRISTAL USA STOCKPILE CHARACTERIZATION - ANCHOR QEA

E2CR Project No. 16559-04

TABLE C-1

Boring No.	SAMPLE					CLASSIFICATION		Moisture Content	ATTERBERG			GRAIN SIZE DIST.			Specific Gravity	Loss on Ignition
	No.	Depth (feet)			Type	USCS	AASHTO	(%)	LL	PL	PI	Gravel (%)	Sand (%)	Fines (%)		
AQ-12	S-1	0	-	2	SPT	CL		18.0%								
	S-2	3	-	5	SPT	CL		17.1%	25	11	14			67.6%	2.74	
	S-3	8	-	10	SPT	CL		12.4%								
	S-4	13	-	15	SPT	SC		15.2%				0.4%	59.8%	39.8%		
	S-5	18	-	20	SPT	CL		19.1%								
	S-6	23	-	25	SPT	CL		9.9%								
	S-7	25	-	27	SPT	CL		18.1%	42	21	21					
	S-8	27	-	29	SPT	CL		14.5%								
	S-9	29	-	31	SPT	CL		13.3%								
	S-10	31	-	33	SPT	SC		12.0%				0.8%	57.3%	41.9%	2.67	1.5%
	S-11	33	-	35	SPT	CL		12.1%								
	S-12	35	-	37	SPT	CL		17.8%	41	20	21					

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	17.0	31.2	51.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.2		
#60	97.6		
#140	86.9		
#200	82.2		

* (no specification provided)

Material Description

Reddish Brown, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 20 LL= 37 PI= 17

Coefficients

D_{90}= 0.1310 D_{85}= 0.0931 D_{60}= 0.0090
D_{50}= 0.0046 D_{30}= 0.0019 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

Natural Moisture: 12.7%

Source of Sample: AQ-01 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/7/2017

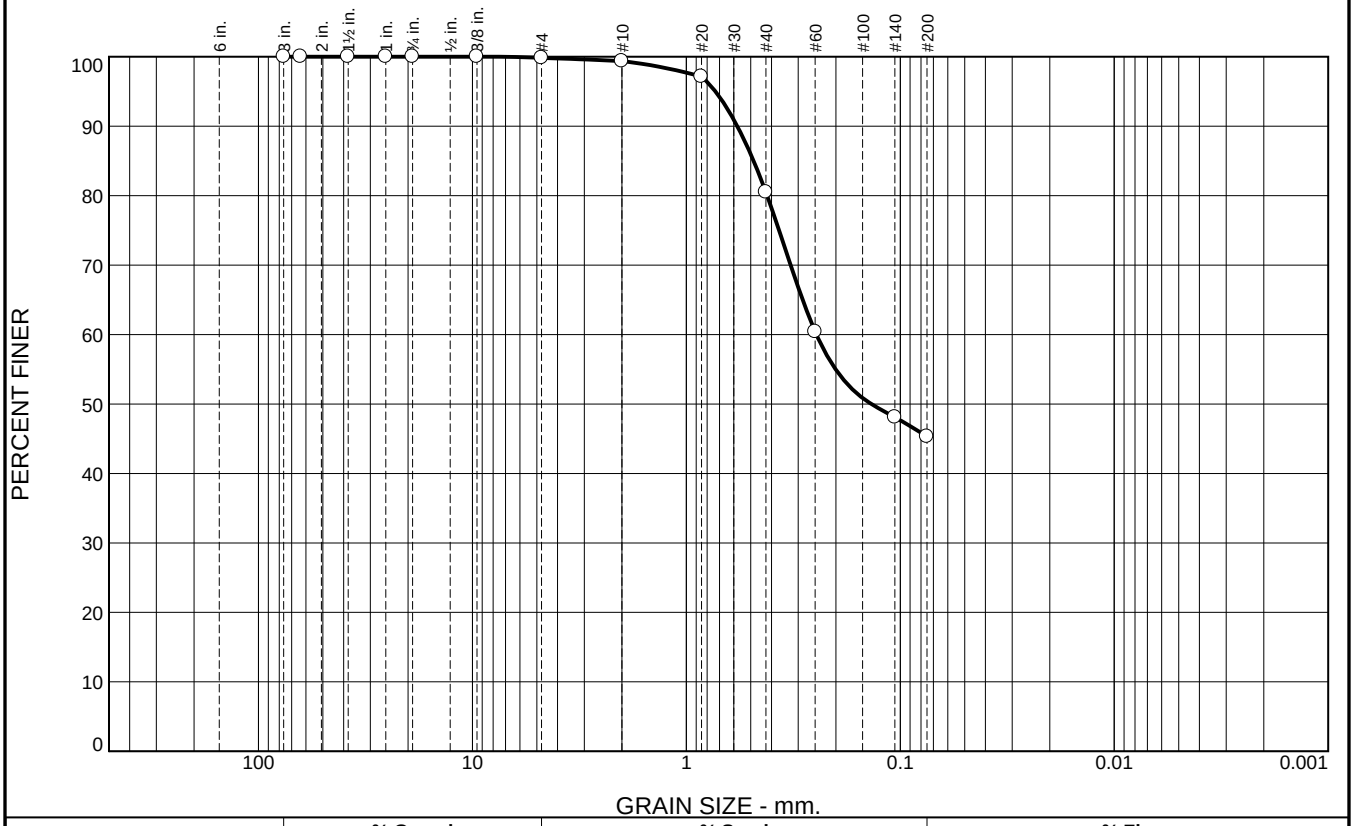
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.4	18.9	35.2	45.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.8		
#10	99.4		
#20	97.1		
#40	80.5		
#60	60.4		
#140	48.1		
#200	45.3		

* (no specification provided)

Material Description

Red, Gray, Brown, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5779 D_{85}= 0.4850 D_{60}= 0.2467
D_{50}= 0.1366 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 13.9%

Source of Sample: AQ-01 **Depth:** 8.0'-10.0'
Sample Number: S-3

Date: 4/7/2017

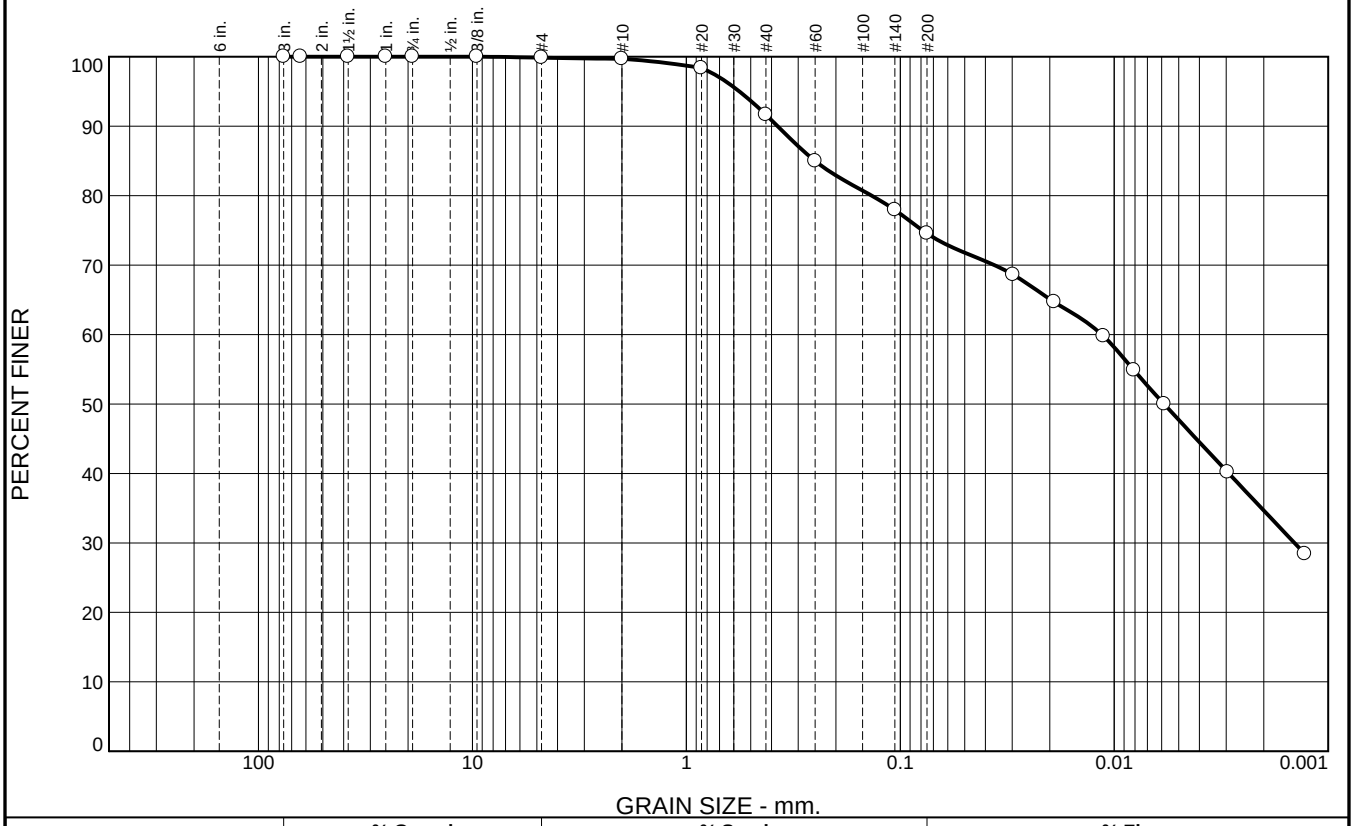
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.1	8.1	17.1	26.8	47.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.8		
#10	99.7		
#20	98.4		
#40	91.6		
#60	85.0		
#140	77.9		
#200	74.5		

* (no specification provided)

Material Description

Reddish Brown, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 17 LL= 36 PI= 19

Coefficients

D_{90}= 0.3746 D_{85}= 0.2505 D_{60}= 0.0114
D_{50}= 0.0058 D_{30}= 0.0014 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

Natural Moisture: 16.5%

Source of Sample: AQ-02 **Depth:** 13.0'-15.0'
Sample Number: S-4

Date: 4/7/2017

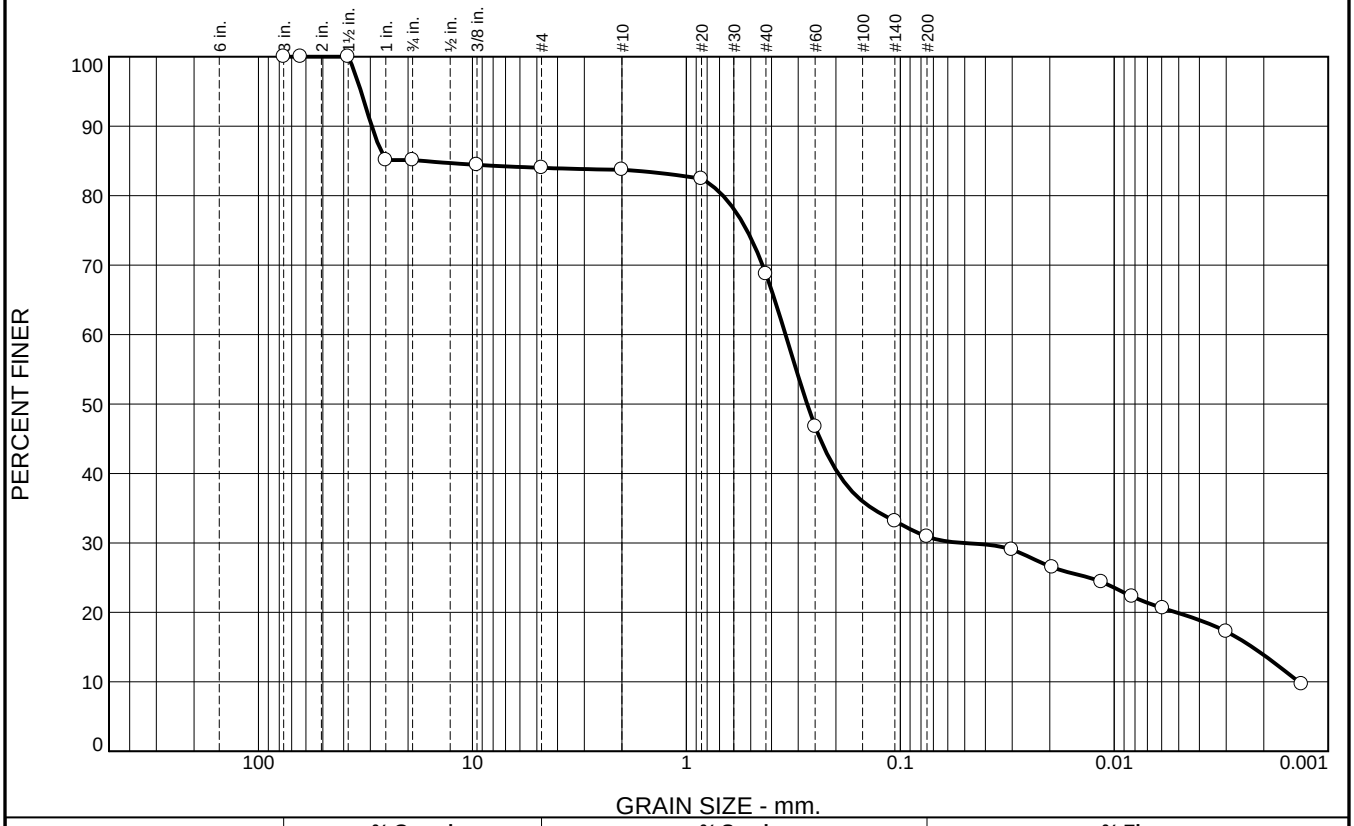
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.9	1.1	0.3	15.0	37.8	11.0	19.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	85.1		
.75	85.1		
.375	84.4		
#4	84.0		
#10	83.7		
#20	82.4		
#40	68.7		
#60	46.7		
#140	33.1		
#200	30.9		

* (no specification provided)

Material Description

Red, Tan, Brown, Silty SAND with Gravel
USDA: Sandy Loam

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.5366 D_{85}= 17.1581 D_{60}= 0.3439
D_{50}= 0.2727 D_{30}= 0.0510 D_{15}= 0.0023
D_{10}= 0.0014 C_u= 250.53 C_c= 5.51

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 10.0%

Source of Sample: AQ-02 **Depth:** 23.0'-25.0'
Sample Number: S-6

Date: 4/10/2017

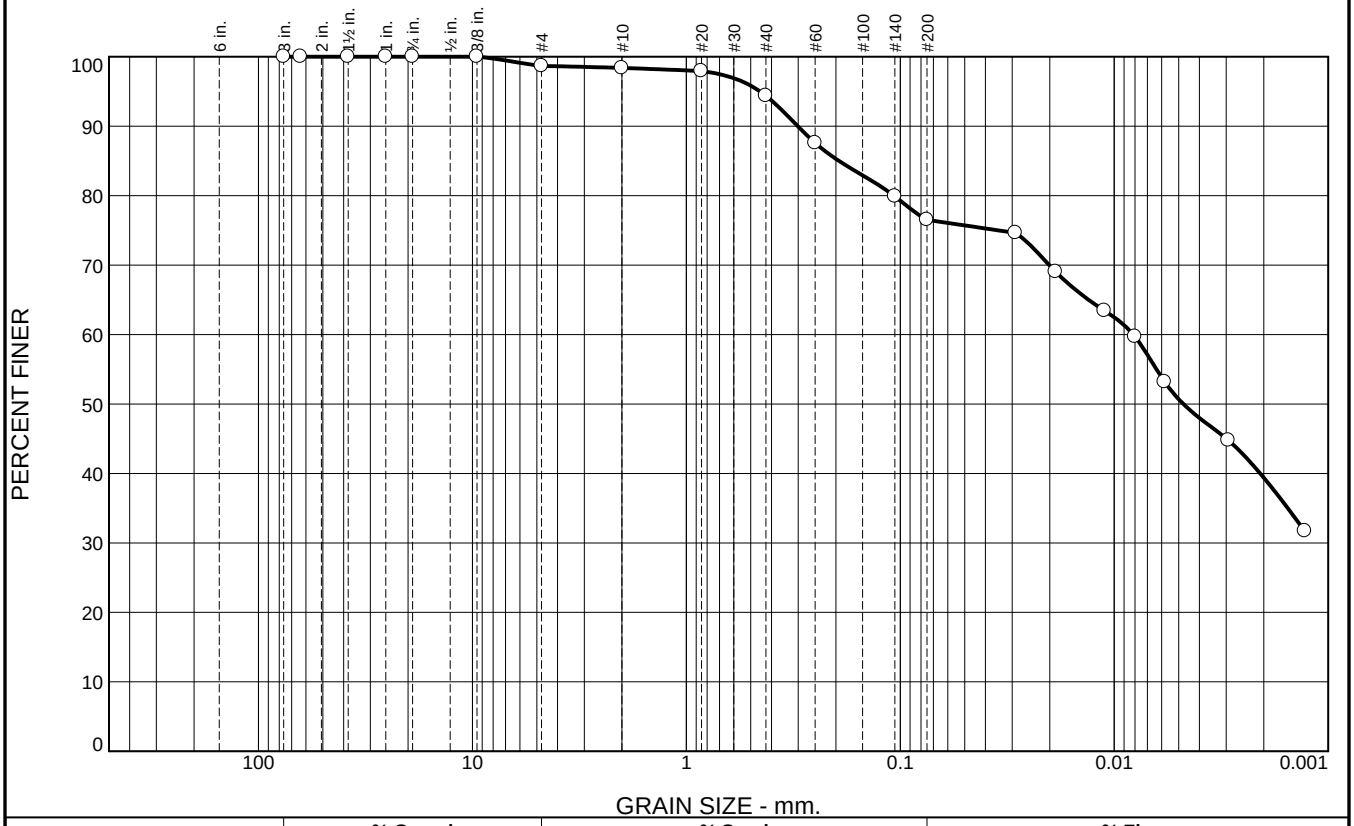
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	0.3	4.0	17.9	25.8	50.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	98.7		
#10	98.4		
#20	97.9		
#40	94.4		
#60	87.6		
#140	79.9		
#200	76.5		

* (no specification provided)

Material Description

Red, Gray, Brown, Lean CLAY with Sand
USDA: Clay

Atterberg Limits

PL= 18 LL= 38 PI= 20

Coefficients

D_{90}= 0.3016 D_{85}= 0.1939 D_{60}= 0.0081
D_{50}= 0.0048 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(14)

Remarks

Natural Moisture: 15.7%

Source of Sample: AQ-02 **Depth:** 44.0'-46.0'
Sample Number: S-12 **Date:** 4/7/2017

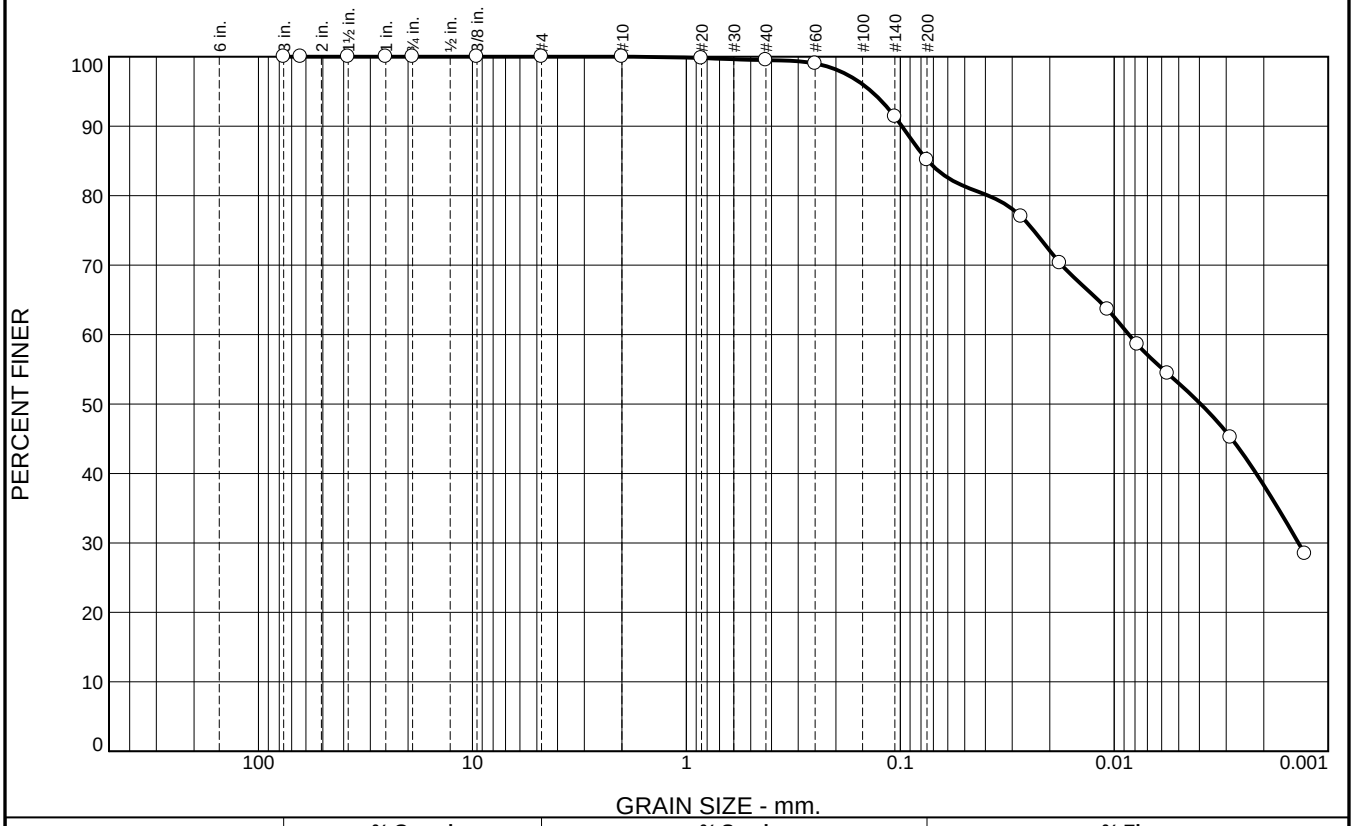
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	14.4	32.1	53.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.5		
#60	99.0		
#140	91.4		
#200	85.1		

* (no specification provided)

Material Description

Gray, Reddish Brown, Lean CLAY with Sand
USDA: Silty Clay Loam

Atterberg Limits

PL= 22 LL= 45 PI= 23

Coefficients

D_{90}= 0.0983 D_{85}= 0.0743 D_{60}= 0.0086
D_{50}= 0.0039 D_{30}= 0.0014 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(20)

Remarks

Natural Moisture: 20.5%

Source of Sample: AQ-03 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/7/2017

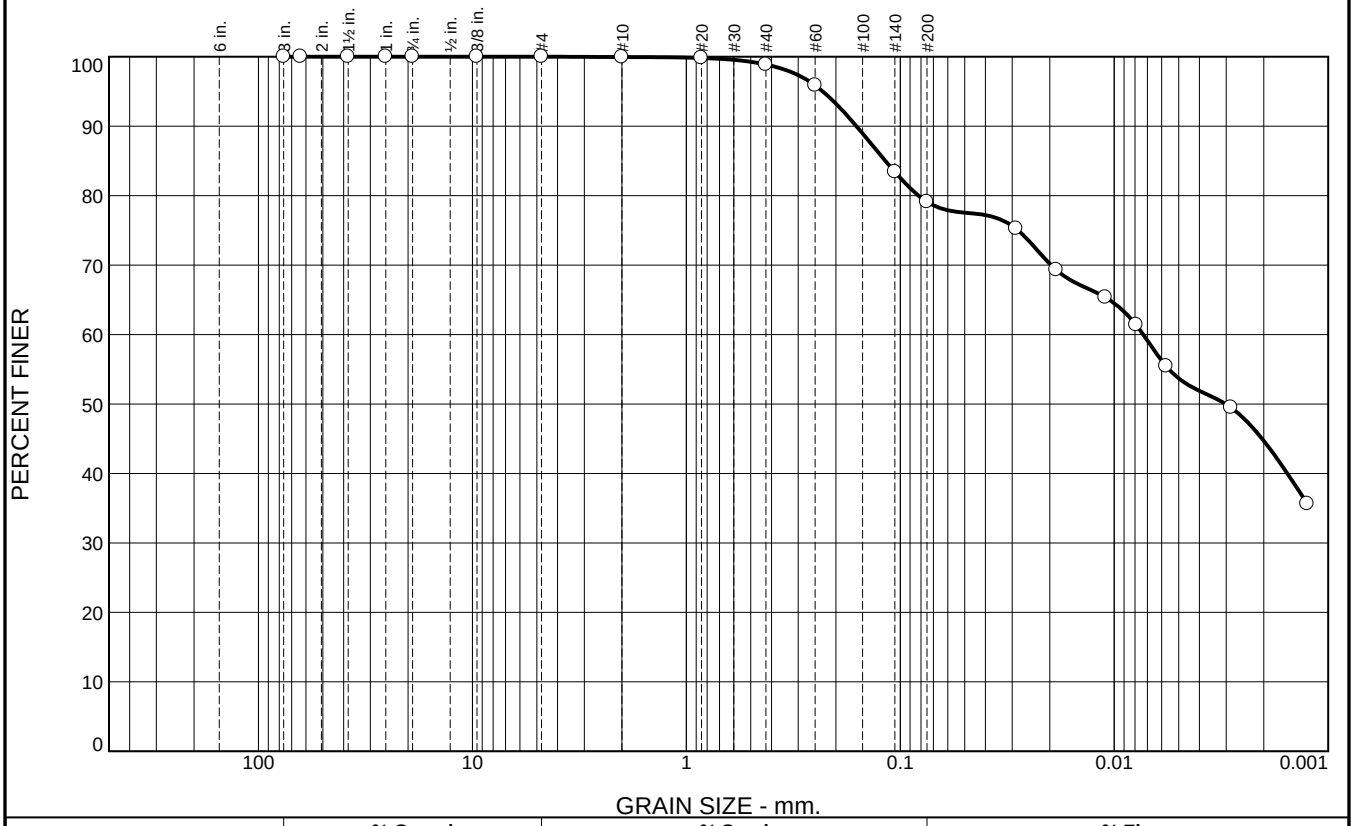
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.0	19.8	25.4	53.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.8		
#40	98.9		
#60	95.9		
#140	83.4		
#200	79.1		

* (no specification provided)

Material Description

Red, Gray, Lean CLAY with Sand
USDA: Clay

Atterberg Limits

PL= 18 LL= 39 PI= 21

Coefficients

D_{90}= 0.1604 D_{85}= 0.1174 D_{60}= 0.0073
D_{50}= 0.0030 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(16)

Remarks

Natural Moisture: 15.5%

Source of Sample: AQ-03 **Depth:** 23.0'-25.0'
Sample Number: S-6

Date: 4/7/2017

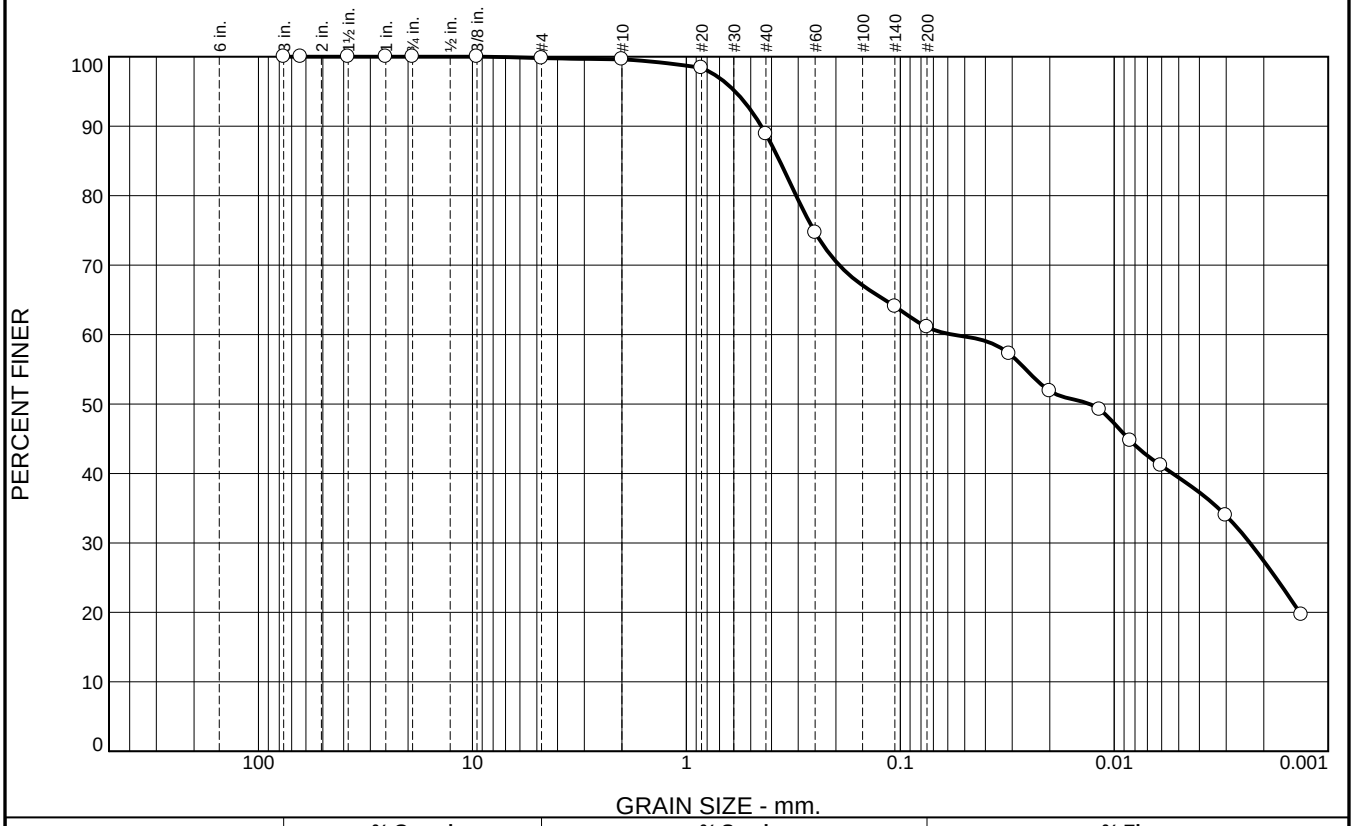
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.2	10.7	27.8	21.7	39.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.8		
#10	99.6		
#20	98.4		
#40	88.9		
#60	74.7		
#140	64.1		
#200	61.1		

* (no specification provided)

Material Description

Reddish Brown, Sandy Lean CLAY
USDA: Clay Loam

Atterberg Limits

PL= 15 LL= 32 PI= 17

Coefficients

D_{90}= 0.4462 D_{85}= 0.3663 D_{60}= 0.0573
D_{50}= 0.0131 D_{30}= 0.0023 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

Natural Moisture: 13.5%

Source of Sample: AQ-03 **Depth:** 44.0'-46.0'
Sample Number: S-12

Date: 4/7/2017

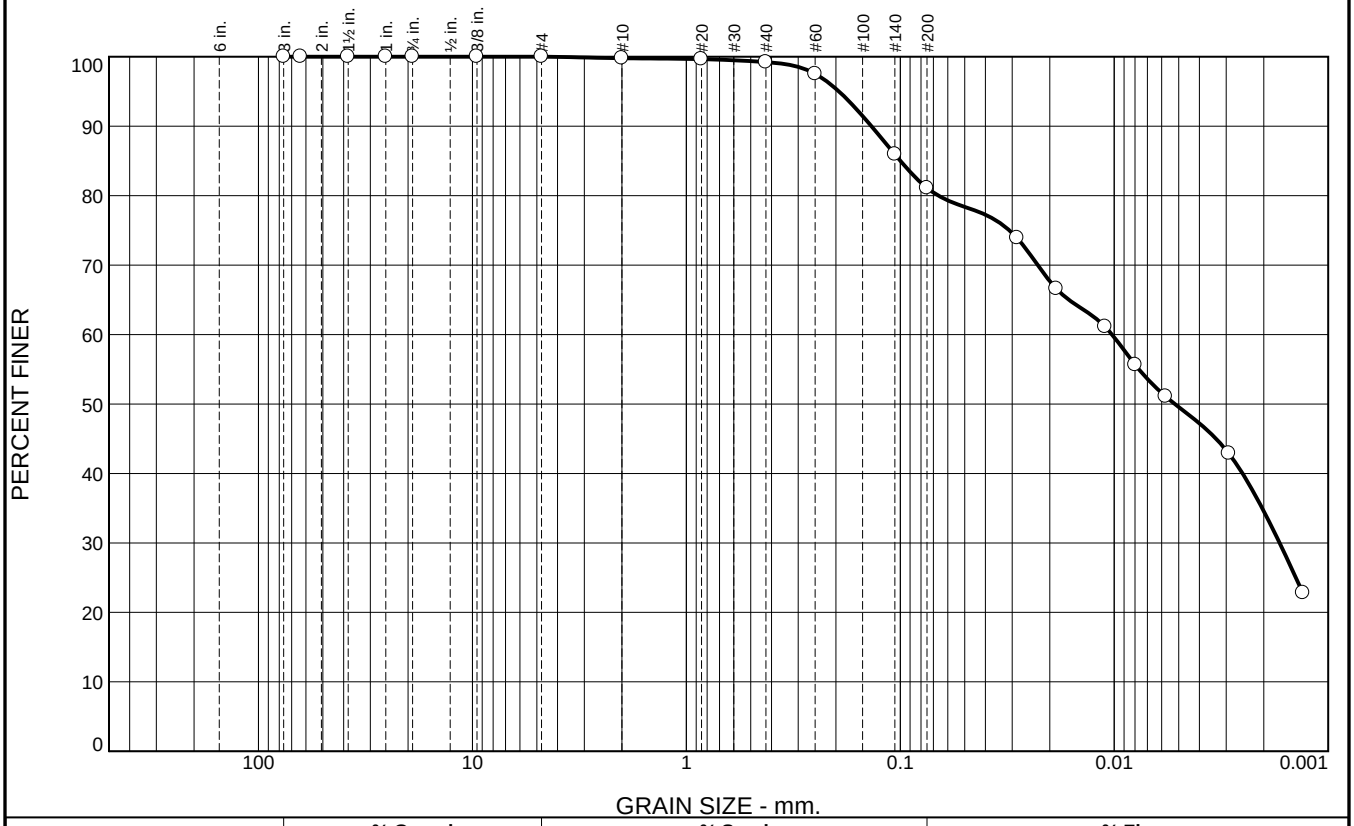
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.6	18.1	31.5	49.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.8		
#20	99.6		
#40	99.2		
#60	97.5		
#140	85.9		
#200	81.1		

* (no specification provided)

Material Description

Red, Gray, Brown, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 17 LL= 35 PI= 18

Coefficients

D_{90}= 0.1365 D_{85}= 0.0999 D_{60}= 0.0102
D_{50}= 0.0052 D_{30}= 0.0017 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

Natural Moisture: 17.1%

Source of Sample: AQ-04 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/7/2017

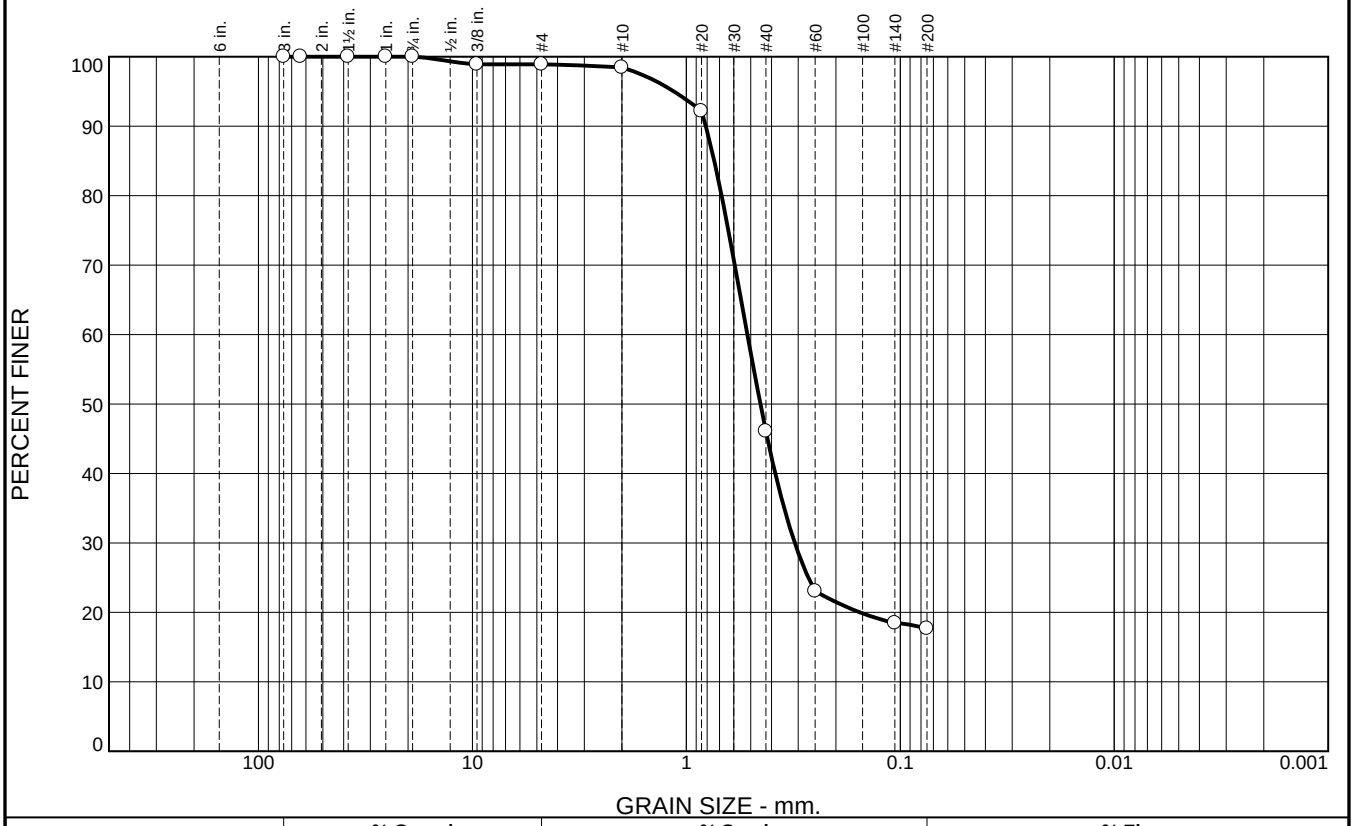
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	0.5	52.3	28.4	17.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	98.9		
#4	98.9		
#10	98.4		
#20	92.2		
#40	46.1		
#60	23.1		
#140	18.5		
#200	17.7		

* (no specification provided)

Material Description

Orange, Brown, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.8115 D_{85}= 0.7409 D_{60}= 0.5186
D_{50}= 0.4509 D_{30}= 0.3115 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 12.5%

Source of Sample: AQ-04 **Depth:** 8.0'-10.0'
Sample Number: S-3

Date: 4/10/2017

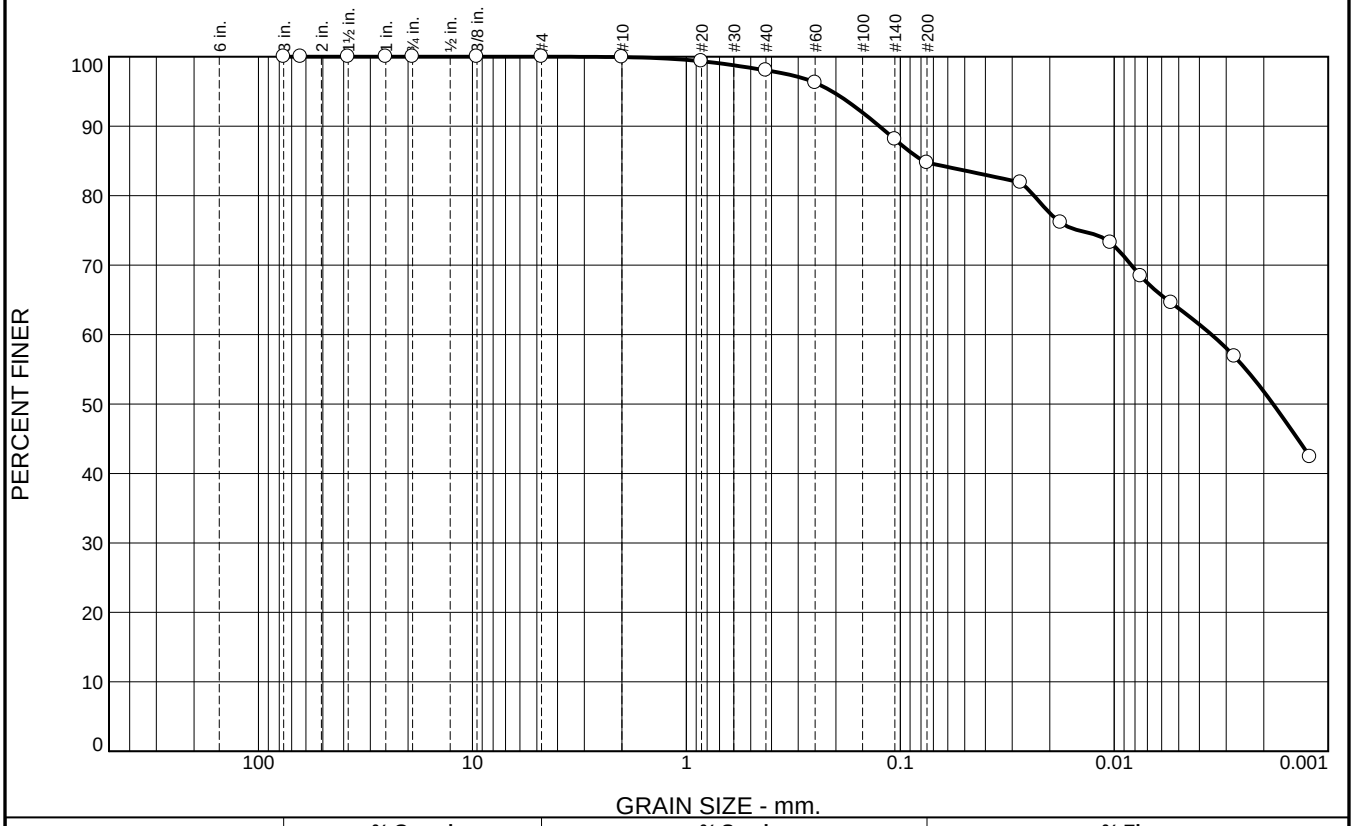
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.9	13.3	20.9	63.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.3		
#40	98.0		
#60	96.3		
#140	88.1		
#200	84.7		

* (no specification provided)

Material Description

Reddish Gray, Fat CLAY with Sand
USDA: Clay

Atterberg Limits

PL= 22 LL= 57 PI= 35

Coefficients

D_{90}= 0.1254 D_{85}= 0.0778 D_{60}= 0.0035
D_{50}= 0.0018 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(32)

Remarks

Natural Moisture: 15.7%

Source of Sample: AQ-04 **Depth:** 27.0'-29.0'
Sample Number: S-8

Date: 4/7/2017

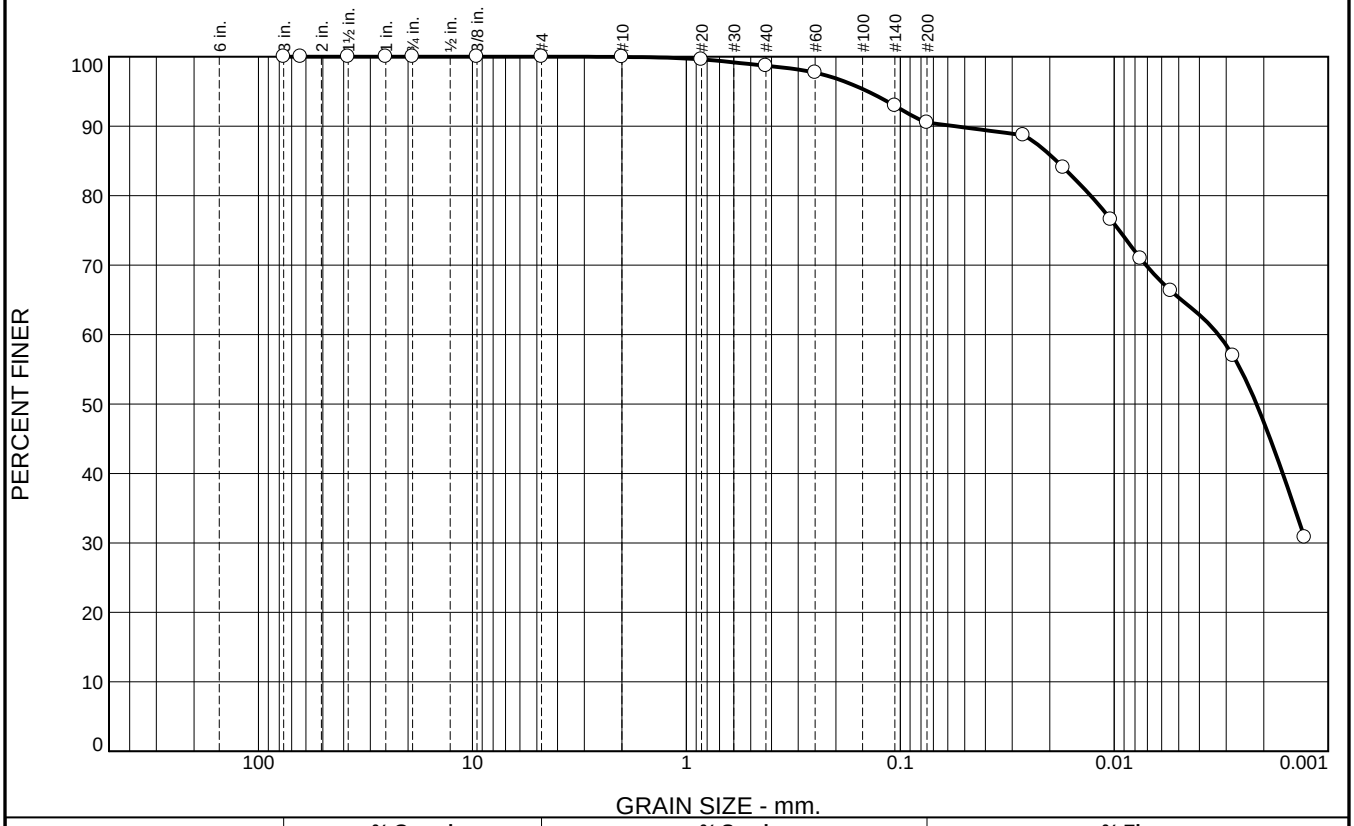
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.3	8.2	25.2	65.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.6		
#40	98.7		
#60	97.7		
#140	92.9		
#200	90.5		

* (no specification provided)

Material Description

Gray, Red, Fat CLAY
USDA: Silty Clay

Atterberg Limits

PL= 20 LL= 56 PI= 36

Coefficients

D_{90}= 0.0559 D_{85}= 0.0186 D_{60}= 0.0033
D_{50}= 0.0022 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(35)

Remarks

Natural Moisture: 17.7%

Source of Sample: AQ-05 **Depth:** 13.0'-15.0'
Sample Number: S-4

Date: 4/7/2017

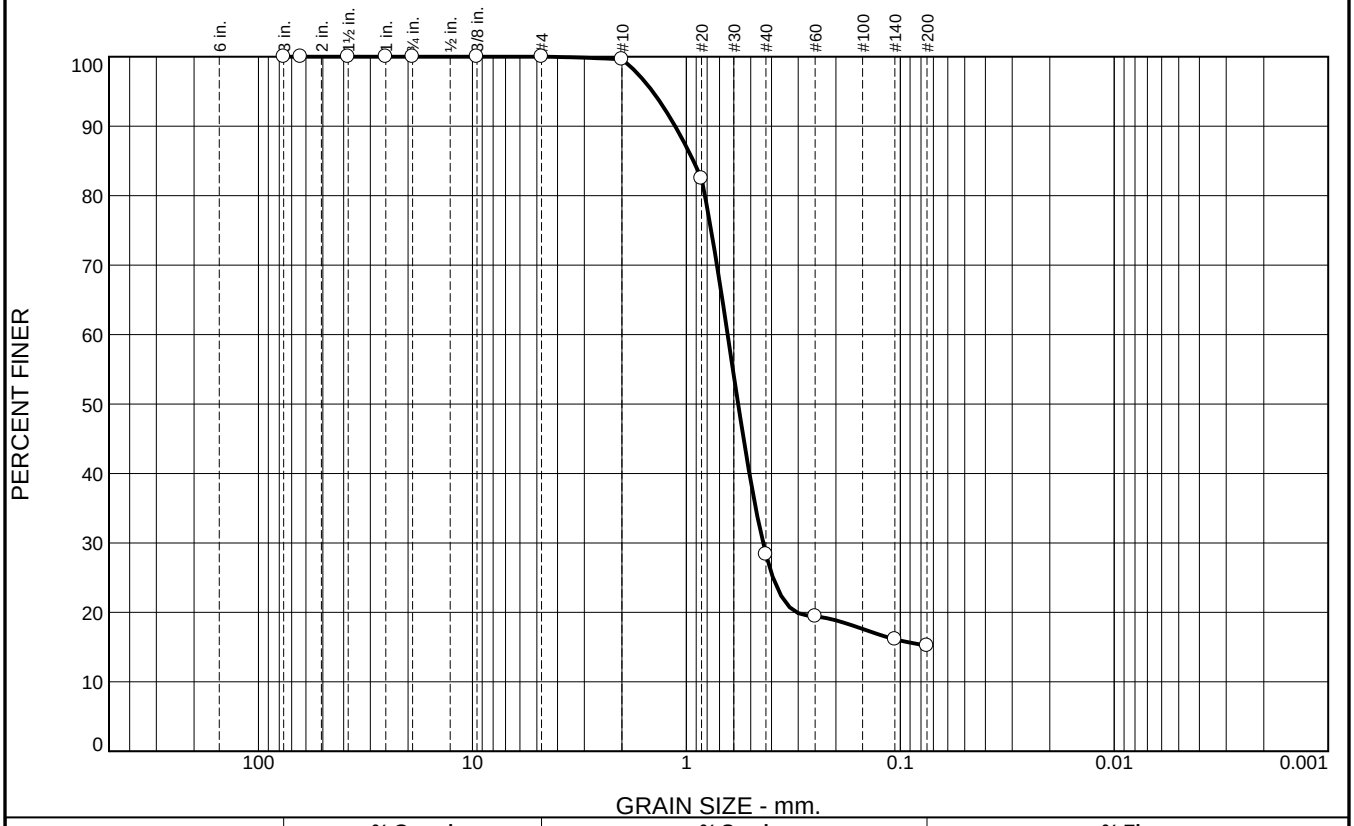
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	71.2	13.2	15.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.6		
#20	82.5		
#40	28.4		
#60	19.4		
#140	16.1		
#200	15.2		

* (no specification provided)

Material Description

Red, Tan, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.1281 D_{85}= 0.9276 D_{60}= 0.6414
D_{50}= 0.5726 D_{30}= 0.4382 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 11.3%

Source of Sample: AQ-05 **Depth:** 28.0'-30.0'
Sample Number: S-7

Date: 4/10/2017

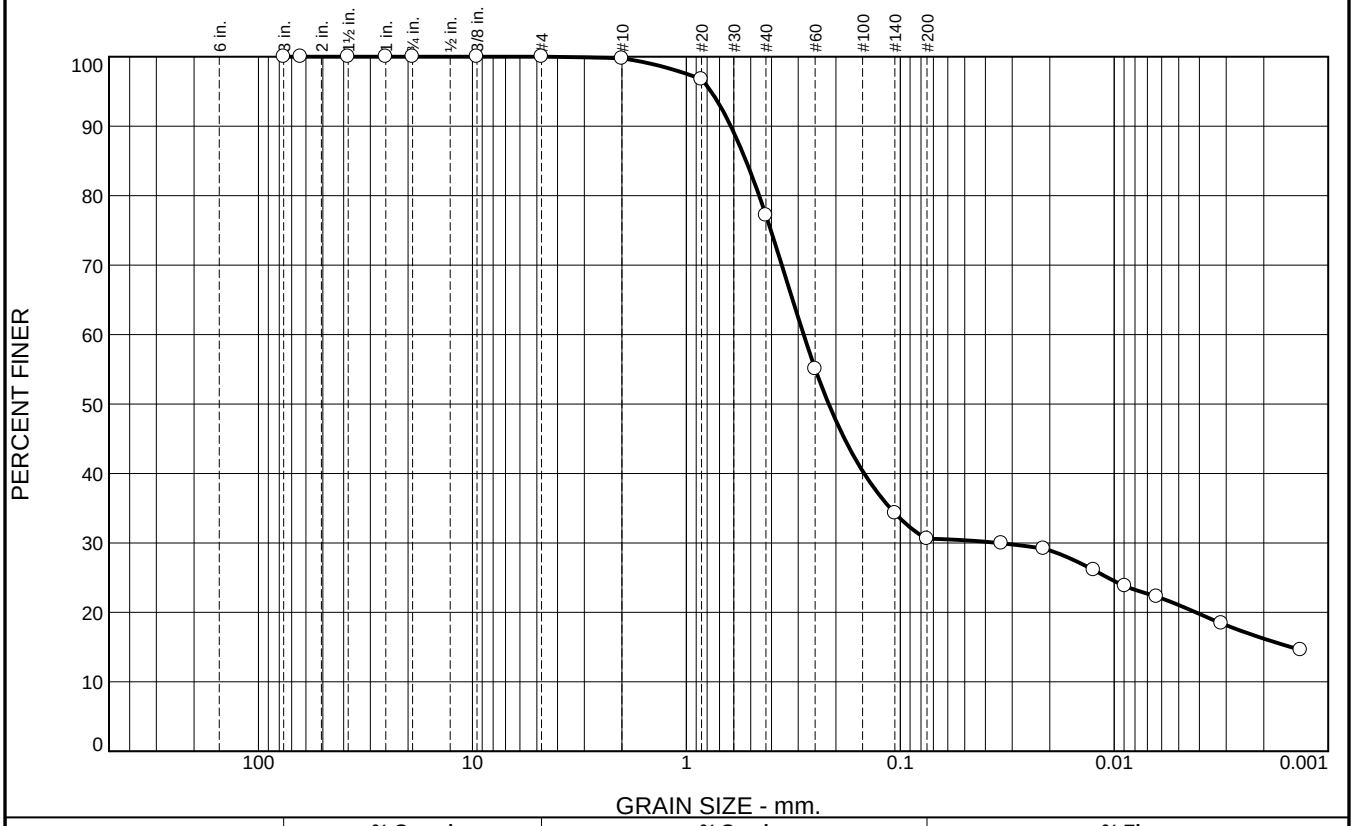
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	22.6	46.6	9.5	21.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.8		
#20	96.8		
#40	77.2		
#60	55.1		
#140	34.3		
#200	30.6		

* (no specification provided)

Material Description

Red, Gray, Brown, Clayey SAND
USDA: Sandy Loam

Atterberg Limits

PL= 12 LL= 23 PI= 11

Coefficients

D_{90}= 0.6197 D_{85}= 0.5259 D_{60}= 0.2832
D_{50}= 0.2162 D_{30}= 0.0351 D_{15}= 0.0015
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Natural Moisture: 13.6%

Source of Sample: AQ-05 **Depth:** 38.0'-40.0'
Sample Number: S-9

Date: 4/11/2017

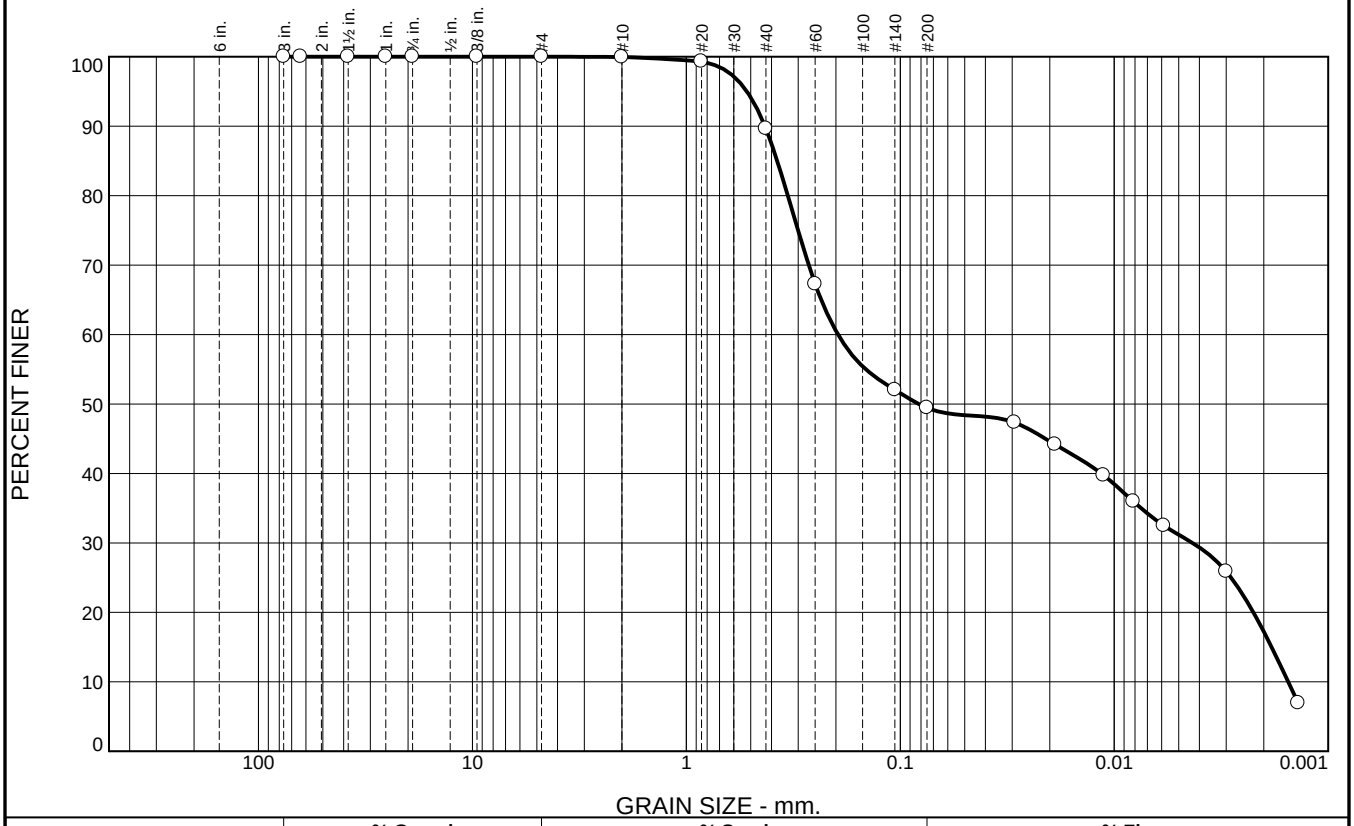
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	10.2	40.3	18.2	31.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.3		
#40	89.7		
#60	67.3		
#140	52.0		
#200	49.4		

* (no specification provided)

Material Description

Red, Brown, Silty SAND
USDA: Loam

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4293 D_{85}= 0.3760 D_{60}= 0.1956
D_{50}= 0.0820 D_{30}= 0.0043 D_{15}= 0.0018
D_{10}= 0.0015 C_u= 127.27 C_c= 0.06

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 12.7%

Source of Sample: AQ-05 **Depth:** 43.0'-45.0'
Sample Number: S-10

Date: 4/10/2017

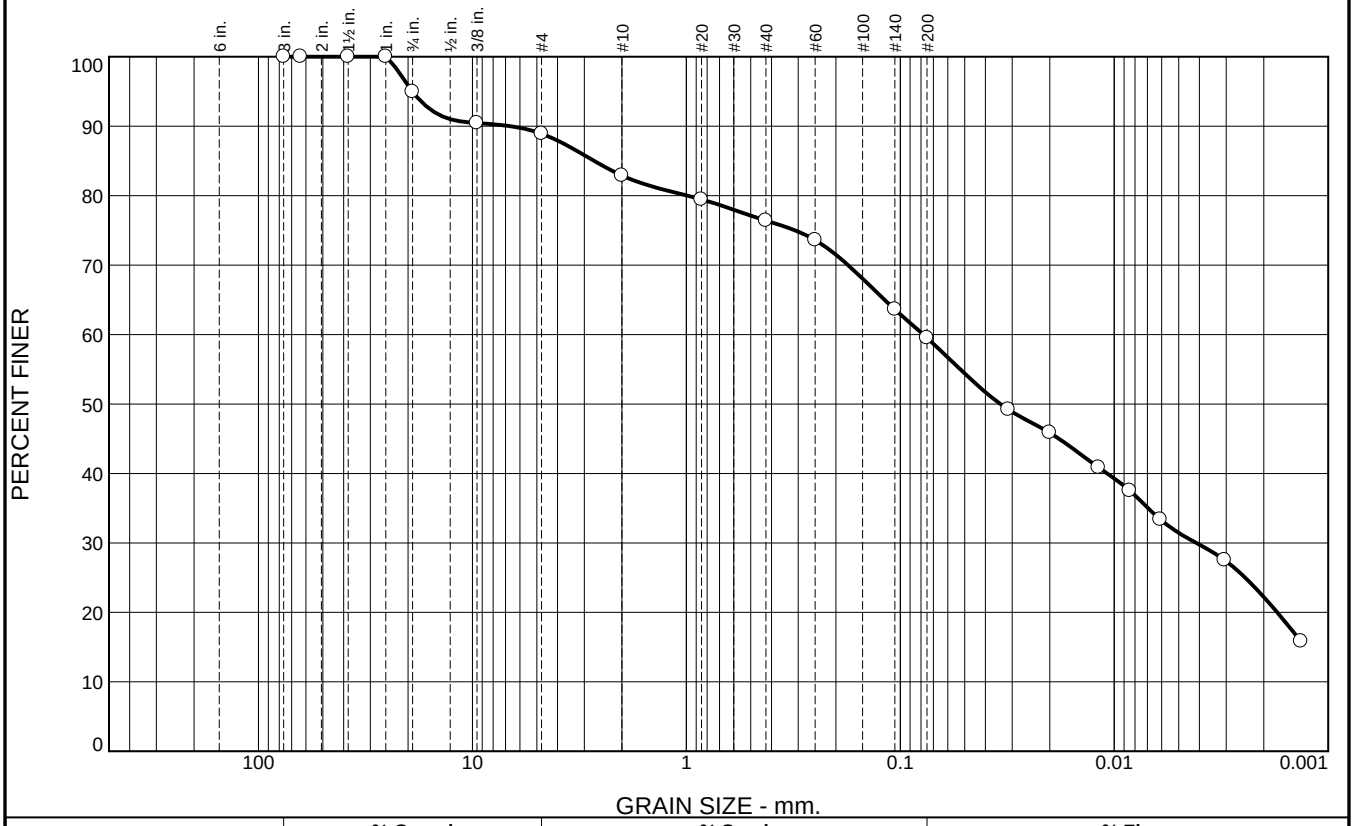
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.0	6.1	6.0	6.5	16.9	28.0	31.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	95.0		
.375	90.4		
#4	88.9		
#10	82.9		
#20	79.5		
#40	76.4		
#60	73.6		
#140	63.6		
#200	59.5		

* (no specification provided)

Material Description

Red, Tan, Sandy Lean CLAY
USDA: Loam

Atterberg Limits

PL= 15 LL= 32 PI= 17

Coefficients

D_{90}= 6.6657 D_{85}= 2.6983 D_{60}= 0.0782
D_{50}= 0.0341 D_{30}= 0.0041 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

Natural Moisture: 11.6%

Source of Sample: AQ-05 **Depth:** 82.0'-84.0'
Sample Number: S-20

Date: 4/11/2017

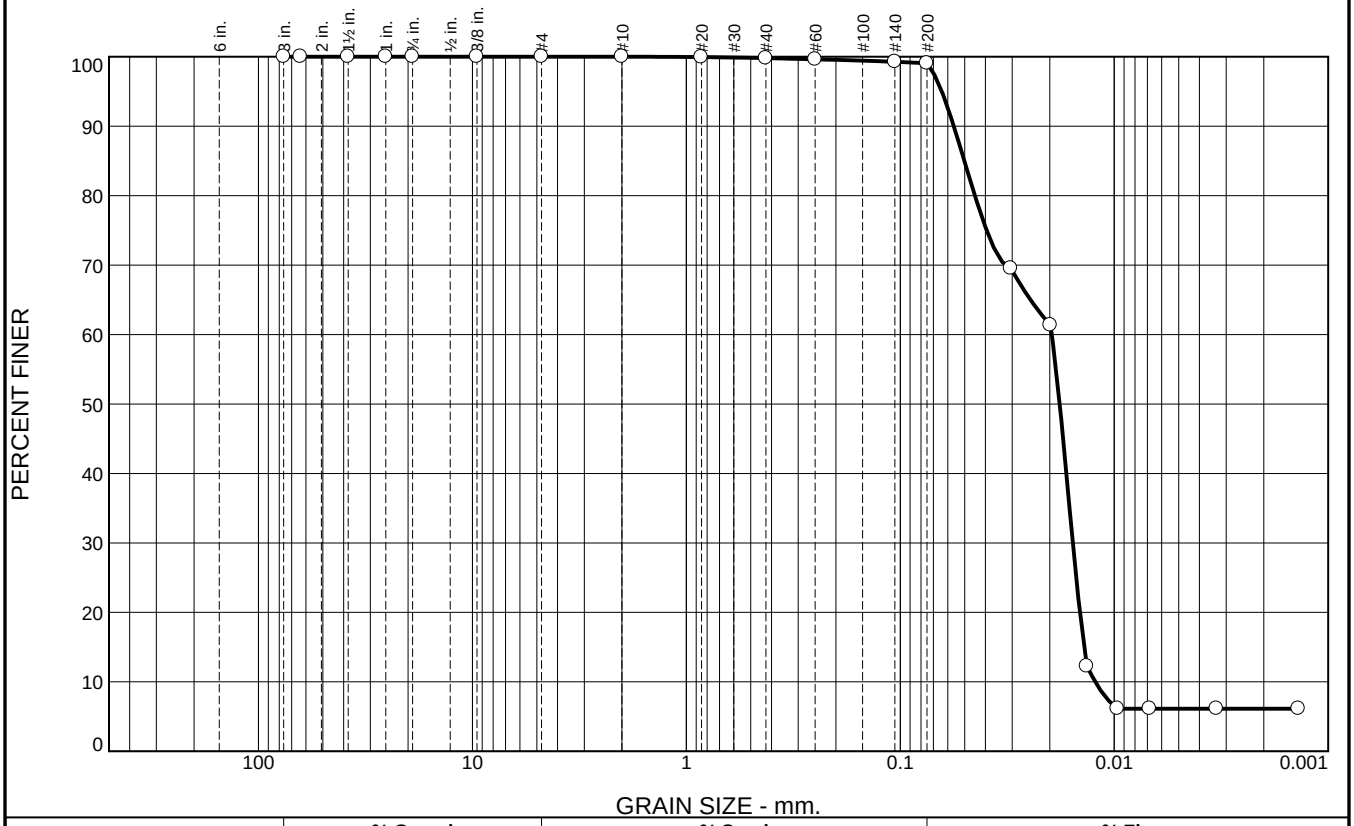
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.7	93.0	6.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	99.6		
#140	99.3		
#200	99.1		

* (no specification provided)

Material Description

Red, Tan, Brown, Elastic SILT
USDA: Silt

Atterberg Limits

PL= 49 LL= 60 PI= 11

Coefficients

D_{90}= 0.0562 D_{85}= 0.0502 D_{60}= 0.0196
D_{50}= 0.0180 D_{30}= 0.0156 D_{15}= 0.0138
D_{10}= 0.0123 C_u= 1.60 C_c= 1.01

Classification

USCS= MH AASHTO= A-7-5(20)

Remarks

Source of Sample: AQ-05 **Depth:** 88.0'-90.0'
Sample Number: S-23 **Date:**

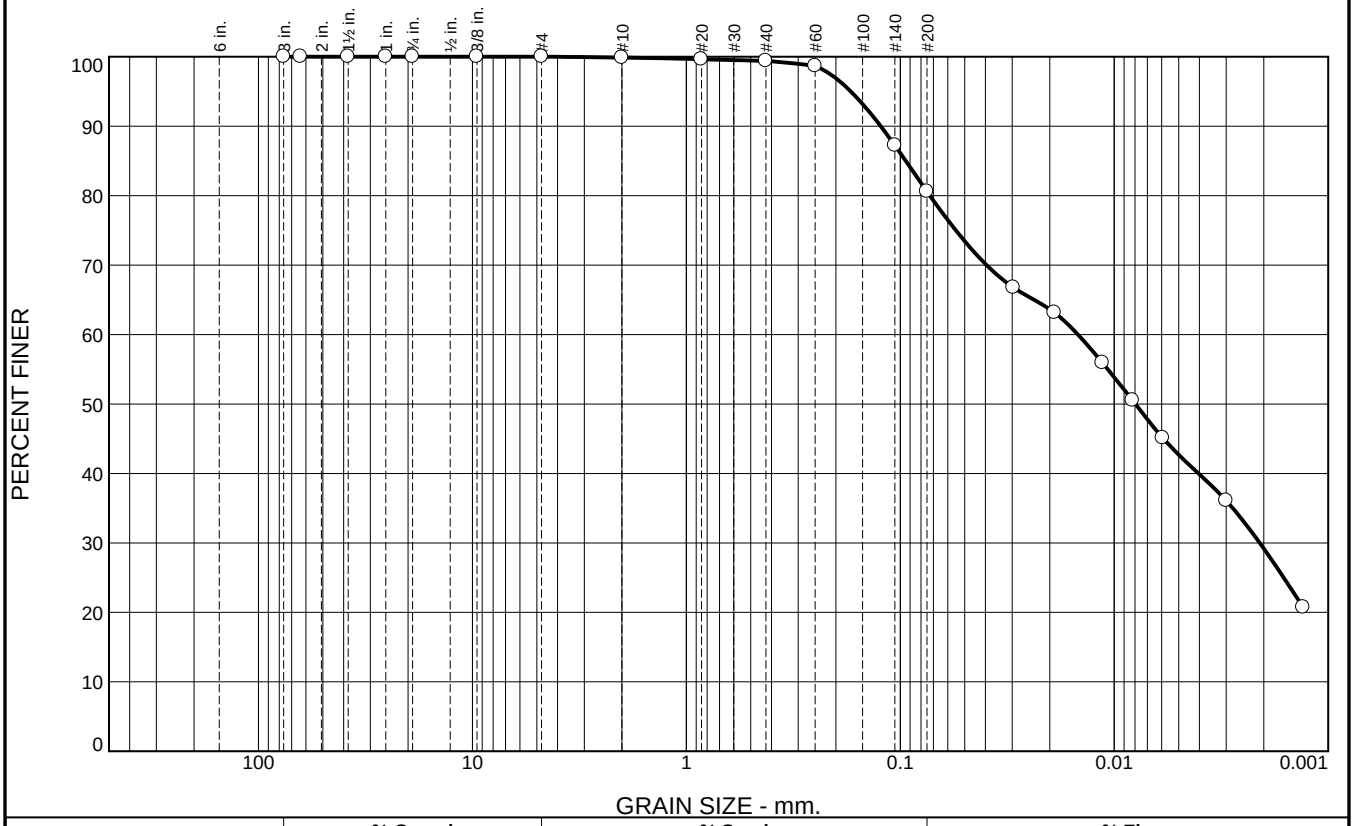
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.5	18.8	37.9	42.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.6		
#40	99.4		
#60	98.7		
#140	87.2		
#200	80.6		

* (no specification provided)

Material Description

Gray, Brown, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 17 LL= 30 PI= 13

Coefficients

D_{90}= 0.1235 D_{85}= 0.0943 D_{60}= 0.0148
D_{50}= 0.0080 D_{30}= 0.0021 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(9)

Remarks

Natural Moisture: 20.5%

Source of Sample: AQ-06 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/12/2017

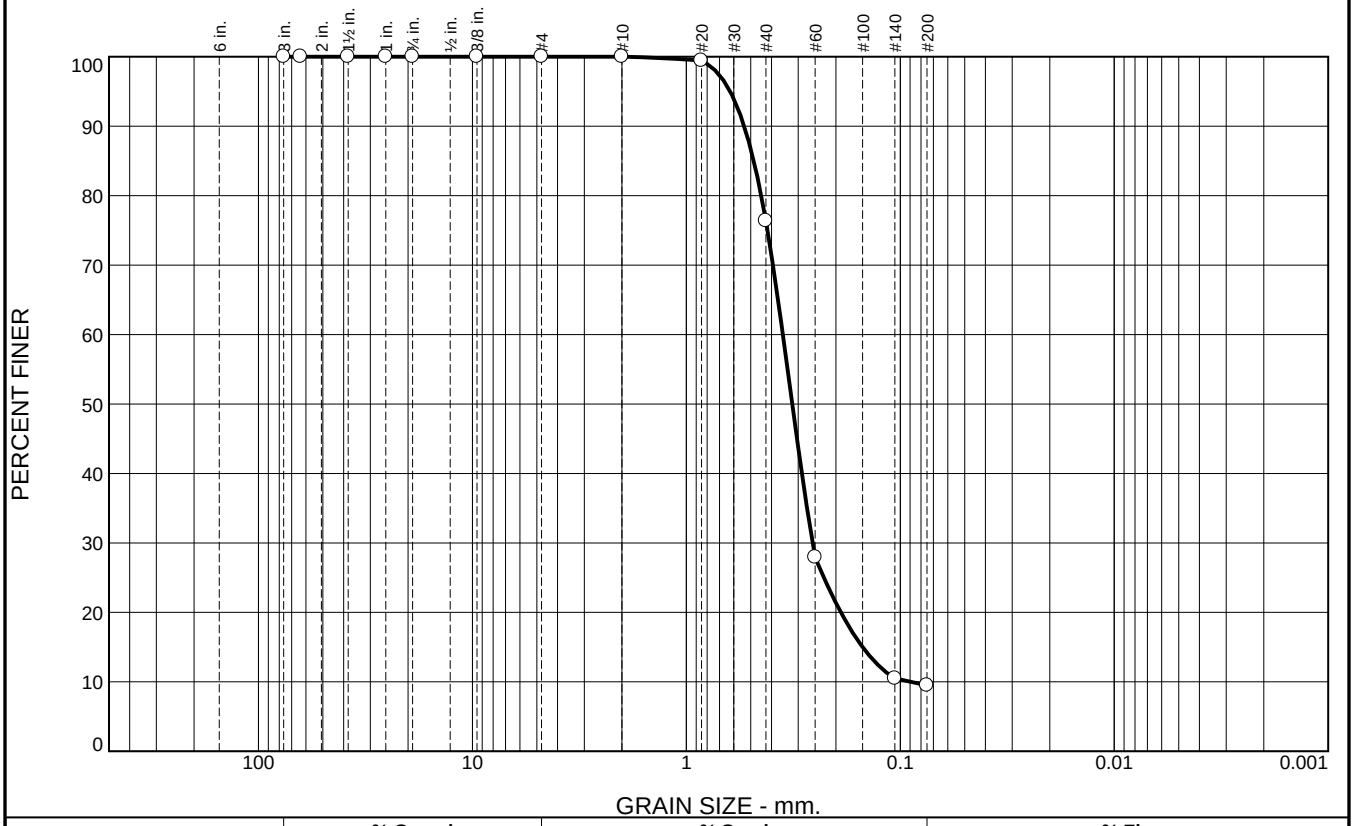
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	23.6	66.9	9.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.4		
#40	76.4		
#60	27.9		
#140	10.5		
#200	9.5		

* (no specification provided)

Material Description

Tan, Poorly Graded SAND with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5365 D_{85}= 0.4841 D_{60}= 0.3539
D_{50}= 0.3200 D_{30}= 0.2570 D_{15}= 0.1500
D_{10}= 0.0893 C_u= 3.96 C_c= 2.09

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 6.6%

Source of Sample: AQ-06 **Depth:** 31.0'-33.0'
Sample Number: S-10

Date: 4/10/2017

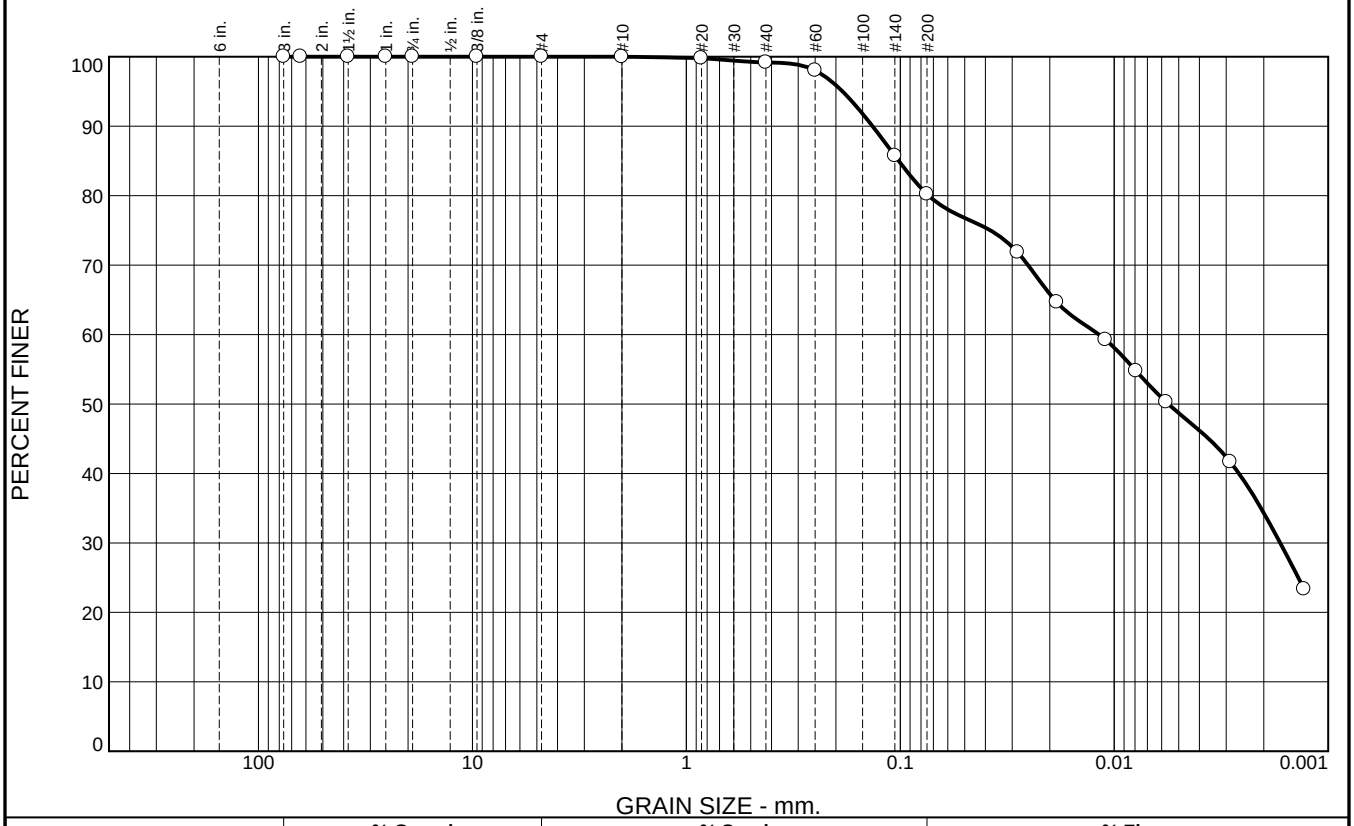
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	19.0	31.5	48.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.2		
#60	98.0		
#140	85.7		
#200	80.2		

* (no specification provided)

Material Description

Red, Gray, Brown, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 18 LL= 36 PI= 18

Coefficients

D_{90}= 0.1349 D_{85}= 0.1017 D_{60}= 0.0118
D_{50}= 0.0056 D_{30}= 0.0017 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

Natural Moisture: 17.2%

Source of Sample: AQ-07 **Depth:** 8.0'-10.0'
Sample Number: S-3

Date: 4/7/2017

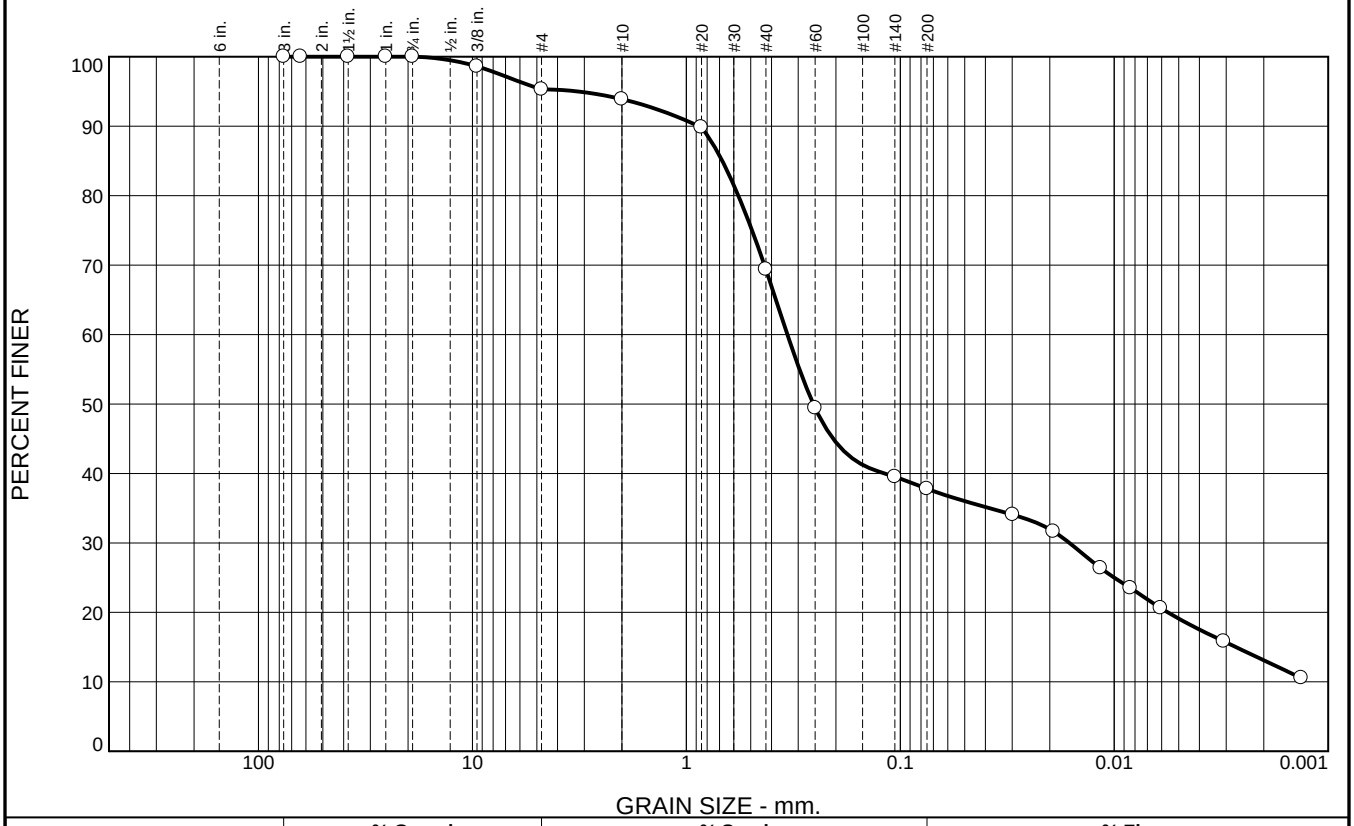
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.7	1.4	24.5	31.6	18.7	19.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	98.6		
#4	95.3		
#10	93.9		
#20	89.8		
#40	69.4		
#60	49.4		
#140	39.5		
#200	37.8		

* (no specification provided)

Material Description

Brown, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.8741 D_{85}= 0.6793 D_{60}= 0.3371
D_{50}= 0.2551 D_{30}= 0.0162 D_{15}= 0.0027
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 11.2%

Source of Sample: AQ-07 **Depth:** 18.0'-20.0'
Sample Number: S-5

Date: 4/10/2017

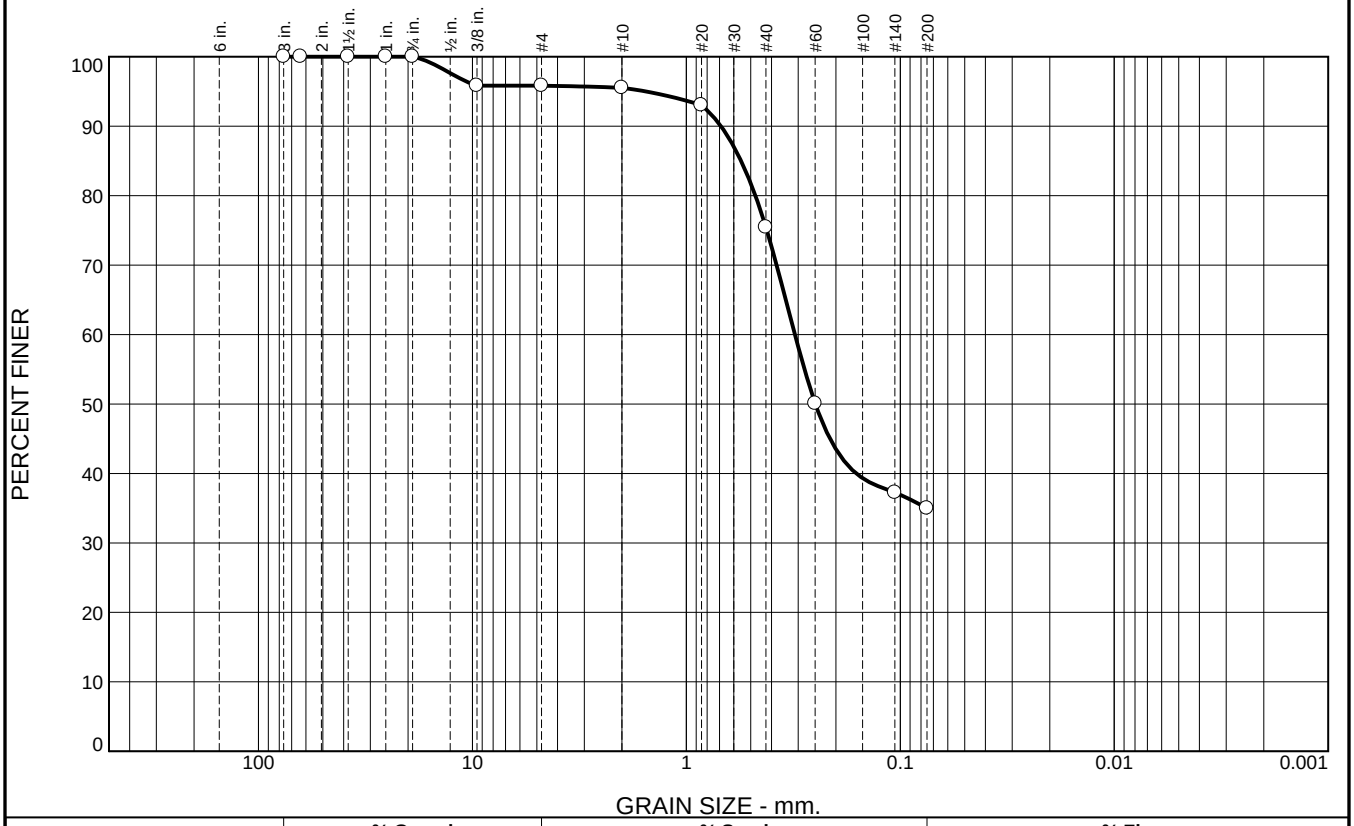
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	0.3	20.0	40.5	35.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	95.8		
#4	95.8		
#10	95.5		
#20	93.0		
#40	75.5		
#60	50.1		
#140	37.2		
#200	35.0		

* (no specification provided)

Material Description

Red, Brown, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6892 D_{85}= 0.5549 D_{60}= 0.3110
D_{50}= 0.2495 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 13.2%

Source of Sample: AQ-07 **Depth:** 29.0'-31.0'
Sample Number: S-9

Date: 4/10/2017

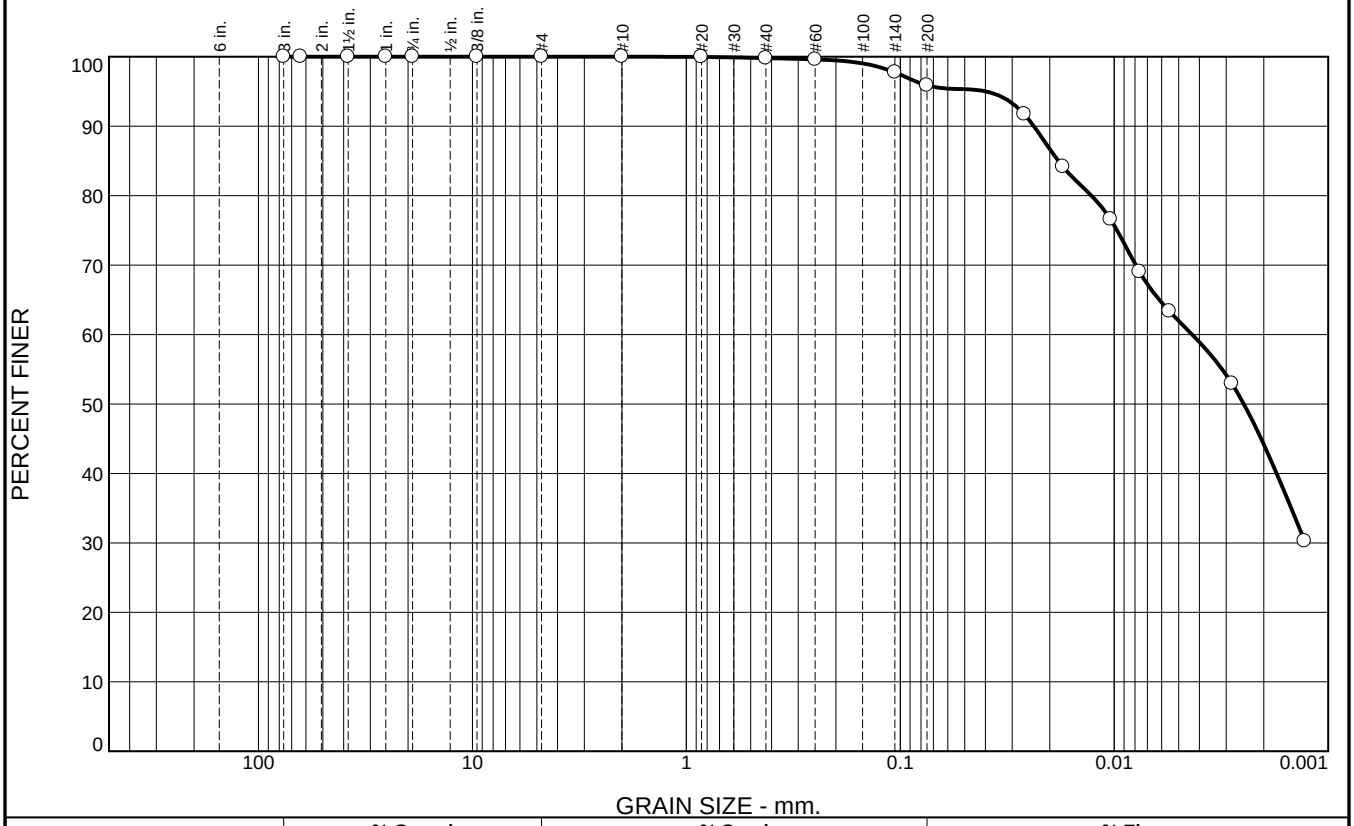
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	3.9	33.9	62.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.8		
#60	99.6		
#140	97.7		
#200	95.9		

* (no specification provided)

Material Description

Red, Brown, Lean CLAY
USDA: Silty Clay

Atterberg Limits

PL= 22 LL= 48 PI= 26

Coefficients

D_{90}= 0.0238 D_{85}= 0.0183 D_{60}= 0.0043
D_{50}= 0.0025 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(28)

Remarks

Natural Moisture: 17.2%

Source of Sample: AQ-08 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/11/2017

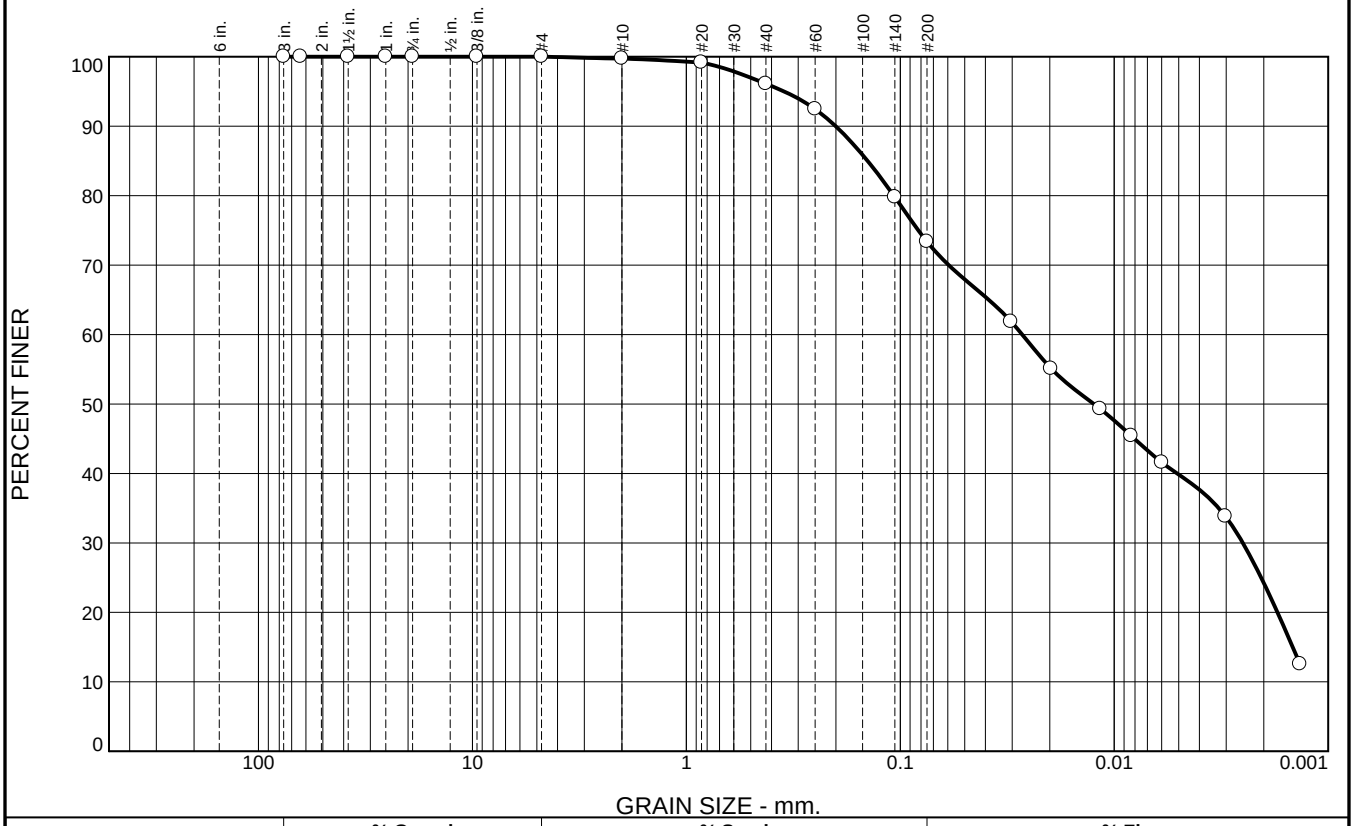
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	3.6	22.7	33.6	39.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.7		
#20	99.2		
#40	96.1		
#60	92.4		
#140	79.8		
#200	73.4		

* (no specification provided)

Material Description

Reddish Brown, Lean CLAY with Sand
USDA: Loam

Atterberg Limits

PL= 16 LL= 33 PI= 17

Coefficients

D_{90}= 0.2006 D_{85}= 0.1423 D_{60}= 0.0269
D_{50}= 0.0124 D_{30}= 0.0025 D_{15}= 0.0015
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

Natural Moisture: 14.4%

Source of Sample: AQ-08 **Depth:** 18.0'-20.0'
Sample Number: S-5

Date: 4/10/2017

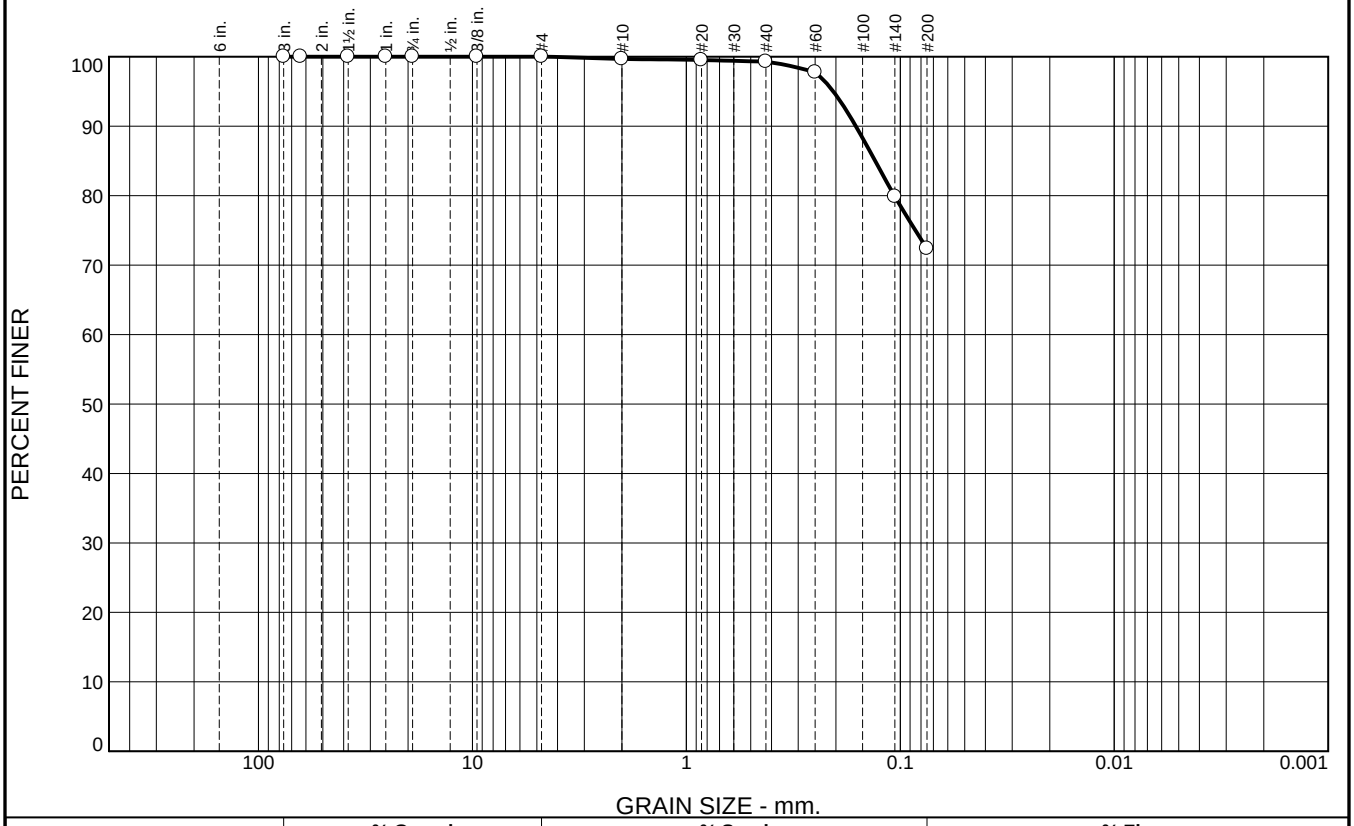
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	0.4	26.9	72.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.7		
#20	99.5		
#40	99.3		
#60	97.7		
#140	79.9		
#200	72.4		

* (no specification provided)

Material Description

Red, Gray, Brown, SILT with Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1614 D_{85}= 0.1311 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 14.6%

Source of Sample: AQ-08 **Depth:** 33.0'-35.0'
Sample Number: S-8

Date: 4/7/2017

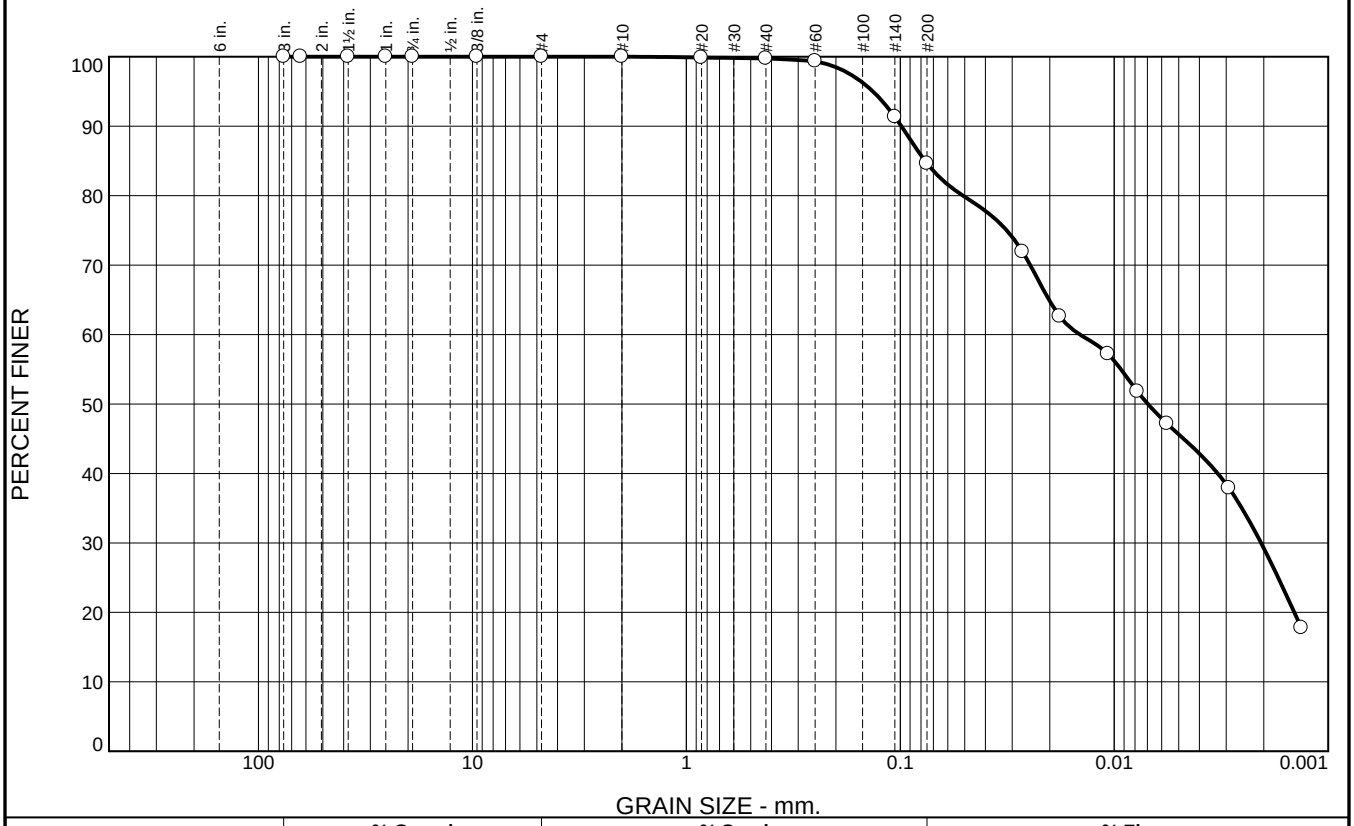
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	15.1	39.0	45.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.7		
#60	99.3		
#140	91.3		
#200	84.6		

* (no specification provided)

Material Description

Red, Gray, Brown, SILT with Sand
USDA: Silty Clay Loam

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0989 D_{85}= 0.0767 D_{60}= 0.0145
D_{50}= 0.0070 D_{30}= 0.0021 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 16.7%

Source of Sample: AQ-08 **Depth:** 38.0'-40.0'
Sample Number: S-9

Date: 4/10/2017

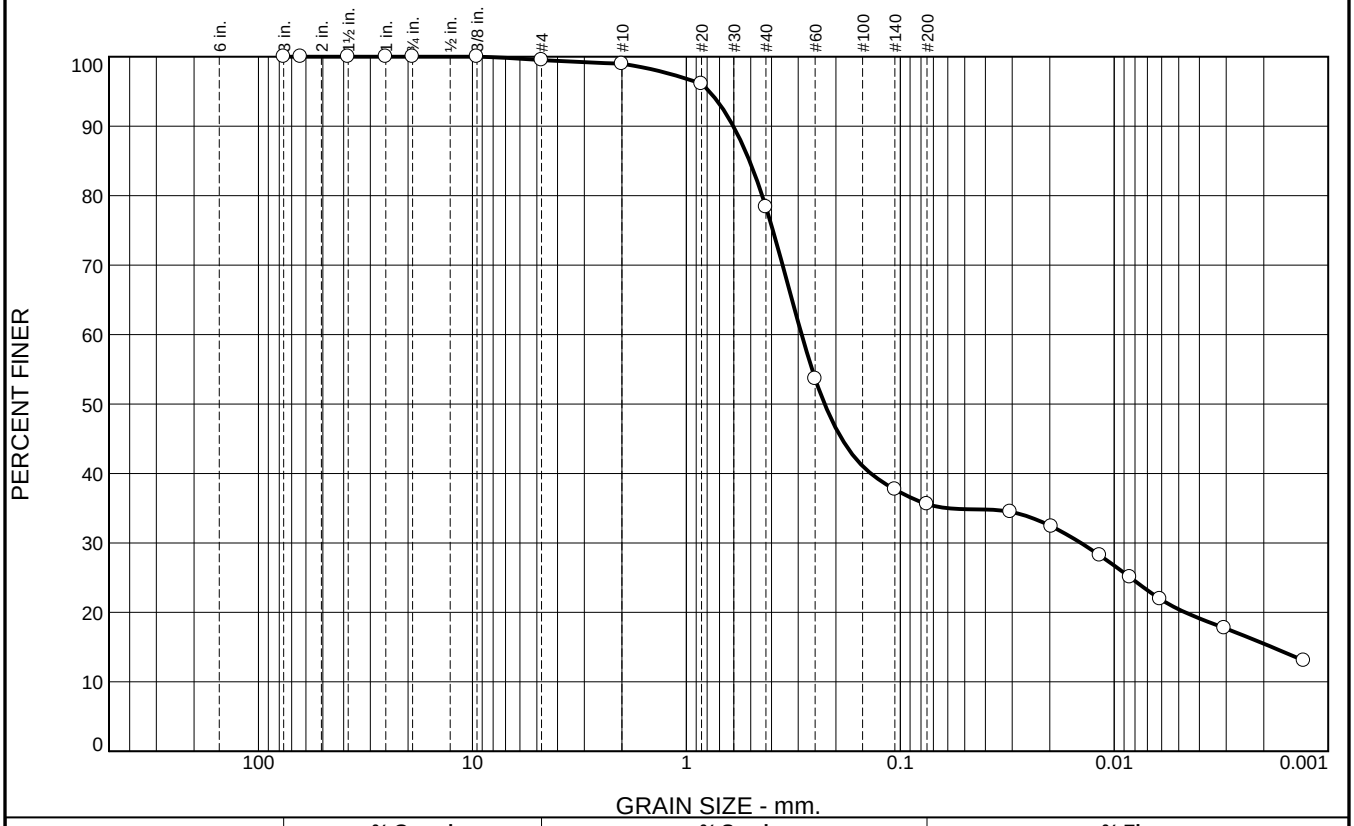
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.5	20.6	42.8	15.2	20.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.5		
#10	99.0		
#20	96.1		
#40	78.4		
#60	53.6		
#140	37.7		
#200	35.6		

* (no specification provided)

Material Description

Tan, Silty SAND
USDA: Sandy Loam

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6033 D_{85}= 0.5067 D_{60}= 0.2893
D_{50}= 0.2259 D_{30}= 0.0143 D_{15}= 0.0018
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 11.5%

Source of Sample: AQ-08 **Depth:** 61.0'-63.0'
Sample Number: S-16

Date: 4/12/2017

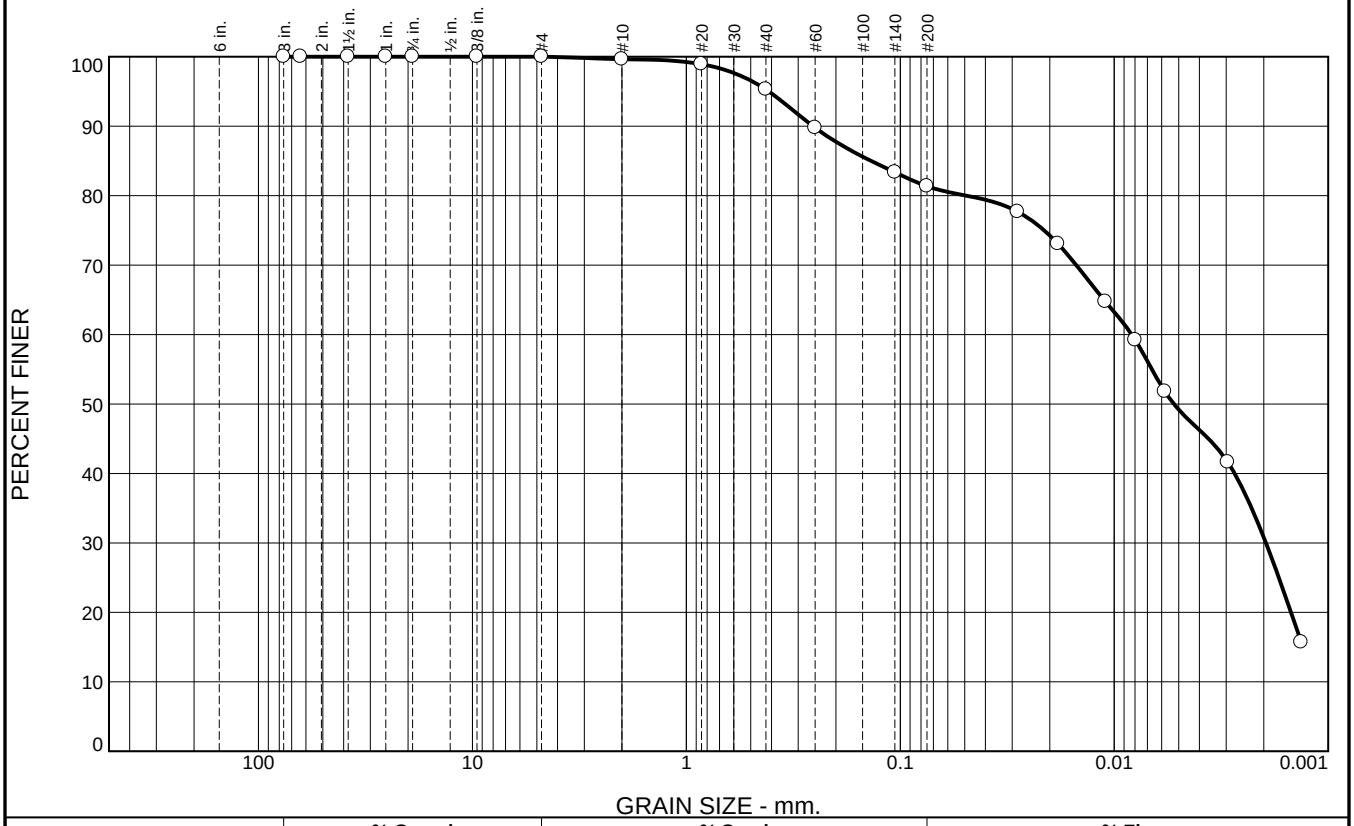
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	4.3	14.0	32.1	49.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.6		
#20	98.9		
#40	95.3		
#60	89.8		
#140	83.4		
#200	81.3		

* (no specification provided)

Material Description

Gray, Red, Tan, Lean CLAY with Sand
USDA: Silty Clay Loam

Atterberg Limits

PL= 18 LL= 36 PI= 18

Coefficients

D_{90}= 0.2560 D_{85}= 0.1369 D_{60}= 0.0083
D_{50}= 0.0053 D_{30}= 0.0020 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(14)

Remarks

Natural Moisture: 18.9%

Source of Sample: AQ-09 **Depth:** 8.0'-10.0'
Sample Number: S-3

Date: 4/12/2017

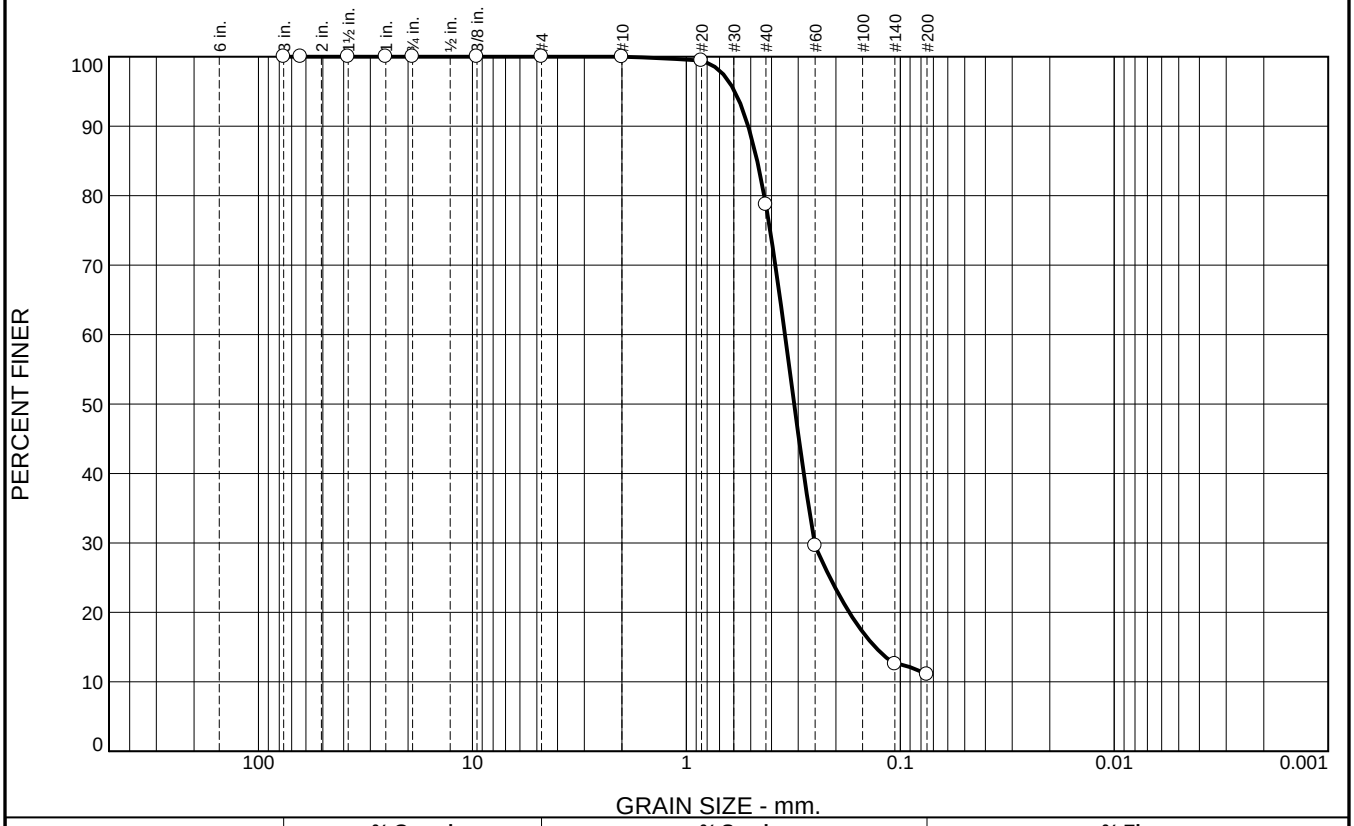
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	21.3	67.6	11.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.4		
#40	78.7		
#60	29.6		
#140	12.6		
#200	11.1		

* (no specification provided)

Material Description

Tan, Poorly Graded SAND with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5139 D_{85}= 0.4664 D_{60}= 0.3460
D_{50}= 0.3134 D_{30}= 0.2514 D_{15}= 0.1309
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 13.1%

Source of Sample: AQ-09 **Depth:** 17.0'-19.0'
Sample Number: S-6

Date: 4/7/2017

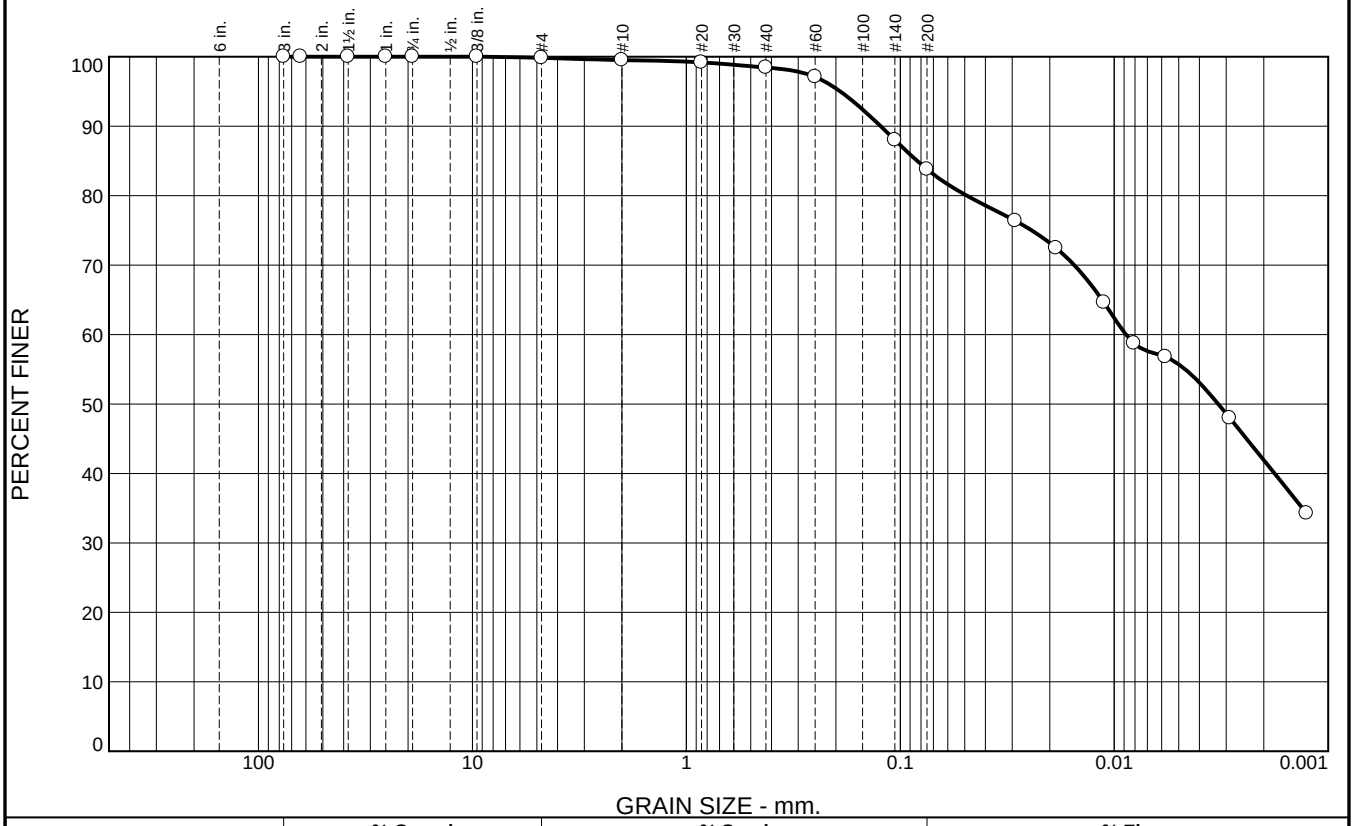
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.3	1.1	14.6	28.1	55.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3.0	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.8		
#10	99.5		
#20	99.2		
#40	98.4		
#60	97.1		
#140	88.0		
#200	83.8		

* (no specification provided)

Material Description

Red, Brown, Lean CLAY with Sand
USDA: Clay

Atterberg Limits

PL= 19 LL= 39 PI= 20

Coefficients

D_{90}= 0.1236 D_{85}= 0.0834 D_{60}= 0.0088
D_{50}= 0.0033 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(16)

Remarks

Natural Moisture: 18.2%

Source of Sample: AQ-10 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/12/2017

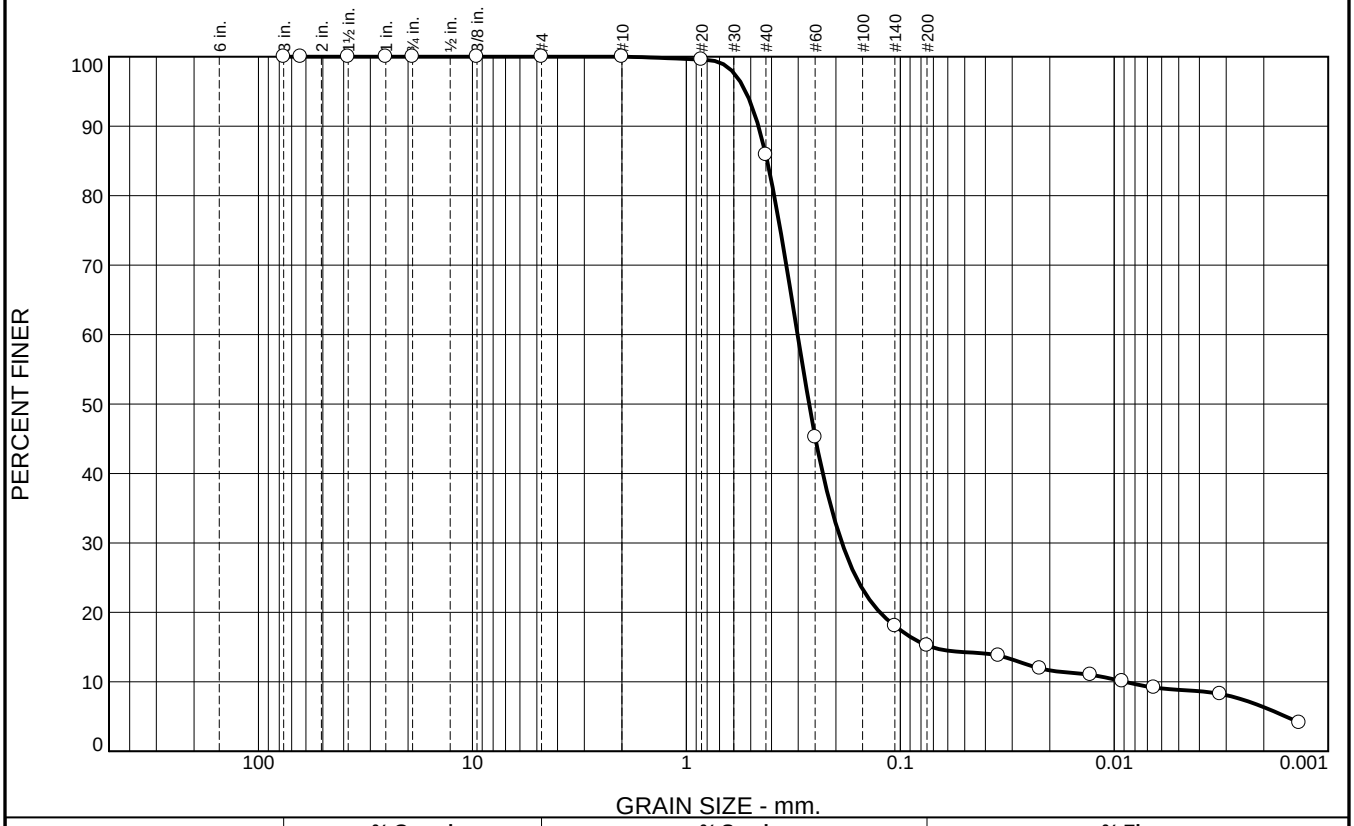
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	14.1	70.7	6.4	8.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.6		
#40	85.9		
#60	45.2		
#140	18.1		
#200	15.2		

* (no specification provided)

Material Description

Tan, Clayey SAND
USDA: Loamy Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4602 D_{85}= 0.4188 D_{60}= 0.3023
D_{50}= 0.2669 D_{30}= 0.1875 D_{15}= 0.0713
D_{10}= 0.0089 C_u= 34.00 C_c= 13.07

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 7.5%

Source of Sample: AQ-10 **Depth:** 15.0'-17.0'
Sample Number: S-5

Date: 4/12/2017

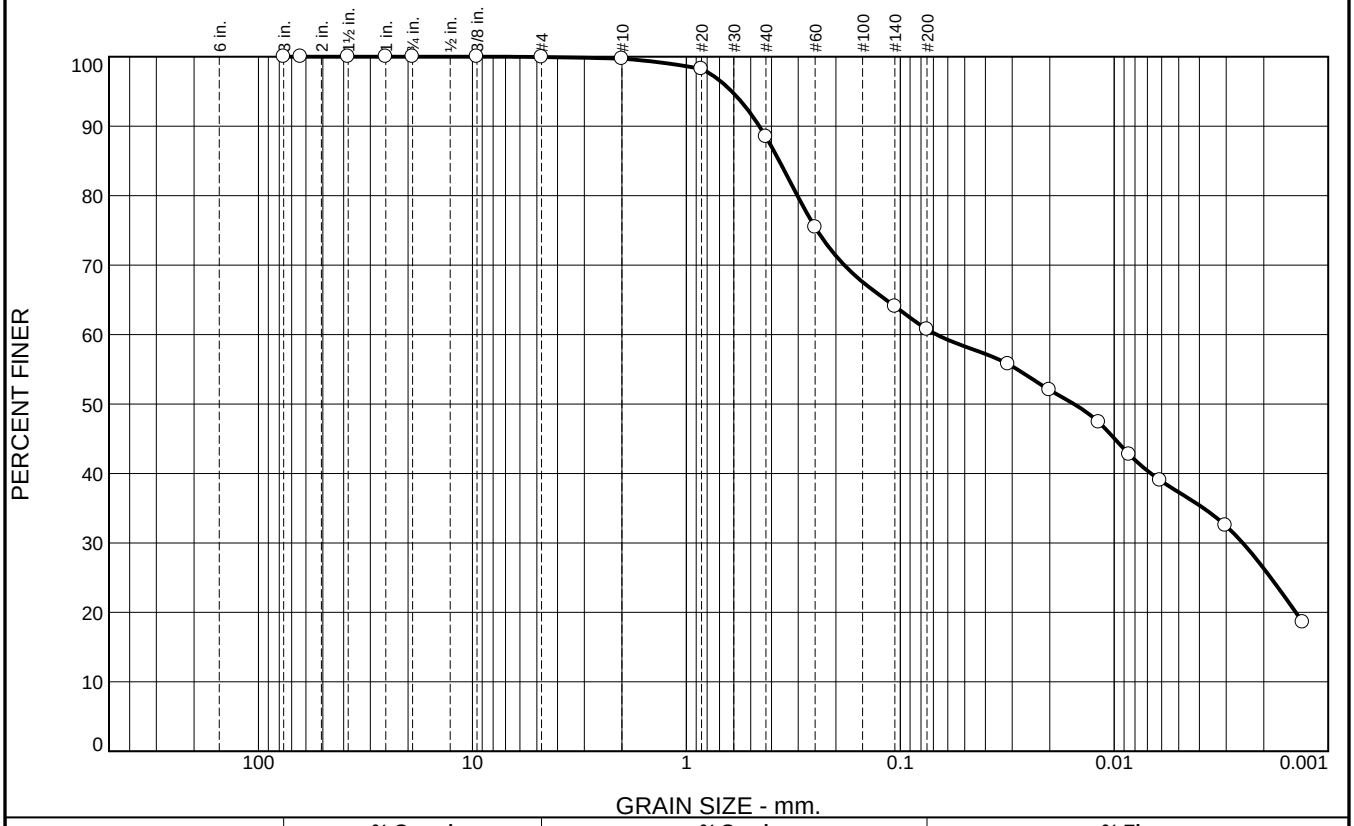
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.2	11.2	27.7	23.5	37.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.9		
#10	99.7		
#20	98.2		
#40	88.5		
#60	75.4		
#140	64.1		
#200	60.8		

* (no specification provided)

Material Description

Red, Brown, Sandy Lean CLAY
USDA: Loam

Atterberg Limits

PL= 15 LL= 28 PI= 13

Coefficients

D_{90}= 0.4562 D_{85}= 0.3679 D_{60}= 0.0678
D_{50}= 0.0154 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

Natural Moisture: 13.7%

Source of Sample: AQ-11 **Depth:** 8.0'-10.0'
Sample Number: S-3

Date: 4/12/2017

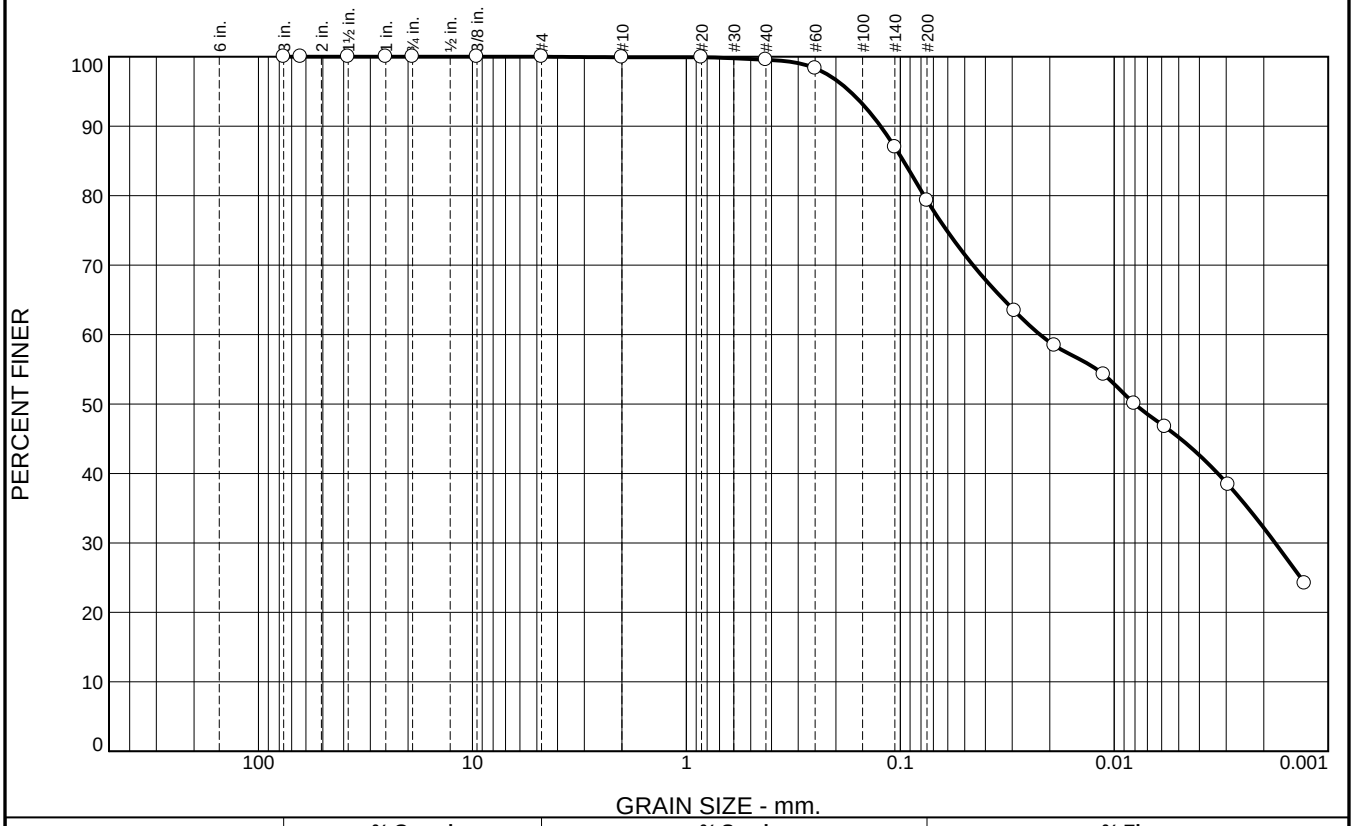
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.3	20.3	34.1	45.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.6		
#60	98.3		
#140	87.0		
#200	79.3		

* (no specification provided)

Material Description

Red, Gray, Lean CLAY with Sand
USDA: Clay Loam

Atterberg Limits

PL= 15 LL= 31 PI= 16

Coefficients

D_{90}= 0.1237 D_{85}= 0.0967 D_{60}= 0.0223
D_{50}= 0.0080 D_{30}= 0.0018 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

Natural Moisture: 13.0%

Source of Sample: AQ-11 **Depth:** 38.0'-40.0'
Sample Number: S-9

Date: 4/12/2017

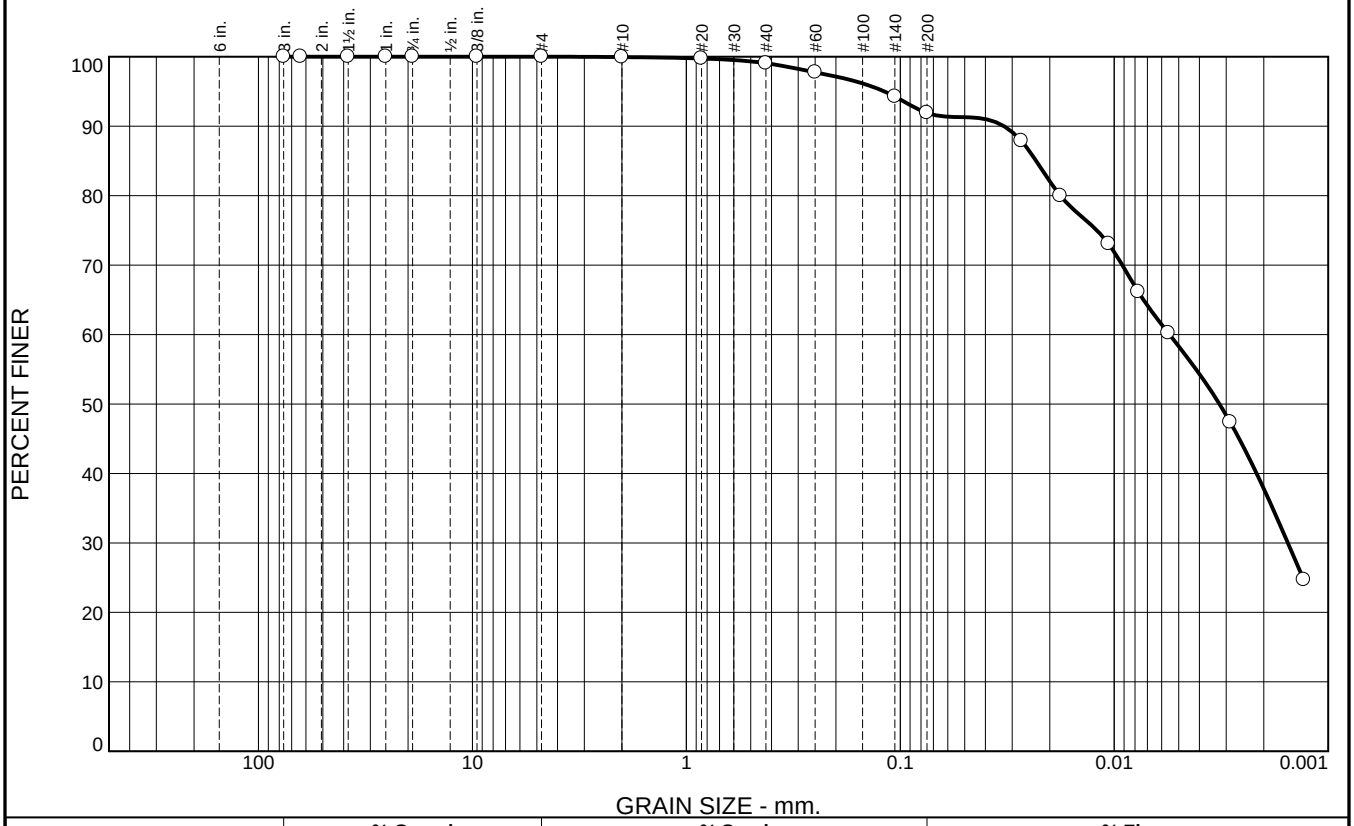
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.8	7.2	33.6	58.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.7		
#40	99.1		
#60	97.7		
#140	94.3		
#200	91.9		

* (no specification provided)

Material Description

Red, Brown, Lean CLAY
USDA: Silty Clay Loam

Atterberg Limits

PL= 19 LL= 46 PI= 27

Coefficients

D_{90}= 0.0328 D_{85}= 0.0232 D_{60}= 0.0055
D_{50}= 0.0032 D_{30}= 0.0015 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(26)

Remarks

Natural Moisture: 15.5%

Source of Sample: AQ-11 **Depth:** 82.0'-84.0'
Sample Number: S-22

Date: 4/11/2017

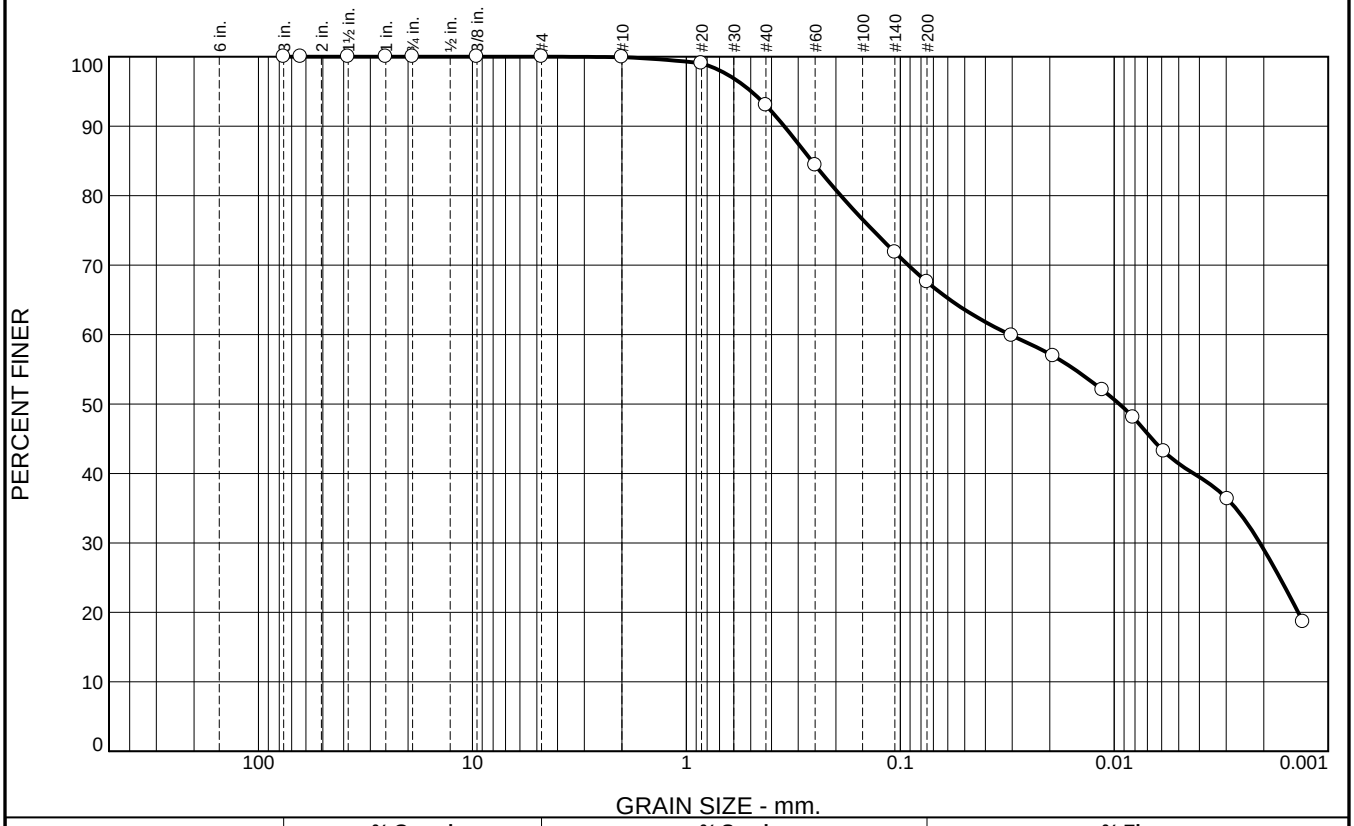
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	6.9	25.4	26.2	41.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.1		
#40	93.0		
#60	84.4		
#140	71.8		
#200	67.6		

* (no specification provided)

Material Description

Red, Brown, Sandy Lean CLAY
USDA: Clay Loam

Atterberg Limits

PL= 11 LL= 25 PI= 14

Coefficients

D_{90}= 0.3488 D_{85}= 0.2595 D_{60}= 0.0308
D_{50}= 0.0095 D_{30}= 0.0021 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

Natural Moisture: 17.1%

Source of Sample: AQ-12 **Depth:** 3.0'-5.0'
Sample Number: S-2

Date: 4/10/2017

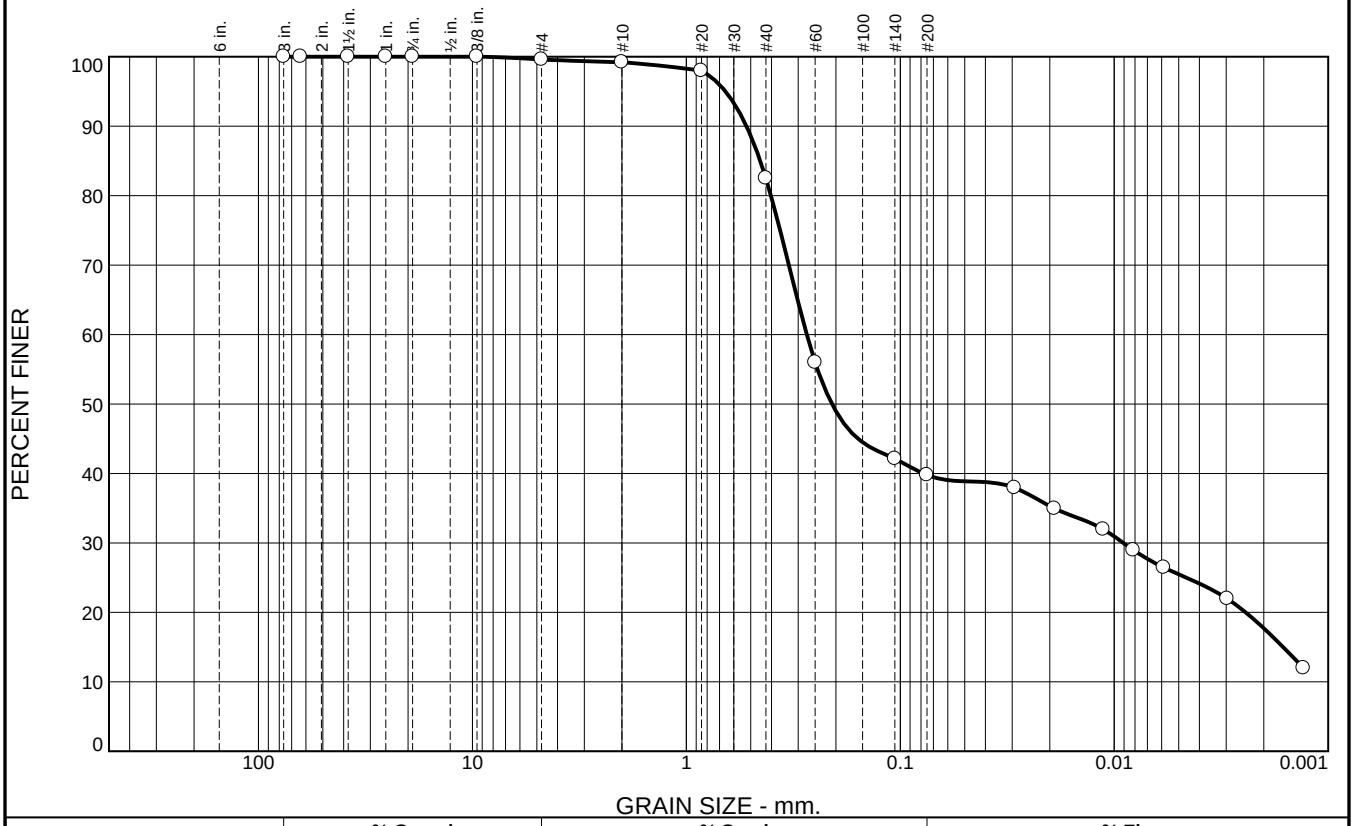
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.4	16.7	42.7	14.3	25.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.6		
#10	99.2		
#20	98.0		
#40	82.5		
#60	56.0		
#140	42.1		
#200	39.8		

* (no specification provided)

Material Description

Red, Brown, Clayey SAND
USDA: Sandy Loam

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5237 D_{85}= 0.4515 D_{60}= 0.2736
D_{50}= 0.2087 D_{30}= 0.0091 D_{15}= 0.0016
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 15.2%

Source of Sample: AQ-12 **Depth:** 13.0'-15.0'
Sample Number: S-4 **Date:** 4/12/2017

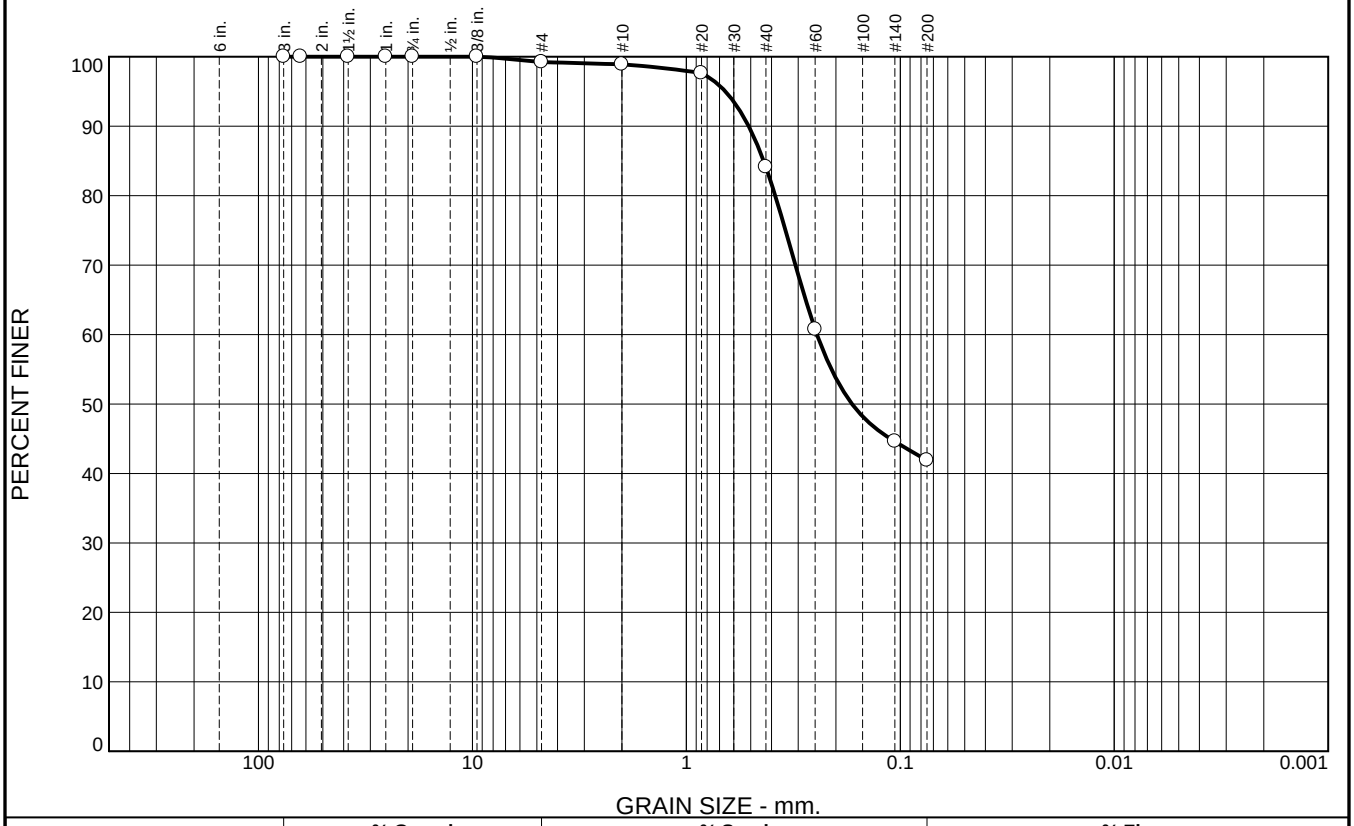
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.3	14.8	42.2	41.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.5	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.2		
#10	98.9		
#20	97.6		
#40	84.1		
#60	60.7		
#140	44.6		
#200	41.9		

* (no specification provided)

Material Description

Red, Brown, Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5114 D_{85}= 0.4353 D_{60}= 0.2451
D_{50}= 0.1681 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture: 12.0%

Source of Sample: AQ-12 **Depth:** 31.0'-33.0'
Sample Number: S-10

Date: 4/10/2017

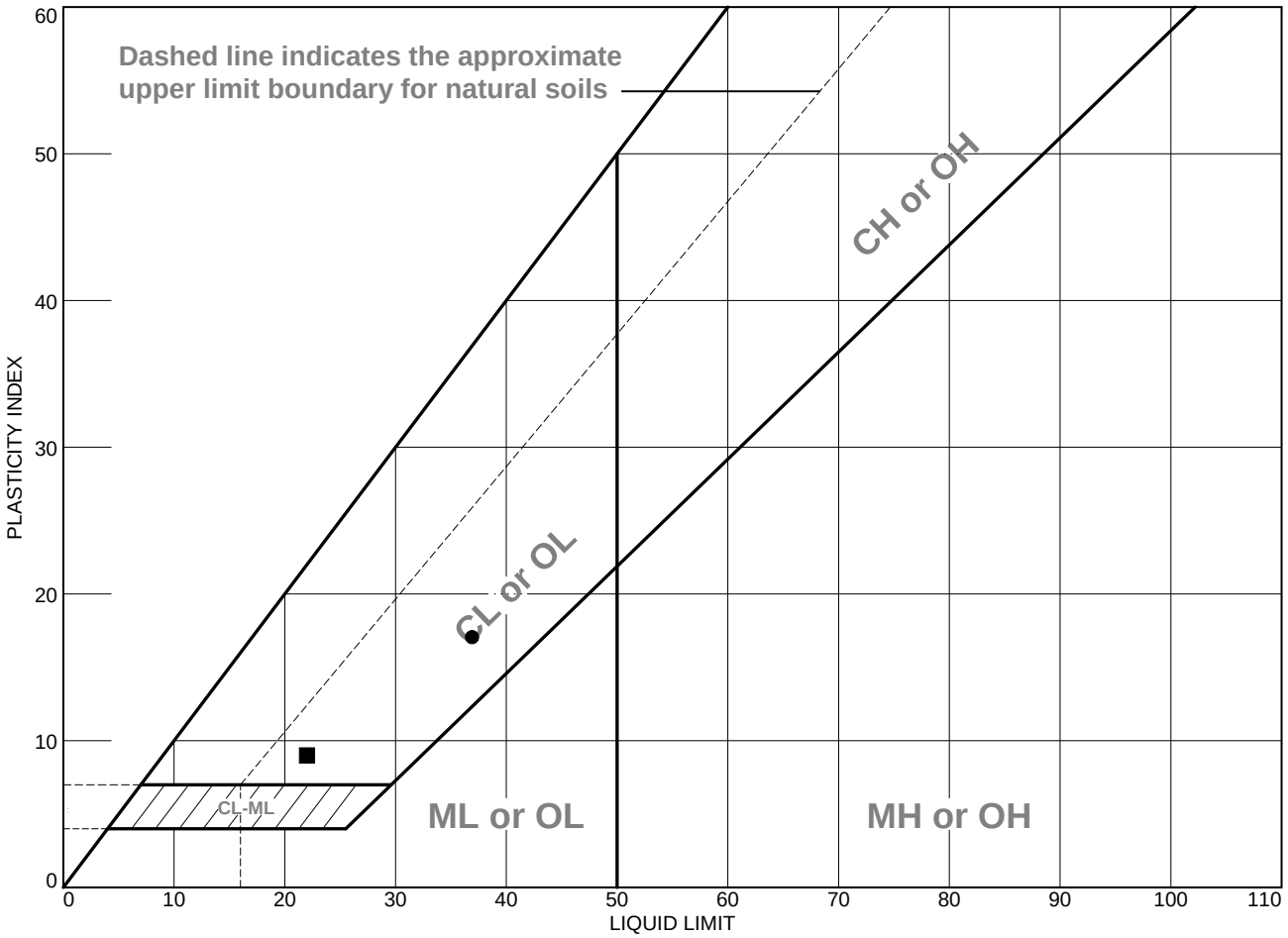
E2CR, Inc.

Baltimore, MD

Client: Anchor QEA
Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Project No: 16559-04 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish Brown, Lean CLAY with Sand USDA: Clay Loam	37	20	17	99.2	82.2	CL
■	Olive gray, brown, Lean CLAY with Sand	22	13	9			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-01 **Depth:** 3.0'-5.0' **Sample Number:** S-2

■**Source of Sample:** AQ-01 **Depth:** 13.0'-15.0' **Sample Number:** S-4A

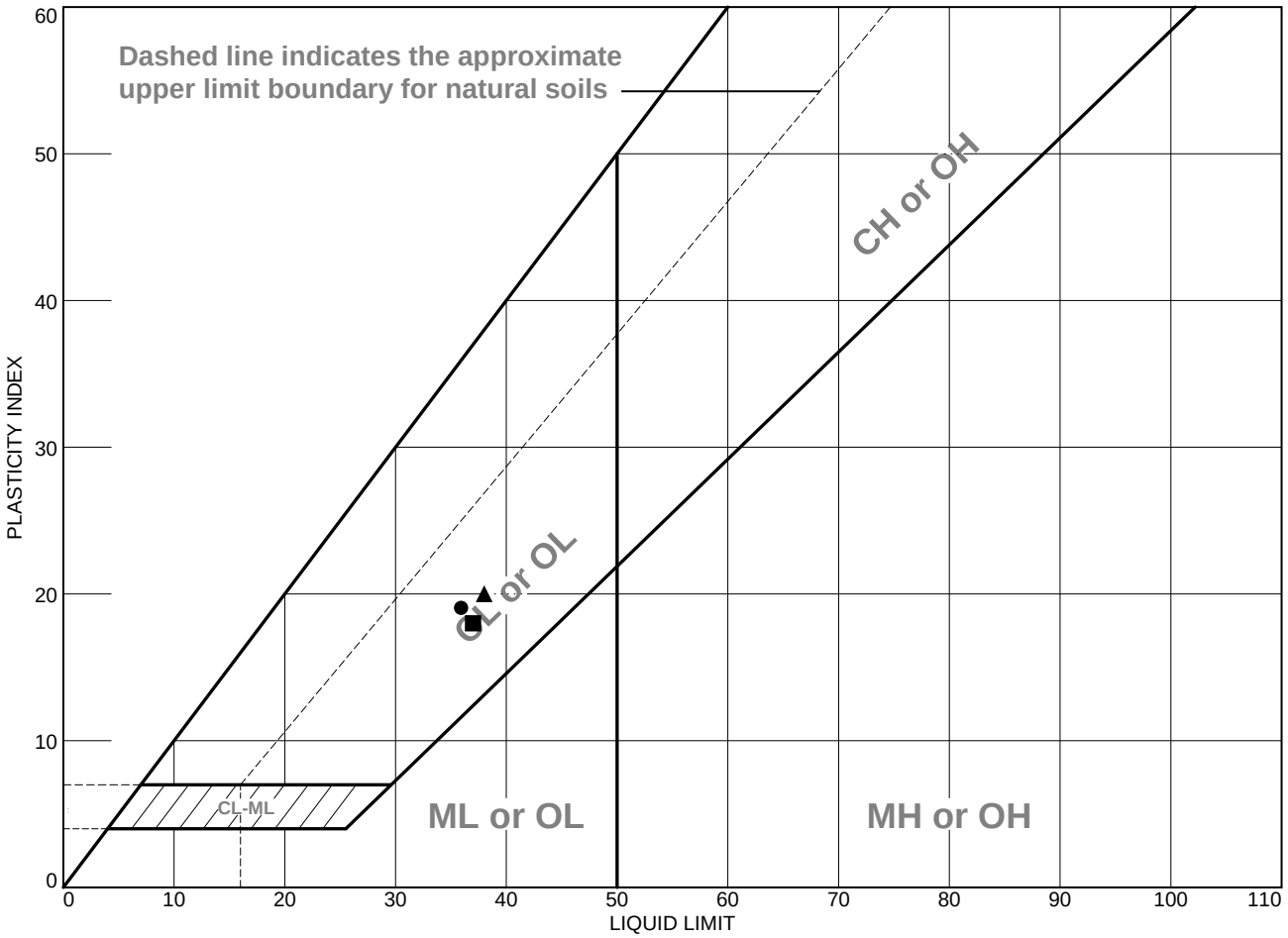
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish Brown, Lean CLAY with Sand USDA: Clay Loam	36	17	19	91.6	74.5	CL
■	Red, pink, light gray, Lean CLAY, trace Sand	37	19	18			CL
▲	Red, Gray, Brown, Lean CLAY with Sand USDA: Clay	38	18	20	94.4	76.5	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-02 **Depth:** 13.0'-15.0' **Sample Number:** S-4

■**Source of Sample:** AQ-02 **Depth:** 38.0'-40.0' **Sample Number:** S-9

▲**Source of Sample:** AQ-02 **Depth:** 44.0'-46.0' **Sample Number:** S-12

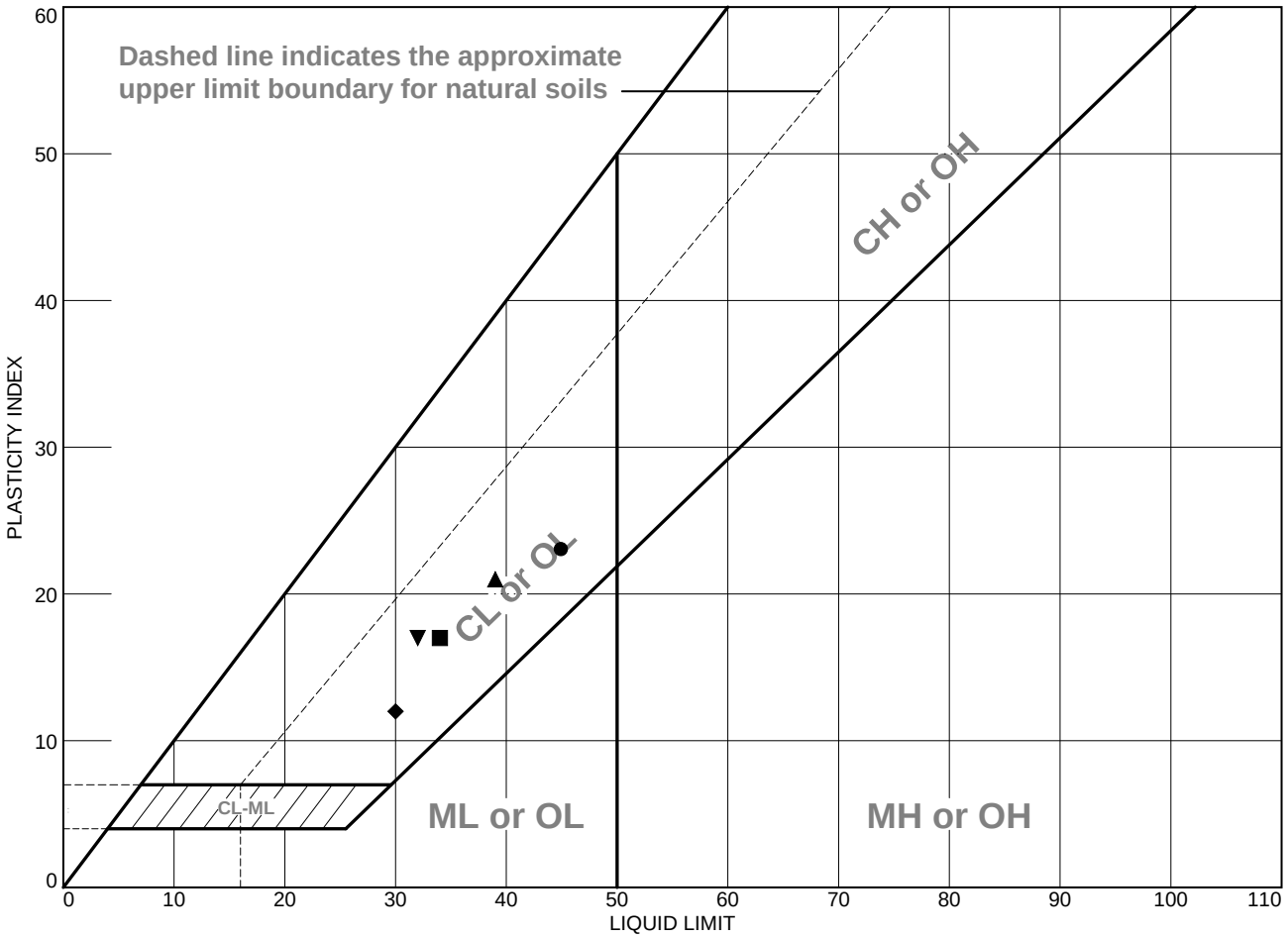
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, Reddish Brown, Lean CLAY with Sand USDA: Silty Clay Loam	45	22	23	99.5	85.1	CL
■	Red, reddish brown, pink, light gray, Lean CLAY with Sand	34	17	17			CL
▲	Red, Gray, Lean CLAY with Sand USDA: Clay	39	18	21	98.9	79.1	CL
◆	Red, reddish brown, pink, light gray, Sandy Lean CLAY	30	18	12			CL
▼	Reddish Brown, Sandy Lean CLAY USDA: Clay Loam	32	15	17	88.9	61.1	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-03 **Depth:** 3.0'-5.0' **Sample Number:** S-2
■**Source of Sample:** AQ-03 **Depth:** 8.0'-10.0' **Sample Number:** S-3
▲**Source of Sample:** AQ-03 **Depth:** 23.0'-25.0' **Sample Number:** S-6
◆**Source of Sample:** AQ-03 **Depth:** 40.0'-42.0' **Sample Number:** S-10
▼**Source of Sample:** AQ-03 **Depth:** 44.0'-46.0' **Sample Number:** S-12

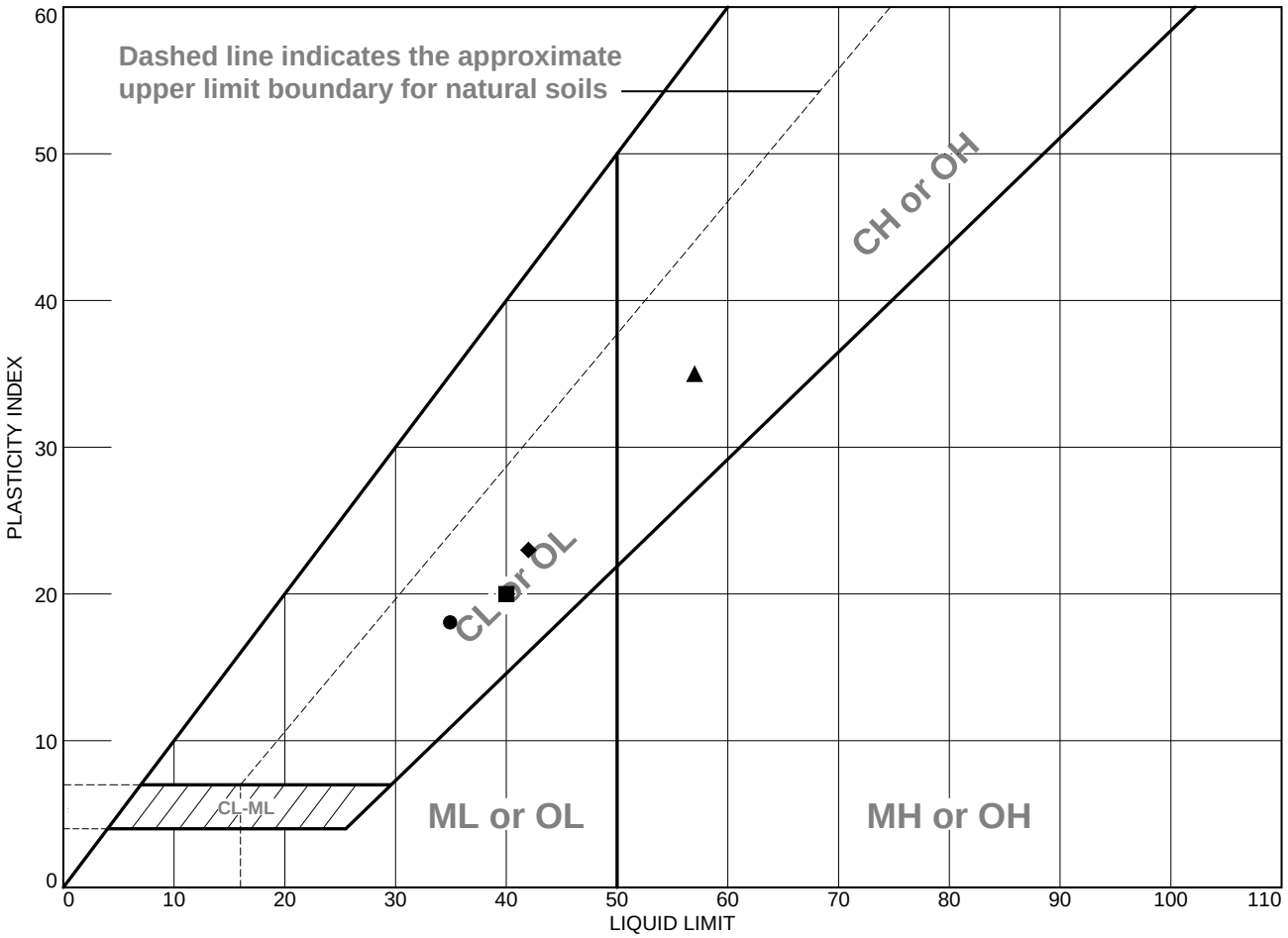
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Gray, Brown, Lean CLAY with Sand USDA: Clay Loam	35	17	18	99.2	81.1	CL
■	Red, pink, light gray, Lean CLAY	40	20	20			CL
▲	Reddish Gray, Fat CLAY with Sand USDA: Clay	57	22	35	98.0	84.7	CH
◆	Red, pink, reddish brown, light gray, Lean CLAY with Sand	42	19	23			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-04 **Depth:** 3.0'-5.0' **Sample Number:** S-2
■**Source of Sample:** AQ-04 **Depth:** 18.0'-20.0' **Sample Number:** S-5
▲**Source of Sample:** AQ-04 **Depth:** 27.0'-29.0' **Sample Number:** S-8
◆**Source of Sample:** AQ-04 **Depth:** 29.0'-31.0' **Sample Number:** S-9

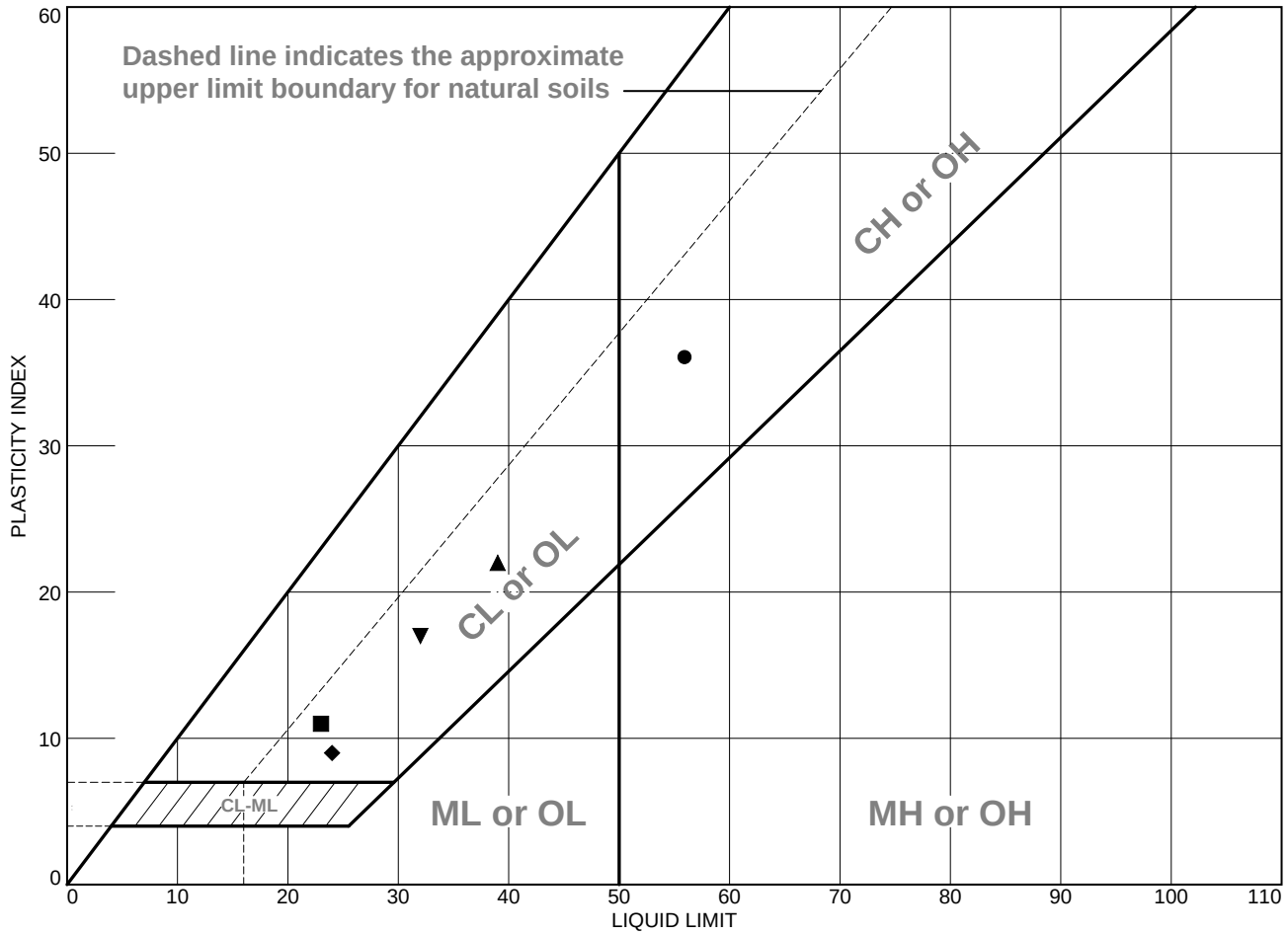
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, Red, Fat CLAY USDA: Silty Clay	56	20	36	98.7	90.5	CH
■	Red, Gray, Brown, Clayey SAND USDA: Sandy Loam	23	12	11	77.2	30.6	SC
▲	Reddish brown, red, Lean CLAY with Sand	39	17	22			CL
◆	Reddish brown, red, Lean CLAY with Sand	24	15	9			CL
▼	Red, Tan, Sandy Lean CLAY USDA: Loam	32	15	17	76.4	59.5	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-05 **Depth:** 13.0'-15.0' **Sample Number:** S-4
■**Source of Sample:** AQ-05 **Depth:** 38.0'-40.0' **Sample Number:** S-9
▲**Source of Sample:** AQ-05 **Depth:** 63.0'-65.0' **Sample Number:** S-14
◆**Source of Sample:** AQ-05 **Depth:** 74.0'-76.0' **Sample Number:** S-16A
▼**Source of Sample:** AQ-05 **Depth:** 82.0'-84.0' **Sample Number:** S-20

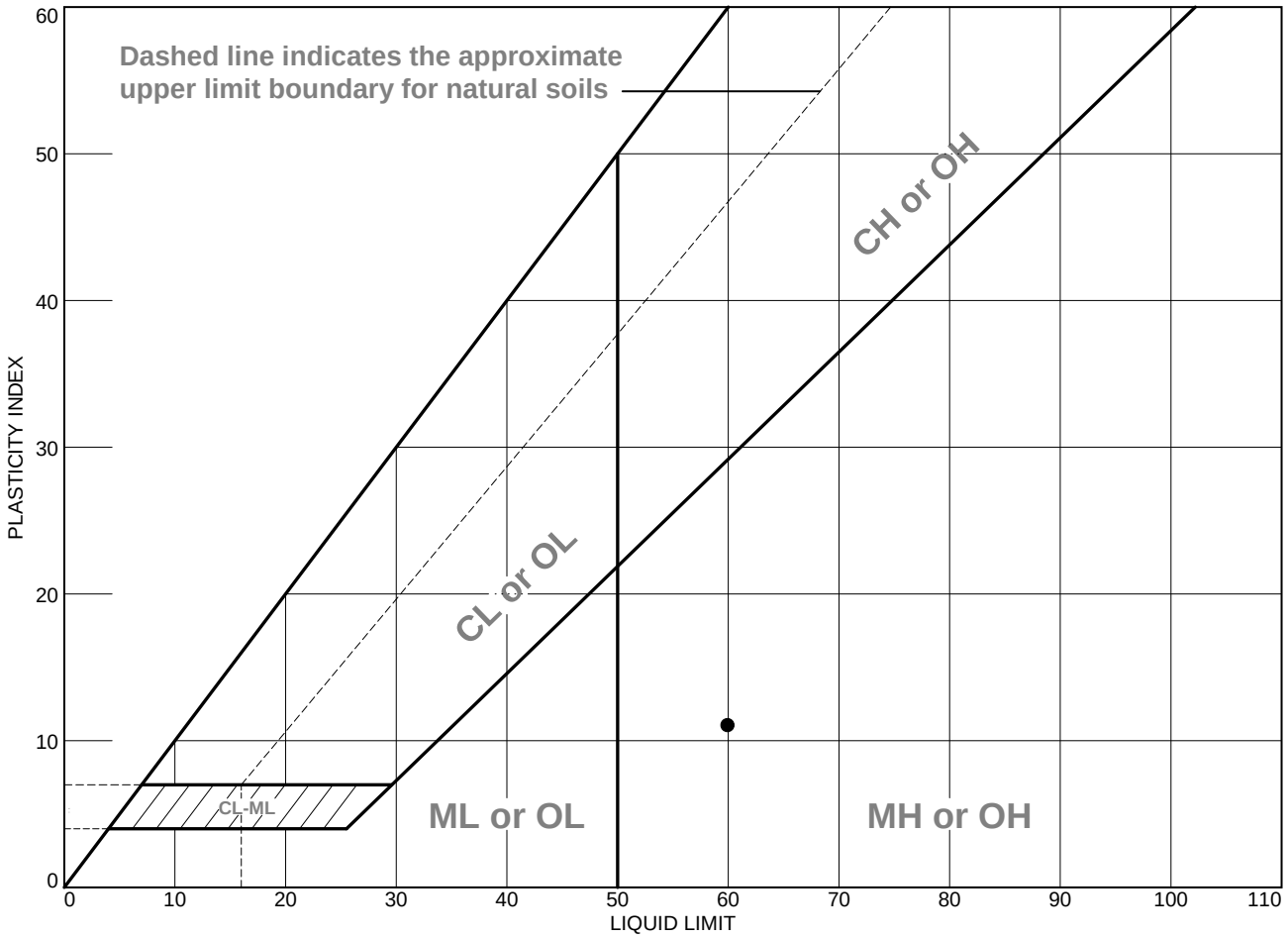
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Tan, Brown, Elastic SILT USDA: Silt	60	49	11	99.8	99.1	MH

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-05 **Depth:** 88.0'-90.0' **Sample Number:** S-23

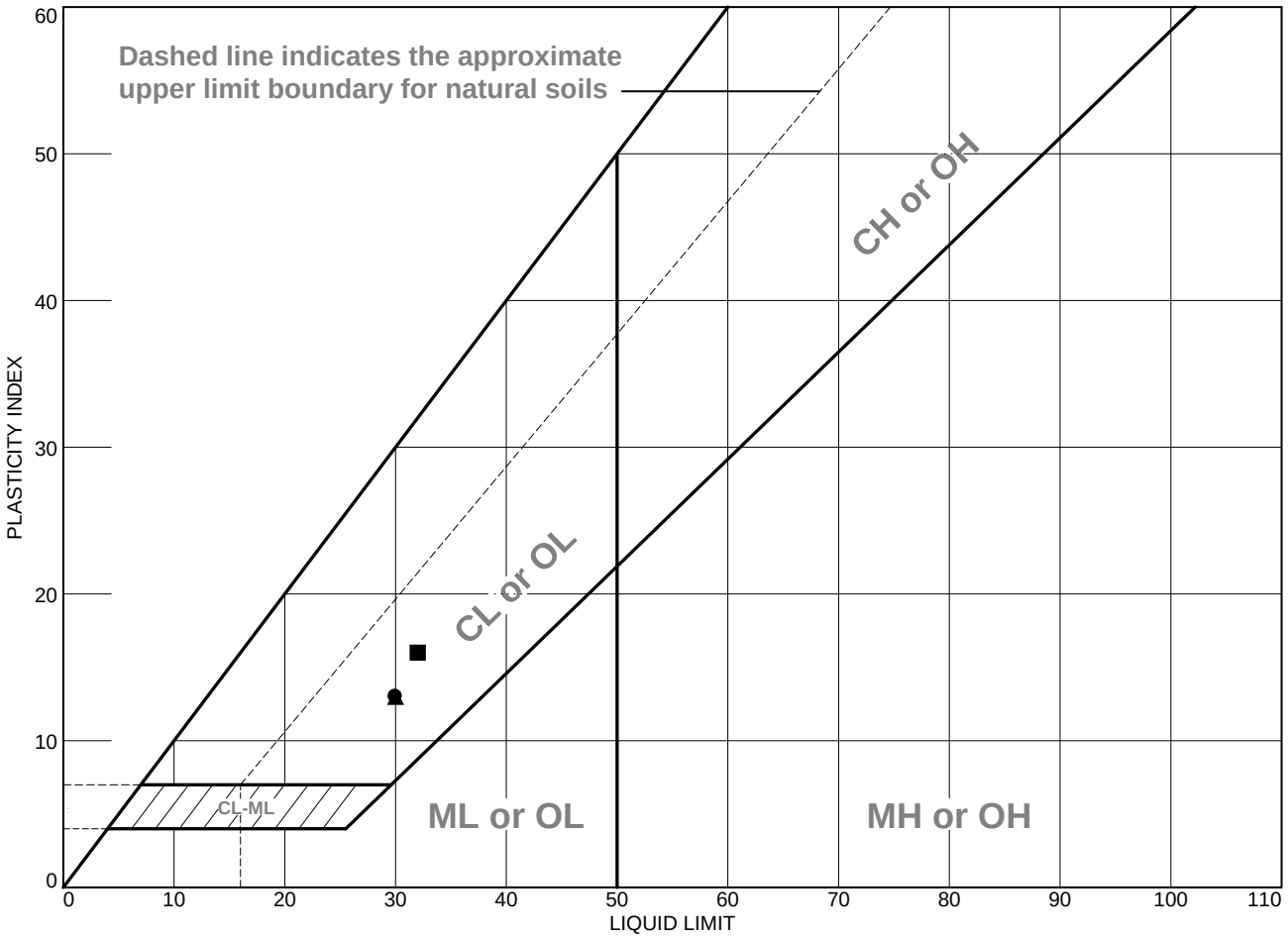
Remarks:

E2CR, Inc.

Baltimore, MD

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, Brown, Lean CLAY with Sand USDA: Clay Loam	30	17	13	99.4	80.6	CL
■	Red, pink, reddish brown, light gray, Lean CLAY with Sand	32	16	16			CL
▲	Red, reddish brown, light gray, Lean CLAY with Sand	30	17	13			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-06 **Depth:** 3.0'-5.0' **Sample Number:** S-2

■**Source of Sample:** AQ-06 **Depth:** 23.0'-25.0' **Sample Number:** S-6

▲**Source of Sample:** AQ-06 **Depth:** 35.0'-37.0' **Sample Number:** S-12

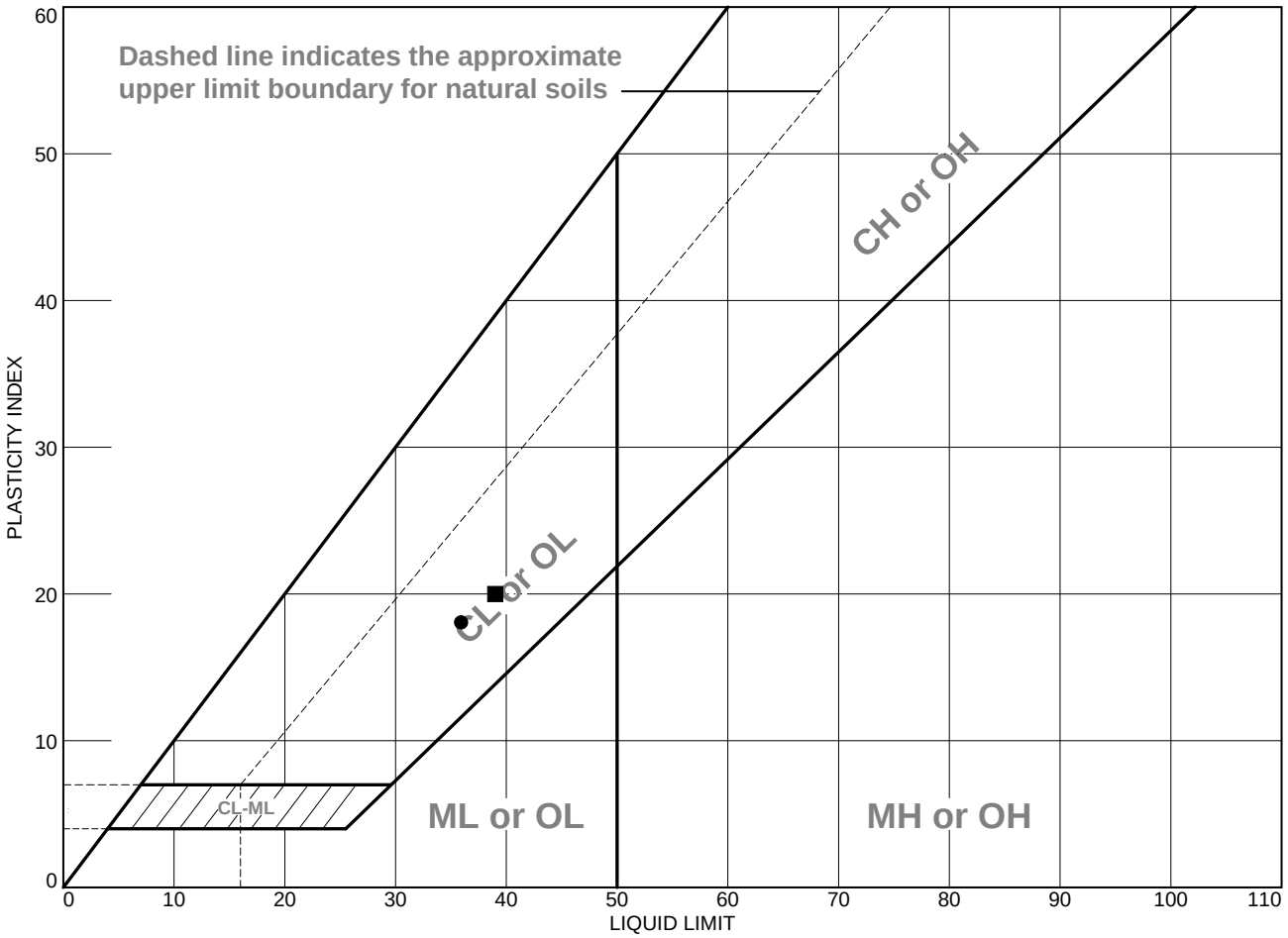
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Gray, Brown, Lean CLAY with Sand USDA: Clay Loam	36	18	18	99.2	80.2	CL
■	Red, pink, reddish brown, light gray, Lean CLAY with Sand	39	19	20			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-07 **Depth:** 8.0'-10.0' **Sample Number:** S-3

■**Source of Sample:** AQ-07 **Depth:** 23.0'-25.0' **Sample Number:** S-6

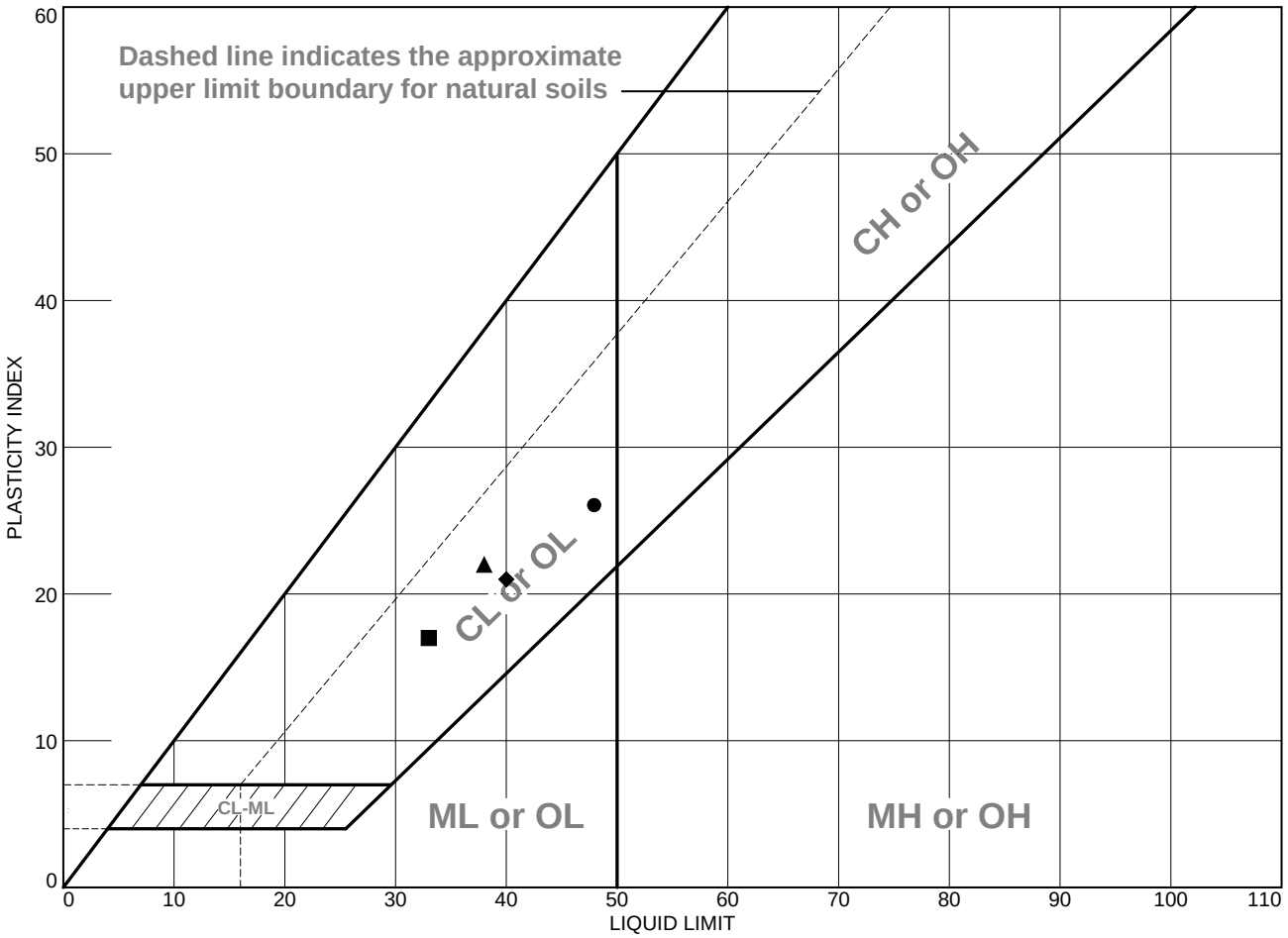
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Brown, Lean CLAY USDA: Silty Clay	48	22	26	99.8	95.9	CL
■	Reddish Brown, Lean CLAY with Sand USDA: Loam	33	16	17	96.1	73.4	CL
▲	Light gray, red, Lean CLAY, with Sand	38	16	22			CL
◆	Light gray, red, Lean CLAY, with Sand	40	19	21			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

Remarks:

●**Source of Sample:** AQ-08 **Depth:** 3.0'-5.0' **Sample Number:** S-2

■**Source of Sample:** AQ-08 **Depth:** 18.0'-20.0' **Sample Number:** S-5

▲**Source of Sample:** AQ-08 **Depth:** 55.0'-57.0' **Sample Number:** S-13

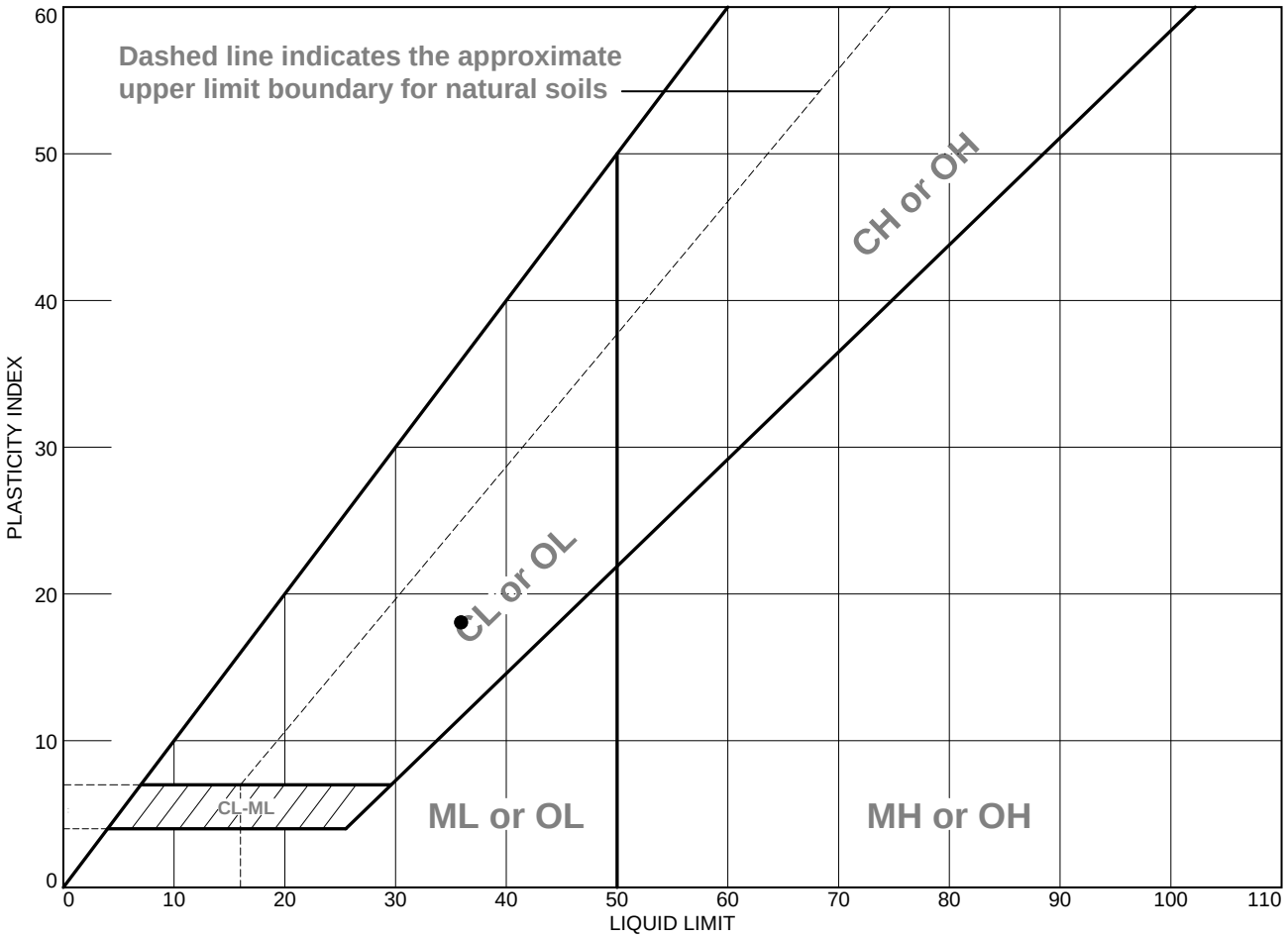
◆**Source of Sample:** AQ-08 **Depth:** 59.0'-61.0' **Sample Number:** S-15

E2CR, Inc.

Baltimore, MD

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, Red, Tan, Lean CLAY with Sand USDA: Silty Clay Loam	36	18	18	95.3	81.3	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-09 **Depth:** 8.0'-10.0' **Sample Number:** S-3

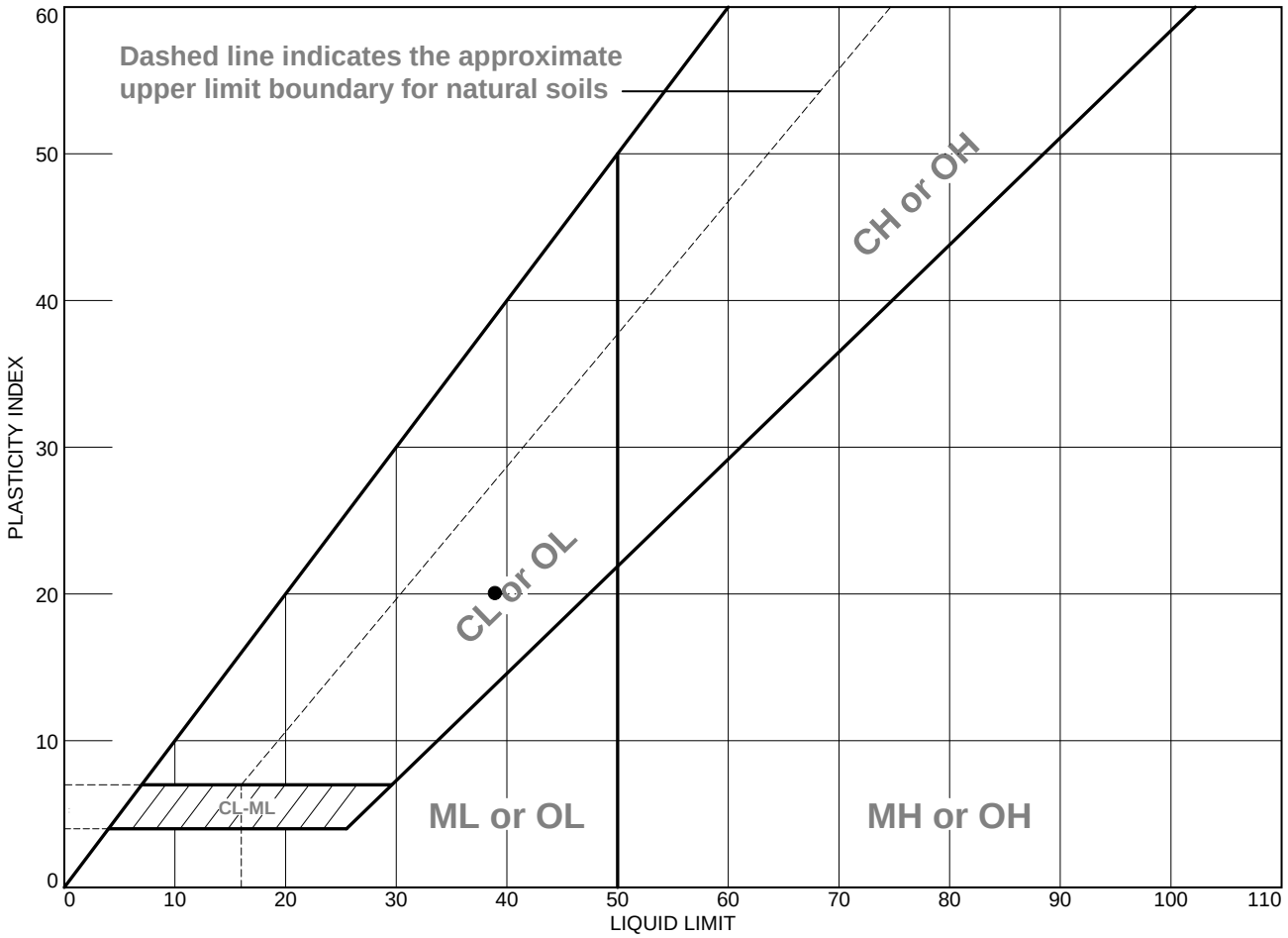
Remarks:

E2CR, Inc.

Baltimore, MD

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Brown, Lean CLAY with Sand USDA: Clay	39	19	20	98.4	83.8	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-10 **Depth:** 3.0'-5.0' **Sample Number:** S-2

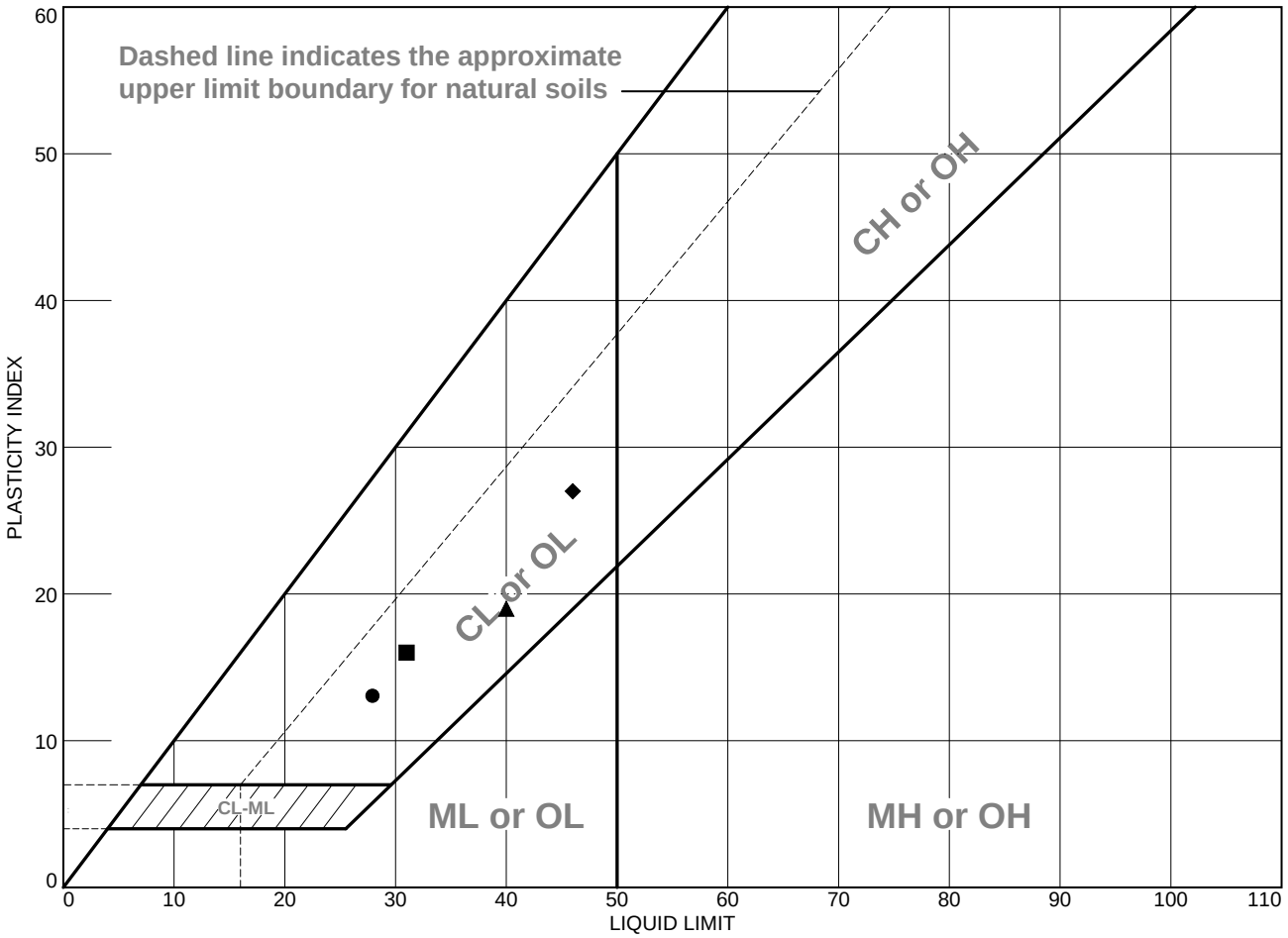
Remarks:

E2CR, Inc.

Baltimore, MD

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Brown, Sandy Lean CLAY USDA: Loam	28	15	13	88.5	60.8	CL
■	Red, Gray, Lean CLAY with Sand USDA: Clay Loam	31	15	16	99.6	79.3	CL
▲	Red, reddish brown, light gray, Lean CLAY with Sand	40	21	19			CL
◆	Red, Brown, Lean CLAY USDA: Silty Clay Loam	46	19	27	99.1	91.9	CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-11 **Depth:** 8.0'-10.0' **Sample Number:** S-3
■**Source of Sample:** AQ-11 **Depth:** 38.0'-40.0' **Sample Number:** S-9
▲**Source of Sample:** AQ-11 **Depth:** 68.0'-70.0' **Sample Number:** S-15
◆**Source of Sample:** AQ-11 **Depth:** 82.0'-84.0' **Sample Number:** S-22

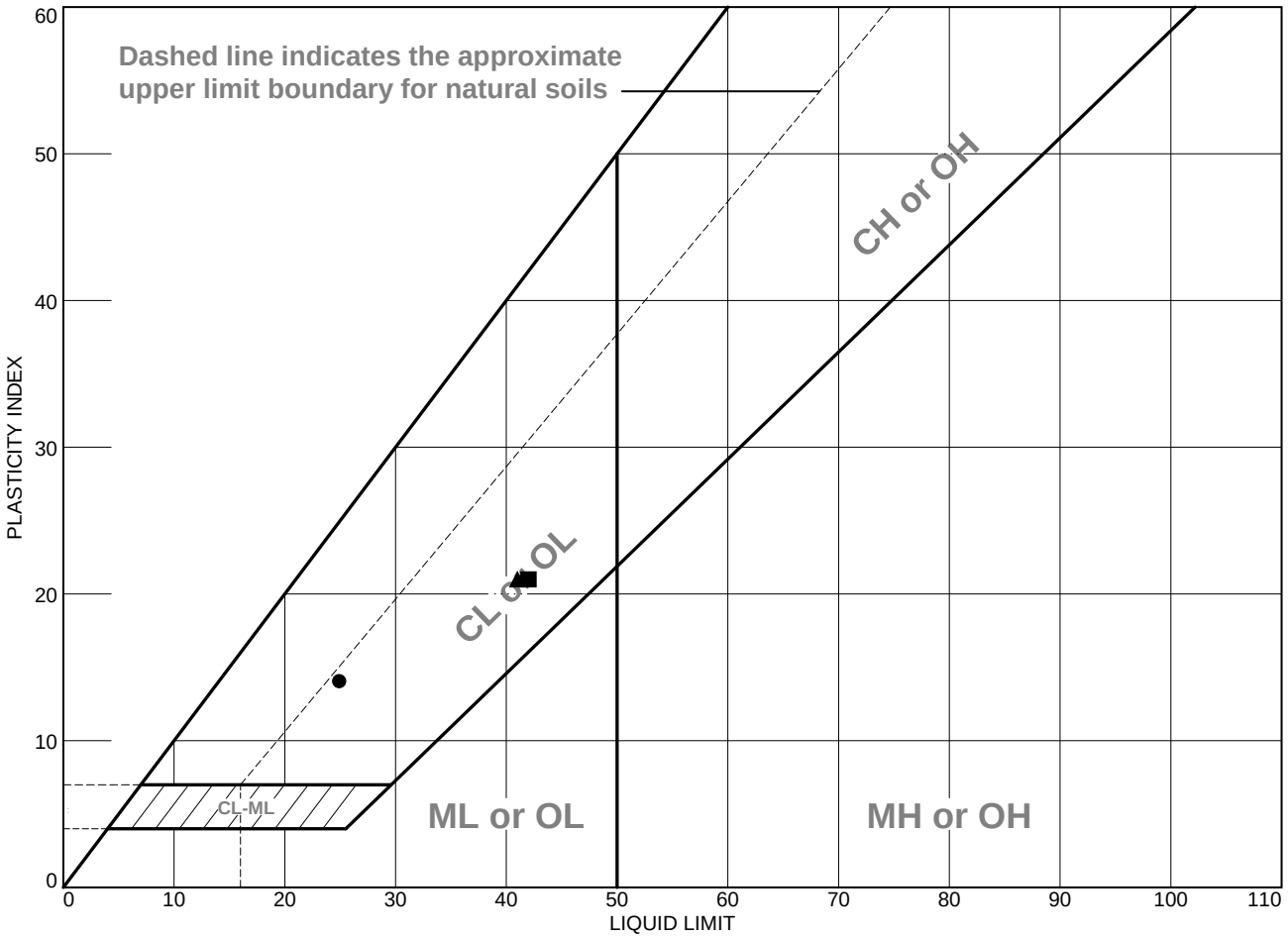
E2CR, Inc.

Baltimore, MD

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red, Brown, Sandy Lean CLAY USDA: Clay Loam	25	11	14	93.0	67.6	CL
■	Red, brown, Lean CLAY with Sand	42	21	21			CL
▲	Gray, red, brown, Lean CLAY with Sand	41	20	21			CL

Project No. 16559-04 **Client:** Anchor QEA

Project: CRISTAL USA STOCKPILE CHARACTERIZATION

●**Source of Sample:** AQ-12 **Depth:** 3.0'-5.0' **Sample Number:** S-2
■**Source of Sample:** AQ-12 **Depth:** 25.0'-27.0' **Sample Number:** S-7
▲**Source of Sample:** AQ-12 **Depth:** 35.0'-37.0' **Sample Number:** S-12

E2CR, Inc.

Baltimore, MD

Remarks:

Figure

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Boston
Atlanta
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Los Angeles
New York
www.geotesting.com

Transmittal

TO:

Rick Schwarz

Anchor QEA, LLC

6720 SW Macadam Ave, Suite 125

Portland, OR 97219

DATE: 5/4/2017	GTX NO: 306179
RE: Cristal	

COPIES	DATE	DESCRIPTION
	5/4/2017	**April 2017 Laboratory Test Report**

REMARKS:

SIGNED:

Ethan Marro, Assistant Laboratory Manager

CC:

APPROVED BY:

Joe Tomei, Laboratory Manager

May 4, 2017

Rick Schwarz
Anchor QEA, LLC
6720 SW Macadam Ave, Suite 125
Portland, OR 97219

RE: Cristal, MD (GTX-306179)

Dear Rick:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received six samples from you on 3/21/2017. These samples were labeled as follows:

Sample
TP01
TP02
TP04
TP05
TP06
TP08A

GTX performed the following tests on these samples:

ASTM D2216 - Moisture Content
ASTM D2974 - Moisture, Ash and Organic Matter
ASTM D854 - Specific Gravity
ASTM D422 - Grain Size Analysis - Sieve and Hydrometer
ASTM D4318 - Atterberg Limits
ASTM D698 - Standard Proctor
ASTM D5084 - Flexible Wall Permeability
ASTM D4767 - Three-Point CU Triaxial Shear Test Series

As requested, the permeability and triaxial test specimens were compacted to a target density of 95% of the maximum dry density at the optimum moisture content.

A copy of your test request is attached.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Ethan Marro
Assistant Laboratory Manager

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Boston
Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

Geotechnical Test Report **5/4/2017**

GTX-306179

Cristal

MD

Client Project No.: 160530-06.01

Prepared for:

Anchor QEA, LLC

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	---	Tested By:	jbr
Sample ID:	---	Test Date:	03/24/17	Checked By:	emm
Depth :	---	Test Id:	406943		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content, %
---	TP01	---	Moist, mottled light gray and light reddish brown clay with sand	13.7
---	TP02	---	Moist, mottled pinkish white and reddish brown clay with sand	16.6
---	TP04	---	Moist, mottled light gray and red clay with sand	19.1
---	TP05	---	Moist, mottled white and red clay	17.8
---	TP06	---	Moist, mottled light gray and light reddish brown clay with sand	16.0
---	TP08A	---	Moist, mottled red and light gray sandy clay	13.6

Notes: Temperature of Drying : 110º Celsius

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	---	Tested By:	cam
Sample ID:	---	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406967		

Moisture, Ash, and Organic Matter - ASTM D2974

Boring ID	Sample ID	Depth	Description	Moisture Content, %	Ash Content, %	Organic Matter, %
---	TP01	---	Moist, mottled light gray and light reddish brown clay with sand	14	98.8	1.2
---	TP02	---	Moist, mottled pinkish white and reddish brown clay with sand	17	98.6	1.4
---	TP04	---	Moist, mottled light gray and red clay with sand	19	98.6	1.4
---	TP05	---	Moist, mottled white and red clay	18	98.8	1.2
---	TP06	---	Moist, mottled light gray and light reddish brown clay with sand	16	98.0	2.0
---	TP08A	---	Moist, mottled red and light gray sandy clay	14	99.2	.8

Notes: Moisture content determined by Method A and reported as a percentage of oven-dried mass;
dried to a constant mass at temperature of 105º C
Ash content and organic matter determined by Method C; dried to constant mass at temperature 440º C

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	---	Tested By:	jbr
Sample ID:	---	Test Date:	03/28/17	Checked By:	emm
Depth :	---	Test Id:	406961		

Specific Gravity of Soils by ASTM D854

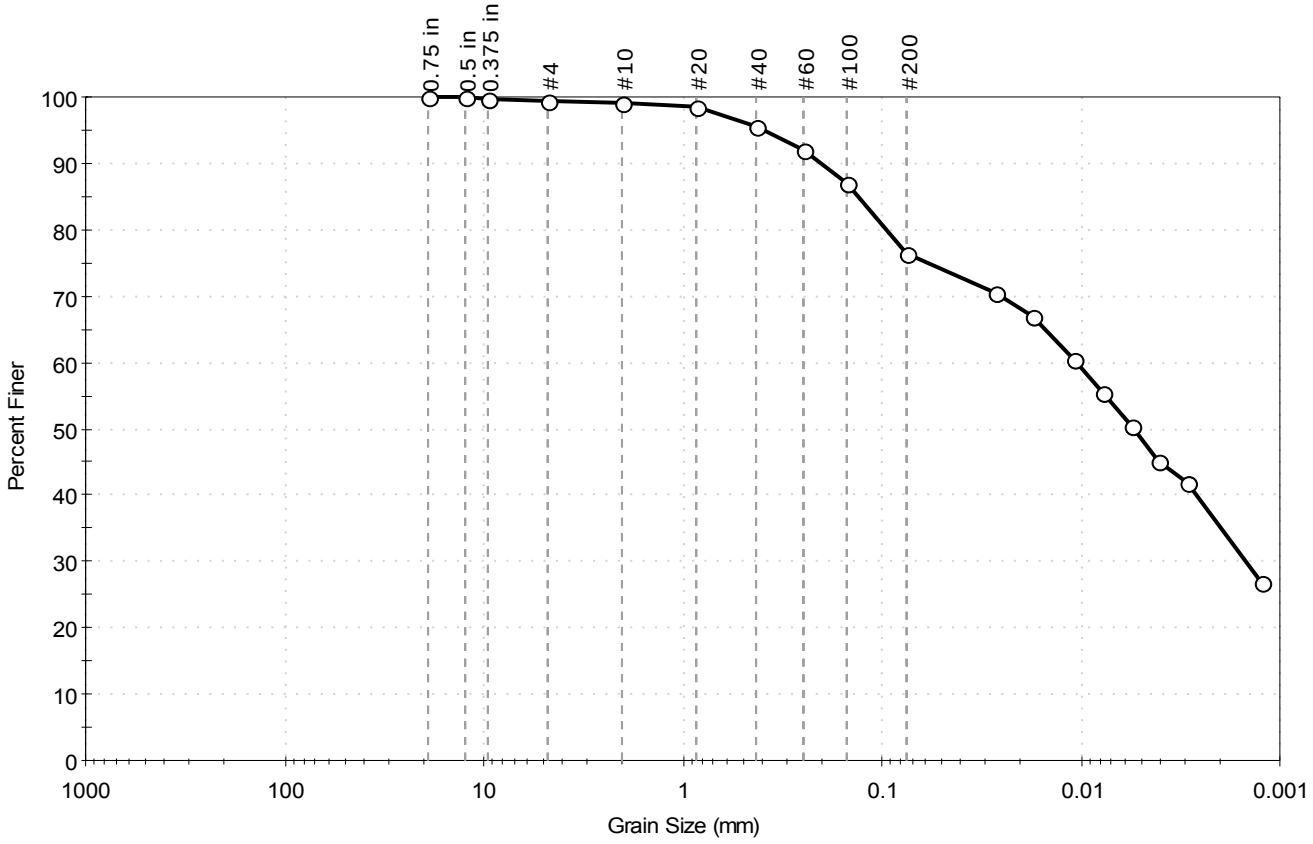
Boring ID	Sample ID	Depth	Visual Description	Specific Gravity	Comment
---	TP01	---	Moist, mottled light gray and light reddish brown clay with sand	2.72	
---	TP02	---	Moist, mottled pinkish white and reddish brown clay with sand	2.73	
---	TP04	---	Moist, mottled light gray and red clay with sand	2.71	
---	TP05	---	Moist, mottled white and red clay	2.72	
---	TP06	---	Moist, mottled light gray and light reddish brown clay with sand	2.69	
---	TP08A	---	Moist, mottled red and light gray sandy clay	2.66	

Notes: Specific Gravity performed by using method B (oven dried specimens) of ASTM D854
Moisture Content determined by ASTM D2216.

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP01	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406950		

Test Comment: ---
Visual Description: Moist, mottled light gray and light reddish brown clay with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.6	22.9	76.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	100		
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	98		
#40	0.42	95		
#60	0.25	92		
#100	0.15	87		
#200	0.075	76		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0272	70		
---	0.0174	67		
---	0.0108	60		
---	0.0078	55		
---	0.0056	50		
---	0.0041	45		
---	0.0029	42		
---	0.0013	27		

Coefficients

D_{85} = 0.1320 mm	D_{30} = 0.0015 mm
D_{60} = 0.0106 mm	D_{15} = N/A
D_{50} = 0.0055 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay with sand (CL)

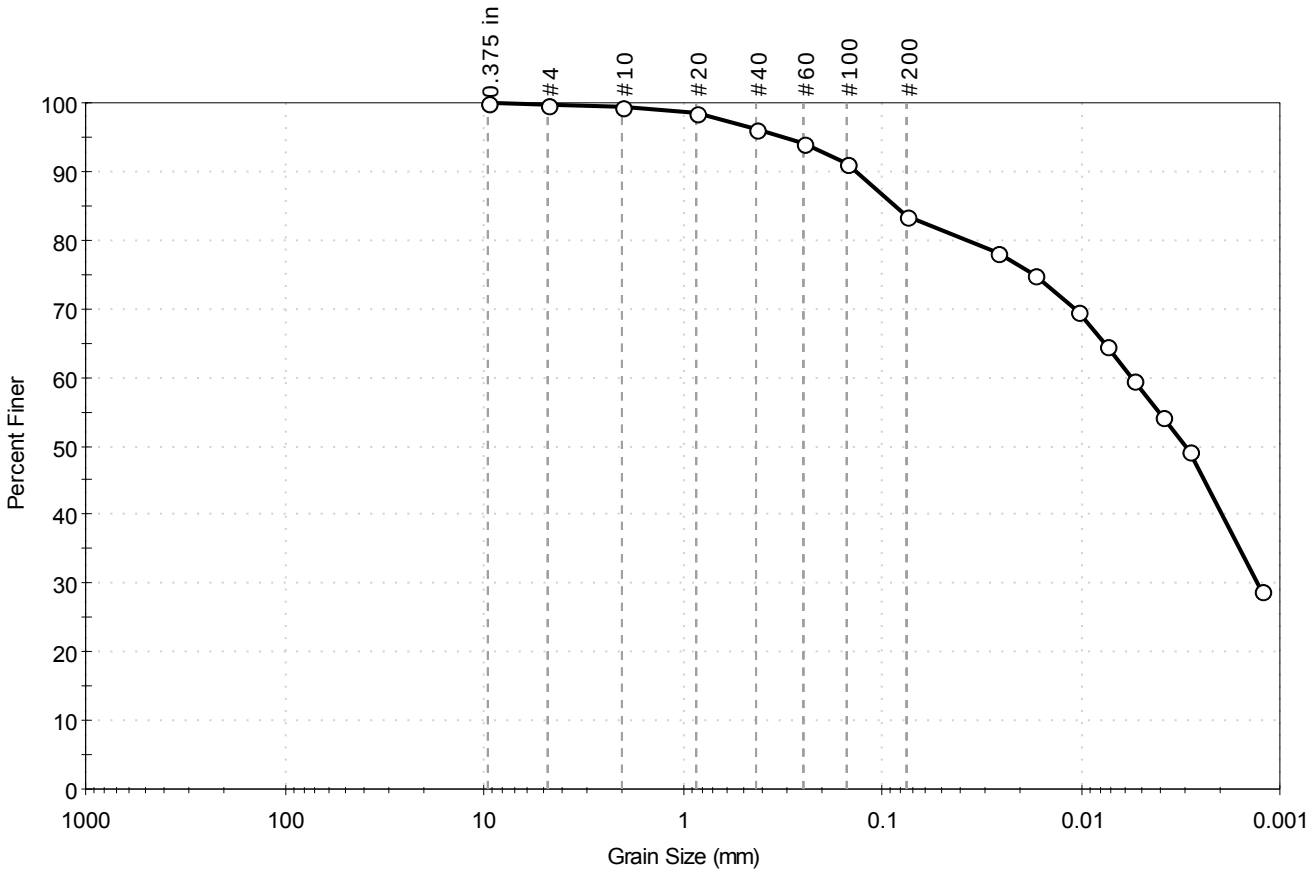
AASHTO Clayey Soils (A-6 (10))

Sample / Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP02	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406951		
Test Comment:	---				
Visual Description:	Moist, mottled pinkish white and reddish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.2	16.1	83.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	96		
#60	0.25	94		
#100	0.15	91		
#200	0.075	84		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0264	78		
---	0.0169	75		
---	0.0103	70		
---	0.0075	65		
---	0.0054	60		
---	0.0039	54		
---	0.0028	49		
---	0.0012	29		

Coefficients

D_{85} = 0.0851 mm	D_{30} = 0.0013 mm
D_{60} = 0.0056 mm	D_{15} = N/A
D_{50} = 0.0030 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay with sand (CL)

AASHTO Clayey Soils (A-6 (17))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

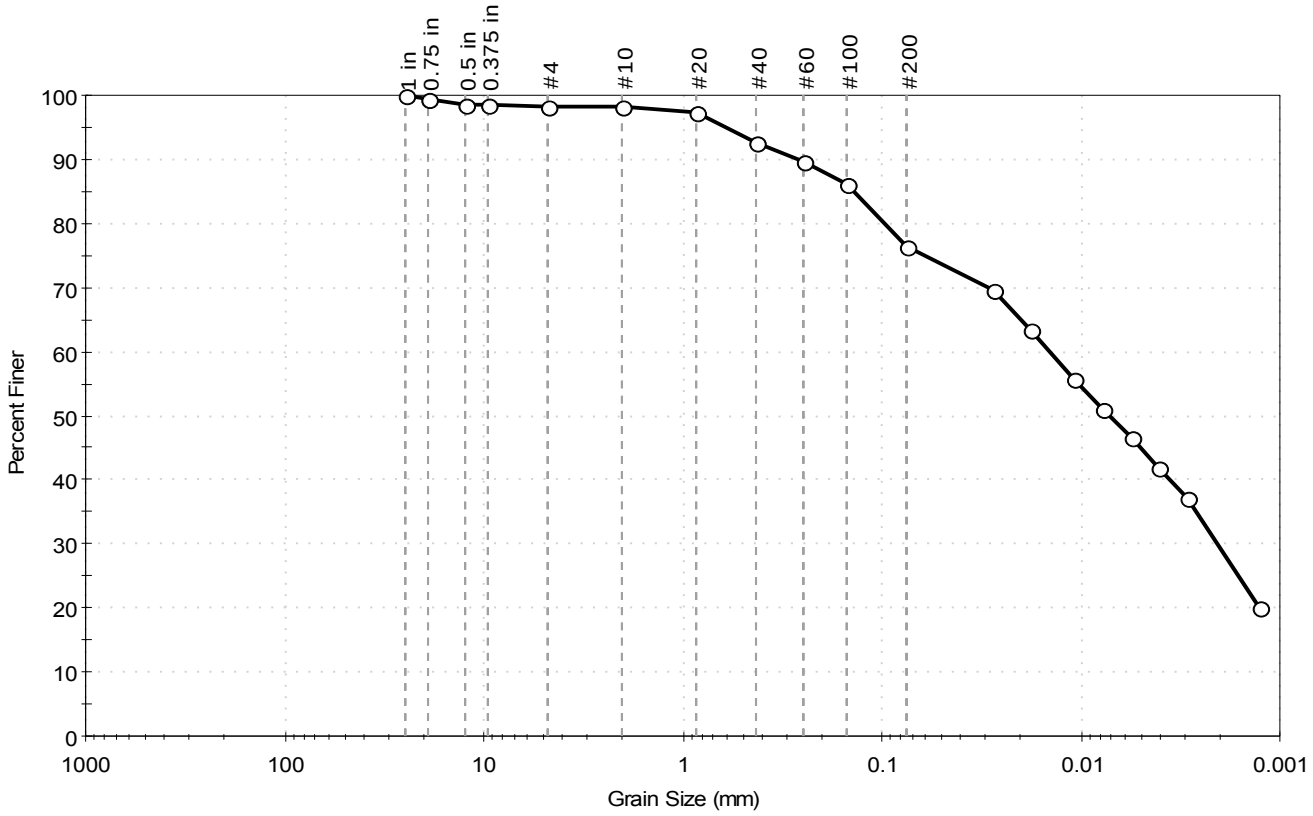
Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP04	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406952		

Test Comment: ---
Visual Description: Moist, mottled light gray and red clay with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.8	21.7	76.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	99		
0.5 in	12.50	99		
0.375 in	9.50	98		
#4	4.75	98		
#10	2.00	98		
#20	0.85	97		
#40	0.42	93		
#60	0.25	90		
#100	0.15	86		
#200	0.075	76		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0275	70		
---	0.0180	64		
---	0.0108	56		
---	0.0078	51		
---	0.0056	46		
---	0.0041	42		
---	0.0030	37		
---	0.0013	20		

Coefficients

D_{85} = 0.1385 mm	D_{30} = 0.0021 mm
D_{60} = 0.0143 mm	D_{15} = N/A
D_{50} = 0.0072 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay with sand (CL)

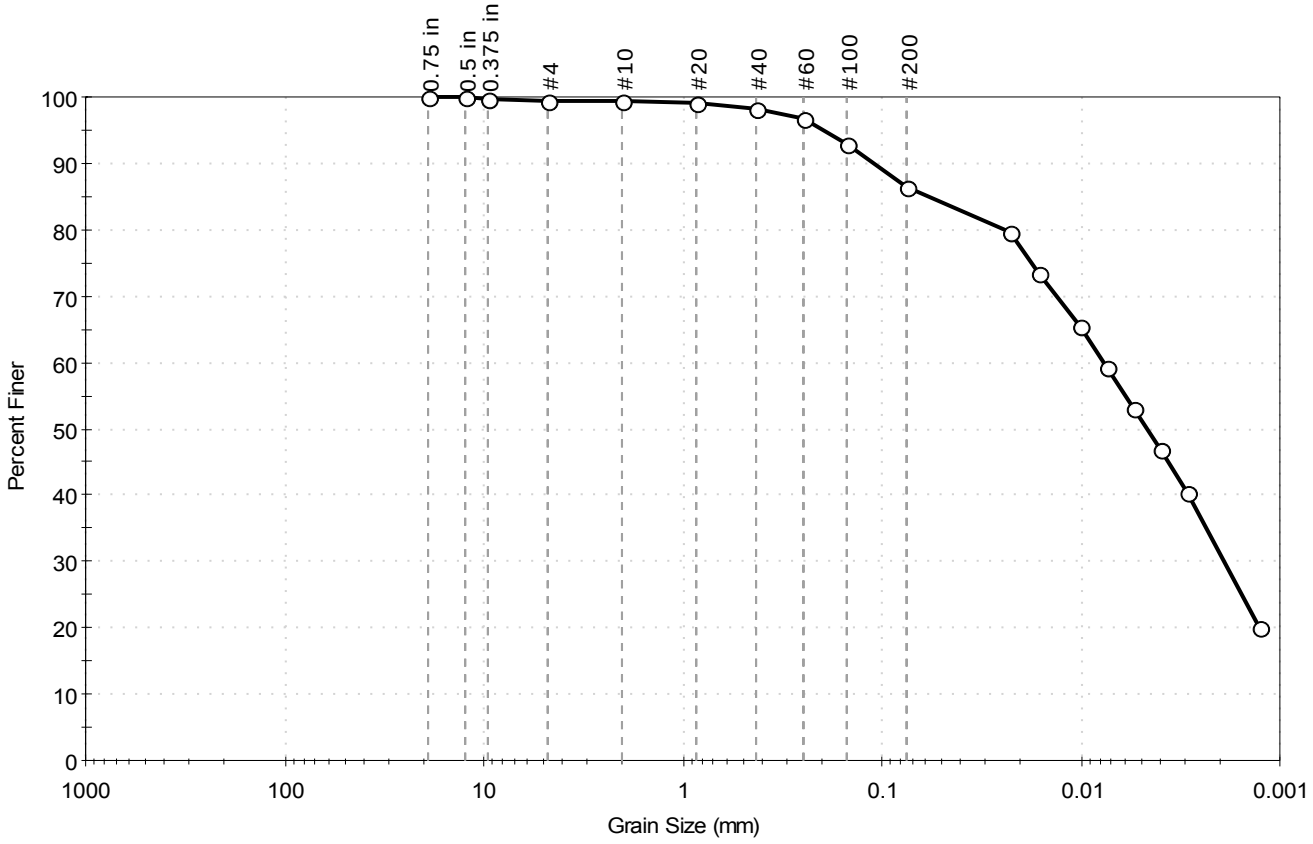
AASHTO Clayey Soils (A-7-6 (15))

Sample / Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP05	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406953		
Test Comment:	---				
Visual Description:	Moist, mottled white and red clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.6	13.1	86.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	100		
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	93		
#200	0.075	86		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0226	80		
---	0.0165	73		
---	0.0102	66		
---	0.0075	59		
---	0.0054	53		
---	0.0040	47		
---	0.0029	41		
---	0.0013	20		

Coefficients

D_{85} = 0.0593 mm	D_{30} = 0.0019 mm
D_{60} = 0.0077 mm	D_{15} = N/A
D_{50} = 0.0047 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay (CL)

AASHTO Clayey Soils (A-6 (16))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

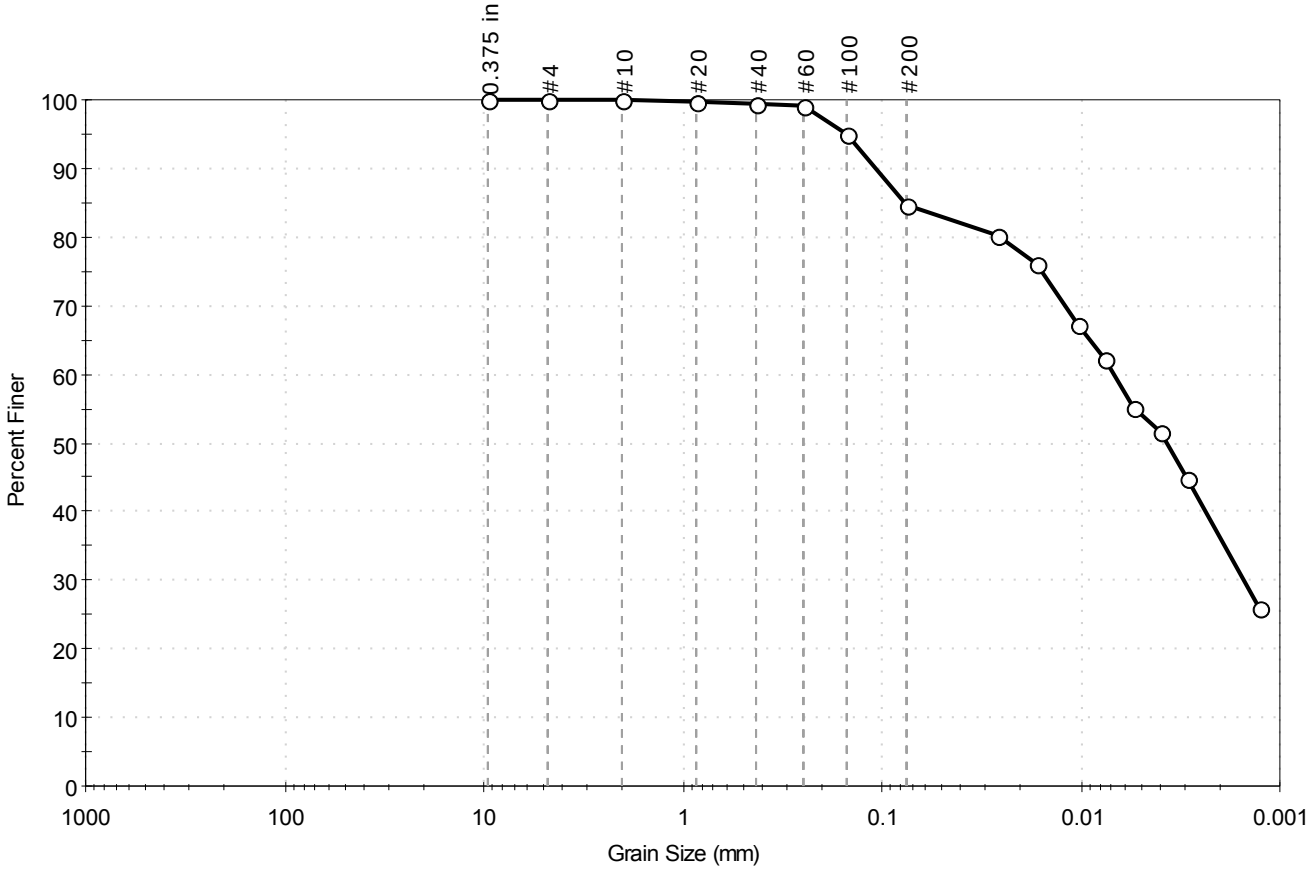
Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP06	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406954		

Test Comment: ---
Visual Description: Moist, mottled light gray and light reddish brown clay with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	15.2	84.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	95		
#200	0.075	85		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0264	80		
---	0.0167	76		
---	0.0104	67		
---	0.0075	62		
---	0.0055	55		
---	0.0040	52		
---	0.0029	45		
---	0.0013	26		

Coefficients

D_{85} = 0.0763 mm	D_{30} = 0.0015 mm
D_{60} = 0.0068 mm	D_{15} = N/A
D_{50} = 0.0037 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay with sand (CL)

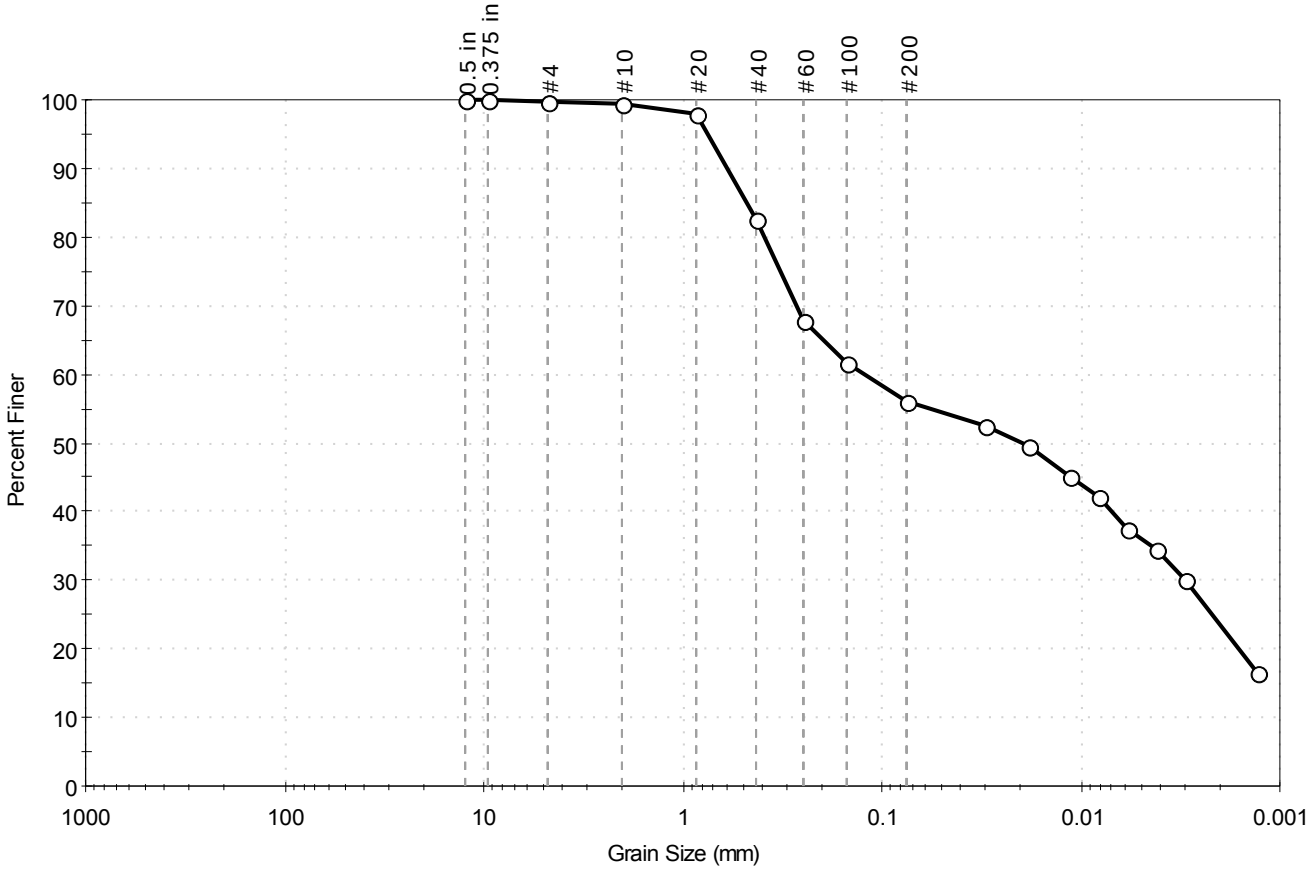
AASHTO Clayey Soils (A-6 (19))

Sample / Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	jbr
Sample ID:	TP08A	Test Date:	03/30/17	Checked By:	emm
Depth :	---	Test Id:	406955		
Test Comment:	---				
Visual Description:	Moist, mottled red and light gray sandy clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.3	43.7	56.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	83		
#60	0.25	68		
#100	0.15	62		
#200	0.075	56		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0306	53		
---	0.0185	50		
---	0.0113	45		
---	0.0081	42		
---	0.0058	38		
---	0.0042	35		
---	0.0030	30		
---	0.0013	17		

Coefficients

D_{85} = 0.4740 mm	D_{30} = 0.0030 mm
D_{60} = 0.1213 mm	D_{15} = N/A
D_{50} = 0.0197 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Lean clay (CL)

AASHTO Clayey Soils (A-6 (5))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

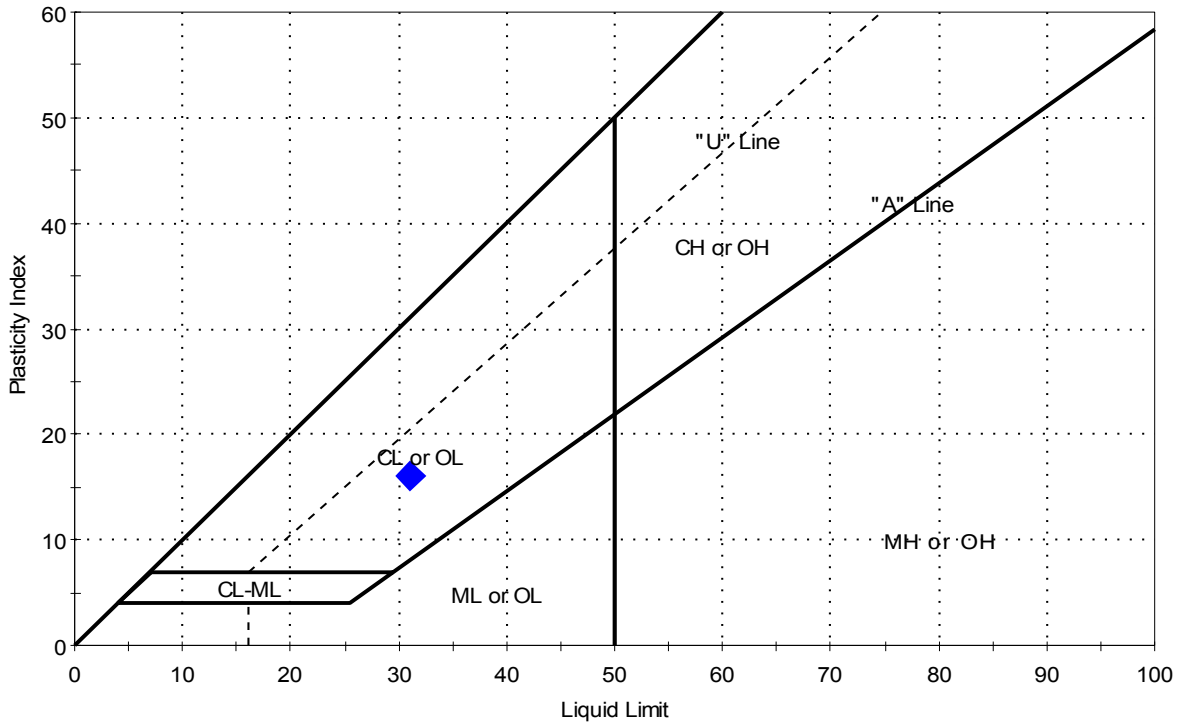
Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP01	Test Date:	03/29/17	Checked By:	emm
Depth :	---	Test Id:	406944		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

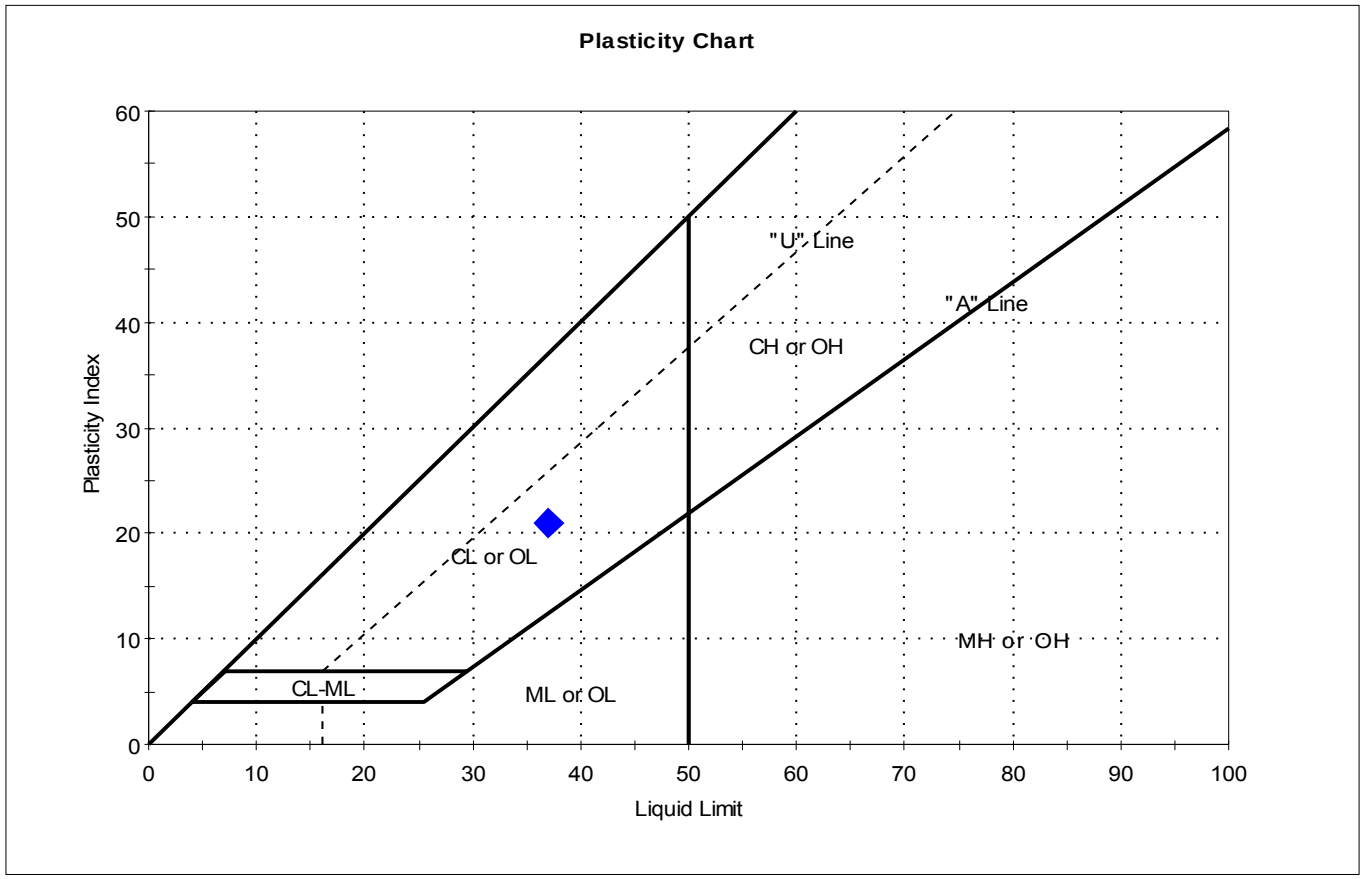


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP01	---	---	14	31	15	16	-0.1	Lean clay with sand (CL)

Sample Prepared using the WET method
5% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP02	Test Date:	03/27/17	Checked By:	emm
Depth :	---	Test Id:	406945		
Test Comment:	---				
Visual Description:	Moist, mottled pinkish white and reddish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP02	---	---	17	37	16	21	0	Lean clay with sand (CL)

Sample Prepared using the WET method

4% Retained on #40 Sieve

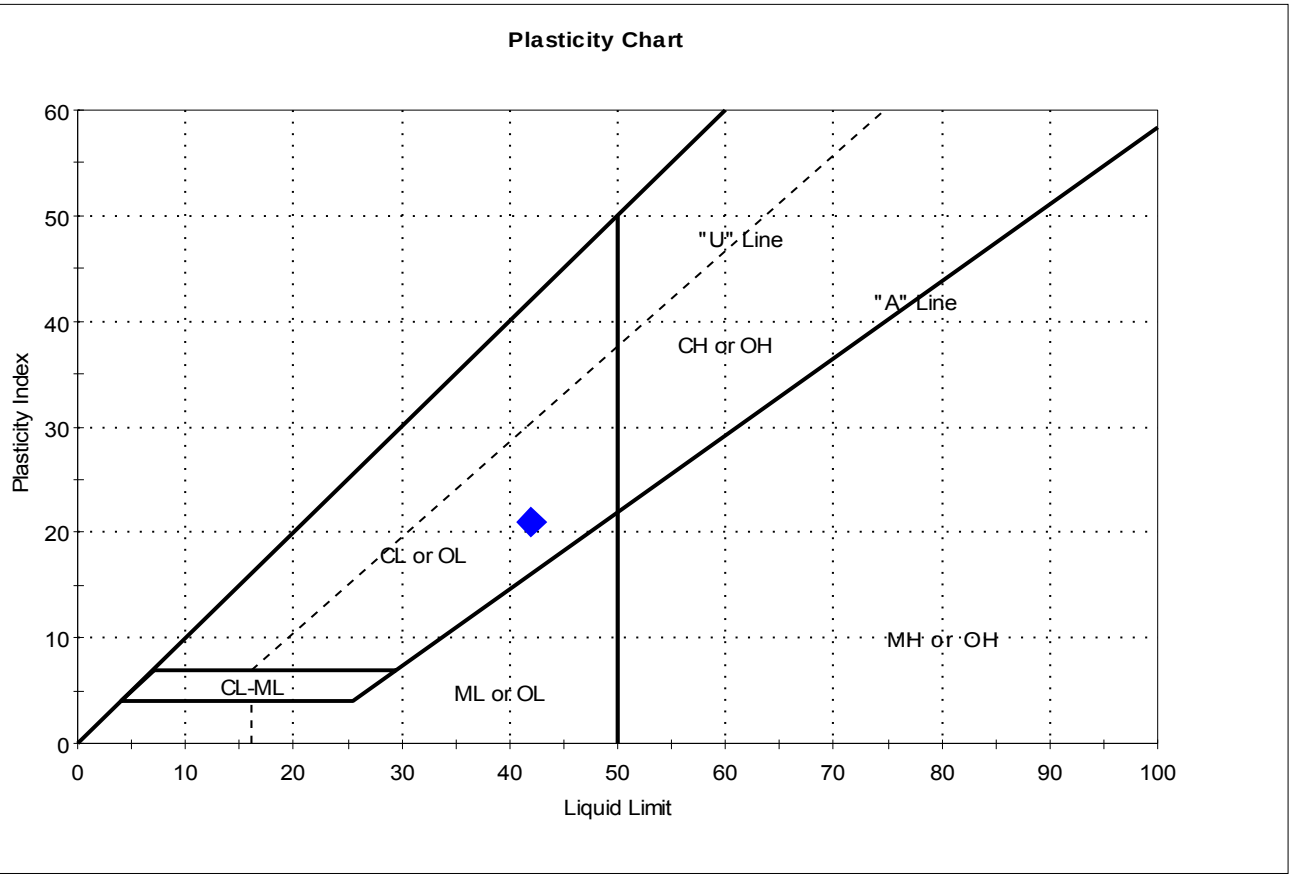
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP04	Test Date:	03/29/17	Checked By:	emm
Depth :	---	Test Id:	406946		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and red clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP04	---	---	19	42	21	21	-0.1	Lean clay with sand (CL)

Sample Prepared using the WET method

7% Retained on #40 Sieve

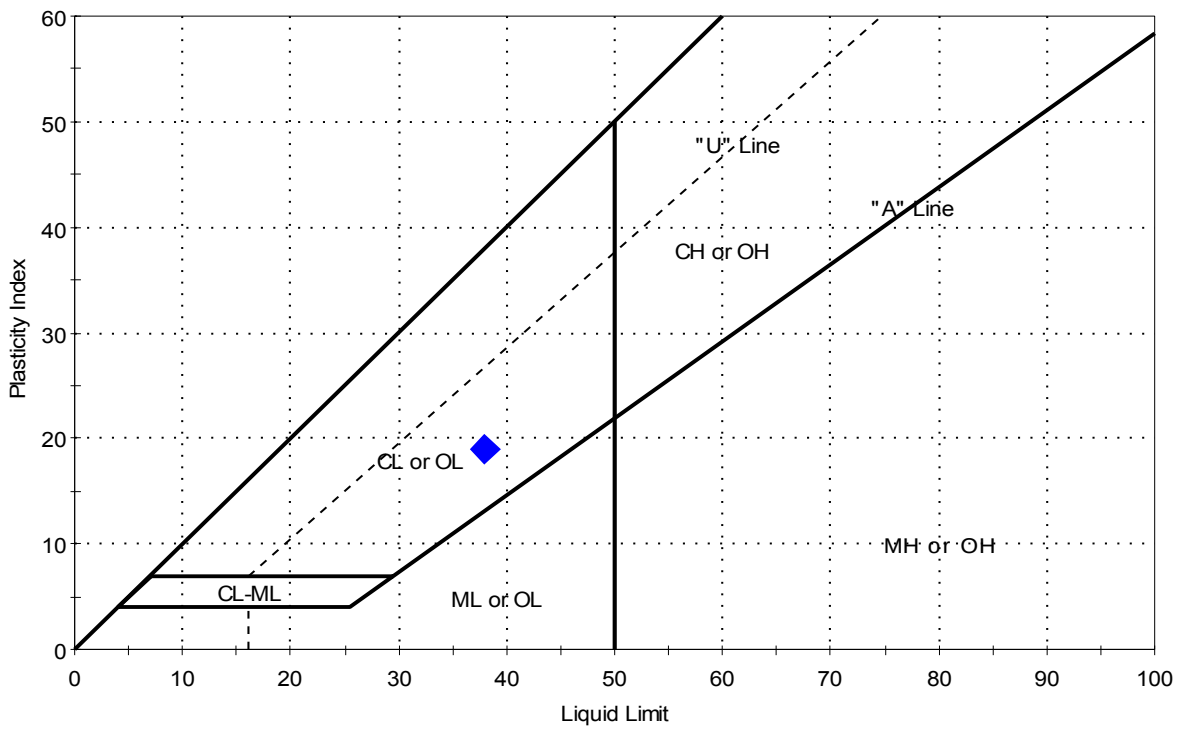
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP05	Test Date:	03/29/17	Checked By:	emm
Depth :	---	Test Id:	406947		
Test Comment:	---				
Visual Description:	Moist, mottled white and red clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

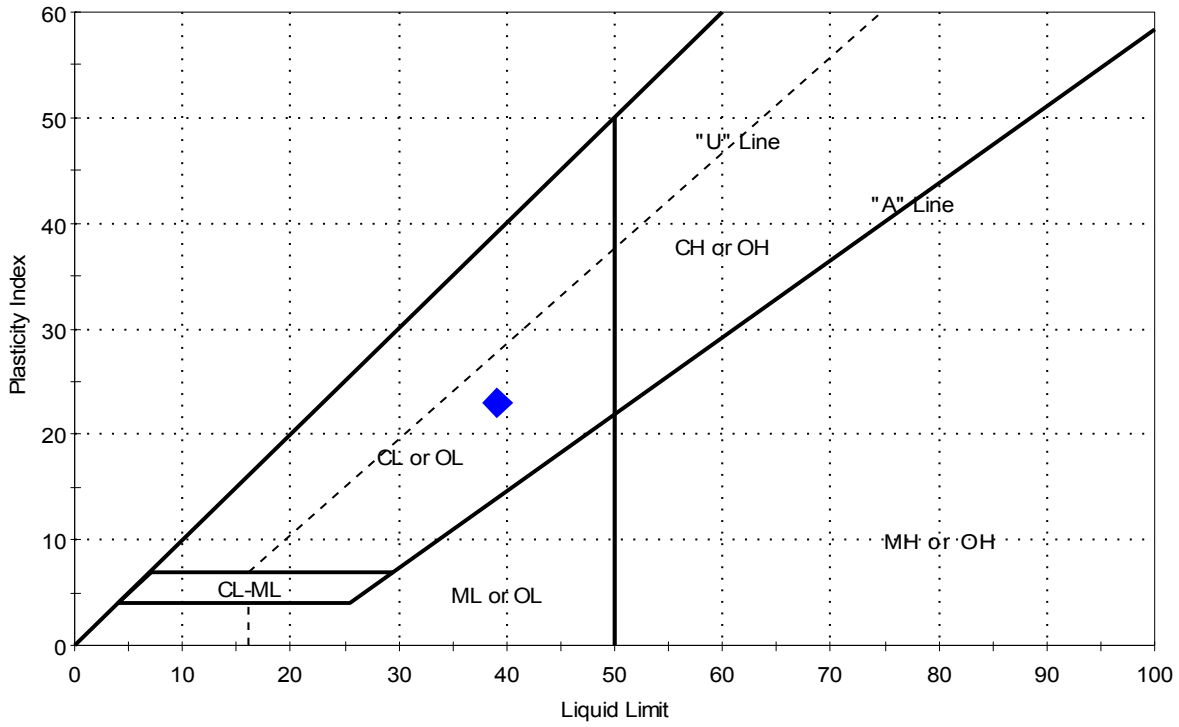


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP05	---	---	18	38	19	19	-0.1	Lean clay (CL)

Sample Prepared using the WET method
2% Retained on #40 Sieve
Dry Strength: HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP06	Test Date:	03/29/17	Checked By:	emm
Depth :	---	Test Id:	406948		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

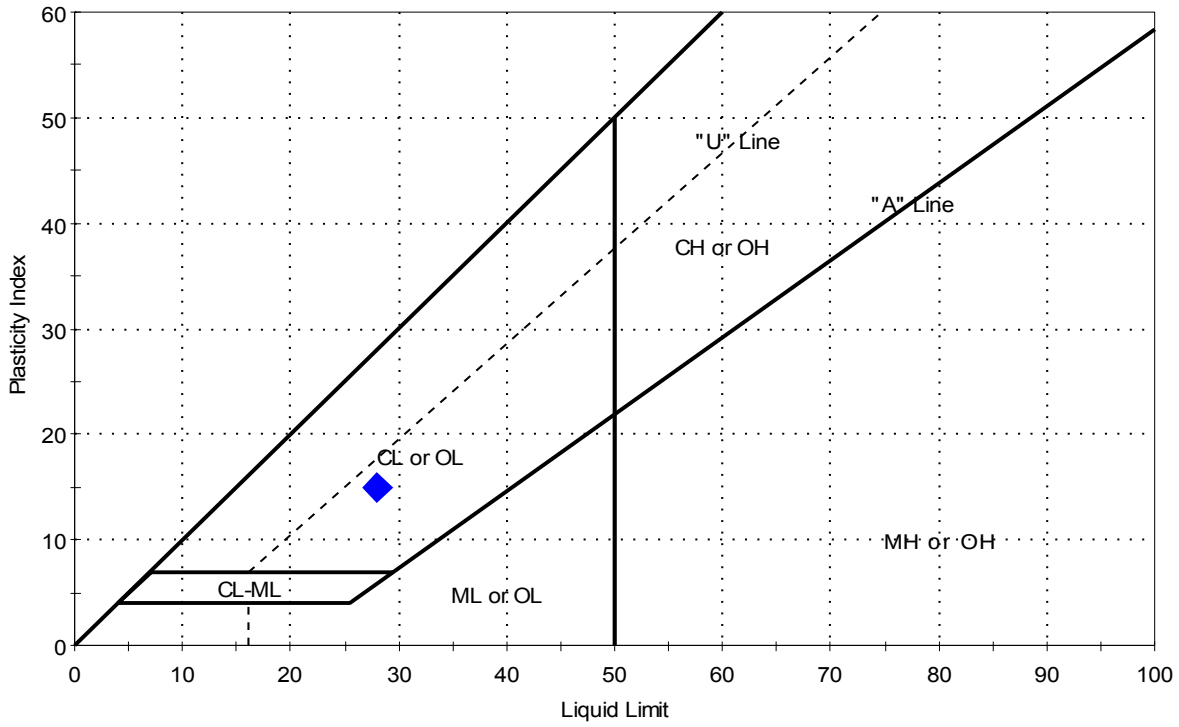


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP06	---	---	16	39	16	23	0	Lean clay with sand (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	TP08A	Test Date:	03/29/17	Checked By:	emm
Depth :	---	Test Id:	406949		
Test Comment:	---				
Visual Description:	Moist, mottled red and light gray sandy clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



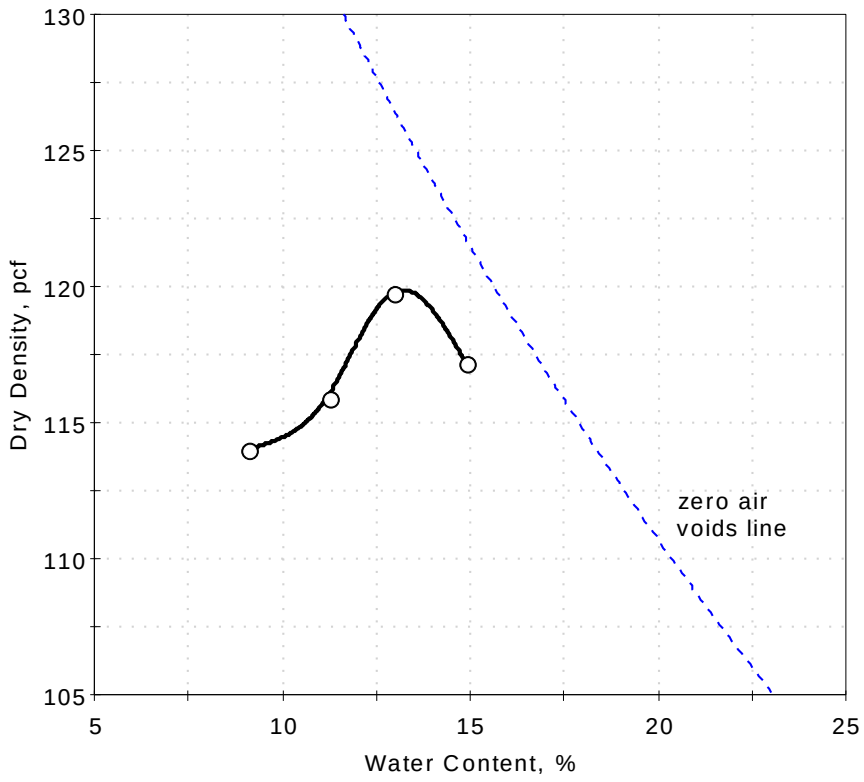
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	TP08A	---	---	14	28	13	15	0	Sandy Lean clay (CL)

Sample Prepared using the DRY method
17% Retained on #40 Sieve
Dry Strength: HIGH
Dilatancy: SLOW
Toughness: LOW

One Point Liquid Limit Test

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP01	Test Date:	04/14/17	Checked By:	emm
Depth :	---	Test Id:	407906		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	114.0	115.9	119.8	117.2
Moisture Content, %	9.1	11.2	13.0	14.9

Method : A

Preparation : WET

As received Moisture :14 %

Rammer : Manual

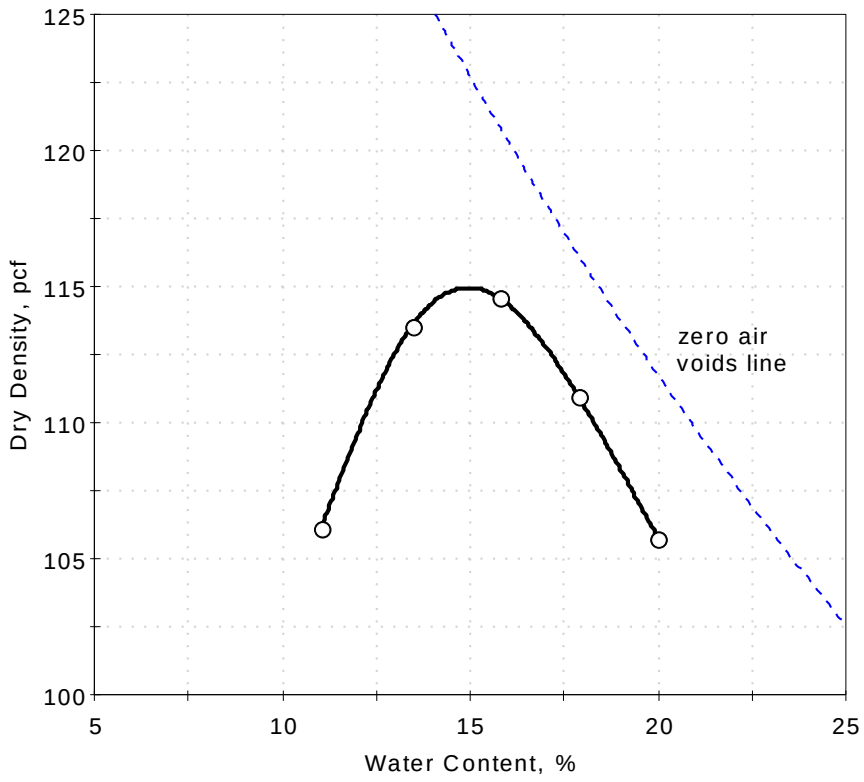
Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 119.9 pcf

Optimum Moisture= 13.2 %

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP02	Test Date:	04/21/17	Checked By:	emm
Depth :	---	Test Id:	407907		
Test Comment:	---				
Visual Description:	Moist, mottled pinkish white and reddish brown clay with sand				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	106.2	113.5	114.6	111.0	105.8
Moisture Content, %	11.0	13.4	15.8	17.9	20.0

Method : A

Preparation : WET

As received Moisture :17 %

Rammer : Manual

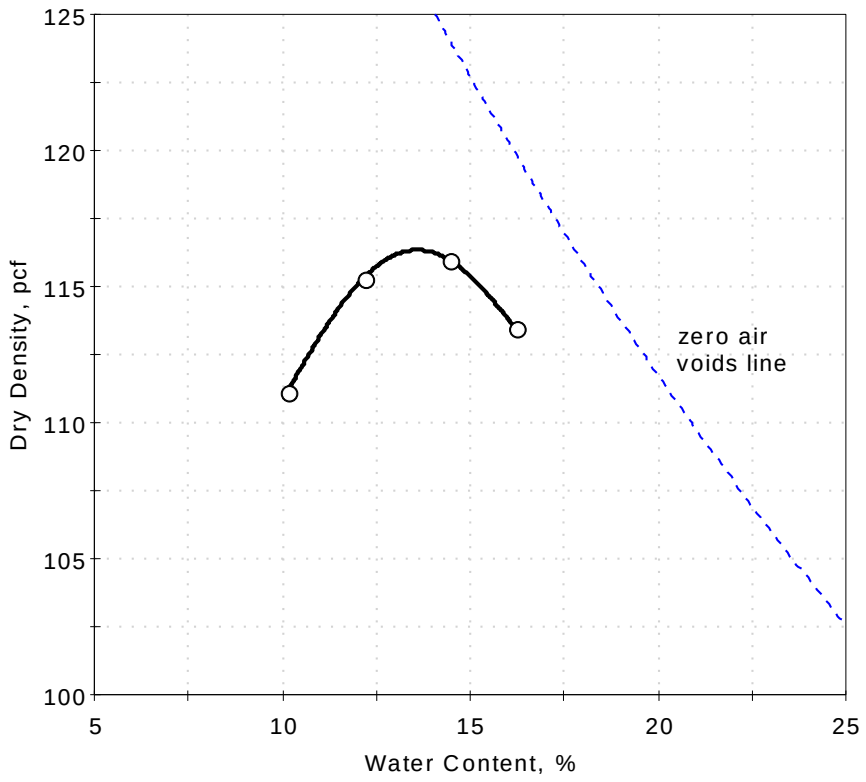
Zero voids line based on assumed specific gravity of 2.79

Maximum Dry Density= 115.0 pcf

Optimum Moisture= 14.9 %

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP04	Test Date:	04/18/17	Checked By:	emm
Depth :	---	Test Id:	407908		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and red clay with sand				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	111.1	115.3	116.0	113.5
Moisture Content, %	10.1	12.2	14.5	16.2

Method : A

Preparation : WET

As received Moisture :19 %

Rammer : Manual

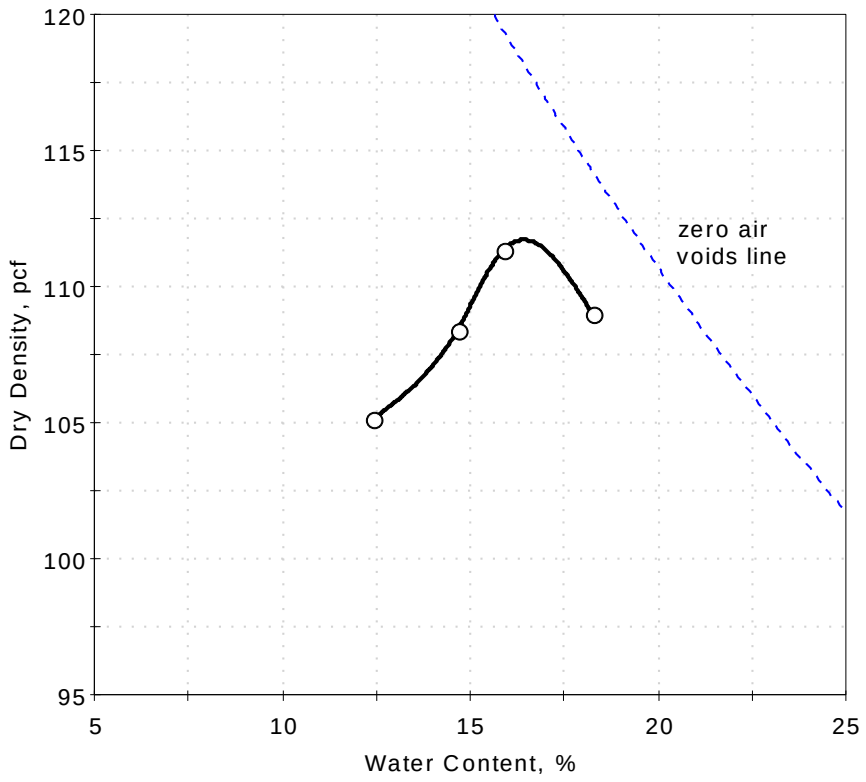
Zero voids line based on assumed specific gravity of 2.79

Maximum Dry Density= 116.3 pcf

Optimum Moisture= 13.6 %

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP05	Test Date:	04/18/17	Checked By:	emm
Depth :	---	Test Id:	407909		
Test Comment:	---				
Visual Description:	Moist, mottled white and red clay				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	105.1	108.4	111.4	109.0
Moisture Content, %	12.4	14.7	15.9	18.2

Method : A

Preparation : WET

As received Moisture :18 %

Rammer : Manual

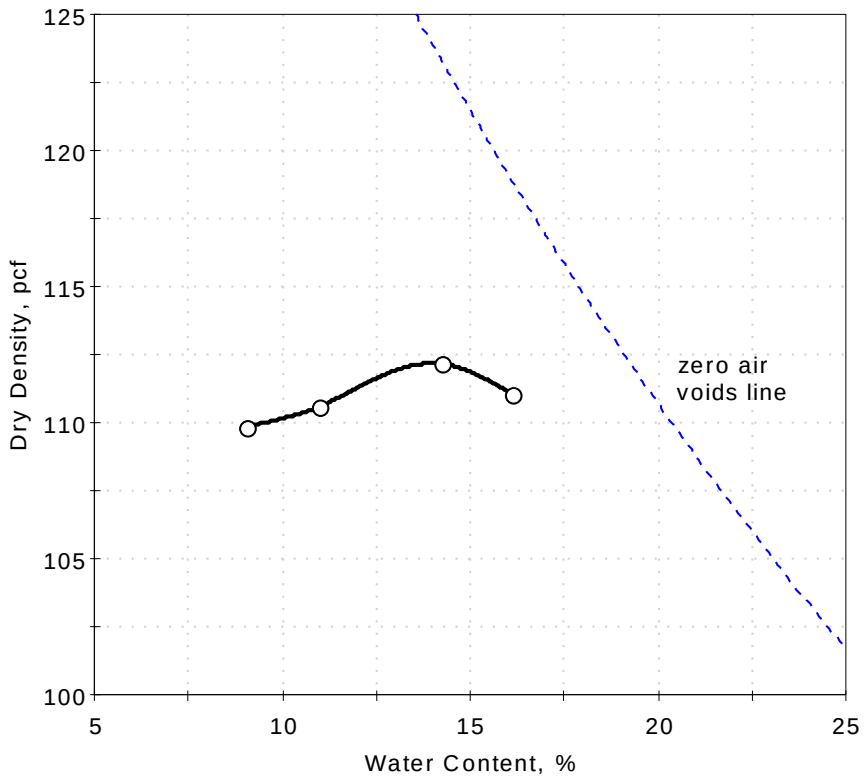
Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 111.7 pcf

Optimum Moisture= 16.4 %

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP06	Test Date:	04/21/17	Checked By:	emm
Depth :	---	Test Id:	407910		
Test Comment:	---				
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	109.8	110.6	112.2	111.0
Moisture Content, %	9.0	11.0	14.2	16.1

Method : A

Preparation : WET

As received Moisture :16 %

Rammer : Manual

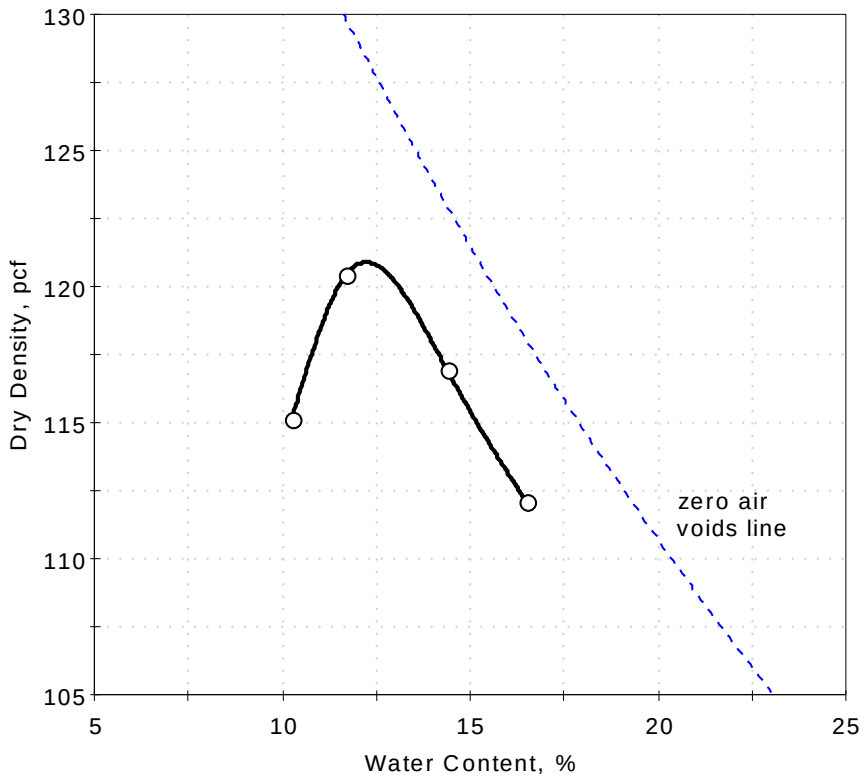
Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 112.2 pcf

Optimum Moisture= 14.0 %

Client:	Anchor QEA, LLC				
Project:	Cristal				
Location:	MD			Project No:	GTX-306179
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	TP08A	Test Date:	04/21/17	Checked By:	emm
Depth :	---	Test Id:	407911		
Test Comment:	---				
Visual Description:	Moist, mottled red and light gray sandy clay				
Sample Comment:	---				

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	115.1	120.5	117.0	112.1
Moisture Content, %	10.2	11.7	14.4	16.5

Method : A

Preparation : WET

As received Moisture :14 %

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 120.9 pcf

Optimum Moisture= 12.2 %

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/14/2017	Tested By:	jcw
End Date:	4/19/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP01		
Depth:	---		
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	4/4

Sample Preparation: Target Compaction: 95% of the maximum dry density (119.9 pcf) at the optimum moisture content (13.2%). Values specified by client. Material > 3/8-inch screened out of sample prior to testing (0%). Trimmings moisture content = 13.1%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.02	3.02
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.4	19.4
Mass, g	652.5	677.1
Bulk Density, pcf	127.9	132.7
Moisture Content, %	13.0	17.2
Dry Density, pcf	113.2	113.2
Degree of Saturation, %	74	99

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.02	Increased Cell Pressure, psi:	95.08	Cell Pressure Increment, psi:	5.06
Sample Pressure, psi:	83.98	Corresponding Sample Pressure, psi:	88.76	Sample Pressure Increment, psi:	4.78
				B Coefficient:	0.95

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/18	1	90.0	84.0	11.5	11.3	0.2	64	18.9	1.3E-07	19.7	1.008	1.3E-07
4/18	2	90.0	84.0	11.5	11.3	0.2	67	18.9	1.2E-07	19.7	1.008	1.2E-07
4/18	3	90.0	84.0	11.5	11.3	0.2	70	18.9	1.2E-07	19.7	1.008	1.2E-07
4/18	4	90.0	84.0	11.5	11.3	0.2	72	18.9	1.1E-07	19.7	1.008	1.1E-07

PERMEABILITY AT 20° C: 1.2 x 10^{-7} cm/sec (@ 6 psi effective stress)

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/19/2017	Tested By:	jcw
End Date:	4/21/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP02		
Depth:	---		
Visual Description:	Moist, mottled pinkish white and reddish brown clay with sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	9/2

Sample Preparation: Target Compaction: 95% of the maximum dry density (115.0 pcf) at the optimum moisture content (14.9%). Values specified by client. Material > 3/8-inch screened out of sample prior to testing (0%). Trimmings moisture content = 14.8%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.02	3.02
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.4	19.4
Mass, g	635.3	663.3
Bulk Density, pcf	124.5	130.0
Moisture Content, %	14.9	20.0
Dry Density, pcf	108.3	108.3
Degree of Saturation, %	75	100

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.04	Increased Cell Pressure, psi:	94.97	Cell Pressure Increment, psi:	4.93
Sample Pressure, psi:	83.97	Corresponding Sample Pressure, psi:	88.67	Sample Pressure Increment, psi:	4.71
				B Coefficient:	0.95

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/20	1	90.0	84.0	12.0	11.8	0.2	72	19.7	1.1E-07	19.8	1.005	1.1E-07
4/20	2	90.0	84.0	12.0	11.8	0.2	77	19.7	1.0E-07	19.8	1.005	1.0E-07
4/20	3	90.0	84.0	12.0	11.8	0.2	82	19.7	9.5E-08	19.8	1.005	9.5E-08
4/20	4	90.0	84.0	12.0	11.8	0.2	85	19.7	9.1E-08	19.8	1.005	9.2E-08

PERMEABILITY AT 20° C: 9.9 x 10^{-8} cm/sec (@ 6 psi effective stress)

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/18/2017	Tested By:	jcw
End Date:	4/21/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP04		
Depth:	---		
Visual Description:	Moist, mottled light gray and red clay with sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	3/2

Sample Preparation: Target Compaction: 95% of the maximum dry density (116.3 pcf) at the optimum moisture content (13.6%). Values specified by client. Material >3/8-inch screened out of sample prior to testing (2%). Trimmings moisture content = 13.7%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.01	3.01
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.3	19.3
Mass, g	635.0	663.5
Bulk Density, pcf	124.8	130.4
Moisture Content, %	13.6	18.7
Dry Density, pcf	109.9	109.9
Degree of Saturation, %	71	98

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	92.00	Increased Cell Pressure, psi:	97.14	Cell Pressure Increment, psi:	5.14
Sample Pressure, psi:	85.95	Corresponding Sample Pressure, psi:	89.85	Sample Pressure Increment, psi:	3.90
				B Coefficient:	0.76

*B value did not increase with increase in pressure. Final degree of saturation >95%.

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/20	1	92.0	86.0	12.0	11.8	0.2	80	19.8	9.7E-08	19.8	1.005	9.7E-08
4/20	2	92.0	86.0	12.0	11.8	0.2	84	19.8	9.2E-08	19.8	1.005	9.3E-08
4/20	3	92.0	86.0	12.0	11.8	0.2	87	19.8	8.9E-08	19.8	1.005	8.9E-08
4/20	4	92.0	86.0	12.0	11.8	0.2	91	19.8	8.5E-08	19.8	1.005	8.5E-08

PERMEABILITY AT 20° C: 9.1 x 10^{-8} cm/sec (@ 6 psi effective stress)

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/19/2017	Tested By:	jcw
End Date:	4/21/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP05		
Depth:	---		
Visual Description:	Moist, mottled red and light gray sandy clay		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	6/7

Sample Preparation: Target Compaction: 95% of the maximum dry density (111.7 pcf) at the optimum moisture content (16.4%). Values specified by client. Material > 3/8-inch screened out of sample prior to testing (0%). Trimmings moisture content = 16.6%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.01	3.01
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.3	19.3
Mass, g	625.1	651.7
Bulk Density, pcf	122.9	128.1
Moisture Content, %	16.4	21.4
Dry Density, pcf	105.5	105.5
Degree of Saturation, %	77	100

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.02	Increased Cell Pressure, psi:	94.99	Cell Pressure Increment, psi:	4.97
Sample Pressure, psi:	84.02	Corresponding Sample Pressure, psi:	88.72	Sample Pressure Increment, psi:	4.70
				B Coefficient:	0.95

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/20	1	90.0	84.0	5.5	5.1	0.4	34	9.1	1.0E-06	19.8	1.005	1.0E-06
4/20	2	90.0	84.0	5.5	5.1	0.4	37	9.1	9.4E-07	19.8	1.005	9.4E-07
4/20	3	90.0	84.0	5.5	5.1	0.4	38	9.1	9.2E-07	19.8	1.005	9.2E-07
4/20	4	90.0	84.0	5.5	5.1	0.4	40	9.1	8.7E-07	19.8	1.005	8.7E-07

PERMEABILITY AT 20° C: 9.4 x 10^{-7} cm/sec (@ 6 psi effective stress)

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/19/2017	Tested By:	jcw
End Date:	4/21/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP06		
Depth:	---		
Visual Description:	Moist, mottled light gray and light reddish brown clay with sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	4/4

Sample Preparation: Target Compaction: 95% of the maximum dry density (112.2 pcf) at the optimum moisture content (14.0%). Values specified by client. Material > 3/8-inch screened out of sample prior to testing (0%). Trimmings moisture content = 15.3%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.01	3.01
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.3	19.3
Mass, g	616.9	651.6
Bulk Density, pcf	121.3	128.1
Moisture Content, %	14.5	21.0
Dry Density, pcf	105.9	105.9
Degree of Saturation, %	69	99

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.04	Increased Cell Pressure, psi:	95.03	Cell Pressure Increment, psi:	4.99
Sample Pressure, psi:	83.99	Corresponding Sample Pressure, psi:	88.84	Sample Pressure Increment, psi:	4.85
				B Coefficient:	0.97

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/20	1	90.0	84.0	5.5	5.0	0.5	34	9.1	1.3E-06	19.8	1.005	1.3E-06
4/20	2	90.0	84.0	5.5	5.0	0.5	36	9.1	1.2E-06	19.8	1.005	1.2E-06
4/20	3	90.0	84.0	5.5	5.0	0.5	37	9.1	1.2E-06	19.8	1.005	1.2E-06
4/20	4	90.0	84.0	5.5	5.0	0.5	38	9.1	1.2E-06	19.8	1.005	1.2E-06

PERMEABILITY AT 20° C: 1.2 x 10^{-6} cm/sec (@ 6 psi effective stress)

Client:	Anchor QEA, LLC		
Project Name:	Cristal		
Project Location:	MD		
GTX #:	306179		
Start Date:	4/19/2017	Tested By:	jcw
End Date:	4/21/2017	Checked By:	emm
Boring #:	---		
Sample #:	TP08		
Depth:	---		
Visual Description:	Moist, mottled red and light gray sandy clay		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	9/5

Sample Preparation: Target Compaction: 95% of the maximum dry density (120.9 pcf) at the optimum moisture content (12.2%). Values specified by client. Material > 3/8-inch screened out of sample prior to testing (0%). Trimmings moisture content = 12.3%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	3.00	3.00
Diameter, in	2.86	2.86
Area, in^2	6.42	6.42
Volume, in^3	19.3	19.3
Mass, g	652.1	675.5
Bulk Density, pcf	128.6	133.2
Moisture Content, %	12.1	16.1
Dry Density, pcf	114.7	114.7
Degree of Saturation, %	73	97

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	92.01	Increased Cell Pressure, psi:	96.95	Cell Pressure Increment, psi:	4.94
Sample Pressure, psi:	85.97	Corresponding Sample Pressure, psi:	90.60	Sample Pressure Increment, psi:	4.63
				B Coefficient:	0.94

*B value did not increase with increase in pressure. Final degree of saturation >95%.

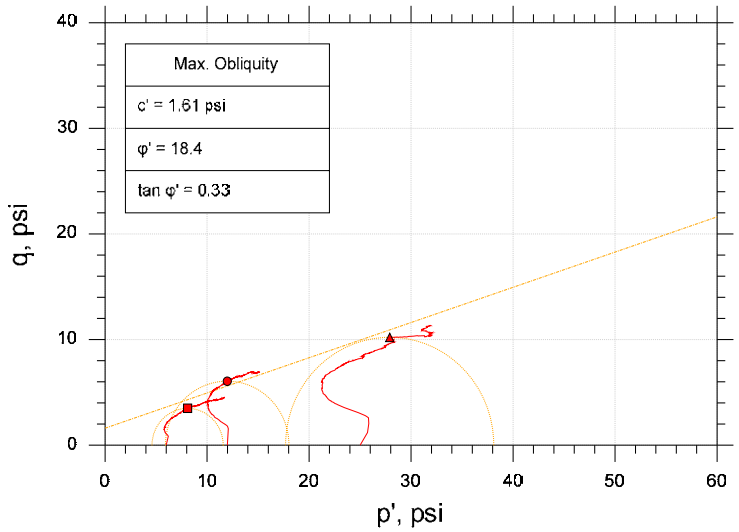
FLOW DATA

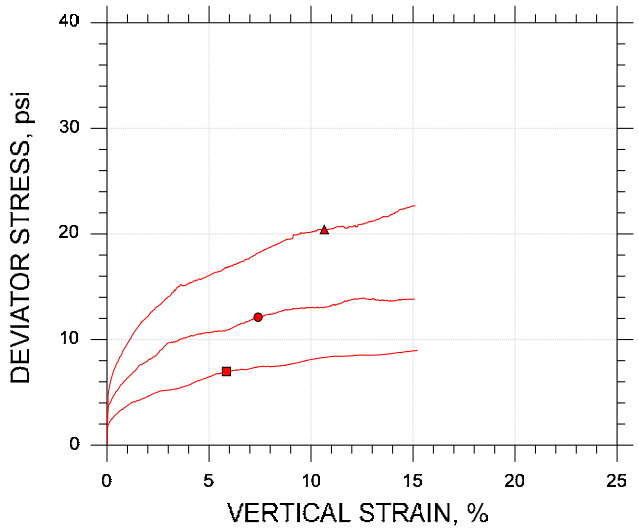
Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
4/20	1	92.0	86.0	11.5	11.1	0.4	40	19.0	4.1E-07	19.8	1.005	4.1E-07
4/20	2	92.0	86.0	11.5	11.1	0.4	41	19.0	4.0E-07	19.8	1.005	4.0E-07
4/20	3	92.0	86.0	11.5	11.1	0.4	42	19.0	3.9E-07	19.8	1.005	3.9E-07
4/20	4	92.0	86.0	11.5	11.1	0.4	42	19.0	3.9E-07	19.8	1.005	3.9E-07

PERMEABILITY AT 20° C: 4.0 x 10^{-7} cm/sec (@ 6 psi effective stress)

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: mcm
Boring ID: ---	
Preparation: Reconstituted	
Description: Moist, mottled light gray and light reddish brown clay with sand	
Classification: Lean Clay with sand	
Group Symbol: CL	
Liquid Limit: 31	Plastic Limit: 15
Plasticity Index: 16	Measured Specific Gravity: 2.72

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

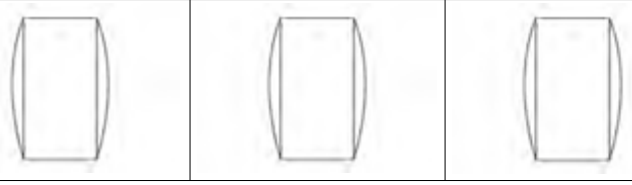




Symbol		■	●	▲
Sample ID		TP01	TP01	TP-01
Depth, ft		---	---	---
Test Number		CU-2-1	CU-2-2	CU-2-3
Initial	Height, in	4.000	4.000	4.000
	Diameter, in	2.000	2.000	2.000
	Moisture Content (from Cuttings), %	13.0	13.1	13.0
	Dry Density, pcf	114.	114.	114.
	Saturation (Wet Method), %	72.5	72.6	72.4
	Void Ratio	0.489	0.490	0.489
Before Shear	Moisture Content, %	17.2	14.7	13.7
	Dry Density, pcf	116.	121.	124.
	Cross-sectional Area (Method A), in²	3.122	3.017	2.960
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.469	0.399	0.374
	Back Pressure, psi	150.8	150.5	150.7
Vertical Effective Consolidation Stress, psi		5.971	11.91	24.89
Horizontal Effective Consolidation Stress, psi		5.989	11.99	25.00
Vertical Strain after Consolidation, %		0.4848	1.004	1.476
Volumetric Strain after Consolidation, %		0.5894	2.498	6.033
Time to 50% Consolidation, min		24.01	88.36	100.0
Shear Strength, psi		3.487	6.057	10.21
Strain at Failure, %		5.85	7.40	10.7
Strain Rate, %/min		0.01600	0.01600	0.01600
Deviator Stress at Failure, psi		6.974	12.11	20.42
Effective Minor Principal Stress at Failure, psi		4.603	5.921	17.70
Effective Major Principal Stress at Failure, psi		11.58	18.03	38.11
B-Value		0.95	0.95	0.95

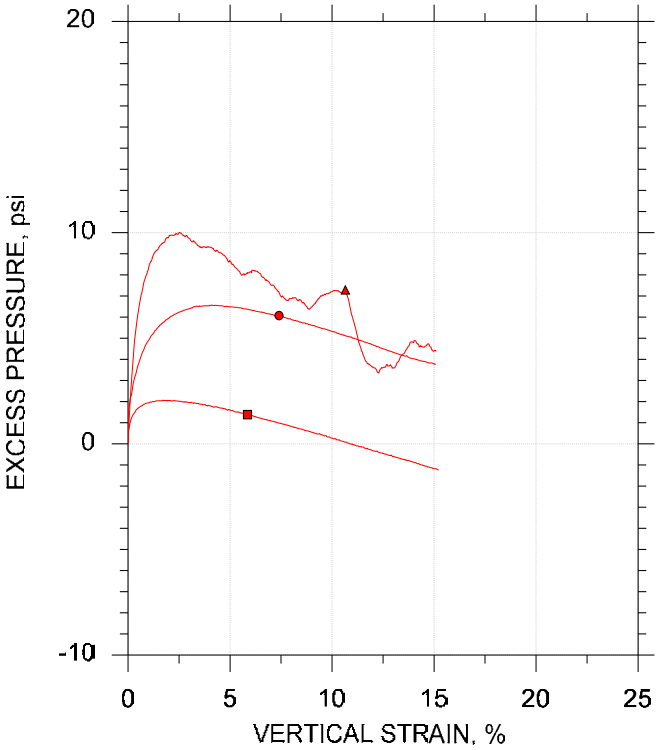
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

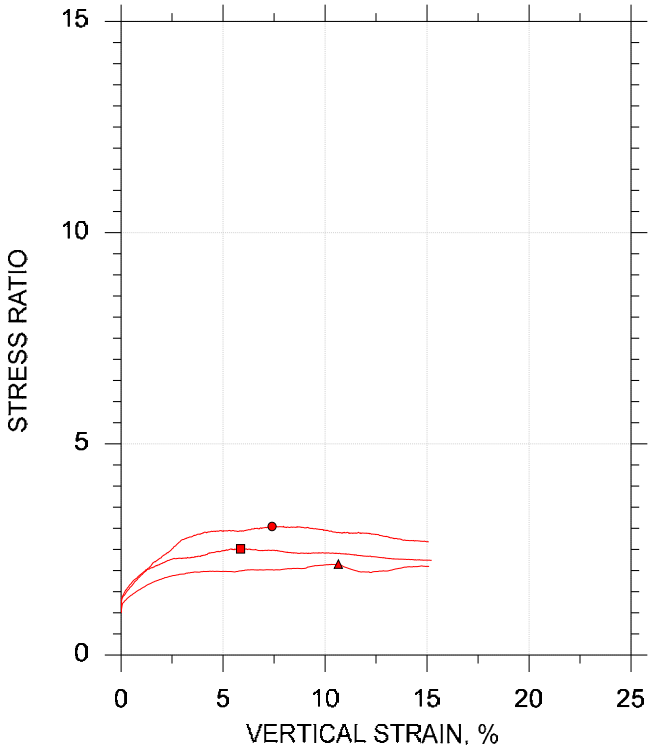
Remarks:

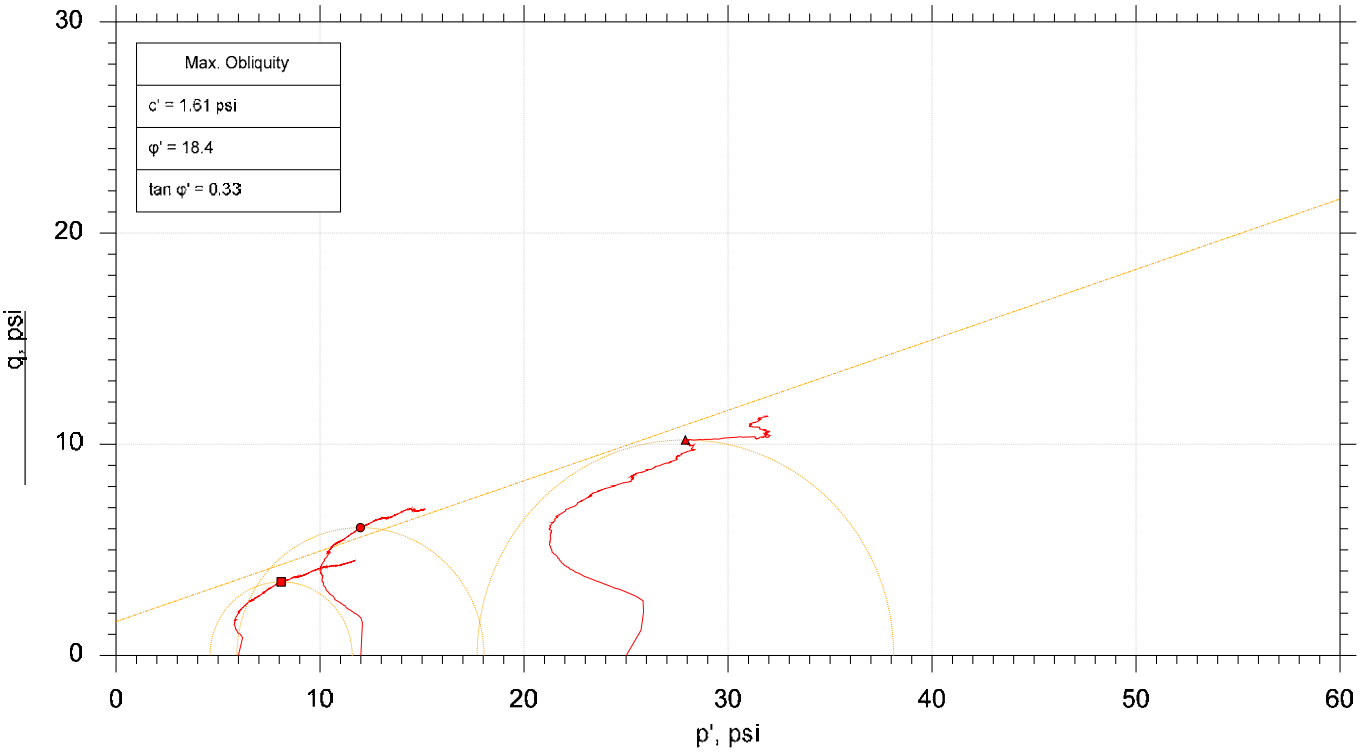


Target Compaction: 95% of (119.9 pcf) at 13.0% Moisture Content, as requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







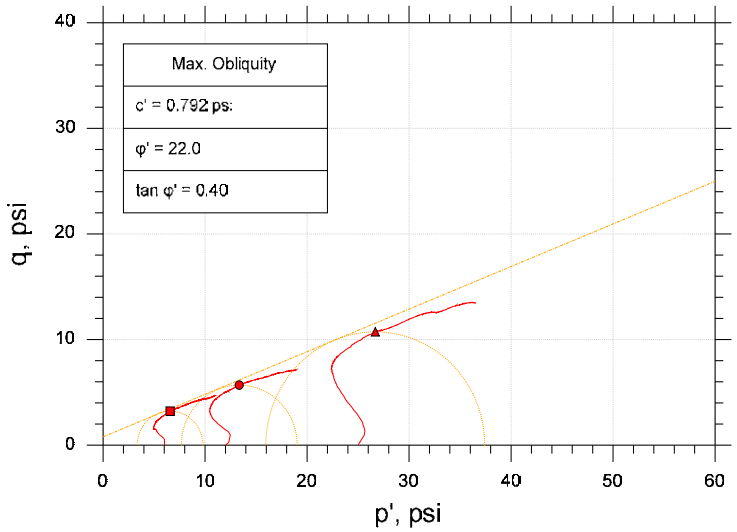
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP01	CU-2-1	---	md	4/17/17	mcm	4/21/17	306179-CU-2-1m.dat
●	TP01	CU-2-2	---	md	4/17/17	mcm	4/21/17	306179-CU-2-2m.dat
▲	TP-01	CU-2-3	---	md	4/17/17	mcm	4/21/17	306179-CU-2-3m.dat

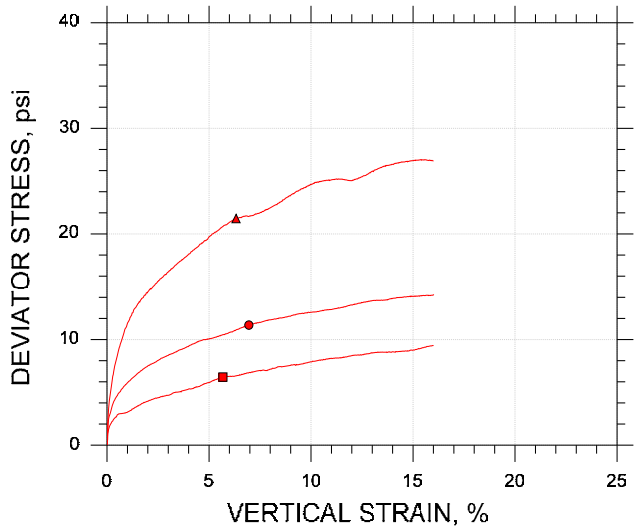
GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: Reconstituted	
Description: Moist, mottled light gray and light reddish brown clay with sand		
Remarks: Target Compaction: 95% of (119.9 pcf) at 13.0% Moisture Content, as requested by client.		

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, mottled pinkish white and reddish brown clay with sand	
Classification: Lean CLAY with Sand	
Group Symbol: CL	
Liquid Limit: 37	Plastic Limit: 16
Plasticity Index: 21	Measured Specific Gravity: 2.73

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

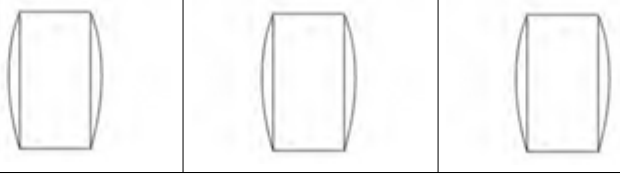




Symbol		■	●	▲
Sample ID		TP02	TP02	TP02
Depth, ft		---	---	---
Test Number		CU-3-1	CU-3-2	CU-3-3
Initial	Height, in	4.000	4.000	4.000
	Diameter, in	2.000	2.000	2.000
	Moisture Content (from Cuttings), %	15.8	15.8	15.8
	Dry Density, pcf	108.	108.	108.
	Saturation (Wet Method), %	75.4	75.6	75.4
	Void Ratio	0.571	0.572	0.571
Before Shear	Moisture Content, %	20.5	19.3	17.2
	Dry Density, pcf	109.	112.	116.
	Cross-sectional Area (Method A), in²	3.122	3.077	2.985
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.560	0.527	0.469
	Back Pressure, psi	152.7	152.6	150.9
Vertical Effective Consolidation Stress, psi		6.011	11.94	24.88
Horizontal Effective Consolidation Stress, psi		6.021	12.00	25.00
Vertical Strain after Consolidation, %		0.3269	0.8051	1.618
Volumetric Strain after Consolidation, %		1.302	2.776	6.504
Time to 50% Consolidation, min		27.00	38.40	96.00
Shear Strength, psi		3.221	5.685	10.73
Strain at Failure, %		5.68	6.95	6.33
Strain Rate, %/min		0.01600	0.01600	0.01600
Deviator Stress at Failure, psi		6.442	11.37	21.46
Effective Minor Principal Stress at Failure, psi		3.351	7.667	15.96
Effective Major Principal Stress at Failure, psi		9.794	19.04	37.42
B-Value		0.95	0.95	0.95

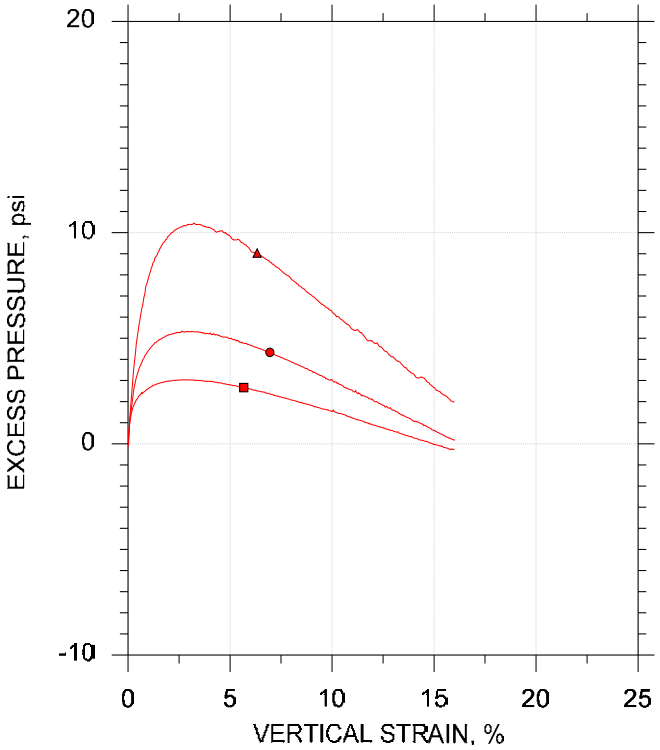
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

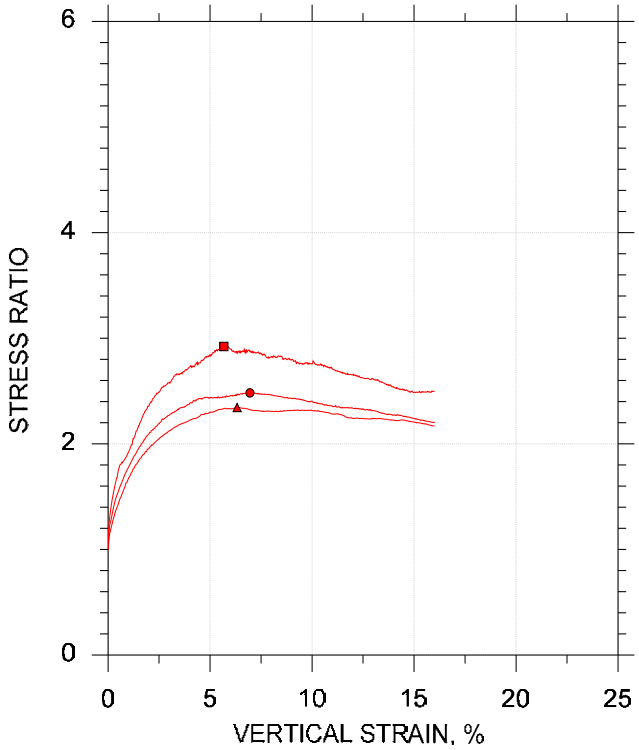
Remarks:

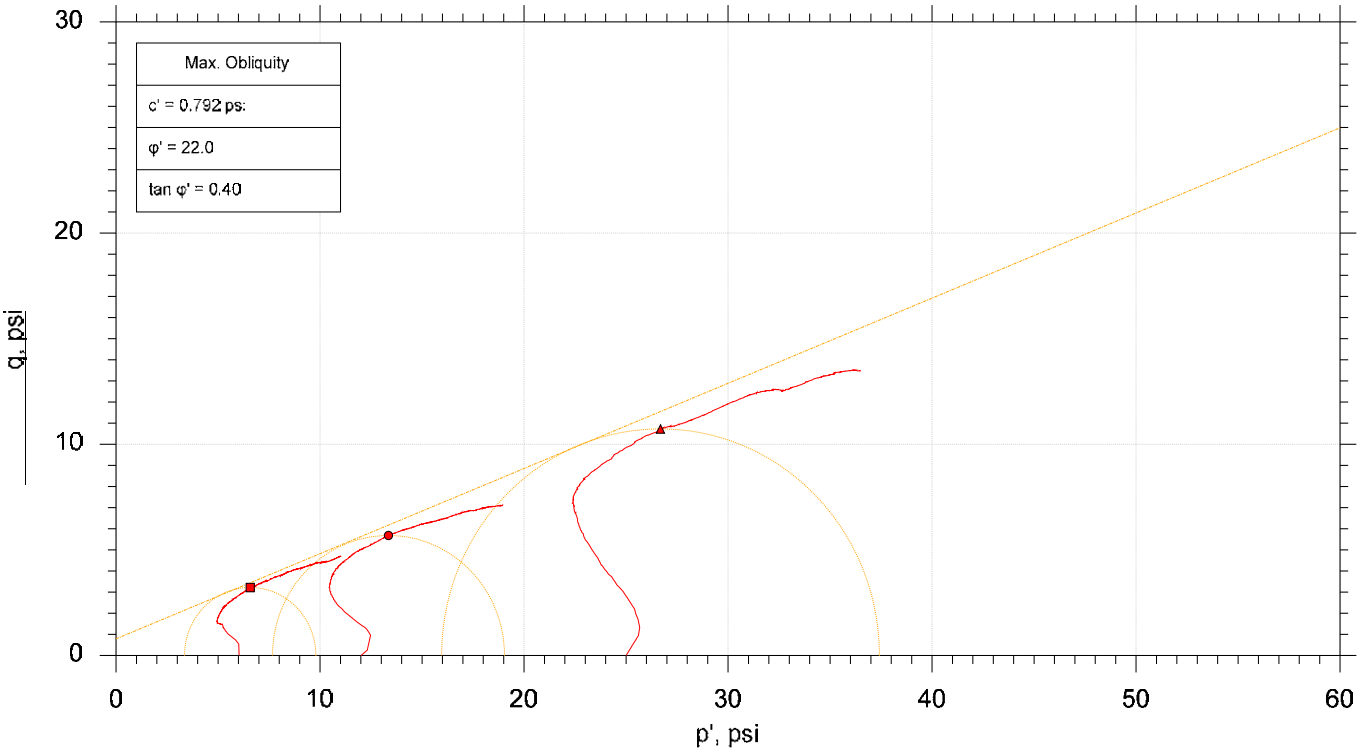


System S, Target Compaction: 95% of 115.0 pcf at 14.9% Moisture Content. As requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







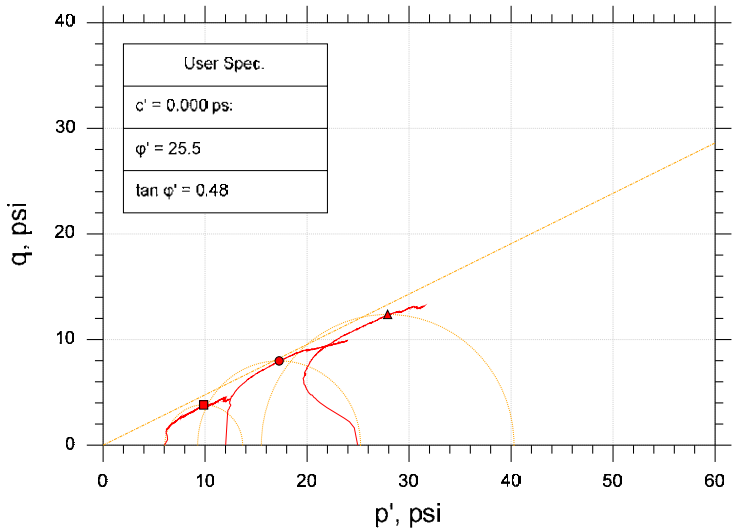
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP02	CU-3-1	---	md	4/19/17	njh	4/26/17	306179-CU-3-1n.dat
●	TP02	CU-3-2	---	md	4/19/17	njh	4/26/17	306179-CU-3-2n.dat
▲	TP02	CU-3-3	---	md	4/19/17	njh	4/26/17	306179-CU-3-3n.dat

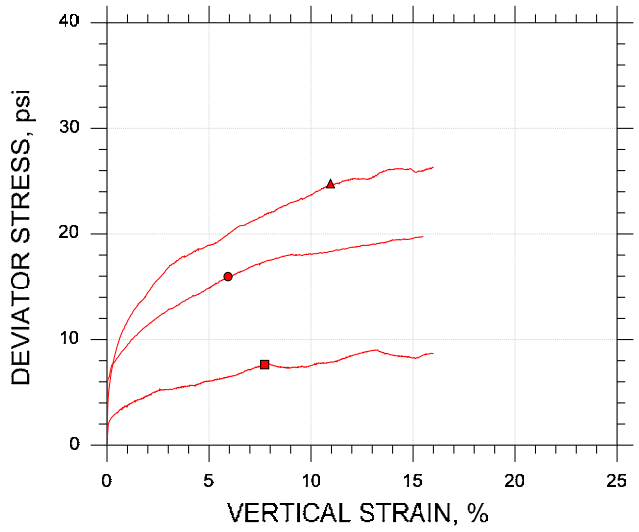
GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, mottled pinkish white and reddish brown clay with sand		
Remarks: System S, Target Compaction: 95% of 115.0 pcf at 14.9% Moisture Content. As requested by client.		

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, mottled light gray and red clay with sand	
Classification: Lean CLAY with Sand	
Group Symbol: CL	
Liquid Limit: 42	Plastic Limit: 21
Plasticity Index: 21	Measured Specific Gravity: 2.71

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

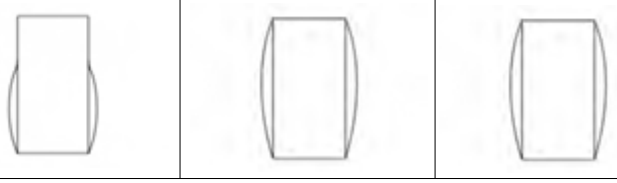




Symbol		■	●	▲
Sample ID		TP04	TP04	TP04
Depth, ft		---	---	---
Test Number		CU-4-1	CU-4-2	CU-4-3
Initial	Height, in	4.000	4.000	4.000
	Diameter, in	2.000	2.000	2.000
	Moisture Content (from Cuttings), %	13.4	13.3	13.5
	Dry Density, pcf	111.	111.	111.
	Saturation (Wet Method), %	68.6	68.2	68.8
	Void Ratio	0.529	0.528	0.530
Before Shear	Moisture Content, %	14.3	19.3	14.0
	Dry Density, pcf	122.	111.	123.
	Cross-sectional Area (Method A), in²	2.938	3.201	2.904
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.389	0.522	0.380
	Back Pressure, psi	180.7	147.3	150.5
Vertical Effective Consolidation Stress, psi		6.027	11.86	24.85
Horizontal Effective Consolidation Stress, psi		6.014	12.01	24.96
Vertical Strain after Consolidation, %		0.06663	2.156	1.493
Volumetric Strain after Consolidation, %		0.8303	0.2401	7.110
Time to 50% Consolidation, min		17.60	4.840	100.0
Shear Strength, psi		3.813	7.977	12.38
Strain at Failure, %		7.73	5.93	11.0
Strain Rate, %/min		0.01600	0.01600	0.01600
Deviator Stress at Failure, psi		7.626	15.95	24.77
Effective Minor Principal Stress at Failure, psi		6.055	9.282	15.51
Effective Major Principal Stress at Failure, psi		13.68	25.24	40.28
B-Value		0.95	0.87	0.94

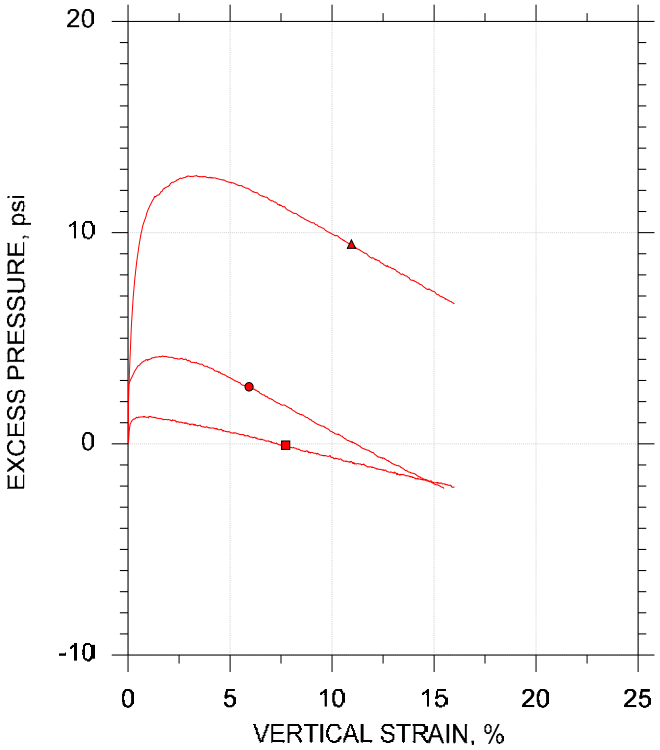
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

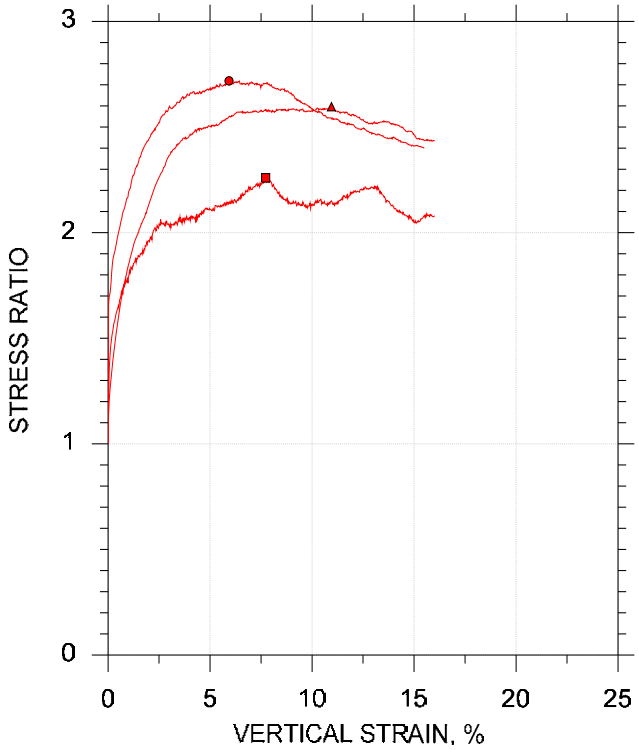
Remarks:

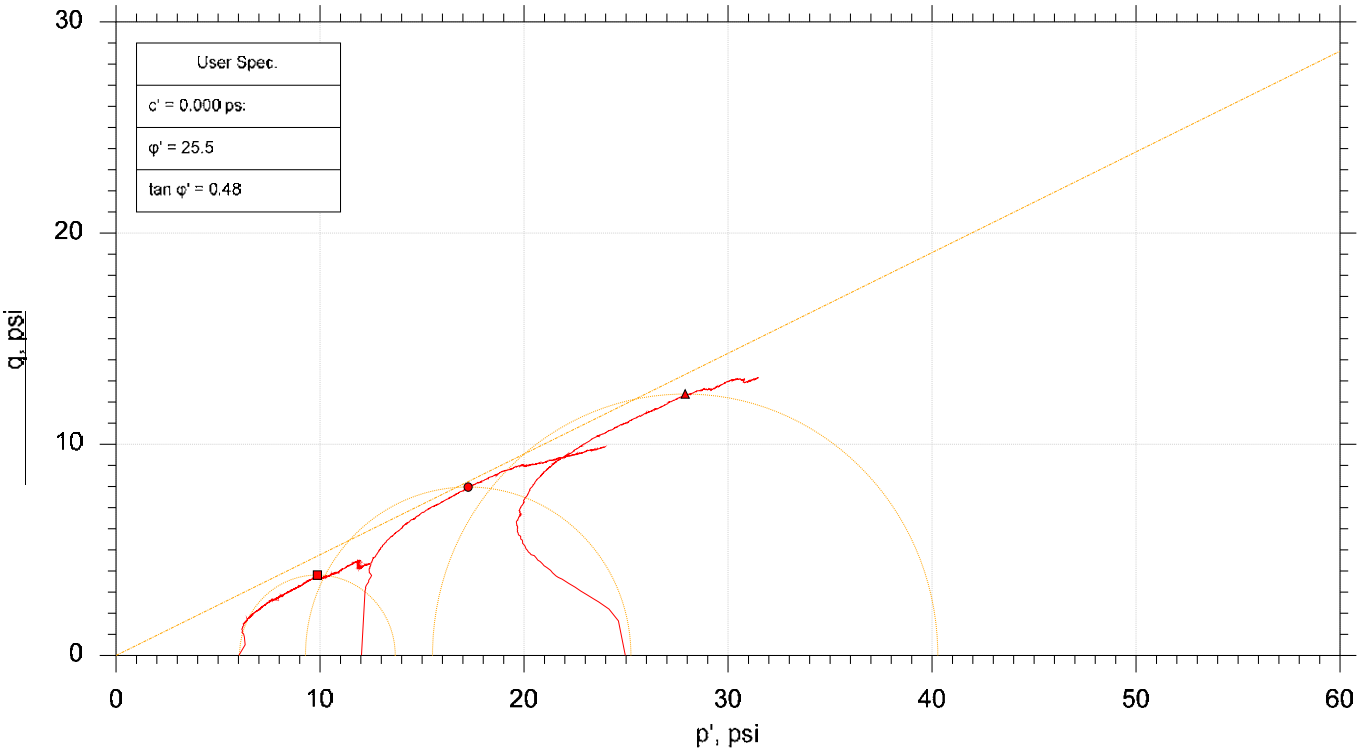


System T, Target Compaction: 95% of 116.3 pcf at 13.6% Moisture Content. As requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







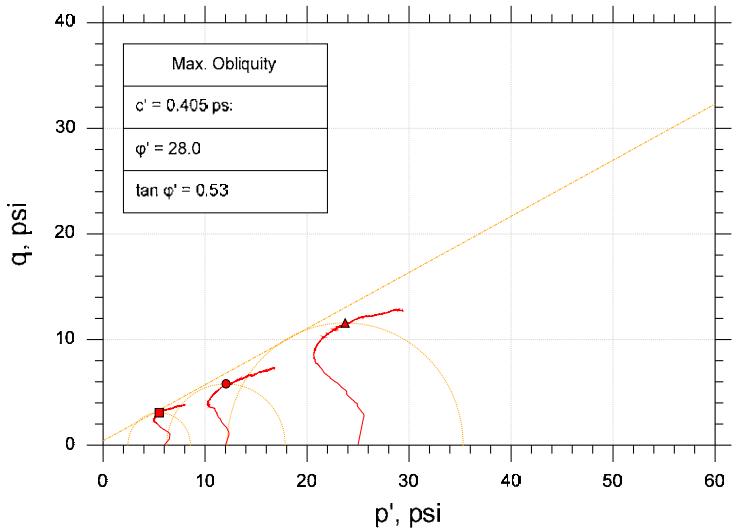
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP04	CU-4-1	---	md	04/20/17	njh	4/26/17	306179-CU-4-1n.dat
●	TP04	CU-4-2	---	md	04/20/17	njh	4/26/17	306179-CU-4-2n.dat
▲	TP04	CU-4-3	---	md	04/20/17	njh	4/26/17	306179-CU-4-3n.dat

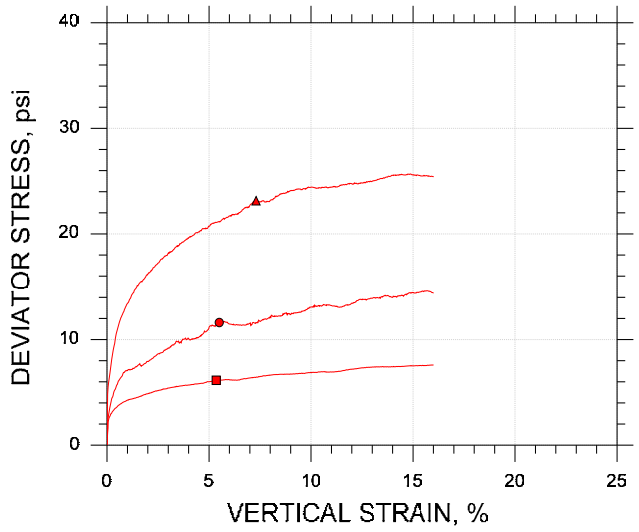
GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, mottled light gray and red clay with sand		
Remarks: System T, Target Compaction: 95% of 116.3 pcf at 13.6% Moisture Content. As requested by client.		

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, mottled white and red clay	
Classification: Lean CLAY	
Group Symbol: CL	
Liquid Limit: 38	Plastic Limit: 19
Plasticity Index: 19	Measured Specific Gravity: 2.72

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

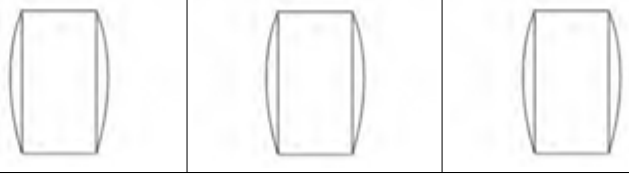




Symbol		■	●	▲
Sample ID		TP05	TP05	TP05
Depth, ft		---	---	---
Test Number		CU-6-1	CU-6-2	CU-6-3
Initial	Height, in	4.000	4.000	4.000
	Diameter, in	2.000	2.000	2.000
	Moisture Content (from Cuttings), %	16.7	16.4	16.7
	Dry Density, pcf	106.	106.	106.
	Saturation (Wet Method), %	75.0	74.2	75.0
	Void Ratio	0.605	0.601	0.605
Before Shear	Moisture Content, %	21.4	19.4	18.8
	Dry Density, pcf	107.	111.	112.
	Cross-sectional Area (Method A), in²	3.109	3.041	3.016
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.583	0.528	0.512
	Back Pressure, psi	152.9	124.9	154.9
Vertical Effective Consolidation Stress, psi		5.963	11.90	24.86
Horizontal Effective Consolidation Stress, psi		5.995	12.00	24.98
Vertical Strain after Consolidation, %		0.4804	1.311	1.942
Volumetric Strain after Consolidation, %		1.875	4.322	6.026
Time to 50% Consolidation, min		3.240	2.250	25.00
Shear Strength, psi		3.070	5.808	11.57
Strain at Failure, %		5.35	5.50	7.30
Strain Rate, %/min		0.01600	0.01600	0.01600
Deviator Stress at Failure, psi		6.140	11.62	23.14
Effective Minor Principal Stress at Failure, psi		2.428	6.246	12.16
Effective Major Principal Stress at Failure, psi		8.568	17.86	35.30
B-Value		0.95	0.94	0.95

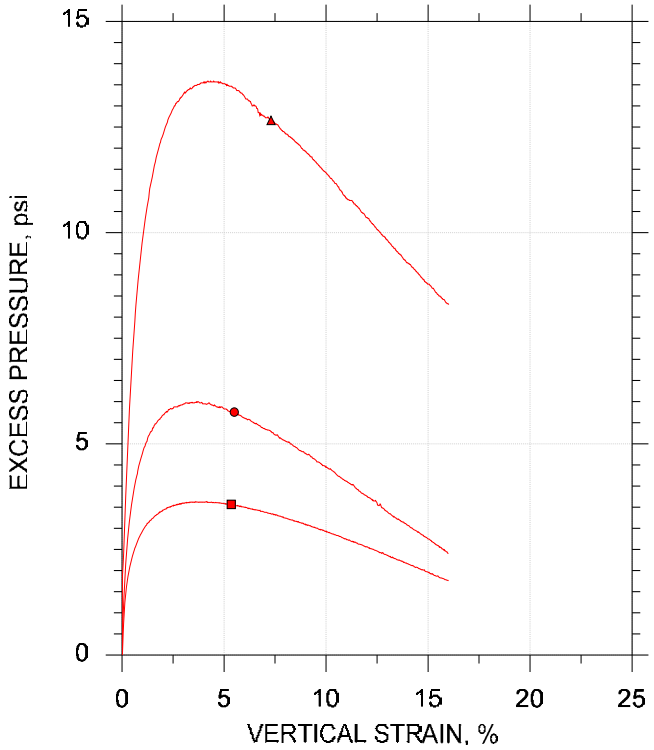
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

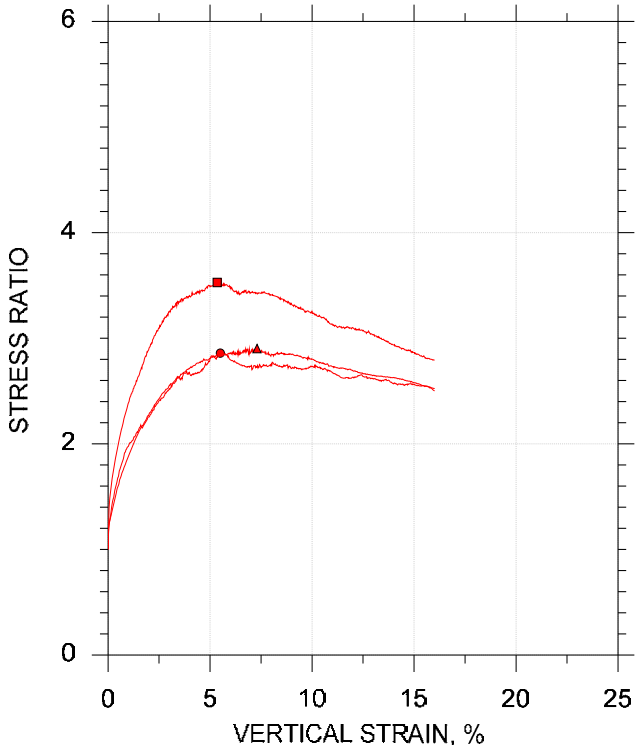
Remarks:

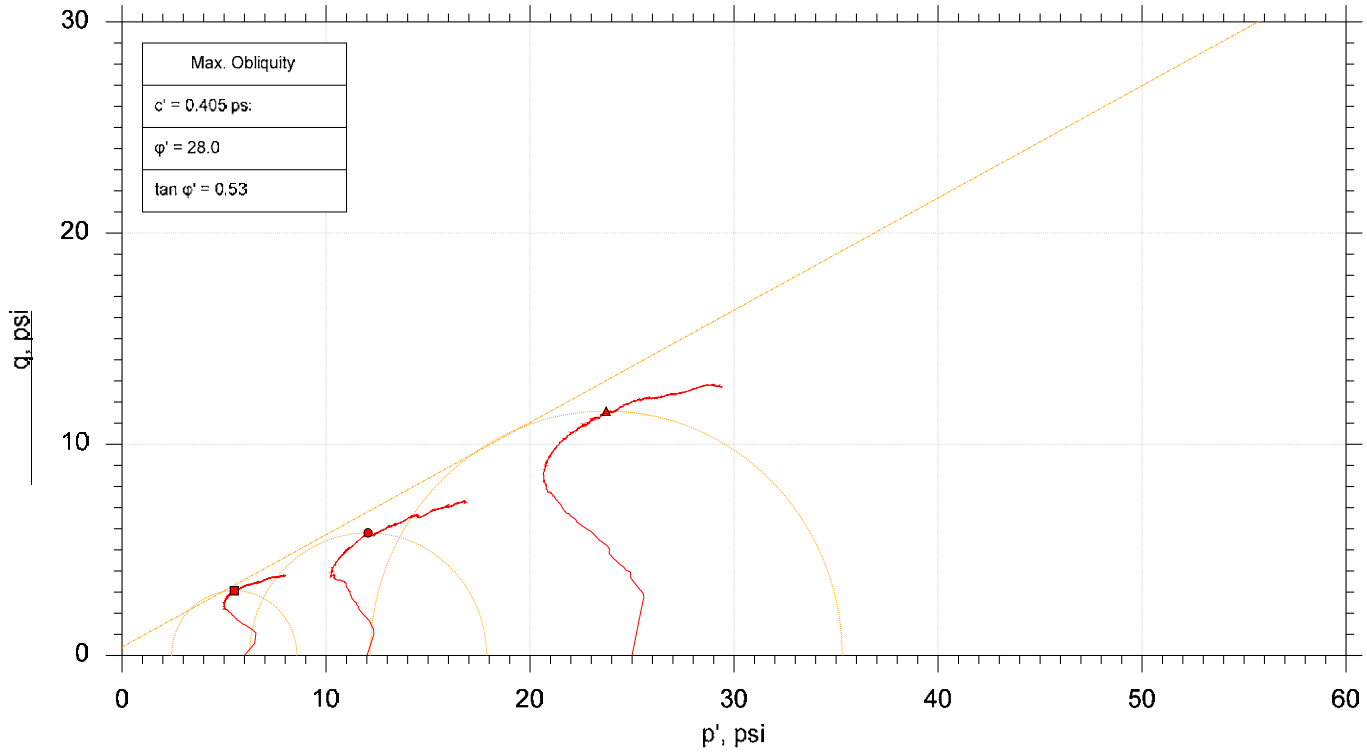


System S, Target Compaction: 95% of 111.7 pcf at 16.4% Moisture Content. As requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







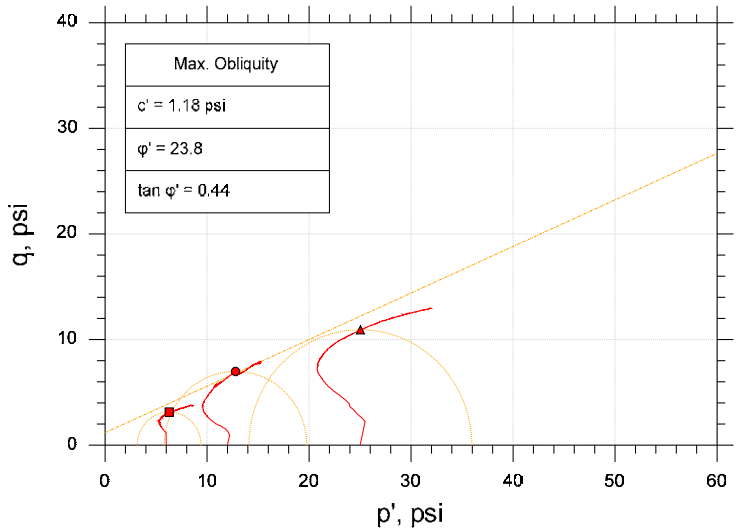
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP05	CU-6-1	---	md	04/21/17	njh	4/26/17	306179-CU-6-1n.dat
●	TP05	CU-6-2	---	md	4/21/17	njh	4/26/17	306179-CU-6-2n.dat
▲	TP05	CU-6-3	---	md	04/21/17	njh	4/26/17	306179-CU-6-3n.dat

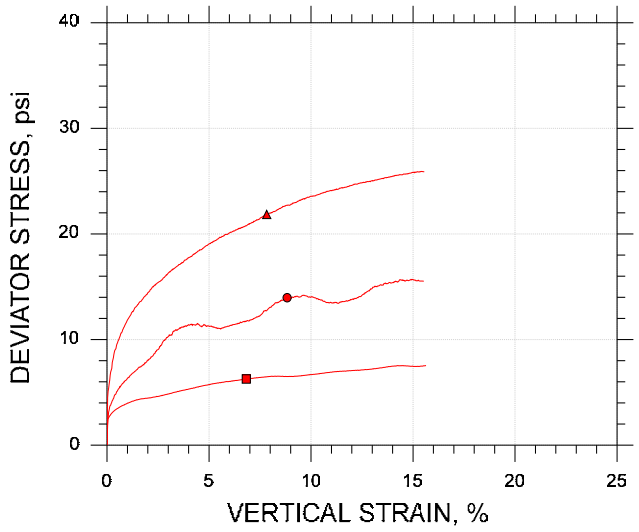
GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, mottled white and red clay		
Remarks: System S, Target Compaction: 95% of 111.7 pcf at 16.4% Moisture Content. As requested by client.		

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: mcm
Boring ID: ---	
Preparation: Reconstituted	
Description: Moist, mottled light gray and light brown clay with sand	
Classification: Lean clay with sand	
Group Symbol: CL	
Liquid Limit: 19	Plastic Limit: 16
Plasticity Index: 3	Measured Specific Gravity: 2.69

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

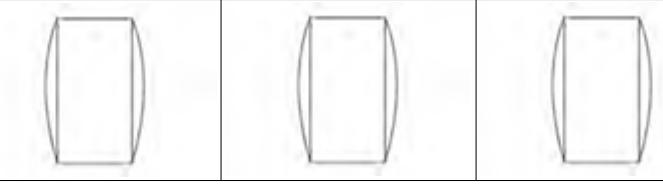




Symbol		■	●	▲	
Sample ID		TP06	TP06	TP06	
Depth, ft		---	---	---	
Test Number		CU-1-1	CU-1-2	CU-1-3	
Initial	Height, in	4.000	4.000	4.000	
	Diameter, in	2.000	2.000	2.000	
	Moisture Content (from Cuttings), %	14.9	14.6	14.5	
	Dry Density, pcf	106.	106.	106.	
	Saturation (Wet Method), %	68.6	67.9	67.4	
	Void Ratio	0.583	0.580	0.577	
Before Shear	Moisture Content, %	20.5	7.7	17.1	
	Dry Density, pcf	108.	139.	115.	
	Cross-sectional Area (Method A), in²	3.097	2.458	2.988	
	Saturation, %	100.0	100.0	100.0	
	Void Ratio	0.550	0.208	0.461	
	Back Pressure, psi	138.8	150.7	150.8	
Vertical Effective Consolidation Stress, psi		5.969	11.91	24.85	
Horizontal Effective Consolidation Stress, psi		5.998	11.98	24.99	
Vertical Strain after Consolidation, %		0.3871	1.081	1.901	
Volumetric Strain after Consolidation, %		1.369	20.79	5.392	
Time to 50% Consolidation, min		38.44	81.00	64.00	
Shear Strength, psi		3.130	6.981	10.92	
Strain at Failure, %		6.83	8.83	7.83	
Strain Rate, %/min		0.01600	0.01600	0.01600	
Deviator Stress at Failure, psi		6.259	13.96	21.85	
Effective Minor Principal Stress at Failure, psi		3.155	5.807	14.11	
Effective Major Principal Stress at Failure, psi		9.414	19.77	35.96	
B-Value		0.95	0.95	0.95	

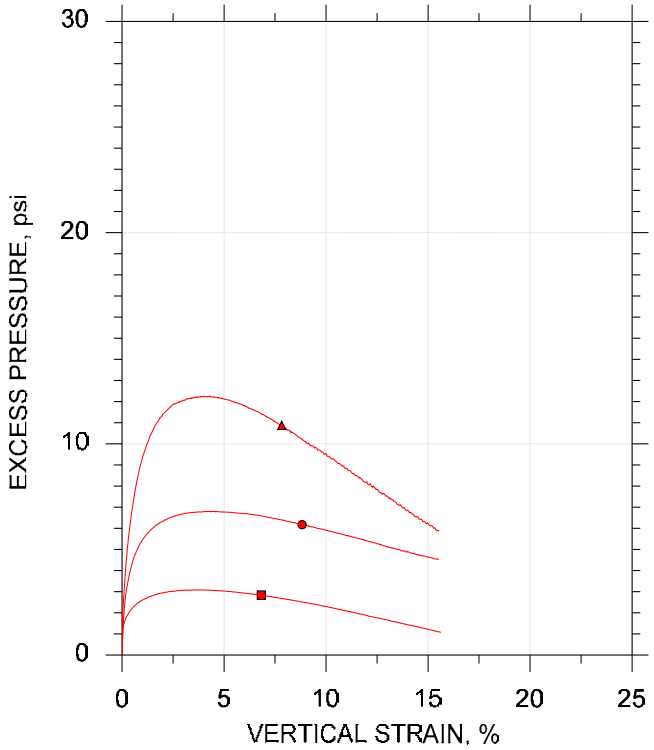
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

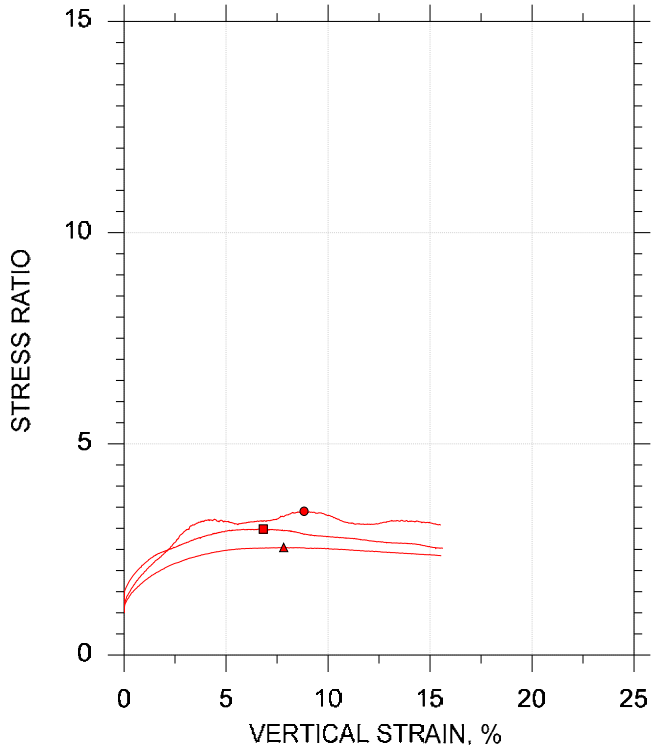
Remarks:

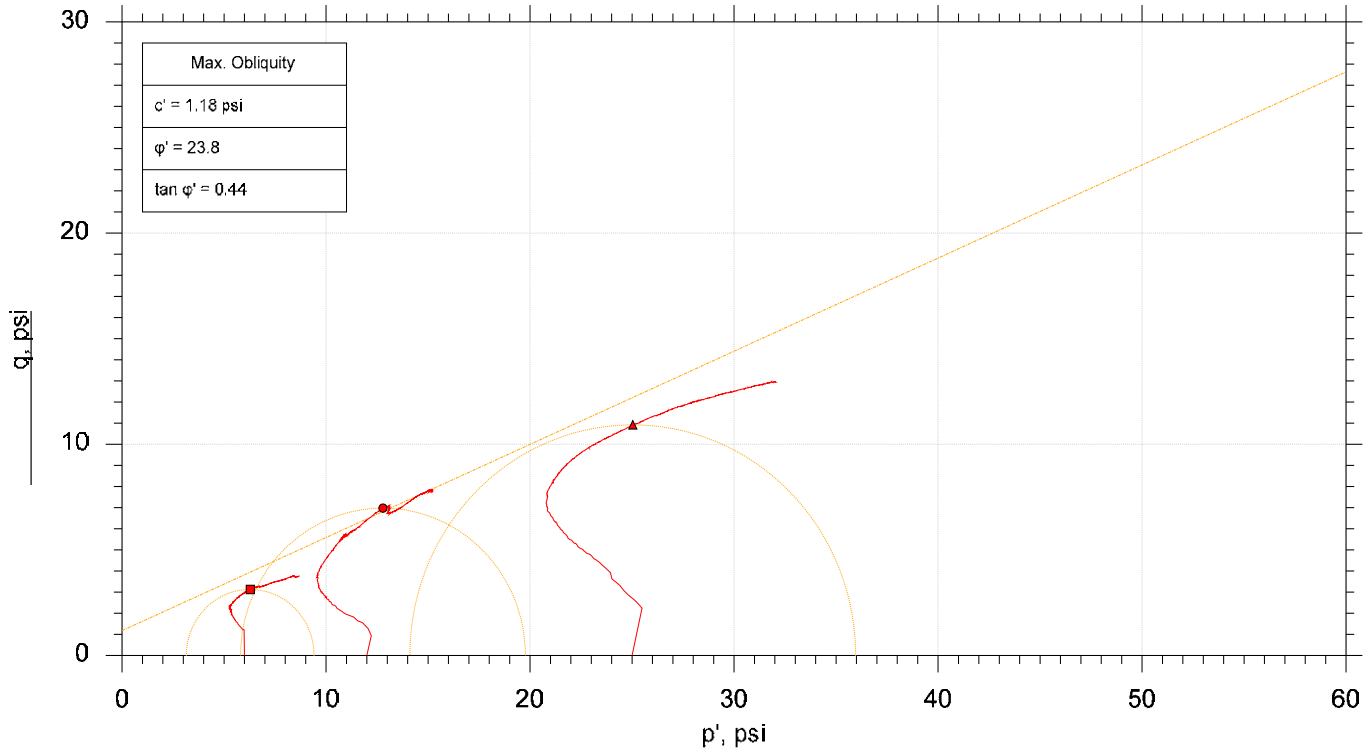


System B, Target Compaction: 95% of (112.2 pcf) at 14.4% Moisture Content. As requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







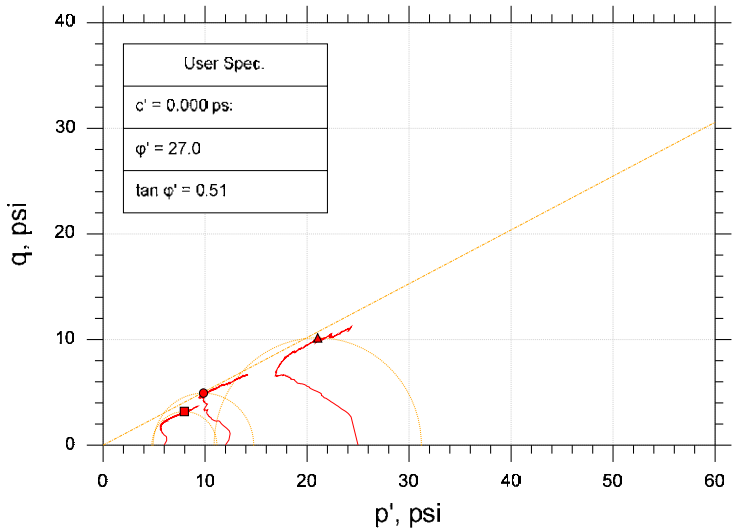
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP06	CU-1-1	---	md	4/14/17	mcm	4/20/17	306179-CU-1-1m.dat
●	TP06	CU-1-2	---	md	4/13/17	mcm	4/20/17	306179-CU-1-2m.dat
▲	TP06	CU-1-3	---	md	4/13/17	mcm	4/20/17	306179-CU-1-3m.dat

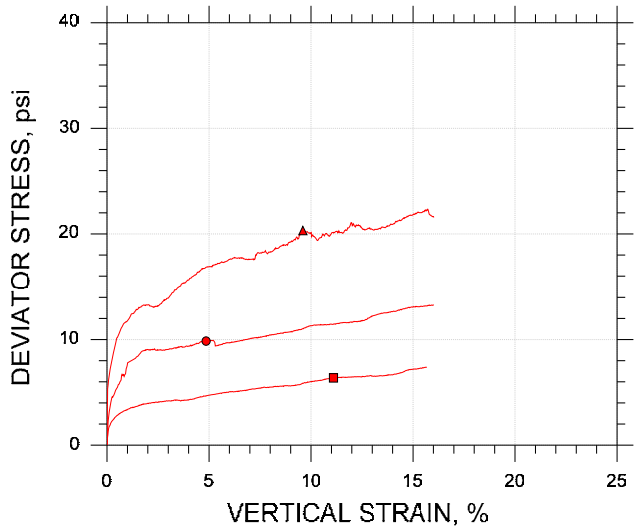
GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: Reconstituted	
Description: Moist, mottled light gray and light brown clay with sand		
Remarks: System B, Target Compaction: 95% of (112.2 pcf) at 14.4% Moisture Content. As requested by client.		

Client: Anchor QEA, LLC	
Project Name: Cristal	
Project Location: MD	
Project Number: GTX-306179	
Tested By: md	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, mottled red and light gray sandy clay	
Classification: Sandy CLAY	
Group Symbol: CL	
Liquid Limit: 28	Plastic Limit: 13
Plasticity Index: 15	Measured Specific Gravity: 2.66

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

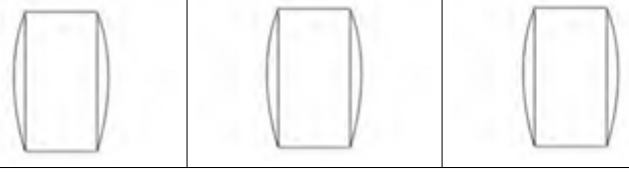




Symbol		■	●	▲	
Sample ID		TP08A	TP08A	TP08A	
Depth, ft		---	---	---	
Test Number		CU-5-1	CU-5-2	CU-5-3	
Initial	Height, in	4.000	4.000	4.000	
	Diameter, in	2.000	2.000	2.000	
	Moisture Content (from Cuttings), %	15.2	16.0	15.9	
	Dry Density, pcf	112.	111.	111.	
	Saturation (Wet Method), %	83.2	85.8	85.6	
	Void Ratio	0.485	0.496	0.495	
Before Shear	Moisture Content, %	17.1	16.0	15.6	
	Dry Density, pcf	114.	117.	117.	
	Cross-sectional Area (Method A), in²	3.093	3.038	3.039	
	Saturation, %	100.0	100.0	100.0	
	Void Ratio	0.455	0.425	0.415	
	Back Pressure, psi	114.9	150.9	150.9	
Vertical Effective Consolidation Stress, psi		5.981	11.93	24.83	
Horizontal Effective Consolidation Stress, psi		5.994	11.99	24.98	
Vertical Strain after Consolidation, %		0.3701	1.041	1.982	
Volumetric Strain after Consolidation, %		1.651	3.475	4.867	
Time to 50% Consolidation, min		0.6400	0.6400	6.250	
Shear Strength, psi		3.186	4.924	10.16	
Strain at Failure, %		11.1	4.85	9.60	
Strain Rate, %/min		0.01600	0.01600	0.01600	
Deviator Stress at Failure, psi		6.371	9.849	20.32	
Effective Minor Principal Stress at Failure, psi		4.783	4.916	10.88	
Effective Major Principal Stress at Failure, psi		11.15	14.76	31.20	
B-Value		0.94	0.95	0.95	

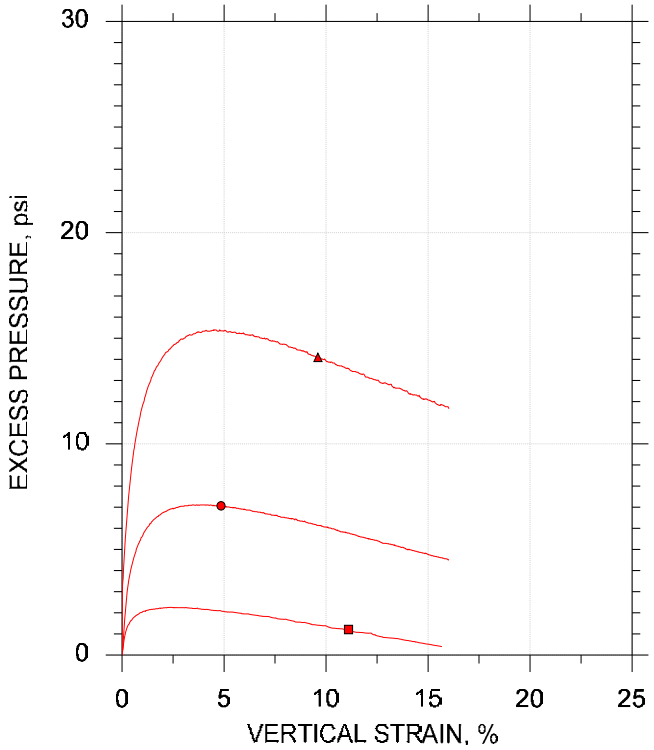
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

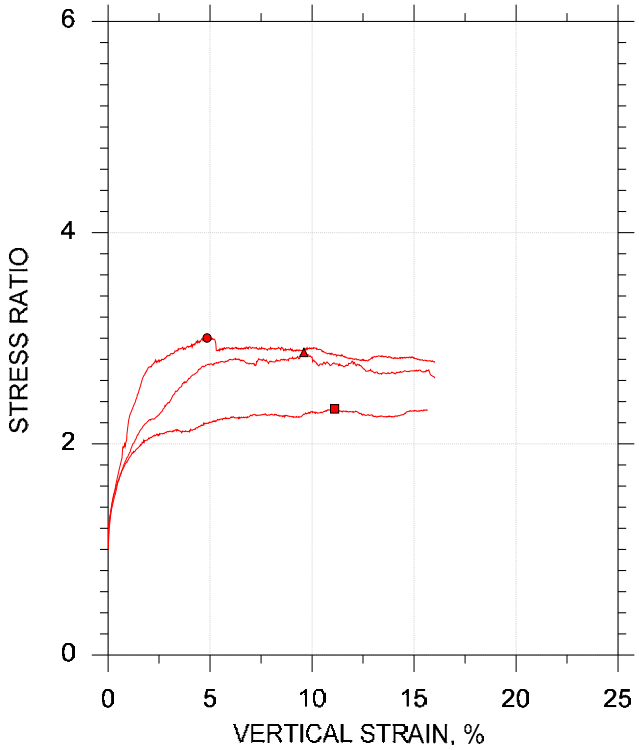
Remarks:

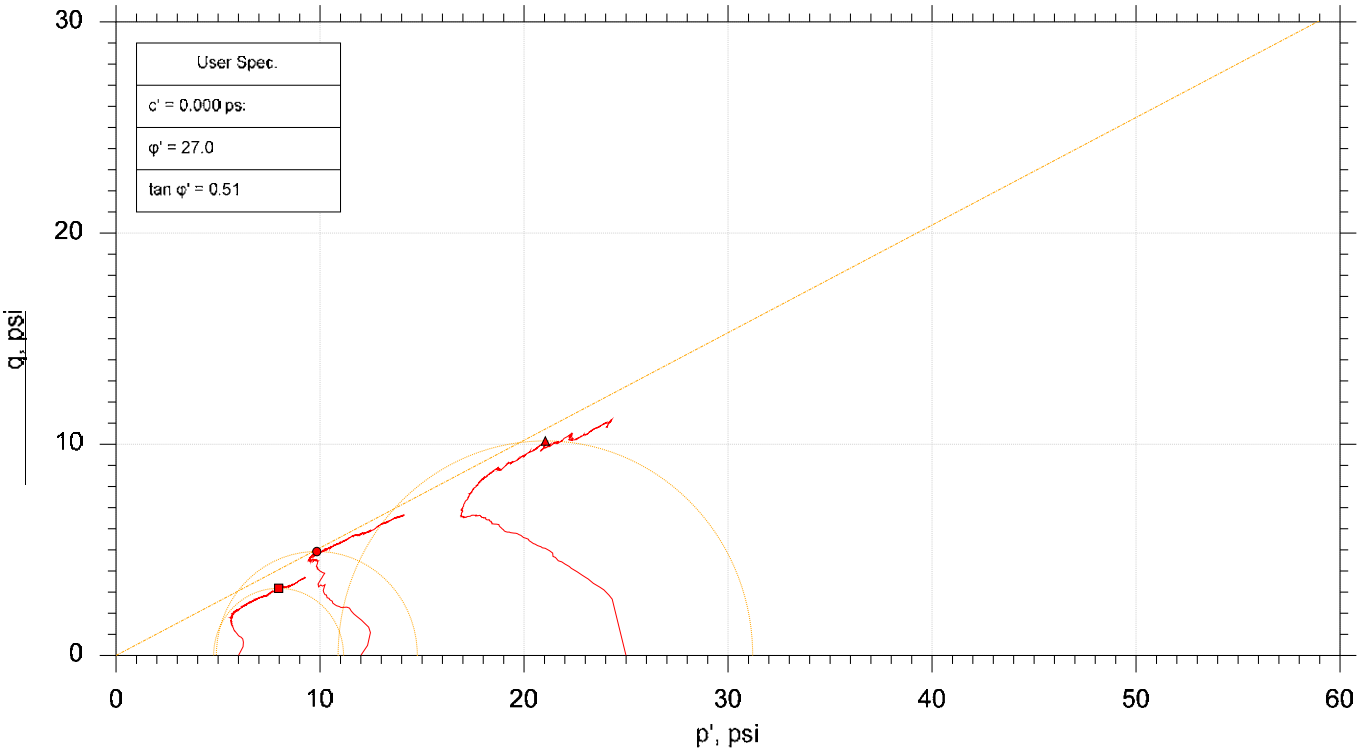


System V, Target Compaction: 95% of 120.9 pcf at 12.2% Moisture Content. As requested by client.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	TP08A	CU-5-1	---	md	04/21/17	njh	4/26/17	306179-CU-5-1n.dat
●	TP08A	CU-5-2	---	md	04/20/17	njh	4/26/17	306179-CU-5-2n.dat
▲	TP08A	CU-5-3	---	md	04/20/17	njh	4/26/17	306179-CU-5-3n.dat

GeoTesting EXPRESS

Project: Cristal	Location: MD	Project No.: GTX-306179
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, mottled red and light gray sandy clay		
Remarks: System V, Target Compaction: 95% of 120.9 pcf at 12.2% Moisture Content. As requested by client.		

Chain of Custody Record & Laboratory Analysis Request

Laboratory Number: GeoTesting Express
Date: 3/10/2017
Project Name: Cristal
Project Number: 160530-06.01
Project Manager: Rick Schwarz
Phone Number: 503-924-6173
Shipment Method: Commercial Courier (FedEx or UPS)

ANCHOR QEA

Line	Field Sample ID	Collection Date	Matrix	No. of Containers	Test Parameters: Moisture Content (D2216)	Atterberg Limits (D4318)	Particle Size w/ Hydro. (D422)	Specific Gravity (D854)	Organic Content (D2974)	Modified Proctor (D1557)	CU- Triaxial (D4767)	Permeability (D5084)	Comments/Preservation
1	TP01	3/9/2017	SOIL	1	X	X	X	X	X				
2	TP02	3/9/2017	SOIL	1	X	X	X	X	X				
3	TP04	3/9/2017	SOIL	1	X	X	X	X	X				
4	TP05	3/10/2017	SOIL	1	X	X	X	X	X				
5	TP06	3/9/2017	SOIL	1	X	X	X	X	X				
6	TP08A	3/10/2017	SOIL	1	X	X	X	X	X				
7													
8													
9													
10													
11													
12													
13													
14													
15													

Notes: Modified Proctor, CU-Triaxial, and Permeability testing will be assigned after initial review of the indicated index testing.
All samples shall be archived until testing results have been reviewed and approved by Anchor QEA

Relinquished By:	Company:	Received By:	Company:
Chad Robinson	Anchor QEA, LLC		GTX
Signature/Printed Name	Date/Time: 3/10/17 1150	Signature/Printed Name	Date/Time: 3/21/17 4:30PM
Relinquished By:	Company:	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

GeoTesting EXPRESS

125 Nagog Park
Acton, MA 01720
978-635-0424 phone
978-635-0266 fax

Client:	Anchor QEA, LLC		
Contact:	Chad Robinson		
e-mail:	crobinson@anchorqea.com		
Address:	290 Elwood Davis Road Suite 340 Liverpool, NY 13088		
Project Name:	Cristal USA		
Project Location:	Baltimore, MD		
Tracking #:	02162017-AnchorQEA-BaltimoreProject	Phone:	(734) 368-9416 x1002
Date:	2/20/2017	Mobile:	

Price Quote for Testing Services

Item #	Test Name	Standard	Notes	Unit Price, $	Quantity	Extended Price, $
1	Modified Proctor (Method A or B)	ASTM D 1557-4IN	---	175.00	8	1,400.00
2	Flexible Wall Permeability; <=2.87 inch diameter	ASTM D 5084	1	295.00	8	2,360.00
3	Three-Point CU Triaxial Shear Test Series with Pore Pressure Measurements; <=2.87 inch diameter (3 confining stresses)	ASTM D 4767-3P	2	1,140.00	8	9,120.00
			Estimated Total:			**12,880.00**

Notes:

1. USACE EM 1110-2-1906 also available; Water as permeant; add $40 for each laboratory reconstituted specimen and specify density and moisture condition; add $25 for each day of flow over 5
2. Specify confining stresses; add $40 for each laboratory reconstituted specimen and specify density and moisture condition; price includes a total of up 2 days for consolidation and shear - add $50 per each additional day

-This quote is valid for a period of sixty (60) days following the date given above.

-GTX's attached Standard Terms and Conditions for Engineering, Testing and Consulting Services apply.

-Unless otherwise noted above, pricing assumes samples are not contaminated and require no special handling.

-GTX will store non-contaminated samples for up to three months following the completion of a testing program. If longer storage times are required, $10 per sample per month will be invoiced. One sample is equivalent to 1 Shelby tube, 1 bag, 1 bucket, 1 box of jars, 1 roll of geosynthetic or 1 rock core box.

-GTX will return contaminated samples to client for disposal upon completion of a testing program. If longer storage times are required, $10 per sample per month will be invoiced. One sample is equivalent to 1 Shelby tube, 1 bag, 1 bucket or 1 box of jars.

GeoTesting EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CAI	CERCHAR Abrasiveness Index
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
CSR	cyclic stress ratio
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D	damping ratio
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
H_R	Rebound Hardness number
i	gradient
I_S	Uncorrected point load strength
$I_{S(50)}$	Size corrected point load strength index
H_A	Modified Taber Abrasion
H_T	Total hardness
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S_r	Post cyclic undrained shear strength
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_s	shear wave velocity
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ'_{vc}	Effective vertical consolidation stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

Appendix B
Chemical Laboratory Report

The chemical laboratory report is a very large file that is available separately.

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: G 1 Sheet 1 of 1
ct Location: Baltimore, MD lient: SCM Chemicals	SAMPLER Type: Split Spoon, 2" O.D. Hammer: 140 lbs. Fall:30 inches	Ground Water Depth Date Depth Date File No.:

oring Co.: Hardin-Huber
oreman: Jeff Stoufer
OBG Geologist: Mike Whittner

Boring Location:
Ground Elevation:
Dates: Started:10/06/88 Ended:10/7/88

Depth	Sample No	Sample Depth	Blows /6"	Penetr/ Recovry	"N" Value	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing pH	Field Testing Sp Cond	Field Testing HNU	Rmks*
0	1	0-2	4/16/18/8	24/20		Dry Orange, tan silt					0	
5	2	5-7	4/8/10/12	24/16		Dry whitish grey clay					0	
10	3	10-12	1/3/8/8	24/12		12-10: Dry whitish grey clay 10-0: Dry whitish-tan medium sand					0	
15	4	15-17	2/2/1/8	24/0		No recovery-no trap in spoon					0	
20	5	20-22	2/3/6/8	24/24		Dry grey clay with red speckles					0	
25	6	25-27	9/12/12/21	24/14		Dry grey clay with red speckles					0	
	7	30-32	8/18/26/35	24/24		Dry red, grey and mustard clay					0	
35	8	35-37	5/10/13/23	24/24		24-10: Same as above 10-0: Damp whitish grey sandy clay					0	
40	9	40-42	6/7/13/12	24/24		Dry red,grey, and mustard clay					0	
45	10	45-47	3/8/13/18	24/24		Dry grey-purple with some mustard colored clay					0	
50	11	50-52	8/14/23/30	24/24		Dry grey-purple clay					0	
55	12	55-57	11/18/33/41	24/24		Dry grey-purple clay					0	
60	13	60-62	4/14/22/28	24/24		Dry grey-rust red clay					0	

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: G 2 Sheet 1 of 1
ect Location: Baltimore, MD Client: SCM Chemicals	SAMPLER Type: Split Spoon, 3" O.D. Hammer: 140 lbs. Fall:30 inches	Ground Water Depth Date Depth Date File No.:

Boring Co.: Hardin-Huber
Foreman: Don Willey
OBG Geologist: Mike Whittner

Boring Location:
Ground Elevation:
Dates: Started:10/10/88 Ended:10/10/88

Depth	Sample No	Sample Depth	Blows /6"	Penetr/ Recovry	"N" Value	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing pH	Field Testing Sp Cond	Field Testing HNU	Rmks*
0	1	0-2	3/12/18/20	24/24		Dry grey clay with red and yellow concretions					0	
5	2	5-7	2/5/10/15	24/16		16-8: Dry reddish tan silty clay 8-0: Dry grey sandy silt					0	
10	3	10-12	3/5/7/10	24/12		Dry grey clay with red and some yellow					0	
15	4	15-17	3/5/7/14	24/24		Dry grey clay with some yellow and red					0	
20	5	20-22	3/5/7/14	24/24		Dry red clay with some grey					0	
25	6	25-27	3/16/27/38	24/24		Dry pinkish grey clay with red concretions					0	
	7	30-32	4/13/27/29	24/24		Dry pinkish grey to yellow clay					0	
35	8	35-37	4/9/30/56	24/24		Moist pinkish grey clay					0	
40	9	40-42	9-29-71-100/5"	23/23		Dry grey clay with some pink					0	
45	10	45-47	5-30-56-101/5"	23/23		Dry grey clay with some pink					0	

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: G 3 Sheet 1 of 1
ect Location: Baltimore, MD ient: SCM Chemicals	SAMPLER Type: Split Spoon, 3" O.D. Hammer: 140 lbs. Fall:30 inches	Ground Water Depth Date Depth Date File No.:

oring Co.: Hardin-Huber
oreman: Don Willey
OBG Geologist: Mike Whittner

Boring Location:
Ground Elevation:
Dates: Started:10/11/88 Ended:10/11/88

Depth	Sample No	Sample Depth	Blows /6"	Penetr/ Recovry	"N" Value	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing pH	Field Testing Sp Cond	Field Testing HNU	Rmks*
0	1	0-2	7/32/15/19	24/24		Dry brown silt					0	
5	2	5-7	6/7/8	18/18		Dry tan sand					0	
10	3	10-12	7/9/11/15	24/24		Damp tan silty fine sand					0	
15	4	15-17	3/5/8	18/18		Dry red silty clay with some grey					0	
20	5	20-22	3/10/17/24	24/18		Dry red clay with some grey clay					0	
25	6	25-27	Shelby			Dry red clay with some grey					0	
	7	30-32	4/7/11/15	24/18		Dry red and grey clay					0	
35	8	35-37	4/7/27/36	24/18		Dry red and grey clay with yellow concretions					0	
											0	
40	9	40-42	4/14/29/40	24/20		same as above					0	
45	10	45-47	12/23/30/45	24/24		same as above but damp					0	
											0	
50	11	50-52	22/35/54/63	24/24		Same as above, top of spoon damp, bottom of spoon dry						

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: G 16 Sheet 1 of 1
ject Location: Baltimore, MD nt: SCM Chemicals	SAMPLER Type: Split Spoon, 3" O.D. Hammer: 140 lbs. Fall:30 inches	Ground Water Depth Date Depth Date File No.:

oring Co.: Hardin-Huber
oreman: Don willey
Geologist: John D. Conway

Boring Location:
Ground Elevation:
Dates: Started:10/26/88 Ended:10/26/88

epth	Sample No	Depth	Blows /6"	Penetr/ Recovry	"N" Value	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing pH	Sp Cond	HNU	Organics*
0	1	0-2	2/7/23	18/14		Dry reddish tan medium sand with 10 cm of topsoil					0	
5	2	5-7	16/33/38/36	24/20		Wet reddish to tannish to yellowish medium to coarse sand with 6 cm of whitish grey clay at bottom of spoon					2	
10	3	10-12	24/29/38/43	24/20		Wet whitish grey clayey quartz sand 1 cm of iron cemented sands at top of spoon					0.2	
15	4	15-17	3/27/23/73	24/25		Dry, maroon and grey mottled hard clay with some 1 cm grey sandy clay lens					0	

te: The MEMO TO THE FILES dated 12/13/88, included on the preceding page, is an integral part of this boring log; this boring log should not be read without first reading the memo.

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: G 18 Sheet 1 of 1
ect Location: Baltimore, MD Client: SCM Chemicals	SAMPLER Type: Split Spoon, 3" O.D. Hammer: 140 lbs. Fall:30 inches	Ground Water Depth Date Depth Date File No.:

oring Co.: Hardin-Huber
oreman: Don Willey
OBG Geologist: John D. Conway

Boring Location:
Ground Elevation:
Dates: Started:10/28/88 Ended:10/28/88

Depth	Sample No	Sample Depth	Blows /6"	Penetr/ Recovry	"N" Value	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing pH	Field Testing Sp Cond	Field Testing HNU	Rmks*
0	1	0-2	1/2/3/3	24/14		Dry light brown to tan silty fine sand					0	
5	2	5-7	6/15/17/20	24/22		14-3: dry light tan almost white clean medium sand 3-0: slightly damp light orange-tan clayey medium sand					0.2	
10	3	10-12	8/9/11/11	24/22		Wet orangey brown clayey medium sand					0	
15	4	15-17	9/18/20/25	24/14		Dry, red and grey clay					0	

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	1 of 3	G-22

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 4:30pm Date: 3-5-91	Time: 7:20am Date: 3-8-91	Clem Walker/ Hillis-Carnes	Mobile B-57 Truck	81.5

Water Level Observations					
Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
3-5-91	4:35pm	4.0	N/A	N/A	3.0*
3-9-91	12:00pm	81.5	N/A	24.1	24.0

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH(ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								48.0							
SS 1	2.0	2.0	2-2-4 -5	6				48				0.5	Loose brown f-m SAND, some clayey silt, tr. roots, moist SAND/clayey silt/ALLUVIAL		* perched water
SS 2	2.0	2.0	5-7-8 -9	15									Loose light tan f-m SAND, tr. silt, moist -- dense, tan, wet		
SS 3	2.0	0.7	3-3-5 -6	8				43	5			5.0	-- SAND/ALLUVIAL		
SS 4	2.0	1.3	4-7-8 -12	15									Medium stiff tan-gray, red-brown **silty CLAY**, mottled, moist -- stiff light gray, red-brown, moist to slightly moist		
SS 5	2.0	1.3	4-4-6 -11	10									-- stiff gray with red-brown speckles, moist to slightly moist		
SS 6	2.0	2.0	4-8-11 -16	19					10				-- very stiff, red-brown, gray, olive-brown, moist to slightly moist		
SS 7	1.9	1.8	8-16- 30-51/5	46									-- as above		
SS 8	1.5	1.5	25-34- 51/6	51/6					15				-- hard, as above, tr. f sand		
SS 9	2.0	2.0	14-18- 36-36	54									-- as above		
SS 10	2.0	2.0	16-16- 18-28	34									Hard red-brown, olive, yellow-gray **silty CLAY**, tr. f sand, (occ. f sand partings), mottled, moist		
SS 11	2.0	2.0	5-5-15 -22	20					20				Very stiff olive, gray, red-brown **silty CLAY**, some f sand, (occ. f sand and clayey silt pockets/seams), moist		
								26				22.0	silty CLAY/sand/ALLUVIAL		
SS 12	2.0	2.0	10-7- 11-16	18									Dense tan-gray, orange-brown, olive **f-m SAND AND CLAY & SILT**, (frequent f-m SAND, little silt seams/layers, and occ. silty clay seams), moist		
SS 13	2.0	2.0	5-7-22 -32	29					25				-- light gray, gray-tan, (frequent f-m SAND, tr. silt layers), moist to very moist		
								22				26.0	SAND/CLAY & SILT/ALLUVIAL		
SS 14	2.0	2.0	5-12- 28-32	40				21				27.0	Hard gray, red-brown silty CLAY, some f sand, moist silty CLAY/sand/ALLUVIAL		
SS 15	2.0	2.0	10-16- 24-38	40									Hard light gray, gray-brown CLAY, moist -- olive, gray, red-brown, brown CLAY to **Silty CLAY**, moist to slightly moist		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	2 of 3	G-22
Project Location		**Logged**	
Baltimore, Maryland		Harvey Beaulieu	

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 16	1.5	1.7	11-19-24	43	23	60	37						Hard red-brown, gray, olive silty CLAY, mottled, tr. f-c iron-cemented concretions up to 1/8", moist		Permeability Test run at 30'
SS 17	2.0	2.0	13-20-30-45	50									-- gray, red-gray, concretions up to 1/4"		
SS 18	2.0	2.0	8-17-30-45	47					35				--		
SS 19	2.0	2.0	11-19-30-42	49									--		
SS 20	2.0	2.0	11-23-33-51	56									-- tr. f sandy iron concretion pockets up to 1/4"		
SS 21	1.5	1.5	20-35-43	78					40				-- red-brown, gray, tr. f iron-cemented concretions up to 1/8", moist to slightly moist		Permeability Test run at 40'
SS 22	2.0	1.5	12-26-32-51	58									-- and brown		
SS 23	1.5	1.0	18-40-51	91					45				--		
SS 24	2.0	1.7	10-21-32-50	53									--		
SS 25	1.5	1.2	16-34-51	85									Hard gray, brown, red-brown silty CLAY mottled, slightly moist		
SS 26	1.5	1.5	14-30-51	81					50				-- gray, red-brown, moist		
SS 27	1.5	1.5	20-35-51	86									--		
SS 28	1.4	1.5	18-34-51/5	51/5					55				-- and olive		
SS 29	1.5	1.5	22-36-51	87									-- gray, red-brown, moist to slightly moist		
SS 30	1.5	1.5	12-22-51	73									-- and brown, mottled/speckled, dry to slightly moist		
SS 31	1.5	1.5	12-22-51	73					60				--, (occ. light gray clayey silt, little f sand pockets), dr		
SS 32	1.5	1.5	18-32-51	83									--		
SS 33	1.5	1.5	10-31-51	82					65				-- and yellow		
SS 34	1.4	1.4	17-34-51/5	51/5									-- speckled/mottled, tr. f iron-cemented concretions up to 1/8", dry		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	3 of 3	G-22

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 35	1.4	1.4	20-35-51/5	51/5								-- and red-gray, dry to slightly moist		
SS 36	1.4	1.4	14-35-51/5	51/5					70			-- as above		
SS 37	1.3	1.3	20-42-51/4	51/4								-- and olive, dry		
SS 38	1.5	1.5	17-32-51	83								-- red-brown, gray, red-gray, dry		
SS 39	1.3	1.0	16-38-51/4	51/4					75			-- as above		
SS 40	1.5	1.5	20-30-51	81								-- as above		
SS 41	1.5	1.5	18-26-51	77					80			-- as above		
								-34			81.5	silty CLAY/ALLUVIAL		
												Boring Terminated at 81.5'		

NOTES:
1. Boring drilled at proposed location

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	1 of 3	G-3D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 2:57pm Date: 2-23-91	Time: 2:27pm Date: 2-27-91	Clem Walker/ Hillis-Carnes	Mobile B-57 Truck	91.4

Water Level Observations					
Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
2-25-91	12:44pm	40.0	N/A	N/A	37.7*

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								60.4							
SS 1	1.8	1.8	2-4-6 -7	10									Medium stiff tan-red-brown **CLAY & SILT**, little f-m sand, tr. roots, moist		* 2-25-91 water reading made before permeability test; level was rising when reading was taken.
								58				2.0	CLAY & SILT/ALLUVIAL		
SS 2	2.0	2.0	2-3-2 -2	5									Loose brown, gray-brown f-m SAND AND **clayey SILT**, tr. f gravel, moist		
SS 3	1.5	1.5	4-5-8 -8	13				56	5			4.5	SAND/clayey SILT/ALLUVIAL Medium dense tan **f-m SAND**, tr. silt, moist		
SS 4	1.7	1.7	5-6-14 -8	20									-- tr. to little clayey silt		
								53				7.5	Dense purple-brown iron-cemented SANDSTONE layer from 7.4' - 7.5'		
SS 5	1.2	1.2	4-7-9 -15	16									SAND/ALLUVIAL Stiff red-brown **silty CLAY** layers (4") alternating with dense tan brown f-m **SAND**, some clayey silt layers (2"), tr. iron cemented sandstone fragments, moist		
								50	10			10.0	silty CLAY/SAND/ALLUVIAL		
SS 6	2.0	2.0	2-5-7 -10	12									Stiff light gray **CLAY & SILT**, (occ. silty clay seams), moist to slightly moist		
SS 7	2.0	2.0	9-11- 14-18	25									-- red-brown, gray, mottled, (one yellow-tan, gray silty CLAY, some f sand layer 12.0' - 12.3', moist)		
SS 8	2.0	2.0	9-17- 19-24	36					15				-- red-brown, gray, mottled		
								44				16.0	CLAY & SILT/ALLUVIAL		
SS 9	1.7	1.7	10-10- 17-17	27									-- as above, **silty CLAY**, slightly moist		
SS 10	2.0	2.0	10-14- 20-20	34									-- hard, as above, silty CLAY, (occ. olive f-sand and silt partings)		
SS 11	2.0	2.0	9-14- 20-45	34					20				Hard red-brown, gray, yellow-brown **silty CLAY**, mottled, moist to slightly moist		
SS 12	2.0	2.0	8-14- 16-21	30											
SS 13	2.0	NR	4-8-11 -16	19					25				No Recovery, three attempts		
SS 14	2.0	2.0	6-8-12 -14	20									-- very stiff, gray, red-brown, moist		
SS 15	2.0	0.7	5-10- 14-18	24									-- very stiff		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	2 of 3	G-3D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 16	2.0	0.5	4-8-14 -16	22									-- very stiff		
								28				32.0	silty CLAY/ALLUVIAL		
SS 17	2.0	2.0	10-17- 22-31	39									Very stiff gray, red-brown **CLAY & SILT**, (occ. SILT & CLAY AND f SAND seams/layers, up to 2"), moist		
SS 18	2.0	2.0	8-15- 15-22	30					35				Very stiff red-brown, gray, yellow-brown **CLAY & SILT**, little f sand, moist		
SS 19	2.0	2.0	10-16- 22-40	38				23				37.0	CLAY & SILT/ALLUVIAL		
SS 20	2.0	2.0	13-18- 17-23	35									Very stiff gray **clayey SILT**, some f sand, (occ. silt & clay seams), moist -- little f sand, (frequent f SAND, little/some silt) layers)		
								20	40			40.0	clayey SILT/sand/ALLUVIAL		
SS 21	2.0	1.5	5-10- 17-21	27									Very stiff red-brown, gray, yellow-brown **CLAY**, (occ. silt & clay seams, with clayey silt and f sand seams), moist		Permeability Test run at 40'
SS 22	2.0	2.0	6-16- 30-40	46									Hard olive, red-brown, gray silty CLAY, tr. f sand partings, mottled, moist		
SS 23	2.0	2.0	13-21- 26-31	47					45				-- moist to slightly moist		
SS 24	2.0	2.0	10-24- 32-50	56									-- and red-gray, tr. f red-brown iron-cemented concretions, moist to slightly moist		
SS 25	2.0	2.0	14-24- 35-25	59									-- as above		
SS 26	1.5	1.5	8-23 -40	63					50				Hard red-brown, gray, olive silty CLAY, tr. f iron concretions, (occ. clay seams), moist		Permeability Test run at 50'
SS 27	1.9	1.9	10-20- 30-51/5	50									-- and brown, moist to slightly moist		
SS 28	1.5	1.5	8-26 -51	77					55				-- as above, mottled, slightly moist		
SS 29	2.0	2.0	10-16- 30-50	46									-- as above, occ. iron stains/concretions, slightly moist		
SS 30	1.9	1.9	13-26- 43-51/5	69									Hard brown, gray, red-gray silty CLAY, mottled, slightly moist to dry		
SS 31	1.6	1.5	12-20- 51	71					60				--		
SS 32	1.5	1.5	13-20- 51/6	71									--		
SS 33	2.0	2.0	8-19- 38-51	57					65				--		
SS 34	1.9	1.8	16-27- 39-51/5	66									--		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	3 of 3	G-3D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 35	1.5	1.5	13-34-51/6	85									--		
SS 36	1.4	1.4	20-34-51/5	51/5					70				--		
SS 37	1.5	1.5	13-30-51	81									Hard red-brown, gray mottled silty CLAY, tr. iron stains/concretions, slightly moist to dry		
SS 38	1.9	1.7	13-28-34-51/5	62					75				--		
SS 39	1.5	1.5	19-34-51/6	51/6									--		
SS 40	1.5	1.5	18-37-51/5	51/5									-- moist to slightly moist		
SS 41	1.4	1.4	30-43-51/5	51/5					80				-- and yellow-tan, tr. f sand, moist		
								-22				82.0	silty CLAY/ALLUVIAL		
SS 42	1.4	1.4	29-43-51/5	51/5									Hard olive, red-brown, gray silty CLAY, tr. f sand, (frequent gray, olive-tan clayey SILT, some f-m sand layers), moist to very moist		
								-24				84.2	silty CLAY/silt/sand/ALLUVIAL		
SS 43	1.4	1.4	19-44-51/5	51/5					85				Hard dark gray, red-brown, olive silty CLAY, mottled, moist		
								-26				86.0	silty CLAY/ALLUVIAL		
SS 44	1.4	1.4	*/12-51/4	51/4									Hard dark gray, gray CLAY & SILT, tr. f black lignite fragments up to 1/2 inch, (occ. silty clay seams with f sand partings), moist to slightly moist		* drill rods dropped, spoon penetrated 12" prior to SPT
SS 45	1.4	1.4	32-44-51/5	51/5									-- (frequent silt & clay layers), slightly moist to dry		
SS 46	1.4	1.4	27-45-51/4	51/4					90				Hard dark to medium gray CLAY & SILT, (frequent clayey silt seams with occ. f sand partings), slightly moist to dry		
								-31				91.4	CLAY & SILT/ALLUVIAL		
													Boring Terminated at 91.4'		

NOTES:
1. Boring offset 18' NE from existing G-3 well.

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	1 of 3	G-16D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 9:00am Date: 2-28-91	Time: 10:11am Date: 3-5-91	Clem Walker/ Hillis-Carnes	Mobil B-57 Truck	71.3

Water Level Observations					
Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
2-28-91	9:18am	6.0	N/A	N/A	5.0*

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	+1 ELEV. (ft)	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								40.8						
SS 1	2.0	1.5	4-7-12 -16	19								Dense brown, tan-brown f-m SAND, little clayey silt, tr. roots, moist		* perched water
SS 2	2.0	1.7	4-7-12 -12	19								-- gray-tan, tan-brown, tr. clayey silt, moist to very moist		
SS 3	2.0	1.7	5-9-9 -14	18					5			-- gray-tan, tr. silt, wet		
								35			6.0	SAND/ALLUVIAL		
SS 4	2.0	2.0	7-10 -14-24	24								Dense gray-tan m SAND, tr. silt, (frequent gray CLAY & SILT, little f-m sand seams/layers with tr. iron-cemented seams), wet to very moist		
SS 5	2.0	1.7	2-10- 22-32	32								-- (tan-yellow silty CLAY layers)		
								31			9.6	SAND/clay & silt/ALLUVIAL		
SS 6	2.0	1.7	11-19- 27-35	46					10			Hard red-brown, tan silty CLAY, some f gravel, tr. f-c sand, iron-stained, very moist		
SS 7	1.9	1.9	19-23- 40-51/5	63				29			12.0	-- CLAY & SILT, little f-c gravel, (occ. black-gray f gravel, some f-m sand seams with occ. f-m sand seams/layers), iron-stained, moist to slightly moist		
												CLAY & SILT/gravel/sand/ALLUVIAL		
SS 8	1.5	1.5	23-27- 51	78					15			Hard red-brown, tan CLAY & SILT, some f sand, mottled, moist -- and olive, AND f SAND, moist to slightly moist		
SS 9	1.0	1.0	30- 51-6	51/6								Hard gray, red-brown SILT & CLAY AND f SAND, mottled, slightly moist to dry		
SS 10	2.0	2.0	24-28- 40-50	68								-- (occ. gray silty clay seams/layers)		
								21	20		20.0	CLAY & SILT/SAND/ALLUVIAL		
SS 11	2.0	2.0	9-19- 37-50	56								Hard gray, red-brown silty CLAY, mottled, slightly moist		Permeability Test run at 20'
SS 12	1.5	1.6	20-30- 51/6	51/6								-- and olive		
SS 13	2.0	2.0	8-14- 19-30	33					25			-- (occ. silty clay, frequent f sand pockets), tr. iron-stains/cementation, moist		
SS 14	2.0	2.0	8-14- 22-30	36								Hard red-brown, purple, gray, olive, silty CLAY, mottled, tr. friable iron-cemented/stained concretions, moist		
SS 15	2.0	2.0	5-10- 16-24	26								--		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	2 of 3	G-16D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 16	1.5	1.5	8-15-21	36									Hard gray-red, red-brown, olive CLAY & **SILT**, (occ. silty clay seams), tr. f sand, (little f sand below 31.5'), moist		Permeability Test run at 30.5'
SS 17	2.0	2.0	5-7-15 -24	22									-- very stiff, and brown, **silty CLAY**, mottled		
								7				34.0	CLAY & SILT/ALLUVIAL		
SS 18	2.0	2.0	9-20- 40-51	60					35				Hard gray, olive, brown, red-brown silty **CLAY**, mottled, moist		
SS 19	2.0	2.0	11-18- 30-50	48									--		
SS 20	2.0	1.5	6-8-15 -35	23									-- very stiff, moist to slightly moist		
SS 21	2.0	2.0	*23-35 -51/5	58					40				-- slightly moist to dry		* drill rods dropped, spoon penetrated 6" prior to SPT
								-1				42.0	silty CLAY/ALLUVIAL		
SS 22	2.0	2.0	9-18- 24-40	42									Hard brown, olive, gray CLAY & SILT, some f sand, occ. silty clay pockets, mottled moist		
SS 23	2.0	2.0	8-20- 30-51	50					45				-- AND f SAND		
SS 24	1.5	1.5	12-30- 51/6	51/6				-6				46.5	CLAY & SILT/SAND/ALLUVIAL Very dense gray f SAND, little silt, (occ. f sand and silt & clay pockets), moist to very moist		
SS 25	1.9	1.9	10-28- 35-51/5	63									-- tan-brown, gray, little to tr. silt, (occ. silty clay partings/seams), moist		
SS 26	1.5	1.5	15-20- 51/6	51/6					50				Very dense olive, gray, brown f-m SAND, little silt, (frequent f-m SAND, some clay & silt pockets), mottled, tr. f silica-cemented sandstone fragments, very moist to moist		
SS 27	1.9	1.9	10-22- 40-51/5	62				-12				52.5	-- (occ. light gray silty clay seams) SAND/clay & silt/ALLUVIAL		
SS 28	1.5	1.5	12-33- 51/6	51/6									Hard gray, red-brown, olive silty CLAY, mottled, moist -- and tan-brown, slightly moist to dry		
SS 29	1.5	1.5	15-30- 51/6	51/6					55				--		
SS 30	1.5	1.5	14-20- 51/6	51/6									-- purple-brown, gray, red-brown, slightly moist to dry		
SS 31	1.9	1.7	10-14- 28-51/5	42					60				-- tr. f sand, moist to slightly moist		
SS 32	1.5	1.5	16-34- 51/6	51/6									-- slightly moist		
SS 33	1.5	1.5	18-26- 51/6	51/6					65				-- red-brown, gray, slightly moist		
SS 34	1.5	1.6	25-35- 51/6	51/6									-- as above		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C1636-02	SCM Chemicals, Inc. HPP Landfill	3 of 3	G-16D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 35	1.3	1.4	12-46-51/4	51/4								-- red-brown, gray, brown, slightly moist		
SS 36	1.3	1.3	30-50-51/4	51/4				-31	70		71.3	-- red-brown, gray, purple, tr. friable iron-cemented concretions, moist to slightly moist silty CLAY/ALLUVIAL		

Boring Terminated at 71.3'

NOTES:

1. Boring offset 20' S from existing G-16 well.

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C-1636-02	SCM Chemicals, Inc. HPP Landfill	1 of 5	G-18D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 10:00am Date: 2-20-91	Time: 5:00pm Date: 3-7-91	W. D. Stephens/ Hillis-Carnes	Mobile B-61 Truck	161.0

Water Level Observations					
Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
2-20-91	10:17am	8.0	N/A	N/A	6.5*
3-27-91	11:26am	161.0	158.4	N/A	44.82
4-11-91	10:09am	161.0	158.4	N/A	45.62

SAMPLE TYPE/NO.	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH(ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								47.5							
SS 1	2.0	1.3	2-3-4 -7	7									Loose light brown f-m SAND, tr. silt, tr. f-c iron-cemented concretions, moist		* perched water
SS 2	2.0	1.3	8-8-11 -16	19									Dense tan f-m SAND, tr. silt, slightly moist		
SS 3	2.0	1.5	8-13- 14-22	27					5				-- very dense tan-brown, very moist		
SS 4	2.0	1.7	6-10-7 -10	17									-- wet		
SS 5	2.0	2.0	3-5-6 -11	11									-- tan-orange-brown, wet		
SS 6	2.0	2.0	4-4-4 -5	8					10				-- medium dense tan-orange-red-brown, grades to c-f SAND, wet		
SS 7	2.0	2.0	8-6-8 -6	14									Medium dense brown m SAND, tr. silt, wet, (dark gray-olive-brown sandy iron-cemented concretion, little silt 13.8' - 13.9')		
								34				13.9	SAND/ALLUVIAL		
SS 8	2.0	0.9	1-4-11 -17	15					15				Medium stiff gray **CLAY & SILT**, some brown c-f sand layers, moist		
								32				16.0	CLAY & SILT/sand/ALLUVIAL		
SS 9	2.0	1.5	8-19- 26-32	45									Hard gray, red-brown silty CLAY, mottled, moist		
SS 10	2.0	1.6	9-18- 23-24	41									-- (occ. layers with little m sand), moist to very moist		
SS 11	2.0	1.6	10-13- 17-19	30					20				--		
SS 12	2.0	1.7	7-10- 12-16	22									--		
SS 13	2.0	1.7	7-10- 16-19	26					25				--		
								22				26.0	silty CLAY/ALLUVIAL		
SS 14	2.0	1.8	8-11- 12-14	23									Dense gray f SAND, little silt, (frequent red-brown, gray silty CLAY layers), very moist		
								20				28.0	SAND/silty clay/ALLUVIAL		
SS 15	2.0	1.8	5-7-12 -14	19									-- f SAND AND clayey SILT, (occ. silty clay layers)		
								18				30.0	SAND/SILT/ALLUVIAL		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C-1636-02	SCM Chemicals, Inc. HPP Landfill	2 of 5	G-18D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 16	2.0	0.9	2-6-13 -20	19									Medium stiff gray, red-brown **silty CLAY**, (occ. silt & clay, little f sand seams), mottled, moist		
SS 17	2.0	1.7	5-12- 16-21	28									Very stiff gray, olive, red-brown **silty CLAY**, moist to very moist		
SS 18	2.0	2.0	7-14- 19-24	33					35				-- red-gray, red-brown, purple		
SS 19	2.0	1.6	9-14- 21-27	35									-- gray, red-brown		
SS 20	2.0	2.0	6-18- 26-33	44									--		
SS 21	2.0	2.0	6-17- 22-30	39					40				--		
SS 22	1.4	1.2	27-39- 51/5	51/5									--		
SS 23	1.4	1.3	27-35- 51/5	51/5					45				-- gray, red-brown, olive-brown, slightly moist		
SS 24	2.0	2.0	22-36- 46-51	82									-- (occ. iron-cemented concretions), moist to slightly moist		
SS 25	0.3	0.3	100/4	100/4				-1				48.0	silty CLAY/ALLUVIAL Hard gray, red-brown, olive CLAY & SILT, (frequent SILT, little f sand pockets w/silica cementation), slightly moist		
SS 26	0.9	0.9	37- 51/5	51/5				-2	50			49.5	CLAY & SILT/ALLUVIAL Hard red-brown, gray, brown silty CLAY, mottled, (occ. iron-cemented pockets up to 1/2 inch), moist		
SS 27	1.3	1.3	23-41- 51/4	51/4									--		
SS 28	0.7	0.7	43- 51/3	51/3					55				--		
SS 29	0.9	0.8	42- 51/5	51/5									--		
SS 30	0.9	0.8	42- 51/5	51/5									-- moist to slightly moist		
SS 31	0.3	0.3	51/4	51/4				-13	60			60.0	silty CLAY/ALLUVIAL Hard gray, olive, red-brown SILT, some f sand, (frequent CLAY & SILT, tr. f sand layers), mottled, slightly moist		
SS 32	0.3	0.3	51/3	51/3									Hard gray-red, brown silty CLAY, (frequent dark brown silty CLAY, some f-m sandy iron-cemented pockets), slightly moist		
SS 33	0.4	0.4	51/5	51/5					65				-- (frequent iron-cemented pockets), moist		
SS 34	0.4	0.4	51/5	51/5									--		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C-1636-02	SCM Chemicals, Inc. HPP Landfill	3 of 5	G-18D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 35	0.4	0.4	51/5	51/5									Hard gray-red, brown, olive silty CLAY, (occ. clay & silt, tr. f sand pockets), mottled, moist		
SS 36	0.9	0.9	37-51/5	51/5					70				--		
SS 37	0.9	0.9	44-51/5	51/5									--		
SS 38	0.8	0.8	43-51/3	51/3					75				-- slightly moist to moist		
SS 39	1.4	1.4	38-39-51/5	51/5									-- moist to very moist		
SS 40	1.0	1.0	42-51/6	51/6									-- dark brown, red-brown		
SS 41	1.4	0.8	37-48-51/5	51/5					80				-- and gray, tr. f friable iron concretions/stains		
SS 42	1.0	0.9	42-51/6	51/6									-- moist to slightly moist		
SS 43	0.5	0.5	51/6	51/6					85				-- moist to slightly moist		
SS 44	0.9	0.8	48-51/5	51/5									-- moist		
SS 45	1.4	1.4	32-43-51/5	51/5									-- slightly moist to moist		
SS 46	1.3	0.8	30-45-51/4	51/4					90				--		
SS 47	1.4	1.5	44-34-51/5	51/5									-- red-brown, gray, (occ. f iron concretions)		
SS 48	0.9	0.9	41-51/5	51/5					95				--		
SS 49	1.0	0.9	32-51/6	51/6									--		
SS 50	1.0	0.9	35-51/6	51/6									-- (occ. f iron-cemented concretions), moist		
SS 51	0.9	0.8	40-51/5	51/5					100				--		
SS 52	0.8	0.8	43-51/4	51/4									-- moist to slightly moist		
SS 53	0.4	0.4	51/5	51/5									--		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C-1636-02	SCM Chemicals, Inc. HPP Landfill	4 of 5	G-18D
Project Location		**Logged**	
Baltimore, Maryland		Harvey Beaulieu	

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 54	0.3	0.3	51/4	51/4									--		
SS 55	0.5	0.5	63/6	63/6									--		
SS 56	0.9	0.9	41-51/5	51/5					110				--		
SS 57	0.8	0.8	43-51/4	51/4									--		
								-67				114.0	silty CLAY/ALLUVIAL		
SS 58	2.0	2.0	27-31-37-31	68					115				Hard tan-brown, gray SILT & CLAY AND f SAND, (frequent wet f SAND, some silt layers), moist		
SS 59	2.0	2.0	22-25-28-35	53									Hard brown clayey SILT, some f sand, very moist		
SS 60	1.4	1.4	37-42-51/5	51/5									-- AND f SAND, (occ. silty clay seams)		
SS 61	1.4	1.4	35-40-51/5	51/5					120				Hard brown CLAY & SILT, some f sand, (occ. silty clay seams), moist		
SS 62	1.4	1.4	20-36-51/5	51/5									-- (occ. gray silty clay seams)		
								-76				123.5			
SS 63	1.0	0.8	27-51/6	51/6					125				Hard brown, olive-brown clayey SILT AND f SAND, moist		
SS 64	1.3	1.3	40-45-51/3	51/3									-- gray, gray-brown, (occ. silty CLAY layers)		
								-81				128.0			
SS 65	0.9	0.8	38-51/3	51/3									Very dense gray, brown gray f SAND, some silt, (frequent olive CLAY & SILT seams/layers), wet to very moist		
								-83	130			130.0	SILT/CLAY/SAND/ALLUVIAL		
SS 66	0.5	0.5	100/6	100/6									Hard light gray silty CLAY, (occ. silty clay, little f sand seams/pockets), moist		
SS 67	0.5	0.3	71/6	71/6									Hard tan-brown, gray CLAY & SILT, little f sand, (occ. silty clay partings/seams), moist		
								-87				134.0	silty CLAY/ALLUVIAL		
SS 68	0.5	0.5	62/6	62/6					135				Very dense gray f SAND, tr. silt, (occ. silty clay seams/partings), wet		
SS 69	0.5	0.4	91/6	91/6									-- gray, tan-gray, (frequent silt & clay seams)		
								-91				138.0	SAND/ALLUVIAL		
SS 70	0.3	0.3	100/4	100/4									Hard light gray SILT & CLAY, little f sand, moist		
SS 71	0.5	0.5	100/6	100/6					140				--		
SS	0.4	0.4	100/5	100/5				-95				142.0	SILT & CLAY/ALLUVIAL		

TEST BORING LOG

Job Number	Client/Project	Sheet No.	Boring No.
C-1636-02	SCM Chemicals, Inc. HPP Landfill	5 of 5	G-18D

Project Location	Logged
Baltimore, Maryland	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. CORE LENG. (ft)	SAMPLE REC. CORE REC. (ft)	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
72													Hard light gray f SAND AND clayey SILT, moist		
								-97				144.0	SAND/clayey SILT/ALLUVIAL		
SS 73	0.3	0.1	100/4	100/4					145				Hard gray, red-brown CLAY & SILT, little f sand, very moist		
								-99				146.0	CLAY & SILT/ALLUVIAL		
SS 74	0.8	0.8	50- 51/3	51/3									Very dense gray f-m SAND, little silt, wet		
SS 75	0.5	0.5	102/6	102/6	22								Very dense gray, gray-tan f SAND, tr. silt, wet		
SS 76	0.5	0.5	112/6	112/6					150				-- tan brown		
SS 77	0.5	0.5	147/6	147/6									--		
SS 78	0.5	0.5	177/6	177/6					155				--		
SS 79	0.5	0.5	145/6	145/6									--		
SS 80	0.5	0.5	154/6	154/6				-111				158.5	-- yellow-tan, gray, wet to very moist SAND/ALLUVIAL		
									160						
								-114				161.0			

Boring Drilled to 161.0' with 7 1/2" wing bit after sampling to 158.5' with split-barrel sampler

NOTES:

1. Well G-18D offset 15' E from existing G-18 well.
2. 8" ID Surface Casing set at 40.0' before drilling below 40'.
3. 4" ID Schedule 40 Flush-Threaded PVC **WELL CONSTRUCTED AS FOLLOWS:**
   Borehole reamed to depth 161' and flushed with thinned Bentonite Gel mud
   0.020" slotted screen set at depth 148.4' to 158.4'
   4" riser from surface down to 148.4', stick-up = 2.0'
   3 PVC centralizers fastened to well at depths 52', 145' and 157'
   2.5 sacks coarse sand pack (Ricci #1) top at depth 135'
   0.75 sacks fine sand pack (Ricci #0) from depth 132'to 135'
   0.75 of five-gallon bucket of 1/4-inch bentonite pellets from depth 130' to 132'
   22 sacks Portland Type I/II mixed with 154 gallons water tremie grouted from depth 130' up to ground surface.

C 1 U312 — SEQUENCE NO. (OEP USE ONLY)

THIS NUMBER IS TO BE PUNCHED (COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER

DATE Received

DATE WELL COMPLETED 5-19-91

Depth of Well 158 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" BC-88-1097

OWNER SCM CHEMICALS

TREET OR RFD 3451 legal name FORT ARMISTEAD ROAD actual name TOWN BALTIMORE

JBDIVISION HAWKINS POINT SECTION LOT

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
FINE TO MEDIUM SAND, Little SILT	0	14'	✓
CLAY & SILT	14	26'	
SAND & SILT, SOME CLAY	26	30'	✓
SILTY CLAY TO LAYEY SILT, Trace fine Sand in layers	30	114'	
SILT & CLAY, Some Sand	114'	1235'	
SILT & SAND, Some CLAY Seams	1235'	130'	
SILTY CLAY	130	134'	
FINE SAND TRACE OF SILT	134	138'	✓
SILT & CLAY	138	142'	
SAND & CLAY-SILT	142	144'	
CLAY & SILT	144'	146	
FINE TO MEDIUM SAND, TRACE SILT	146	161	✓

CIRCLE APPROPRIATE LETTER

A — A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED

E — ELECTRIC LOG OBTAINED

P — TEST WELL CONVERTED TO PRODUCTION WELL (MONITORING WELL)

HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 10.17.13 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION RESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST F MY KNOWLEDGE.

DRILLERS IDENT. NO. 343

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

ITE SUPERVISOR (sign; of driller or journeyman esponsible for sitework if different from permittee)

GROUTING RECORD

WELL HAS BEEN GROUTED (Circle Appropriate Box) — YES (Y) / NO (N)

TYPE OF GROUTING MATERIAL

CEMENT (CM) BENTONITE CLAY (BC)

NO. OF BAGS 22 NO. OF POUNDS 208

GALLONS OF WATER 154

DEPTH OF GROUT SEAL (to nearest foot)

from 0 ft. (TOP) to 130 ft. (BOTTOM)

(enter 0 if from surface)

CASING RECORD

casing types — Insert appropriate code below

STEEL (ST) CONCRETE (CO) PLASTIC (PL) OTHER (OT)

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	4	

OTHER CASING (if used) — EACH CASING

	diameter inch	depth (feet) from	to
PL	8	0	40

SCREEN RECORD

screen type or open hole — Insert appropriate code below

STEEL (ST) BRASS BRONZE (BR) OPEN HOLE (HO) PLASTIC (PL) OTHER (OT)

C 2

DEPTH (nearest ft.) — EACH SCREEN

1	PL	148	158
2			
3			

SLOT SIZE 1 020 2 3

DIAMETER OF SCREEN 4 (NEAREST INCH)

GRAVEL PACK from 132 to 158

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

OEP USE ONLY (NOT TO BE FILLED IN BY DRILLER)

T — TELESCOPE CASING

(E.R.O.S.) — LOG INDICATOR

WQ — OTHER DATA

C 3

PUMPING TEST

HOURS PUMPED (nearest hour) 4

PUMPING RATE (gal. per min. to nearest gal.) 16

METHOD USED TO MEASURE PUMPING RATE Time/Volume

WATER LEVEL (distance from land surface)

BEFORE PUMPING 45

WHEN PUMPING 77

TYPE OF PUMP USED (for test)

A air — P piston — T turbine — C centrifugal — R rotary — O other (describe below) — J jet — S submersible

PUMP INSTALLED

DRILLER WILL INSTALL PUMP (CIRCLE) (YES or NO) — YES / NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE

TYPE OF PUMP INSTALLED

PLACE (A,C,J,P,R,S,T,O) IN BOX - SEE ABOVE:

CAPACITY: GALLONS PER MINUTE (to nearest gallon)

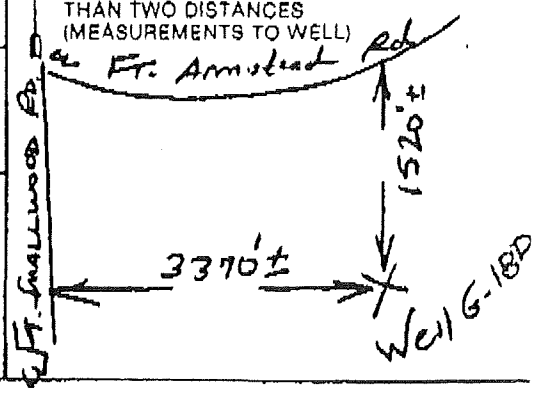
PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) — (+) above / (−) below LAND SURFACE — 2 (nearest foot)

LOCATION OF WELL ON LOT

SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	1 of 4	M 1

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 12:30 pm Date: 10-17-92	Time: 3:20 pm Date: 10-20-92	Mark Fletcher Hardin Huber, Inc.	Mobile B-57	137.0

Water Level Observations Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
10-19-92	8:00 am	60.0	N/A	N/A	59.0
10-28-92	3:47 pm	137.0	136.0	N/A	43.8

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	+1 ELEV. (ft)	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								45.0							
SS 1	1.5	0.8	3-4-3	7									Loose yellow-tan, gray-tan medium to fine **SAND**, little silt, moist		** Water level measured from top of PVC Riser w/stickup 1.8 ft
SS 2	1.5	1.0	3-4-4	8				41.0				4.0	Do. SAND/FILL		4" ID PVC WELL INSTALLATION:
									5				Medium stiff gray, red-brown, brownish yellow silty CLAY, tr. f sand, tr. roots, mottled, moist		5-foot long steel 6" ID Well Cover w/locking cap set in concrete with stickup of 2.5 ft
SS 3	1.5	1.1	3-5-7	12									Do.		Portland Type I/II Cement Grout 2.5' - 116.0'
									10						
SS 4	1.5	0.5	4-4-7	11									Do.		
									15						
SS 5	1.5	1.5	6-8-11	19									Do.		
									20						
SS 6	1.5	1.0	5-6-11	17									Do., mottled reddish gray, red-brown, gray		
									25						
SS 7	1.5	1.5	5-16 -20	36									Do., hard, mottled grayish red, gray, yellow		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 1

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	2 of 4	M 1

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								11.5				33.5	silty CLAY/ALLUVIAL		
SS 8	1.5	0.8	14-20 -30	50					35				Hard olive, tan-brown silty CLAY, trace fine iron-cemented concretions, trace fine sand, moist		
								8.0				37.0	silty CLAY/ALLUVIAL		
SS 9	1.5	1.5	14-24 -50	74					40				Hard reddish gray, gray silty CLAY, trace fine sand, mottled, moist		
SS 10	1.5	1.5	27-40 -60	100					45				Do., mottled red-brown, gray		
SS 11	1.5	1.5	25-40 -70	110					50				Do., mottled red-brown, gray		
SS 12	1.5	1.5	12-18 -40	58					55				Do., mottled red-brown, gray, greenish-yellow		
								-12.0				57.0	silty CLAY/ALLUVIAL		
SS 13	1.5	0.8	24-40 -57	97				-14.0				59.0	Hard grayish olive, tan-gray SILT & CLAY, little fine sand, moist SILT & CLAY/ALLUVIAL		
									60				Very dense gray, tan f-m SAND, tr. silt, wet		
SS 14	1.3	0.8	35-65 -100/3	165 /9					65				Do., yellow-tan, gray-tan f SAND, little silt		
								-22.0				67.0	SAND/ALLUVIAL		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	3 of 4	M 1

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. CORE LENG. (ft)	SAMPLE REC. CORE REC. (ft)	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 15	1.0	1.0	56-100/5	100/5					70				Hard grayish red, gray silty CLAY, little seams f sand, mottled, moist		
SS 16	0.1	0.1	100/1	100/1					75				Do.		
								-32.0				77.0	silty CLAY/ALLUVIAL		
SS 17	0.4	0.4	100/5	100/5					80				Very dense gray, tan-brown fine to medium SAND, little silt, wet		
SS 18	0.4	0.3	100/5	100/5					85				Do., some silt		
SS 19	0.0	0.3	100/4	100/4									Do., trace silt		
								-45.0	90			90.0	SAND/ALLUVIAL		
SS 20	1.3	1.0	40-80-100/4	180/10									Hard, brown, gray silty CLAY, tr. f sand, mottled, moist		
									95						
SS 21	1.5	0.8	37-59-53	112					100				Do., brown, red-brown, gray		
SS 22	1.5	1.5	32-54-73	127									Do., mottled grayish brown, gray, red-brown		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	4 of 4	M 1

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 23	0.9	0.9	49-100/5	100/5					110				Do.		
SS 24	0.9	0.9	39-100/5	100/5					115				Do.		
								-72.0				117.0	silty CLAY/ALLUVIAL		Bentonite Pellet Seal 116.0' - 119.0'
SS 25	0.4	0.4	100/5	100/5					120				Hard gray clayey SILT AND fine SAND, very moist		#00 Well Sand 119.0' - 121.0'
								-77.0				122.0	clayey SILT/SAND/ALLUVIAL		# 1 Well Sand 121.0' - 137.0'
SS 26	0.4	0.1	100/5	100/5					125				Very dense brown, gray-tan-brown fine to medium SAND, little silt, wet		Stainless Steel Centralizer @ 126.0'
SS 27	0.3	0.3	100/3	100/3									Do., gray, trace silt		
SS 28	0.3	0.1	100/3	100/3					130				Do., gray, gray-brown		0.020" slotted 4" ID PVC Well Screen 126.0' - 136.0"
SS 29	0.3	0.3	100/4	100/4									Do., gray, gray-brown		
SS 30	0.3	0.3	100/4	100/4					135				Do., light gray		Stainless Steel Centralizer @ 135.5'
SS 31	0.3	0.3	100/4	100/4				-92.0				137.0	Do., light gray SAND/ALLUVIAL		
													End of Exploration at 137.0'		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	1 of 6	M 2

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 8:35 am Date: 10-17-92	Time: 12:15 pm Date: 10-20-92	Steve Ulrich Hardin Huber, Inc.	Mobile B-80	191.5

Water Level Observations Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
10-17-92	8:49 am	10.0	N/A	N/A	9.0
10-27-92	8:54 am	192.0	189.6	N/A	60.0

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 1	1.5	1.5	7-9-12	21				60.0					Dense tan-brown **clayey SILT** AND fine to medium SAND, trace fine gravel, moist		** Water level measured from top of PVC Riser w/stickup 1.8 ft
								57.0				3.0	clayey SILT/SAND/ALLUVIAL		
SS 2	1.5	1.0	4-6-7	13					5				Medium dense light tan, tan-brown fine to medium SAND, trace silt, moist		4" ID PVC WELL INSTALLATION:
SS 3	1.5	1.2	5-6-8	14					10				Do., fine to coarse **SAND**, little fine gravel, wet		5-foot long steel 6" ID Well Cover w/locking cap set in Concrete with stickup of 2.4 ft Portland Type I/II Cement Grout 2.6' - 173.0'
								48.0				12.0	SAND/ALLUVIAL		
SS 4	1.5	0.5	6-9-11	20					15				Very stiff gray, red-brown **silty CLAY**, trace fine sand, mottled, very moist		
SS 5	1.5	0.3	4-8-11	19					20				Do.		
SS 6	1.5	1.3	4-7-12	19					25				Do., gray, brown, red-brown		
SS 7	1.5	1.5	7-11-11	22									Do., red-brown, brown, gray		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	2 of 6	M 2

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 8	1.5	0.5	8-12-21	33					35			Do., hard, trace fine sand, mottled, moist		
								23.0			37.0	silty CLAY/ALLUVIAL		
SS 9	1.5	1.2	9-17-23	40					40			Hard gray, red-brown, trace green-yellow **CLAY & SILT**, trace to little fine to medium sand, mottled, moist		
								18.0			42.0	CLAY & SILT/ALLUVIAL		
SS 10	1.5	1.5	10-19-21	30					45			Hard gray, red-gray, brown silty **CLAY**, trace fine sand, moist		
SS 11	1.5	1.5	18-25-37	62					50			Do.		
SS 12	1.5	1.5	15-33-53	86					55			Do., brown, red-brown, gray		
SS 13	1.5	1.2	22-49-70	109					60			Do., gray, yellow-brown, red-brown		
SS 14	1.5	1.5	16-42-56	98					65			Do., gray, green, red-brown		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	3 of 6	M 2

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 15	1.5	1.5	20-35-46	81					70				Hard gray, dark green, brown silty CLAY, trace fine sand, mottled, moist		
SS 16	1.5	1.5	19-34-53	87					75				Do.		
SS 17	1.5	1.5	25-23-29	52					80				Do.		
SS 18	1.5	1.5	18-27-32	59					85				Do.		
								-27.0				87.0	silty CLAY/ALLUVIAL		
SS 19	1.5	0.7	16-33-54	87					90				Hard dark gray CLAY & SILT, trace fine sand, moist		
SS 20	1.5	1.2	19-37-63	100					95				Do., trace fine sand partings		
SS 21	1.5	0.5	26-28-40	68					100				Do., little fine sand, occasional fine sand and silt seams		
SS 22	1.5	0.9	28-29-56	85									Hard gray, brownish gray SILT & CLAY, little fine sand, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	4 of 6	M 2

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								-47.0				107.0	SILT/CLAY/ALLUVIAL		
SS 23	1.5	1.3	37-48-68	116					110				Very dense gray fine **SAND**, little silt, very moist		
SS 24	0.8	0.8	54-100/4	100/4					115				Do., some clayey silt		
								-57.0				117.0	SAND/clayey silt/ALLUVIAL		
SS 25	1.5	1.5	25-33-67	100					120				Hard gray, red-gray, red-brown silty **CLAY**, trace fine sand, mottled, moist		
SS 26	1.5	1.5	21-45-73	118					125				Do., trace brown		
								-67.0				127.0	silty CLAY/ALLUVIAL		
SS 27	1.5	1.5	22-42-48	86					130				Hard gray, tan-brown, **SILT & CLAY**, some fine sand, mottled, moist		
SS 28	1.5	1.5	19-25-36	61					135				Hard gray, brownish gray, brown **CLAY & SILT**, trace fine sand, little seams/layers of (fine sand and silt), moist to wet		
								-77.0				137.0	SILT/CLAY/sand/ALLUVIAL		
SS 29	1.5	1.5	14-28-48	76					140				Very dense gray fine **SAND** AND **SILT**, wet		
								-82.0				142.0	SAND/SILT/ALLUVIAL		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	5 of 6	M 2

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 30	1.5	1.5	26-47-83	130					145				Hard gray **CLAY & SILT**, trace fine sand, little seams of (silt and fine sand), moist		
SS 31	1.2	1.2	25-95-100/2	100/2					150				Hard gray clayey **SILT**, some fine sand, trace silty clay seams, moist		
								-92.0				152.0	SILT/clay/sand/ALLUVIAL		
SS 32	0.9	0.9	73-100/5	100/5					155				Very dense gray, tan-gray fine to medium **SAND**, trace silt, wet		
								-96.0				156.0	SAND/ALLUVIAL		
SS 33	1.2	1.2	34-70-100/2	100/2				-98.0				158.0	Hard light gray fine **SAND AND clayey SILT**, very moist SAND/clayey SILT/ALLUVIAL		
SS 34	0.4	0.4	100/5	100/5				-100.0	160			160.0	Hard, gray **CLAY & SILT**, trace fine sand, moist CLAY & SILT/ALLUVIAL		
SS 35	1.1	0.9	40-89-100/1	100/1				-102.0				162.0	Very dense gray fine **SAND**, some silt, very moist to wet SAND/silt/ALLUVIAL		
SS 36	0.7	0.6	75-100/2	100/2									Hard, gray **SILT & CLAY**, trace fine sand, moist		
SS 37	0.6	0.5	77-100/1	100/1					165				Do., **clayey SILT**, little fine sand		
SS 38	0.3	0.3	100/3	100/3									Hard, gray, brownish gray clayey **SILT**, little fine sand, moist		
SS 39	0.3	0.1	100/3	100/3					170				Do., trace fine sand		
SS 40	0.1	0.1	100/3	100/3					175				Do., gray, trace fine sand		Bentonite Pellet Seal 173.0' - 175.0' #00 Well Sand 175.0' - 177.0'
								-118.0				178.0	clayey SILT/ALLUVIAL		Stainless Steel Centralizer @ 179.0'

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	6 of 6	M 2

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. CORE LENG. (ft)	SAMPLE REC. CORE REC. (ft)	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 41	0.3	0.2	100/4	100/3									Very dense light tan-gray fine to medium SAND, trace silt, wet		# 1 Well Sand 177.0' - 192.0'
SS 42	0.7	0.0	98-100/2	100/2									No Recovery		0.020" slotted 4" ID PVC Well Screen 179.6' - 189.6"
SS 43	0.8	0.5	105-100/4	100/4					185				Do., light gray, tan-gray		
SS 44	0.5	0.5	200/6	200/6									Do., trace fine to 1" rounded quartz gravel, trace silty clay seams		Stainless Steel Centralizer @ 189.0'
									190				Do., little silt, trace fine to 1" gravel SAND/ALLUVIAL		
								-131.0				191.0			
SS 45	0.5	0.5	200/6	200/6				-131.5				191.5	Hard light gray clayey SILT, moist clayey SILT/ALLUVIAL		
													End of Exploration at 191.5'		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	1 of 5	M 3

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 5:30 pm Date: 10-14-92	Time: 9:40 am Date: 10-17-92	Mark Fletcher Hardin Huber, Inc.	Mobile B-57 & B-80	175.0

Water Level Observations Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
10-15-92	7:45 am	20.0	N/A	N/A	18.5
10-27-92	9:48 am	175.0	170.0	N/A	52.9

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH(ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 1	0.8	0.8	5-4-6	10				56.0					Medium dense brown fine to medium **SAND**, some fine gravel, little clayey silt, moist		** Water level measured from top of PVC Riser w/stickup 1.8 ft
								53.0				3.0	SAND/FILL		
SS 2	1.5	1.5	3-6-7	13					5				Stiff yellow-brown **CLAY & SILT**, little fine sand, moist		4" ID PVC WELL INSTALLATION:
SS 3	1.5	1.5	4-7-12	19				47.0	10			9.0	Very stiff tan-gray **clayey SILT**, little fine sand, moist SILT/CLAY/ALLUVIAL Dense brown fine to medium **SAND**, trace silt, little clayey silt layers, moist		5-foot long steel 6" ID Well Cover w/locking cap set in Concrete with stickup of 2.5 ft Portland Type I/II Cement Grout 2.5' - 150.0'
SS 4	1.5	1.5	9-25-32	57					15				Very dense light brown to grayish-tan fine to medium SAND, trace silt, slightly moist		
SS 5	1.5	1.0	22-17-17	34				37.0	20			19.0	Do., wet SAND/ALLUVIAL Hard, red-brown, tan-gray silty CLAY, some layers/seams of (clayey SILT, little fine sand), mottled, moist		
SS 6	1.5	0.7	7-10-11	21					25				Do., occasional iron-cemented nodules/seams		
SS 7	1.5	1.5	12-24-30	54									Hard, dark red-brown, trace yellow-green **silty CLAY**, little fine to medium sand, trace iron stains, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	2 of 5	M 3

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								24.0				32.0			
SS 8	1.5	1.5	12-26-38	54					35				Hard, dark red-brown, yellow-green, gray CLAY & SILT, little fine friable iron-cemented pockets, trace fine to medium sand, moist		
SS 9	1.5	1.5	17-30-50	80					40				Do., gray, little fine sand, little silty clay seams, little layers of (fine to medium sand, trace silt)		
								14.0				42.0	CLAY & SILT/ALLUVIAL		
SS 10	1.5	1.0	17-26-31	57					45				Hard, gray, brownish gray silty CLAY, some fine to medium sand, little black lignite seams, moist		
								9.0				47.0	silty CLAY/sand/ALLUVIAL		
SS 11	1.5	1.5	13-21-32	53					50				Hard, gray, yellow-gray silty CLAY, waxy lustre, moist		
SS 12	1.5	1.0	18-34-60	94					55				Do., gray, trace brown, trace fine sand, trace lignite		
SS 13	1.5	1.5	17-28-34	62					60				Do., red-brown, gray, brown, trace fine sand		
SS 14	1.5	1.5	20-30-40	70					65				Do., gray, red-brown, trace spheroidal silica concretions up to 1 mm diameter		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	3 of 5	M 3

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 15	1.5	1.5	22-30-45	75					70			Hard gray, grayish-red, trace green silty **CLAY**, trace fine sand, moist		
SS 16	1.5	1.5	18-42-45	87					75			Do.		
SS 17	1.5	1.5	14-26-30	56					80			Do., gray, red-brown		
SS 18	1.5	1.5	20-38-48	86					85			Do., gray, dark green trace fine sand partings		
								-31.0			87.0	silty CLAY/ALLUVIAL		
SS 19	1.5	1.5	21-48-80	128					90			Hard dark gray **CLAY & SILT**, trace fine sand interlayered with **(SILT AND fine SAND)** layers, very moist to moist		
SS 20	1.5	0.3	21-38-80	118					95			Hard gray, black **SILT AND fine SAND**, seams/partings interlayered with **LIGNITE/PEAT** seams/partings, very moist		
SS 21	1.5	1.0	24-46-81	127				-43.0	100		99.0	Hard dark gray, dark red-brown **SILT & CLAY**, some fine sand, moist SILT/CLAY/sand/ALLUVIAL Hard, red-brown, gray silty **CLAY**, trace fine sand, moist		
SS 22	1.3	0.2	29-64-100/4	100/4								Do., gray, red-brown		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	4 of 5	M 3

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								51.0				107.0	silty CLAY/ALLUVIAL		
SS 23	0.9	0.6	31-100/5	100/5					110				Very dense, light gray fine **SAND AND SILT**, wet		
SS 24	1.5	0.8	27-31-96	127					115				Do., light gray to light brown		
								61.0				117.0	SAND/SILT/ALLUVIAL		
SS 25	1.2	0.3	57-91-100/2	100/2					120				Hard, gray, brown silty **CLAY**, little fine to medium sand, moist		
SS 26	0.4	0.2	100/5	100/5					125				Do.		
SS 27	0.9	0.3	44-100/5	100/5					130				Do., gray, red-gray, red-brown, trace fine sand		
								76.0				132.0	silty CLAY/ALLUVIAL		
SS 28	0.3	0.3	36-54-72	126					135				Very dense light gray fine **SAND AND SILT**, wet		
								81.0				137.0	SAND/SILT/ALLUVIAL		
SS 29	1.3	1.3	27-42-59	101					140				Hard, red-brown, gray, dark green-brown **SILT & CLAY**, little fine sand, mottled, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	5 of 5	M 3

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. CORE LENG. (ft)	SAMPLE REC. CORE REC. (ft)	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 30	1.2	1.2	21-39-38	77				-88.0	145			144.0	Hard, light gray clayey SILT, some fine sand, moist SILT/sand/ALLUVIAL Very dense, gray fine **SAND AND SILT**, wet		
								-91.0				147.0	SAND/SILT/ALLUVIAL		
SS 31	1.4	1.4	30-47-100/5	100/5					150				Hard, light gray SILT & CLAY, little fine sand, moist		Bentonite Pellet Seal 150.0' - 152.0'
															#00 Well Sand 152.0' - 154.0'
SS 32	0.7	0.7	150-100/2	100/2					155				Hard, light gray CLAY & SILT, little fine sand, occasional layers of (fine sand and silt), wet		Stainless Steel Centralizer @ 154.0'
								-101.0				157.0	CLAY/SILT/ALLUVIAL		# 1 Well Sand 154.0' - 175.0'
SS 33	0.5	0.1	400/6	400/6									Very dense, gray, gray-brown fine **SAND**, little silt, wet		
SS 34	0.5	N/R	135/6	135/6					160						
SS 35	0.4	0.1	600/5	600/5									Do., seam of silt & clay, one rounded 3/4" yellow-tan f sandstone fragment,		
SS 36	0.5	0.5	200/6	200/6									Do., fine to medium **SAND**, trace silt, wet to very moist		
									165						0.010" slotted 4" ID PVC Well Screen 160.0' - 170.0'
SS 37	0.5	0.5	280/6	280/6									Do., fine to medium **SAND**, trace silt, wet to very moist		
SS 38	0.2	0.2	100/2	100/2									Very dense, light gray, gray-brown fine to medium **SAND**, trace silt, wet		Stainless Steel Centralizer @ 169.0'
SS 39	0.3	0.3	100/3	100/3				-114.3	170			170.3	SAND/ALLUVIAL		
													Augered down to 175 ft. without sampling		
								-119.0	175			175.0			
													End of Exploration at 175.0'		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 3

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	1 of 5	M 4

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 9:55 am Date: 10-12-92	Time: 3:45 pm Date: 10-14-92	Mark Fletcher Hardin Huber, Inc.	Mobile B-57 & B-80	163.3

Water Level Observations Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
10-12-92	10:30 am	10.0	N/A	N/A	9.5
10-27-92	10:15 am	163.0	160.0	N/A	41.8

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								40.0							
SS 1	1.5	1.5	WOH-5-9	14									Stiff brown **clayey SILT** AND fine to medium **SAND**, trace roots, moist		** Water level measured from top of PVC Riser w/stickup 1.6 ft
								38.0				2.0	clayey SILT/SAND/POSSIBLE FILL		
SS 2	1.5	1.0	3-4-4	8					5				Loose, light grayish-brown fine to medium **SAND**, trace silt, moist		4" ID PVC WELL INSTALLATION: 5-foot long steel 6" ID Well Cover w/locking cap set in Concrete with stickup of 2.5 ft
SS 3	1.5	1.2	26-30-63	93					10				Very dense, red-orange, orange-brown, gray medium to fine **SAND**, trace silt, little pockets/seams of silty clay, trace iron-cemented seams, very moist to wet		Portland Type I/II Cement Grout 2.5' - 141.0'
SS 4	1.5	0.9	9-15-21	36				26.0				14.0	SAND/ALLUVIAL		
									15				Hard, red-brown, gray silty **CLAY**, trace fine sand, mottled moist		
SS 5	1.5	0.8	20-33-41	74					20				Hard, gray, red-brown, trace yellow **CLAY & SILT**, trace fine sand moist		
SS 6	1.5	1.0	9-12-16	28				16.0				24.0	CLAY/SILT/ALLUVIAL		
									25				Dense, gray, olive-gray fine **SAND**, some silt, wet to very moist		
								13.0				27.0	SAND/silt/ALLUVIAL		
SS 7	1.5	1.1	15-21-25	46									Hard, gray, red-brown fine SAND AND **CLAY & SILT**, mottled, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	2 of 5	M 4

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. CORE LENG. (ft)	SAMPLE REC. CORE REC. (ft)	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 8	1.1	0.4	29-51-100/1	100/1					35				Very dense, gray, black-gray, black fine to medium SAND, some silt & clay, little black lignite seams, very moist		
								3.0				37.0	SAND/silt/clay/ALLUVIAL		
SS 9	1.5	1.4	16-21-31	52					40				Hard, gray, dark red-brown, brown mottled silty CLAY, waxy lustre, moist		
SS 10	1.5	1.3	17-25-35	60					45				Do., trace yellow		
													Do.		
SS 11	1.5	0.8	9-23-28	51					50						
SS 12	1.5	0.9	29-40-50	90					55				Do., reddish-gray, gray, slightly moist to moist		
SS 13	1.5	1.5	12-30-35	65					60				Hard, red-gray, gray, red-brown, trace yellow silty CLAY, trace fine sand, mottled moist		
SS 14	1.5	0.8	31-51-72	123					65				Do.		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 4

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	3 of 5	M 4

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) +1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 15	1.5	1.1	33-29-60	89					70				Do., red gray, gray, red-brown, trace yellow		
SS 16	1.5	1.1	44-49-96	145					75				Do.		
								-37.0				77.0	silty CLAY/ALLUVIAL		
SS 17	1.5	1.3	30-43-60	103					80				Hard, red gray, gray, red-brown, trace yellow **CLAY & SILT**, trace fine sand, mottled, moist to slightly moist		
SS 18	1.5	1.3	26-36-40	76					85				Do.		
								-47.0				87.0	CLAY & SILT/ALLUVIAL		
SS 19	1.5	1.4	23-35-77	112					90				Hard, gray fine **SAND** AND clayey **SILT**, moist		
SS 20	1.5	1.0	29-35-72	107					95				Do., fine **SAND**, little silt, AND layers of silty **CLAY** AND fine **SAND**, moist to wet		
								-57.0				97.0	SAND/SILT/CLAY/ALLUVIAL		
SS 21	0.4	0.4	100/5	100/5					100				Very dense, light gray fine **SAND**, little to trace silt, wet		
SS 22	1.5	0.9	84-74-40	114									Do., tan-gray to gray fine to medium **SAND**, trace silt		
								-62.0				102.0	SAND/ALLUVIAL		
SS 23	1.5	1.0	42-47-58	105									Hard, gray, reddish gray silty CLAY, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	4 of 5	M 4

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 24	1.5	1.5	29-39-51	90									Hard, gray, reddish gray, brown, trace green **CLAY & SILT**, trace fine sand, moist		
								-72.0	110			112.0	CLAY/SILT/ALLUVIAL		
SS 25	1.5	1.5	28-27-41	68									Hard, gray clayey SILT, some fine sand, moist to slightly moist		
									115						
SS 26	0.9	0.8	23-100/5	100/5									Hard, light gray fine **SAND AND clayey SILT**, trace silty clay seams, moist		
									120						
SS 27	1.5	0.9	25-35-50	85									Do., some layers of (clay & silt, some fine sand), very moist		
									125						
SS 28	0.7	0.7	35-100/2	100/2									Hard, light gray fine **SAND AND silty CLAY**, some layers of (fine SAND, little silt), wet to moist		
									130						
								-92.0				132.0	SAND/CLAY/SILT/ALLUVIAL		
SS 29	0.7	0.7	62-100/2	100/2									Hard, light gray CLAY & SILT, little fine sand, trace seams of (silt and fine sand), trace fine micro-crystalline pyrite concretions up to 1/4", moist		
									135						
SS 30	0.1	0.1	100/1	100/1									Do., pyrite concretions up to 1/2"		
									140						
								-102.0				142.0	CLAY & SILT/ALLUVIAL		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 4

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	5 of 5	M 4

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 31	0.4	0.3	200/5	200/5					145				Very dense, light gray fine **SAND**, little silt, little silt & clay seams, wet		Bentonite Pellet Seal 141.0' - 144.5'
SS 32	0.4	0.4	200/5	200/5									Do.		#00 Well Sand 144.5' - 148.5'
SS 33	0.5	0.4	200/6	200/6					150				Very dense, tan fine **SAND**, little clayey silt, trace silty clay seams up to 1/4", wet		Stainless Steel Centralizer @ 150.0' # 1 Well Sand 148.5' - 163.0'
SS 34	0.4	0.1	200/5	200/5				-114.0				154.0	Do. SAND/silt/ALLUVIAL		
SS 35	0.5	0.5	200/6	200/6					155				Very dense, light gray medium to fine **SAND**, trace silt, wet		0.020" slotted 4" ID PVC Well Screen 150.0' - 160.0'
SS 36	0.4	0.4	200/5	200/5									Do.		
SS 37	0.5	0.3	132/6	132/6				-120.0	160			160.0	Do., little silt SAND/ALLUVIAL		Stainless Steel Centralizer @ 159.5'
SS 38	0.3	0.5	300/3	300/3									Hard, light gray clayey SILT, trace fine sand, moist		
SS 39	0.3	0.5	300/3	300/3				-123.2				163.2	Do., brown, tr. concretions clayey SILT/ALLUVIAL End of Exploration at 163.3'		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 4

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	1 of 5	M 5

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE LEGEND:
- NR = Sample Not Recovered
- SS = Standard Penetration Split Spoon Sample
- ST = Pushed Shelby Tube
- B = Disturbed Bag Sample
- LL = Liquid Limit
- PI = Plasticity Index
- AC = Auger Cutting

Start	Finish	Driller/Subcontractor	Drill Make & Model	Total Depth (ft)
Time: 2:30 pm Date: 10-15-92	Time: 3:45 pm Date: 10-20-92	Bob Jordon Hardin Huber, Inc.	Mobile B-80	165.0

Water Level Observations Date	Time	Boring Depth(ft)	Casing Depth(ft)	Caved Depth(ft)	Water Depth(ft)
10-15-92	4:30 pm	15.0	N/A	N/A	14.0
10-28-92	9:22 am	165.0	160.0	N/A	45.1

SAMPLE TYPE	SAMP. ADV. (ft) CORE LENG.	SAMPLE REC. (ft) CORE REC.	SAMPLE BLOWS %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	+1 ELEV. (ft)	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
								45.0							
SS 1	1.5	1.0	4-4-6	10									Medium dense, yellow-brown, brown fine to medium SAND, some silt, trace roots, moist		** Water level measured from top of PVC Riser w/stickup 2.1 ft
								42.0				3.0	SAND/silt/ALLUVIAL		
SS 2	1.5	0.7	4-5-10	15					5				Dense yellow-tan, tr. gray f-m SAND, little clayey silt, moist		4" ID PVC WELL INSTALLATION:
															5-foot long steel 6" ID Well Cover w/locking cap set in Concrete with stickup of 2.8 ft
SS 3	1.5	0.3	3-3-5	8					10				Do.		Portland Type I/II Cement Grout 2.75' - 142.0'
SS 4	1.5	0.7	26-32-38	70					15				Very dense, brownish gray, light brown medium to fine SAND, trace silt, wet		
								27.0				18.0	SAND/ALLUVIAL		
SS 5	1.5	0.8	14-26-50	76					20				Hard, red-brown, gray silty CLAY, trace fine sand, mottled, moist		
SS 6	1.5	0.5	15-30-40	70					25				Do., trace yellowish-green		
SS 7	1.5	0.5	14-32-43	75									Do., trace yellowish-green		

HALEY & ALDRICH INC.
Silver Spring, Maryland

BORING NO. M 5

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	2 of 5	M 5

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LL	PI	ELEV. (ft) ±	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 8	1.5	0.8	14-52-74	126					35				Hard, red-brown, gray, yellow silty CLAY, trace fine sand, mottled, moist		
SS 9	1.5	1.5	15-25-42	67					40				Do.		
SS 10	1.5	0.5	15-25-61	86					45 ▼				Do.		
SS 11	1.5	0.7	15-45-65	110					50				Do., gray, reddish gray, red-brown		
SS 12	1.5	1.5	25-48-52	100					55				Do., brown, gray, yellow-green, trace friable iron-cemented pockets		
SS 13	1.5	1.5	27-45-55	100					60				Do., gray, dark green, reddish gray		
SS 14	1.5	1.0	39-47-58	108					65				Do., light gray, reddish gray		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	3 of 5	M 5

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. / CORE LENG. (ft)	SAMPLE REC. / CORE REC. (ft)	SAMPLE BLOWS / %CORE RECOVERY RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LL	PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 15	1.5	1.5	32-55-72	127					70			Hard, red-brown, green, gray silty CLAY, trace fine sand, mottled, moist		
SS 16	1.5	1.0	37-48-60	108					75			Do., gray, red-brown, trace green		
SS 17	1.5	1.5	40-56-65	121					80			Do., red-gray, gray, brown		
SS 18	1.5	1.5	46-59-70	129					85			Do., gray, brown, red-brown		
SS 19	1.5	1.3	52-75-100/3	100/3					90			Do., gray, reddish gray, trace brown		
SS 20	1.5	1.4	26-45-63	108					95			Do., gray, reddish gray, trace red-brown		
SS 21	0.9	0.9	66-100/5	100/5					100			Do., red-brown, gray		
SS 22	0.8	0.8	63-100/3	100/3								Hard, dark red-brown, gray, trace yellow silty CLAY, trace fine sand, mottled, moist		

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	4 of 5	M 5

Project Location: HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND

Logged: Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT(%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 23	0.8	0.8	70-100/2	100/2					110				Do., dark red-brown, gray, brown		
SS 24	1.5	1.1	66-76-100	176					115				Do., brown, red-brown, gray		
SS 25	1.5	1.3	25-40-50	90					120				Do., brown, yellow-brown, gray		
								-77.0				122.0	silty CLAY/ALLUVIAL		
SS 26	0.7	0.6	28-100/2	100/2					125				Hard, gray CLAY & SILT, some fine sand, moist		
SS 27	0.2	0.2	100/2	100/2					130				Hard, gray fine SAND AND clayey SILT, moist		
SS 28	0.1	0.1	200/1	200/1					135				Hard, gray SILT & CLAY, little fine sand, moist		
SS 29	0.1	0.1	200/1	200/1					140				Hard, gray clayey SILT AND fine SAND, moist		

HALEY & ALDRICH INC.
Silver Spring, Maryland

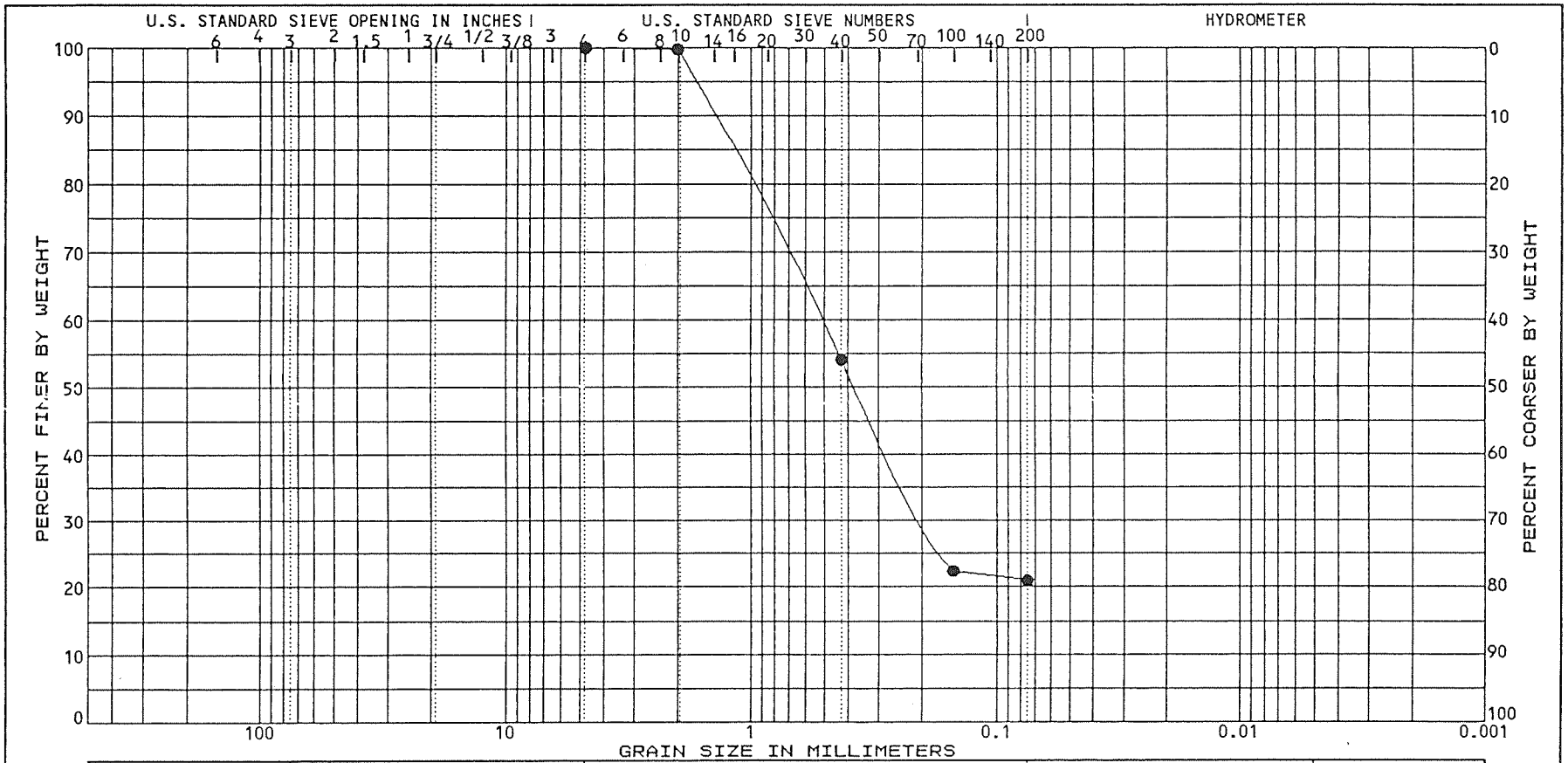
BORING NO. M 5

TEST BORING LOG

Project Number	Client/Project	Sheet No.	Boring No.
65358-03	SCM Chemicals - Americas GROUNDWATER MONITORING WELLS	5 of 5	M 5

Project Location	Logged
HAWKINS POINT PLANT LANDFILL, BALTIMORE, MARYLAND	Harvey Beaulieu

SAMPLE TYPE	SAMP. ADV. (ft) / CORE LENG.	SAMPLE REC. (ft) / CORE REC.	SAMPLE BLOWS / %CORE RECOVERY / RQD	N" VALUE BLOWS/FOOT	LAB TESTS: MOISTURE CONTENT (%)	LAB TESTS: LL	LAB TESTS: PI	ELEV. (ft) ±1	DEPTH (ft)	GRAPHICS	SAMPLE	STRATA DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	WELL	REMARKS
SS 30	0.1	0.1	200/1	200/1					145				Hard, gray, red-brown **CLAY & SILT**, some seams of (fine to medium SAND, little silt), very moist		Bentonite Pellet Seal 142.0' - 145.0'
								-102.0				147.0	CLAY/SILT/sand/ALLUVIAL		#00 Well Sand 145.0' - 147.0'
SS 31	0.9	0.7	230-200/5	200/5					150				Very dense, tan-gray fine to medium **SAND**, trace silt, wet		Stainless Steel Centralizer @ 149.0'
SS 32	0.7	0.6	500/6-300/1	300/1									Do., light brown, gray		# 1 Well Sand 147.0' - 165.0'
SS 33	0.6	0.5	400-200/1	200/1					155				Do., light brown, gray		0.020" slotted 4" ID PVC Well Screen 150.0' - 160.0'
SS 34	0.7	0.6	426-400/2	400/2									Do., light brown, gray		
SS 35	0.7	0.5	300-240/2	240/2					160				Do., brown		Stainless Steel Centralizer @ 159.5'
								-115.7				160.7	SAND/ALLUVIAL		
													Augered down to 165 ft. without sampling		
								-120.0	165			165.0			
													End of Exploration at 165.0'		



Boring	Depth (ft.)	Classification	WC%	LL	PL	PI	Cc	Cu
G-13D	4.0	Tan brown SAND, some clayey silt	13					

Boring	Depth (ft.)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
G-13D	4.0	4.75	0.52	0.193		0.0	79.0	21.0	

OOSTERBAAN ASSOCIATES, P.C.

Client: SCM Chemicals, Inc.
Location: Baltimore, MD
Job No. C1636-02 Date: May 13, 1991

Project: HPP Landfill
GRADATION CURVES
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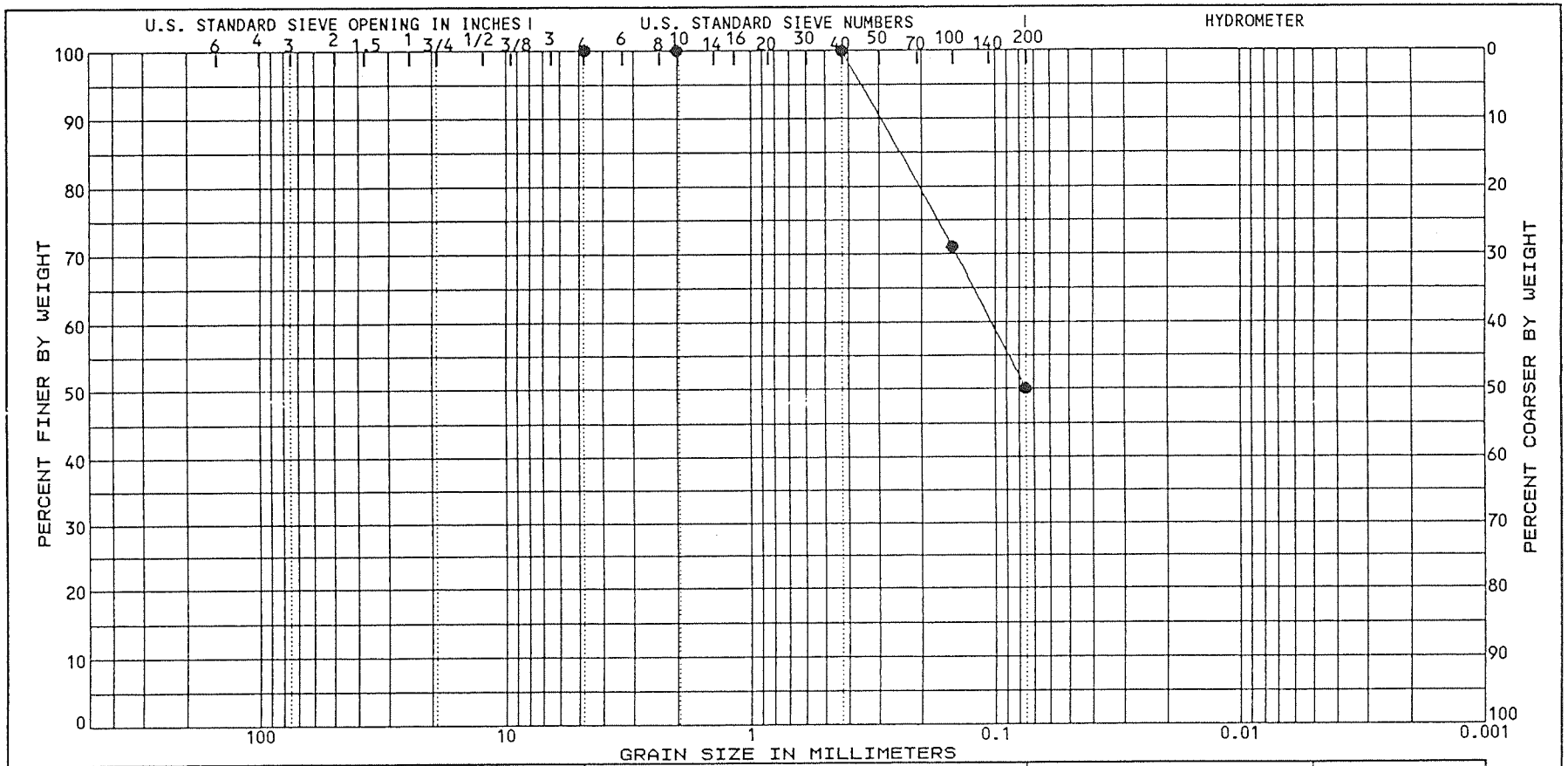

COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Boring	Depth (ft.)	Classification	WC%	LL	PL	PI	Cc	Cu
G-13D	66.0	Light brown SAND & silty CLAY	18.9					

Boring	Depth (ft.)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
G-13D	66.0	2.00	0.10			0.0	49.9	50.1	

OOSTERBAAN
ASSOCIATES, P.C.

Client: SCM Chemicals, Inc.
Location: Baltimore, MD
Job No. C1636-02 Date: May 13, 1991

Project: HPP Landfill
GRADATION CURVES
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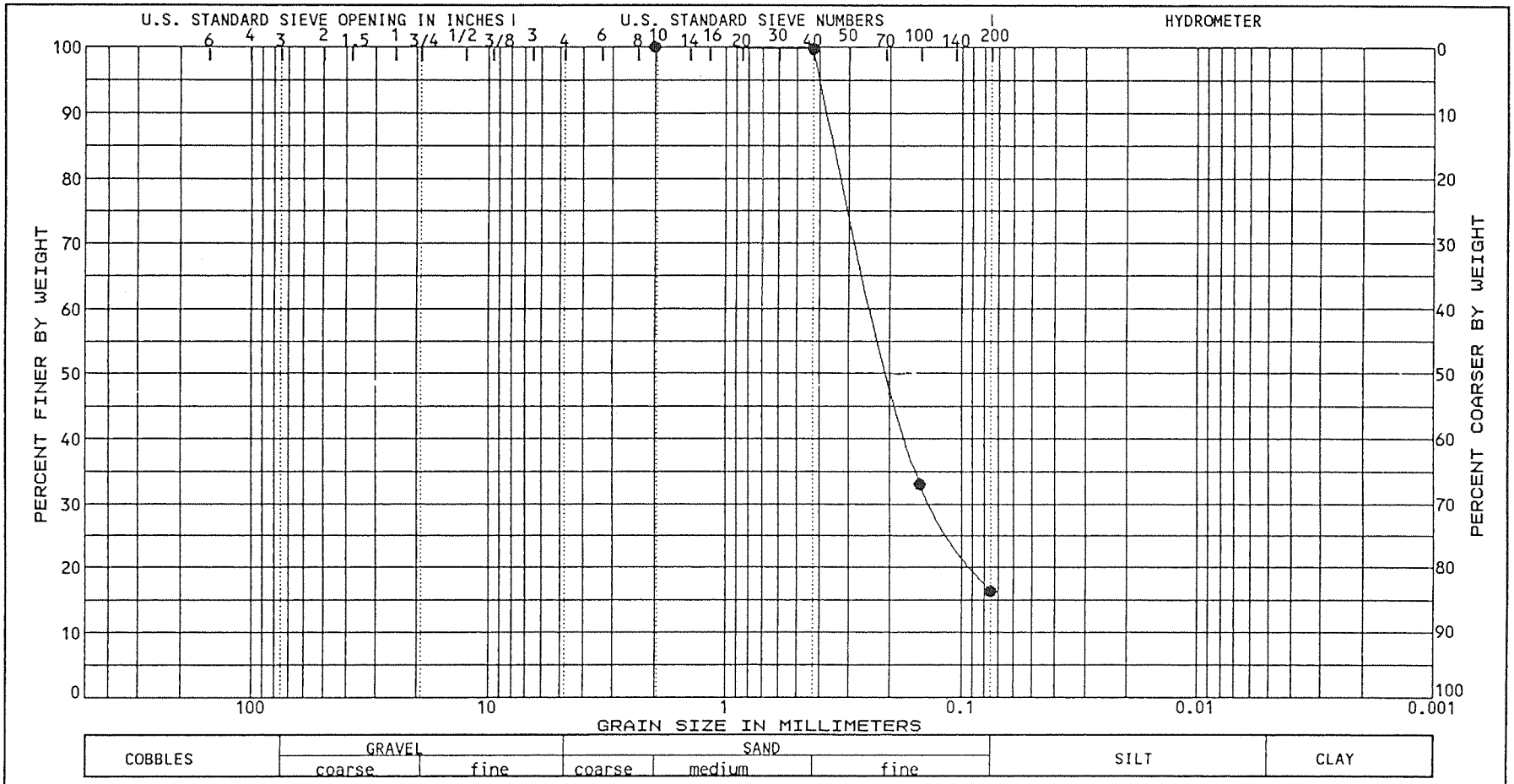

Boring	Depth (ft.)	Classification	WC%	LL	PL	PI	Cc	Cu
G-18D	148.0	Brown SAND, little clayey silt	22					

Boring	Depth (ft.)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
G-18D	148.0	2.00	0.23	0.132		0.0	83.7	16.3	

OOSTERBAAN
ASSOCIATES, P.C.

Client: SCM Chemicals, Inc.
Location: Baltimore, MD
Job No. C1636-02
Date: May 13, 1991

Project: HPP Landfill
GRADATION CURVES
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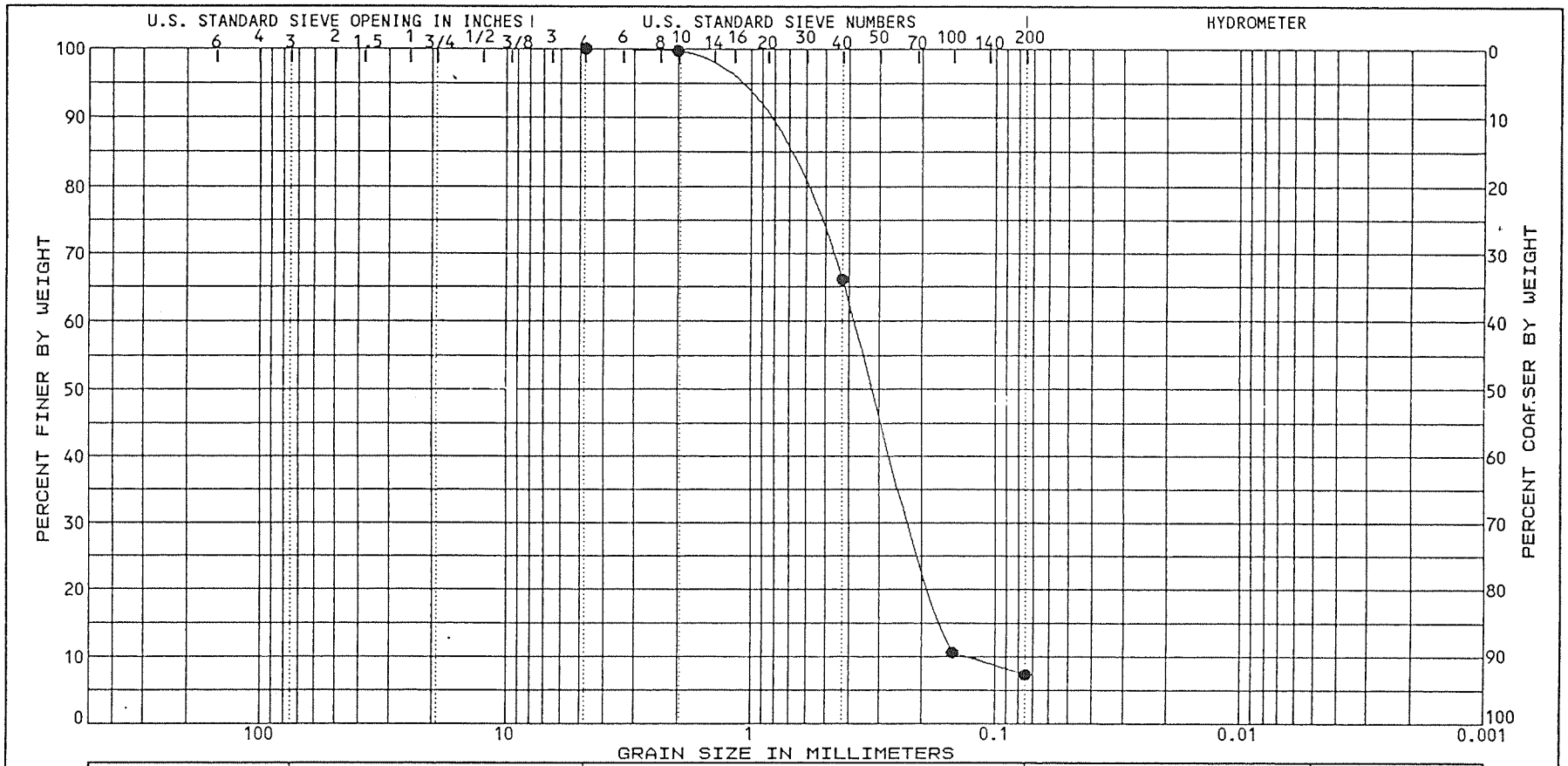

COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Boring	Depth (ft.)	Classification	WC%	LL	PL	PI	Cc	Cu
G-19	128.0	Greyish brown SAND, tr. silt	17				0.93	2.9

Boring	Depth (ft.)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
G-19	128.0	4.75	0.38	0.216	0.1322	0.0	92.7	7.3	

OOSTERBAAN
ASSOCIATES, P.C.

Client: SCM Chemicals, Inc.
Location: Baltimore, MD
Job No. C1636-02 Date: May 13, 1991

Project: HPP Landfill
GRADATION CURVES
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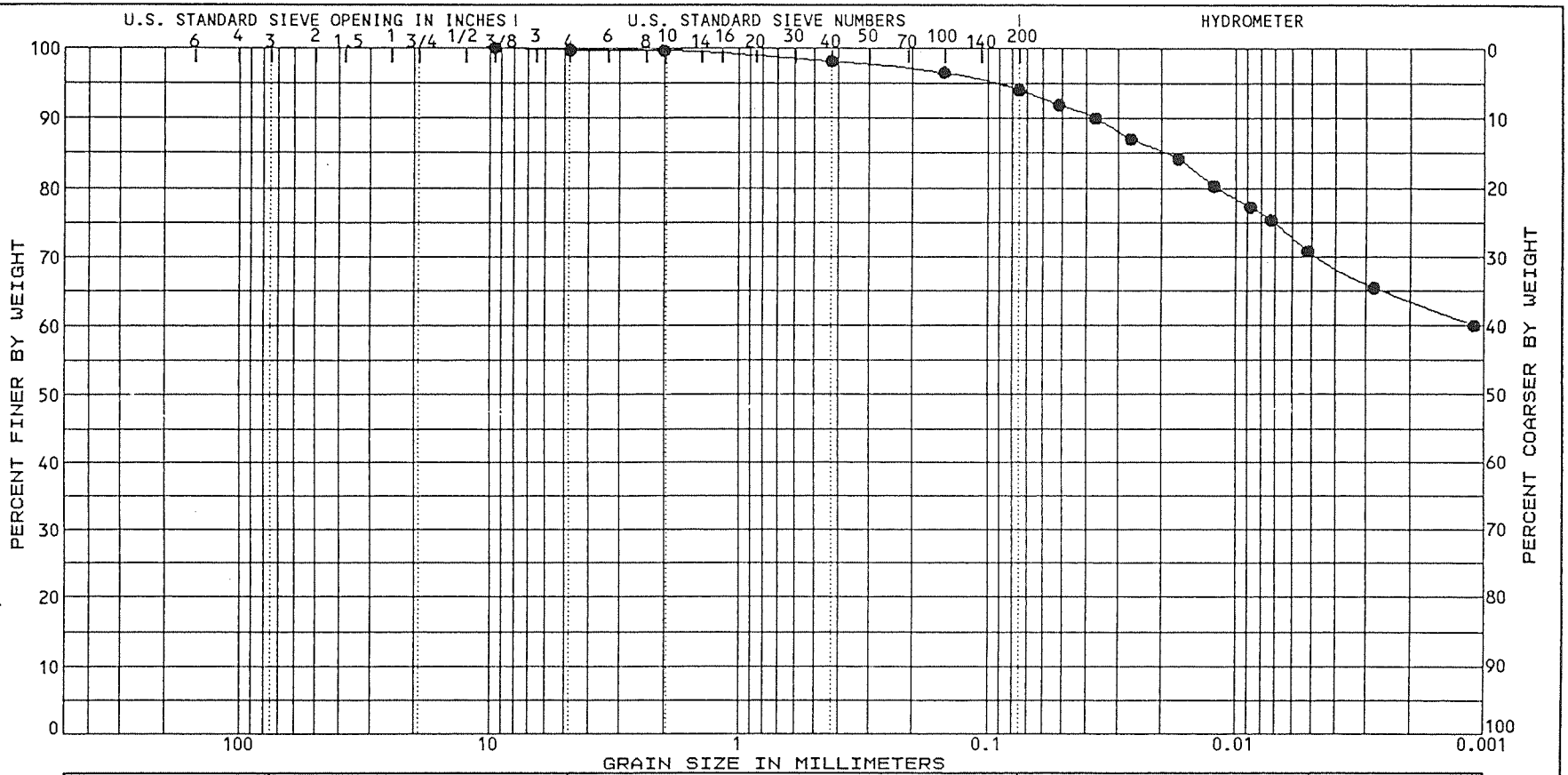

COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Boring	Depth (ft.)	Classification	WC%	LL	PL	PI	Cc	Cu
G-22	30.5	Red brown CLAY, some silt, tr. sand	23	60	23	37		

Boring	Depth (ft.)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
G-22	30.5	9.50	0.00			0.3	5.7	23.5	70.4

OOSTERBAAN ASSOCIATES, P.C.

Client: SCM Chemicals, Inc.
Location: Baltimore, MD
Job No. C1636-02 Date: May 13, 1991

Project: HPP Landfill
GRADATION CURVES
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TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL200

Fort Armistead Rd. Landfill
G-13

Sampled By: TTL
Date Sampled: 05/22/91
@ 5:35 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	1306 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	752	2.0	130.1	06/11/91 10:00 JA
pH	6.72 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	20	2.0	310.1	06/07/91 10:00 JA
Chloride	23	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	05/30/91 10:00 JA
Fluoride	0.28	0.20	340.2	06/19/91 12:00 MC
Nitrate	4.9	1.0	353.3	06/03/91 10:00 SR
Sulfate	644	1.0	375.4	05/28/91 9:30 PC
Phenolics	0.10	0.05	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL362

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-13D

Sampled By: TTL
Date Sampled: 05/30/91
@ 10:00 a.m.

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	6.14	0.50	202.1	06/12/91 10:00 FA
Antimony	ND	0.3	204.1	06/12/91 12:00 FA
Arsenic	ND	0.005	206.2	06/12/91 9:00 FA
Barium	ND	0.30	208.1	06/12/91 8:00 FA
Beryllium	ND	0.02	210.1	06/12/91 11:00 FA
Cadmium	ND	0.02	213.1	06/10/91 2:00 FA
Chromium	ND	0.06	218.1	06/12/91 9:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	0.04	0.03	220.1	06/11/91 10:00 FA
Iron	12.7	0.05	236.1	06/11/91 10:00 FA
Lead	ND	0.2	239.1	06/10/91 2:00 FA
Manganese	0.205	0.04	243.1	06/11/91 9:00 FA
Mercury	ND	0.0005	245.1	06/13/91 9:00 FA
Nickel	ND	0.06	249.1	06/11/91 4:00 FA
Selenium	ND	0.005	270.2	06/12/91 9:00 FA
Silver	ND	0.03	272.1	06/11/91 4:00 FA
Thallium	ND	0.40	279.1	06/12/91 12:00 FA
Zinc	0.154	0.008	289.1	06/11/91 9:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL362

Respectfully Submitted:

M. Cohen

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-13D

Sampled By: TTL
Date Sampled: 05/30/91
@ 10:00 a.m.

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	264 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	113	2.0	130.1	06/11/91 10:00 JA
pH	7.42 (std. units)	-	150.1	05/30/91 5:00 SR
Alkalinity	100	2.0	310.1	06/12/91 9:00 JA
Chloride	10	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	0.24	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	22	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL201

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-15

Sampled By: TTL
Date Sampled: 05/22/91
@ 3:50 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	7.07	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	0.008	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	ND	0.03	220.1	05/31/91 10:00 FA
Iron	7.02	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	1.384	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.465	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL201

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-15

Sampled By: TTL
Date Sampled: 05/22/91
@ 3:50 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	499 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	72	2.0	130.1	06/11/91 10:00 JA
pH	4.30 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	ND	2.0	310.1	06/07/91 10:00 JA
Chloride	22	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	05/30/91 10:00 JA
Fluoride	1.68	0.20	340.2	06/19/91 12:00 MC
Nitrate	1.2	1.0	353.3	06/03/91 10:00 SR
Sulfate	83	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL202

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-16

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:10 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	2.89	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	0.025	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	0.042	0.03	220.1	05/31/91 10:00 FA
Iron	33.65	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	2.473	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.048	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL202

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-16

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:10 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	257 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	223	2.0	130.1	06/11/91 10:00 JA
pH	4.00 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	ND	2.0	310.1	06/07/91 10:00 JA
Chloride	17	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	05/30/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	218	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL203

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-18

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:52 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	14.04	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	0.018	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	0.124	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	0.240	0.03	220.1	05/31/91 10:00 FA
Iron	27.22	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.718	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	0.34	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	3.06	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL203

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-18

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:52 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	258 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	96	2.0	130.1	06/11/91 10:00 JA
pH	4.48 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	ND	2.0	310.1	06/07/91 10:00 JA
Chloride	5	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	0.07	0.02	335.2	06/02/91 10:00 JA
Fluoride	0.64	0.20	340.2	06/19/91 12:00 MC
Nitrate	11.1	1.0	353.3	06/03/91 10:00 SR
Sulfate	76	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL233

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-18D

Sampled By: TTL
Date Sampled: 05/24/91
@ 12:30 p.m.

Date Received: 05/24/91 @ 3:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	0.90	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 4:00 FA
Copper	ND	0.03	220.1	05/31/91 10:00 FA
Iron	2.40	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.039	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.035	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL233

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-18D

Sampled By: TTL
Date Sampled: 05/24/91
@ 12:30 p.m.

Date Received: 05/24/91 @ 3:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	68 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	13	2.0	130.1	06/11/91 10:00 JA
pH	5.99 (std. units)	-	150.1	05/24/91 4:00 SR
Alkalinity	19	2.0	310.1	06/07/91 10:00 JA
Chloride	2	1.0	325.1	06/17/91 3:30 SR
Cyanide (Total)	ND	0.02	335.2	06/02/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	16	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL228

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-19

Sampled By: TTL
Date Sampled: 05/23/91
@ 3:45 p.m.

Date Received: 05/23/91 @ 4:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	0.54	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	ND	0.03	220.1	05/31/91 10:00 FA
Iron	2.02	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.108	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.063	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL228

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-19

Sampled By: TTL
Date Sampled: 05/23/91
@ 3:45 p.m.

Date Received: 05/23/91 @ 4:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	36 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	8	2.0	130.1	06/11/91 10:00 JA
pH	5.05 (std. units)	-	150.1	05/23/91 5:00 SR
Alkalinity	2.9	2.0	310.1	06/07/91 10:00 JA
Chloride	4	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	06/02/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	6.6	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

APPENDIX D

GROUNDWATER QUALITY DATA

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

4643 BENSON AVENUE
BALTIMORE, MD 21227
TELEPHONE: (301) 247-7400
FAX: (301) 247-7402

June 24, 1991

Mr. Hal Garber
SCM Chemicals
3901 Fort Armistead Road
Baltimore, Maryland 21226

Dear Hal:

Enclosed is the data package for SCM Chemicals' Fort Armistead Road Landfill monitoring wells. Each monitoring well was sampled and analyzed in duplicate per your request.

Technical Testing Laboratories (TTL) incorporates a stringent daily QA/QC policy. Upon receipt, samples are logged-in and placed on a Chain of Custody Record. They are preserved as needed and kept at 4°C until the analyses are ready to be performed.

Each analysis must abide by the following QA/QC criteria:

a. Initial calibration/standardization for each parameter measured in the analysis. A minimum of three points over a reasonable concentration range.

b. A daily or continuing calibration check at a midrange concentration.

c. Method blank (incorporating glassware and all reagents used in the analysis). For analysis in which an extraction step occurs prior to analysis, a method blank can represent a longer period but should not exceed 48 hours.

d. Instrument blank (if required by the specific method).

e. One duplicate analysis for each ten (or fraction of ten) samples. (Duplicate means **prepared** and **analyzed** in duplicate.)

f. One spike analysis for each ten (or fraction of ten) samples. (Spike level should be 5 to 10 x MDL).

g. A matrix spike/matrix spike dup may be submitted for the dup and spike and performed each twenty samples (or fraction of twenty).

h. For most methods, a final calibration check should be performed at the end of the analysis.

This is a routine policy for TTL, and it is incorporated into all of SCM Chemicals' analytical projects.

If you need any additional information, please feel free to contact us.

Very truly yours,

Matthew B. Cohee
Laboratory Supervisor

MBC/sdo

Enclosure

cc: Ngoan V. Vo

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL366

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-1

Sampled By: TTL
Date Sampled: 05/30/91
@ 2:15 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	35.0	0.50	202.1	06/12/91 10:00 FA
Antimony	ND	0.3	204.1	06/12/91 12:00 FA
Arsenic	0.021	0.005	206.2	06/12/91 9:00 FA
Barium	0.43	0.30	208.1	06/12/91 8:00 FA
Beryllium	0.02	0.02	210.1	06/12/91 11:00 FA
Cadmium	ND	0.02	213.1	06/10/91 2:00 FA
Chromium	0.221	0.06	218.1	06/12/91 9:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	0.232	0.03	220.1	06/11/91 10:00 FA
Iron	77.6	0.05	236.1	06/11/91 10:00 FA
Lead	ND	0.2	239.1	06/10/91 2:00 FA
Manganese	0.305	0.04	243.1	06/11/91 9:00 FA
Mercury	ND	0.0005	245.1	06/13/91 9:00 FA
Nickel	ND	0.06	249.1	06/11/91 4:00 FA
Selenium	ND	0.005	270.2	06/12/91 9:00 FA
Silver	ND	0.03	272.1	06/11/91 4:00 FA
Thallium	ND	0.40	279.1	06/12/91 12:00 FA
Zinc	0.201	0.008	289.1	06/11/91 9:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL366

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-1

Sampled By: TTL
Date Sampled: 05/30/91
@ 2:15 p.m.

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	196 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	40	2.0	130.1	06/11/91 10:00 JA
pH	6.95 (std. units)	-	150.1	05/30/91 5:00 SR
Alkalinity	67	2.0	310.1	06/12/91 9:00 JA
Chloride	7	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	22	1.0	375.4	06/04/91 11:00 JA
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL318

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-2

Sampled By: TTL
Date Sampled: 05/29/91
@ 3:15 p.m.

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	26.52	0.50	202.1	06/06/91 9:00 JL
Antimony	ND	0.3	204.1	06/06/91 11:00 JL
Arsenic	0.026	0.005	206.2	06/05/91 3:00 JL
Barium	0.41	0.30	208.1	06/05/91 4:00 JL
Beryllium	ND	0.02	210.1	06/06/91 3:00 JL
Cadmium	ND	0.02	213.1	06/04/91 4:00 JL
Chromium	0.117	0.06	218.1	06/05/91 1:00 JL
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	0.084	0.03	220.1	06/04/91 4:30 JL
Iron	107.43	0.05	236.1	06/04/91 4:30 JL
Lead	ND	0.2	239.1	06/04/91 4:00 JL
Manganese	0.371	0.04	243.1	06/06/91 10:00 JL
Mercury	ND	0.0005	245.1	06/05/91 11:00 FA
Nickel	ND	0.06	249.1	06/05/91 12:00 JL
Selenium	ND	0.005	270.2	06/06/91 2:00 JL
Silver	ND	0.03	272.1	06/05/91 12:00 JL
Thallium	0.57	0.40	279.1	06/06/91 11:00 JL
Zinc	0.380	0.008	289.1	06/06/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL318

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-2

Sampled By: TTL
Date Sampled: 05/29/91
@ 3:15 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	149 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	30	2.0	130.1	06/11/91 10:00 JA
pH	7.27 (std. units)	-	150.1	05/29/91 5:00 SR
Alkalinity	53	2.0	310.1	06/12/91 9:00 JA
Chloride	3	1.0	325.1	06/17/91 3:30 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	0.36	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	17	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL364

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-3

Sampled By: TTL
Date Sampled: 05/30/91
@ 1:50 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	31.6	0.50	202.1	06/12/91 10:00 FA
Antimony	ND	0.3	204.1	06/12/91 12:00 FA
Arsenic	0.020	0.005	206.2	06/13/91 9:00 FA
Barium	0.52	0.30	208.1	06/12/91 8:00 FA
Beryllium	0.04	0.02	210.1	06/12/91 11:00 FA
Cadmium	ND	0.02	213.1	06/10/91 2:00 FA
Chromium	0.412	0.06	218.1	06/12/91 9:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	ND	0.03	220.1	06/11/91 10:00 FA
Iron	138.2	0.05	236.1	06/11/91 10:00 FA
Lead	ND	0.2	239.1	06/10/91 2:00 FA
Manganese	0.664	0.04	243.1	06/11/91 9:00 FA
Mercury	ND	0.0005	245.1	06/13/91 9:00 FA
Nickel	0.12	0.06	249.1	06/11/91 4:00 FA
Selenium	ND	0.005	270.2	06/13/91 9:00 FA
Silver	ND	0.03	272.1	06/11/91 4:00 FA
Thallium	ND	0.40	279.1	06/12/91 12:00 FA
Zinc	0.275	0.008	289.1	06/11/91 9:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL364

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-3

Sampled By: TTL
Date Sampled: 05/30/91
@ 1:50 p.m.

Date Received: 05/30/91 @ 4:00 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	270 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	60	2.0	130.1	06/11/91 10:00 JA
pH	6.70 (std. units)	-	150.1	05/30/91 5:00 SR
Alkalinity	104	2.0	310.1	06/12/91 9:00 JA
Chloride	5	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	27	1.0	375.4	06/04/91 11:00 JA
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL198

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-4

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:33 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	3.80	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	0.190	0.03	220.1	05/31/91 10:00 FA
Iron	7.10	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.482	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	0.50	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	4.8	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL198

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-4

Sampled By: TTL
Date Sampled: 05/22/91
@ 4:33 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	282 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	119	2.0	130.1	06/11/91 10:00 JA
pH	4.33 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	ND	2.0	310.1	06/07/91 10:00 JA
Chloride	5	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	0.04	0.02	335.2	05/30/91 10:00 JA
Fluoride	0.40	0.20	340.2	06/19/91 12:00 MC
Nitrate	14.3	1.0	353.3	06/03/91 10:00 SR
Sulfate	60	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.02	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL314

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-5

Sampled By: TTL
Date Sampled: 05/29/91
@ 1:10 p.m.

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	0.69	0.50	202.1	06/06/91 9:00 JL
Antimony	ND	0.3	204.1	06/06/91 11:00 JL
Arsenic	ND	0.005	206.2	06/05/91 3:00 JL
Barium	ND	0.30	208.1	06/05/91 1:00 JL
Beryllium	ND	0.02	210.1	06/06/91 3:00 JL
Cadmium	ND	0.02	213.1	06/04/91 4:00 JL
Chromium	ND	0.06	218.1	06/05/91 1:00 JL
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	ND	0.03	220.1	06/04/91 4:30 JL
Iron	5.082	0.05	236.1	06/04/91 4:30 JL
Lead	ND	0.2	239.1	06/04/91 4:00 JL
Manganese	0.073	0.04	243.1	06/06/91 10:00 JL
Mercury	ND	0.0005	245.1	06/05/91 11:00 FA
Nickel	ND	0.06	249.1	06/05/91 12:00 JL
Selenium	ND	0.005	270.2	06/06/91 2:00 JL
Silver	ND	0.03	272.1	06/05/91 12:00 JL
Thallium	0.95	0.40	279.1	06/06/91 11:00 JL
Zinc	0.015	0.008	289.1	06/06/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL314

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-5

Sampled By: TTL
Date Sampled: 05/29/91
@ 1:10 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	144 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	66	2.0	130.1	06/11/91 10:00 JA
pH	9.60 (std. units)	-	150.1	05/29/91 5:00 SR
Alkalinity	96	2.0	310.1	06/12/91 9:00 JA
Chloride	10	1.0	325.1	06/17/91 3:30 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	0.34	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	21	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL316

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-7

Sampled By: TTL
Date Sampled: 05/29/91
@ 2:35 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	2.87	0.50	202.1	06/06/91 9:00 JL
Antimony	ND	0.3	204.1	06/06/91 11:00 JL
Arsenic	ND	0.005	206.2	06/05/91 3:00 JL
Barium	ND	0.30	208.1	06/05/91 4:00 JL
Beryllium	ND	0.02	210.1	06/06/91 3:00 JL
Cadmium	ND	0.02	213.1	06/04/91 3:00 JL
Chromium	ND	0.06	218.1	06/05/91 1:00 JL
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	ND	0.03	220.1	06/04/91 4:30 JL
Iron	29.0	0.05	236.1	06/04/91 4:30 JL
Lead	ND	0.2	239.1	06/04/91 4:00 JL
Manganese	0.566	0.04	243.1	06/06/91 10:00 JL
Mercury	ND	0.0005	245.1	06/05/91 11:00 FA
Nickel	ND	0.06	249.1	06/05/91 12:00 JL
Selenium	ND	0.005	270.2	06/06/91 2:00 JL
Silver	ND	0.03	272.1	06/05/91 12:00 JL
Thallium	0.50	0.40	279.1	06/06/91 11:00 JL
Zinc	0.099	0.008	289.1	06/06/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL316

Respectfully Submitted:

M. Cole

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-7

Sampled By: TTL
Date Sampled: 05/29/91
@ 2:35 p.m.

Date Received: 05/29/91 @ 4:10 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	114 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	50	2.0	130.1	06/11/91 10:00 JA
pH	5.90 (std. units)	-	150.1	05/29/91 5:00 SR
Alkalinity	4.3	2.0	310.1	06/12/91 9:00 JA
Chloride	26	1.0	325.1	06/17/91 3:30 SR
Cyanide (Total)	ND	0.02	335.2	06/06/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	10	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL199

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-8

Sampled By: TTL
Date Sampled: 05/22/91
@ 5:13 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	3.20	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	0.029	0.03	220.1	05/31/91 10:00 FA
Iron	7.28	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.124	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.05	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES

A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL199

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-8

Sampled By: TTL
Date Sampled: 05/22/91
@ 5:13 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	110 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	46	2.0	130.1	06/11/91 10:00 JA
pH	5.50 (std. units)	-	150.1	05/23/91 8:00 SR
Alkalinity	5.7	2.0	310.1	06/07/91 10:00 JA
Chloride	10	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	05/30/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	27	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	05/23/91 9:00 PC

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL227

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

Fort Armistead Rd. Landfill
G-10

Sampled By: TTL
Date Sampled: 05/23/91
@ 1:45 p.m.

Date Received: 05/23/91 @ 4:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	2.18	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	1.476	0.03	220.1	05/31/91 10:00 FA
Iron	4.18	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.072	0.04	243.1	05/31/91 3:00 FA
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.041	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL227

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-10

Sampled By: TTL
Date Sampled: 05/23/91
@ 1:45 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/23/91 @ 4:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	110 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	44	2.0	130.1	06/11/91 10:00 JA
pH	6.53 (std. units)	-	150.1	05/23/91 5:00 SR
Alkalinity	44	2.0	310.1	06/07/91 10:00 JA
Chloride	2	1.0	325.1	06/18/91 8:15 SR
Cyanide (Total)	ND	0.02	335.2	06/02/91 10:00 JA
Fluoride	ND	0.20	340.2	06/19/91 12:00 MC
Nitrate	2.1	1.0	353.3	06/03/91 10:00 SR
Sulfate	3.2	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

Please note the disperity of these two samples from the same well taken on two different days.

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL294

Respectfully Submitted:

Fort Armistead Rd. Landfill
G-12

Sampled By: TTL
Date Sampled: 05/28/91
@ 4:45 p.m.

Ngoan V. Vo
Lab Manager

Date Received: 05/28/91 @ 5:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	2.71	0.50	202.1	06/06/91 9:00 JL
Antimony	0.34	0.3	204.1	06/06/91 11:00 JL
Arsenic	ND	0.005	206.2	06/05/91 3:00 JL
Barium	ND	0.30	208.1	06/05/91 4:00 JL
Beryllium	ND	0.02	210.1	06/06/91 3:00 JL
Cadmium	ND	0.02	213.1	06/04/91 4:00 JL
Chromium	ND	0.06	218.1	06/05/91 1:00 JL
Hexavalent Chromium	ND	0.01	SM312B	05/30/91 5:00 MC
Copper	ND	0.03	220.1	06/04/91 4:30 JL
Iron	1.395	0.05	236.1	06/04/91 4:30 JL
Lead	ND	0.2	239.1	06/04/91 4:00 JL
Manganese	0.06	0.04	243.1	06/06/91 10:00 JL
Mercury	ND	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/05/91 12:00 JL
Selenium	ND	0.005	270.2	06/06/91 2:00 JL
Silver	ND	0.03	272.1	06/05/91 12:00 JL
Thallium	ND	0.40	279.1	06/06/91 11:00 JL
Zinc	0.020	0.008	289.1	06/06/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL294

Fort Armistead Rd. Landfill
G-12

Sampled By: TTL
Date Sampled: 05/28/91
@ 4:45 p.m.

Respectfully Submitted:

M. Cohee

Ngoan V. Vo
Lab Manager

Date Received: 05/28/91 @ 5:30 p.m.

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Conductivity	140 umhos/cm @ 25°C	-	120.1	06/18/91 11:15 SR
Hardness	34	2.0	130.1	06/11/91 10:00 JA
pH	9.39 (std. units)	-	150.1	05/29/91 8:00 SR
Alkalinity	63	2.0	310.1	06/07/91 10:00 JA
Chloride	ND	1.0	325.1	06/17/91 3:30 SR
Cyanide (Total)	ND	0.02	335.2	06/04/91 10:00 JA
Fluoride	0.48	0.20	340.2	06/19/91 12:00 MC
Nitrate	ND	1.0	353.3	06/03/91 10:00 SR
Sulfate	10	1.0	375.4	05/28/91 9:30 PC
Phenolics	ND	0.05	420.1	06/17/91 10:00 JL

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

TECHNICAL TESTING LABORATORIES
A DIVISION OF COMMERCIAL TESTING & ENGINEERING CO.

LABORATORY ANALYSIS REPORT

June 20, 1991

SCM Chemicals

Laboratory Number: AL200

Fort Armistead Rd. Landfill
G-13

Sampled By: TTL
Date Sampled: 05/22/91
@ 5:35 p.m.

Date Received: 05/22/91 @ 5:50 p.m.

Respectfully Submitted:

Ngoan V. Vo
Lab Manager

PARAMETER	RESULT	MDL	METHOD	DATE/TIME/ANALYST
Aluminum	4.65	0.50	202.1	06/04/91 9:00 FA
Antimony	ND	0.3	204.1	06/03/91 9:00 FA
Arsenic	ND	0.005	206.2	06/03/91 9:00 FA
Barium	ND	0.30	208.1	06/04/91 8:00 FA
Beryllium	ND	0.02	210.1	06/04/91 10:00 FA
Cadmium	ND	0.02	213.1	05/31/91 9:00 FA
Chromium	ND	0.06	218.1	05/30/91 8:00 FA
Hexavalent Chromium	ND	0.01	SM312B	05/24/91 10:00 FA
Copper	ND	0.03	220.1	05/31/91 10:00 FA
Iron	9.34	0.05	236.1	05/31/91 10:00 FA
Lead	ND	0.2	239.1	05/31/91 9:00 FA
Manganese	0.394	0.04	243.1	05/31/91 3:00 FA
Mercury	0.0006	0.0005	245.1	05/29/91 4:45 PC
Nickel	ND	0.06	249.1	06/03/91 2:00 FA
Selenium	ND	0.005	270.2	06/03/91 9:00 FA
Silver	ND	0.03	272.1	06/03/91 2:00 FA
Thallium	ND	0.40	279.1	06/03/91 9:00 FA
Zinc	0.132	0.008	289.1	05/31/91 3:00 FA

All results expressed as mg/l unless otherwise indicated.

ND: Not detected at a concentration greater than or equal to the Method Detection Limit (MDL).

Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, March 1983.

APPENDIX E

SLOPE STABILITY STUDY

SLOPE STABILITY STUDY

FOR

FINAL GRADING MODIFICATIONS

Quarantine Road Landfill

Baltimore, Maryland

Prepared For Counsel

For:

SCM Chemicals
3901 Glidden Road
Baltimore, Maryland 21226

Prepared By:

Oosterbaan Associates, P.C.
4909 Cordell Avenue
Bethesda, Maryland 20814

January 31, 1989

88C1416.SS

January 31, 1989
88C 1416

SCM Chemicals, Inc.
3901 Fort Armistead Road
Baltimore, Maryland 21226

Attention: Mr. Sean Smith

Subject: Slope Stability Study
Revised Final Grading Plan: 2H:1V Slopes
Quarantine Road Landfill
Hawkins Point, Maryland

Dear Mr. Smith:

In accordance with your authorization, we have completed our study to investigate the stability of proposed two horizontal to one vertical (2H:1V) fill slopes intended to replace the existing 4H:1V slope configuration at the SCM Chemicals Quarantine Road Landfill. In order to estimate the stability of the proposed slopes, shear strengths of the materials in the landfill were required. These values were obtained by field and laboratory tests.

The materials landfilled to date include primary and secondary gypsum, neutralized and uneutralized batch attack mud (Cell No. 1, only) and middle lagoon dredgings.

In order to characterize the physical and strength characteristics of the materials in the landfill so that a slope stability analysis could be performed, our study consisted of:

1. Drilling six soil borings to identify material types and obtain undisturbed samples for laboratory triaxial shear testing.

2. Performing two direct shear and one triaxial consolidated undrained (CU) tests to provide estimates of in-situ shear strength for secondary gypsum and middle lagoon dredgings.

3. Using field and laboratory data to formulate typical cross sections with shear strength parameters for slope stability by computer analysis.

4. Running computer code PCSTABL5M to analyze the stability of two cross sections for the 2:1 slope configuration.

SOIL BORINGS

Six soil borings were drilled at the locations shown on the enclosed Boring Location Plan, Figure 1, (24 x 36 inch format). The borings were located in areas of the landfill where there was expected to be a high probability of penetrating primary and secondary gypsum and middle lagoon dredgings. Review of the boring logs in Appendix A, indicates that these materials were encountered during drilling at random depths and thicknesses. Undisturbed samples were obtained in zones exhibiting the lowest Standard Penetration Test N-values, which are often indicative of the lowest strength materials.

Sampling of the batch attack mud was not attempted since this operation would have involved drilling through the final engineered cover of Cell No. 1. Based on visual observation and limited laboratory grain size data, it is our opinion that the in-situ strength parameters for these materials should be similar to those of the middle lagoon dredgings.

Previous drilling at the site for the installation of monitoring wells, indicates natural foundation soils for the landfill consist of dense to very dense sand and gravel and very stiff to hard silty clay. These materials typically exhibit high shear strengths and potential slippage paths passing through these soils result in acceptable factors of safety. These soils were not sampled during the drilling.

LABORATORY TESTING

Laboratory testing to determine material characteristics consisted of four moisture content tests, two tests to check for plasticity, two grain size distributions by hydrometer, seven in-place densities from undisturbed samples, and two specific gravity tests. Shear strengths of the in-place materials were estimated from the results of two direct shear tests and one consolidated-undrained (CU) triaxial shear test. The results of the laboratory tests are shown at the applicable depth on the boring logs and in Appendix B.

SUBSURFACE CONDITIONS

Based on the subsurface data contained in the boring logs and in previous reports of drilling (refer to Well Construction Monitoring, by Oosterbaan Associates, P.C., December 30, 1987, addressed to Mr. William Lammeree of SCM) the generalized subsurface cross sections shown on pages C-1 and C-2 were formulated. The materials encountered during the drilling for this present study consisted of loose to medium dense soil-like fill comprised of primary and secondary gypsum and middle lagoon dredgings. The laboratory tests indicate these materials to be non-plastic silt size particles with moisture contents of approximately 56 percent of dry weight for secondary gypsum and ranging between 28 and 36 percent for middle lagoon dredgings.

It should be noted that the soil descriptions on the shear strength tests performed by Law Engineering under subcontract to Oosterbaan Associates, P.C., refer to secondary gypsum and middle lagoon dredgings as clay. Law used visual estimates of soil type and did not have access to laboratory soil classification data which takes precedent. Shear strength and density parameters were assigned to the fill materials from the results of the direct shear and triaxial shear tests as follows:

			Dry Density
Secondary Gypsum:	ϕ = 30 ,	C = 0,	= 70 PCF
Middle Lagoon Dredgings:	ϕ = 38 ,	C = 0,	= 85 PCF
Foundation Soil (est.):	ϕ = 0 ,	C = 8000 PSF,	= 115 PCF

SLOPE STABILITY ANALYSES

Attempts were made to locate cross sections through the landfill at critical areas for slope stability analyses. All proposed fill slopes will be constructed at a 2H:1V configuration, so the steepness of slope was not a factor in the location of study sections. Material strengths should be relatively uniform throughout the landfill since the same materials have been placed using the same methods and the location of study slopes was considered independent of this factor.

Two study sections, Section 1 and Section 2 located on Figure 1, were placed in areas of long slope length judged to reflect zones which might be more disposed toward failure than others.

The stability of slopes placed at a 2H:1V configuration were analyzed using PCSTABL5 computer program and the assigned shear strength parameters. The idealized sections, input data, and results of the computations are contained in Appendix C. Review of the results on pages C-1 and C-2 indicate that 2H:1V slopes are likely to be stable since minimum factors of safety were computed at approximately 1.9 for Section 1 (Run 1, page C-1 of Appendix C) and 2.1 for Section 2 (Run 2, page C-2 of Appendix C).

The mode of potential failure for the lowest factor of safety in Section 1 is a deep seated path which encompasses the slope crest, slope length and area beyond the toe of slope. At Section 2, the potential failure path is shallow, occurring within the bounds of the slope length. Factors of safety of at least 1.5 are generally considered acceptable for slope stability by governmental review agencies.

LIMITATIONS

The work on this project has been carried out in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is applicable on this work. Classifications of the recovered soil samples are based on recognized standards.

We have enjoyed working on this interesting project, and hope to be of service on future endeavors. If there are any questions concerning our findings, please do not hesitate to call.

Yours Truly,

OOSTERBAAN ASSOCIATES, P.C.

Thomas J. Moynahan, P.E.

Attachments: Appendix A - Boring Logs
Appendix B - Laboratory Data
Appendix C - Slope Stability Computations

APPENDIX A

BORING LOGS

DRILLING PROCEDURE

Six borings were drilled for the slope stability analyses by Hardin-Huber Associates under subcontract to Oosterbaan Associates, P.C. The drill holes were advanced using a truck mounted B-61 drill rig with 8-inch diameter hollow stem augers. The borings were located visually in the field after consultation with Mr. Brent Collier of SCM and Mr. John Sganga and Mr. Lee Williamson of Cecos International such that the borings were likely to penetrate both secondary gypsum and middle lagoon dredgings. The approximate boring locations are shown on Figure 1, Boring Location Plan. The borings were advanced to depths ranging from 30 to 34.2 feet.

Standard Penetration tests were performed using a 2-inch diameter split barrel sampler. The sampler was driven over 18-inches by a 140-pound hammer free falling 30-inches. Hammer blows required to drive the sampler were recorded every six inches and representative samples of material recovered were collected in sealed glass jars for laboratory testing and classification.

In additional, five samples for laboratory strength testing were obtained by pushing thin-walled steel tubes (Shelby Tubes) into the undisturbed materials at the bottom of the lead auger flight. Prior to pushing tubes, the bottom of borehole was cleaned of loose material to the extent practical.

Groundwater levels encountered in the drill holes are noted on the logs. Depth of caving, which may be indicative of groundwater level, is also recorded on the logs.

DEPTH IN FEET	SAMPLE	blows/ 6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 110.5	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No.	Recovery / Test Data
	8	10 7			Medium dense reddish - brown SILT, moist (Secondary Gyspum)		S - 1	8"
5	3	7 8			Same as Sample S - 1		S - 2	15"
10	14	12 9			Same as Sample S - 1, Dense		S - 3	13"
15	2	2 6			Loose tan and reddish - brown SILT, moist (Secondary and Primary Gypsum)		S - 4	12"
20	11	14 14			Dense reddish - brown SILT, moist (Secondary Gypsum)		S - 5	14"
25	3	4 4			Same , loose, very moist (Secondary Gypsum)		S - 6	18"
30	3	2 4			Same as Sample S - 6		S - 7	18"
UD	P - 1				*PUSHED TUBE 21" RECOVERED 21" (Secondary Gypsum)			γ_d = 69.4 PCF γ_d = 70.9 PCF
	6	7 10		76.25	Same as Sample S - 6, medium dense, wet		S - 8	18"
35					BOTTOM OF BORING @ 34.25" *Cleaned out 6" below bottom of auger to 30.5' Pushed tube 21" to 32.75'			
40								
45								

	DEPTH(ft.)		TIME(hrs.)		DATE
START	0.0	@	9 AM	ON	10-7-88
FINAL	33.75	@	11AM	ON	10-7-88
WATER	None	@		ON	
WATER		@		ON	
WATER		@		ON	

LOCATION See Figure

LOG OF BORING B - 1

PAGE 1 OF 1

DEPTH IN FEET	SAMPLE	blows/6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 120.0	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No. / Test Data	Recovery
	6	5 4			Medium dense reddish - brown SILT, moist (Secondary Gypsum)		S - 1	12"
5	2	3 2			Loose reddish brown and gray SILT, moist (Secondary Gypsum)		S - 2	9"
	1	2 2			SAME AS SAMPLE S - 3		S - 3	6"
10	P - 1				*PUSHED TUBE 16" RECOVERED 16" (Middle Lagoon Dredgings)	27.7	$\phi = 40^{o}$ γ_d= 83.5-88.5 PCF	
	4	10 8			Dense reddish - brown and tan SILT, moist (Secondary and Primary Gypsum)		S - 4	13"
15								
	8	7 9			Medium dense reddish - brown SILT, moist (Secondary Gypsum)		S - 5	18"
20								
	3	2 4			SAME AS SAMPLE S - 5, loose very moist		S - 6	18"
25								
	2	2 9		90.0	SAME AS SAMPLE S - 6		S - 7	15"
30					BOTTOM OF BORING @ 30.0'			
					* Moved Drill Rig 5' West, Augered 8.5,' Split spoon sample from 8.5' to 10.0' [2-2-2], Loose brown and gray SILT, moist (Middle Lagoon Dredgings) Cleaned out 6", Pushed tube 21" to 12.7' Split spoon sample from 12.2' to 13.7' [16-15-14], Dense gray SILT, moist (Middle Lagoon Dredgings)			
35								
40								
45								

	DEPTH(ft.)		TIME(hrs.)		DATE
START	0.0	@	11:35	ON	10-7-88
FINAL	30.0	@	3:15	ON	10-7-88
WATER	None	@		ON	
WATER		@		ON	
WATER		@		ON	

LOCATION See Figure

LOG OF BORING B - 2

PAGE 1 OF 1

DEPTH IN FEET	SAMPLE	blows/ 6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 120.0	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No. / Test Data	Recovery
	2	4 5			Medium dense brown and gray SILT, moist (Middle Lagoon Dredgings)		S - 1	6"
5	2	2 1			Loose gray SILT, moist (Middle Lagoon Dredgings)		S - 2	6"
10	4	10 12			Dense reddish - brown SILT, moist (Secondary Gypsum)	56.2	S - 3 non-plastic sp. gr. = 2.85	
15	3	7 6			SAME AS S - 3, medium dense		S - 4	18"
20	4	5 3			Loose reddish - brown and tan SILT, moist (Secondary and Primary Gypsum		S - 5	14"
25	2	1 1			Very loose reddish - brown SILT, very moist (Secondary Gypsum)		S - 6	18"
	P - 1				*PUSHED TUBE 28" RECOVERED 28" (Secondary Gypsum)			
30	5	8 12		90.0	SAME AS S - 6, medium dense		S - 7	18"
35					BOTTOM OF BORING @ 30.0' Moved Drill rig 5.0' South, augered 23.5' Split spoon sample from 23.5' to 25.0' [3-3-3] Loose brown and gray SILT, moist (Middle Lagoon Dredgings) Drilled to 25.0', cleared out bottom of augers, Pushed tube 28" to 27.3'. Split spoon sample from 27.3' to 28.8' [5-4-5] Loose tan, brown and gray SILT, moist (Primary and Secondary Gypsum)			
40								
45								

	DEPTH(ft.)	TIME(hrs.)	DATE
START	0.0	@ 10:30 AM	ON 10-10-88
FINAL	30.0'	@ 12NOON	ON 10-10-88
WATER	None	@	ON
WATER		@	ON
WATER		@	ON

LOCATION See Figure

LOG OF BORING B - 3

PAGE 1 OF 1

DEPTH IN FEET	SAMPLE	blows/ 6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 112.5	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No. / Recovery / Test Data
0	1	4 7 8			Dense reddish - brown SILT, moist (Secondary Gypsum)		S - 1 12"
5	2	2 5 5			SAME AS SAMPLE S - 1, medium dense		S - 2 12"
10	3	3 3 3			SAME AS SAMPLE S - 1, loose		S - 3 14"
15	4	4 11 20			Dense reddish - brown, gray and tan SILT, moist (Secondary Gypsum and neutralized Batch Ahock Mud)		S - 4 18"
20	5	2 2 3			Loose gray SILT, very Moist (Middle Lagoon Dredgings)		S - 6 18"
UD					PUSHED TUBE 30" RECOVERED 27" (Middle Lagoon Dredgings)	36.4	$\phi = 39^{0}$ $\gamma_d = 78.7$ PCF
25	6	2 2 3			Loose gray SILT, wet (Middle Lagoon Dredgings)		S - 6 18"
30	7	3 3 5			Loose brown and gray SILT (Middle Lagoon Dredgings)		S - 7 18"
35					BOTTOM OF BORING @ 30.0' Moved Drill Rig 10' south, Augered 18.5' Split Spoon sample from 18.5' to 20.0' [3-3-3] Loose gray silt, very moist (Middle Lagoon Dredgings) Augered to 20', Cleared out 6" below bottom of augers Pushed tube 30" to 23.0' Split spoon sample from 23.0' to 14.5' [2-2-3] Loose gray silt (Middle Lagoon Dredgings)		
40							
45							

	DEPTH(ft.)		TIME(hrs.)		DATE
START	0.0	@	1:00 PM	ON	10-10-88
FINAL	30.0	@	3:30 PM	ON	10-10-88
WATER	None	@		ON	
WATER		@		ON	
WATER		@		ON	

LOCATION See Figure

LOG OF BORING B - 4

PAGE 1 OF 1

DEPTH IN FEET	SAMPLE	blows/ 6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 120.0	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No. / Test Data	Recovery
	7	4 4			Loose reddish - brown and tan SILT, moist (Secondary and Primary Gypsum)		S - 1	12"
5	3	5 3			Loose gray SILT, moist (Middle Lagoon Dredgings)		S - 2	8"
	2	2 2			Loose reddish brown SILT, moist (Secondary Gypsum)	56.6	S - 3	18"
10	UD				* PUSH TUBE 30" RECOVERED 26" (Secondary Gypsum)		non-plastic sp. gr. = 2.75 $\phi = 30^0$ γ_d = 69.5 PCF	
	3	3 4			SAME AS SAMPLE S - 1		S - 4	12"
15								
	4	3 3			Loose gray SILT, very moist (Middle Lagoon Dredgings)		S - 5	15"
20								
	1	3 8			SAME AS SAMPLE S - 5, medium dense		S - 6	18"
25								
	2	3 2			SAME AS SAMPLE S - 3		S -7	18"
30					BOTTOM OF BORING @ 30.0'			
					Moved Drill Rig 10' south, Augered to 8.5'			
					Split spoon sample from 8.5' to 10.0' [1-2-4]			
					Loose reddish - brown SILT			
					Pushed tube 30" to 13.0'			
35					Split spoon sample from 13.0' to 14.5' [4-6-6]			
					Medium dense reddish - brown SILT, moist			
40								
45								

	DEPTH(ft.)		TIME(hrs.)		DATE
START	0.0	@	4PM	ON	10-7-88
FINAL	30.0	@	5:30	ON	10-7-88
WATER	None	@	8:20	ON	10-10-88
WATER		@		ON	
WATER		@		ON	

LOCATION See Figure

LOG OF BORING B - 5

PAGE 1 OF 1

C 1416 | SCM CHEMICALS | QUARANTINE ROAD LANDFILLS SLOPE STABILITY STUDY

OOSTERBAAN ASSOCIATES

DEPTH IN FEET	SAMPLE	blows/ 6 in.	WATER LEVEL	ELEV. LOWEST FLOOR / GROUND 92.5	MATERIAL DESCRIPTION	MOISTURE CONTENT %	Sample No.	Recovery Test Data
		6 8 9			Dense reddish - brown and tan SILT, moist (Secondary and Primary Gypsum)		S - 1	13"
5		20 38 44			SAME AS SAMPLE S - 1, very dense		S - 2	13"
10		11 13 14			Dense reddish - brown SILT, moist (Secondary Gypsum)		S - 3	14"
15		2 7 7			SAME AS SAMPLE S - 3, medium dense		S - 4	10"
20		5 7 7			SAME AS SAMPLE S - 3, medium dense		S - 5	15"
25		9 17 17			SAME AS SAMPLE S - 3		S - 6	17"
30		5 5 10			SAME AS SAMPLE S - 3, medium dense		S - 7	22"
					BOTTOM OF BORING @ 30.0'			
35								
40								
45								

	DEPTH(ft.)	TIME(hrs.)	DATE
START	0	@ 3:45	ON 10-10-88
FINAL	30.0'	@ 5:30	ON 10-10-88
WATER	NONE	@	ON
WATER		@	ON
WATER		@	ON

LOCATION See Figure

LOG OF BORING B - 6

PAGE 1 OF 1

APPENDIX B

LABORATORY TESTING

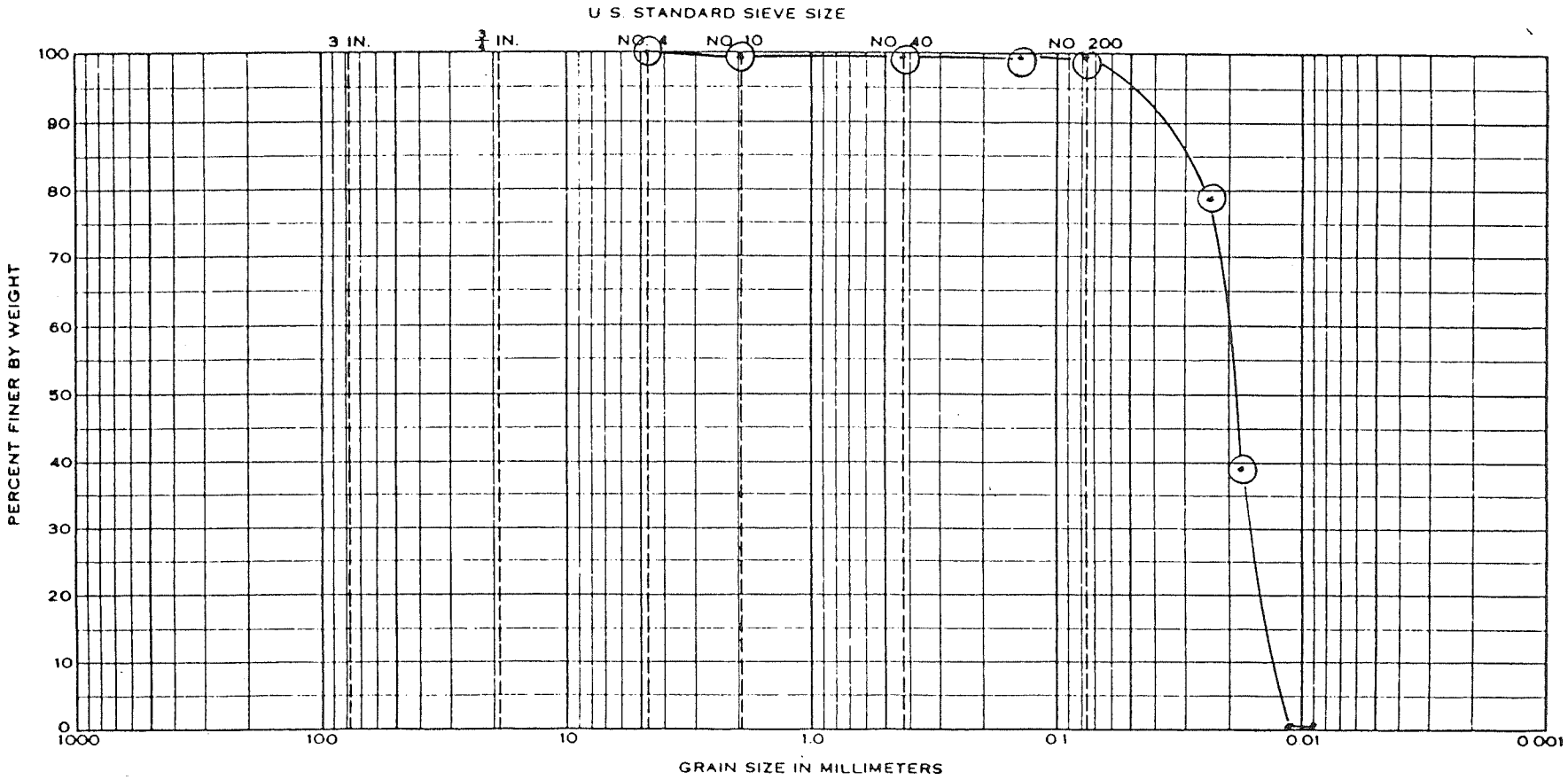
OOSTERBAAN ASSOCIATES

C1416

SCM Chemicals, Inc.

Quarantine Road Landfill

Fig. 1 of 5



Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI	
B-3, S-3	8.5 - 10.0'	Reddish Brown SILT	56.2	*		NP	Non Plastic
		(Secondary Gypsum)					
				* 24 hr., 110 degrees C			

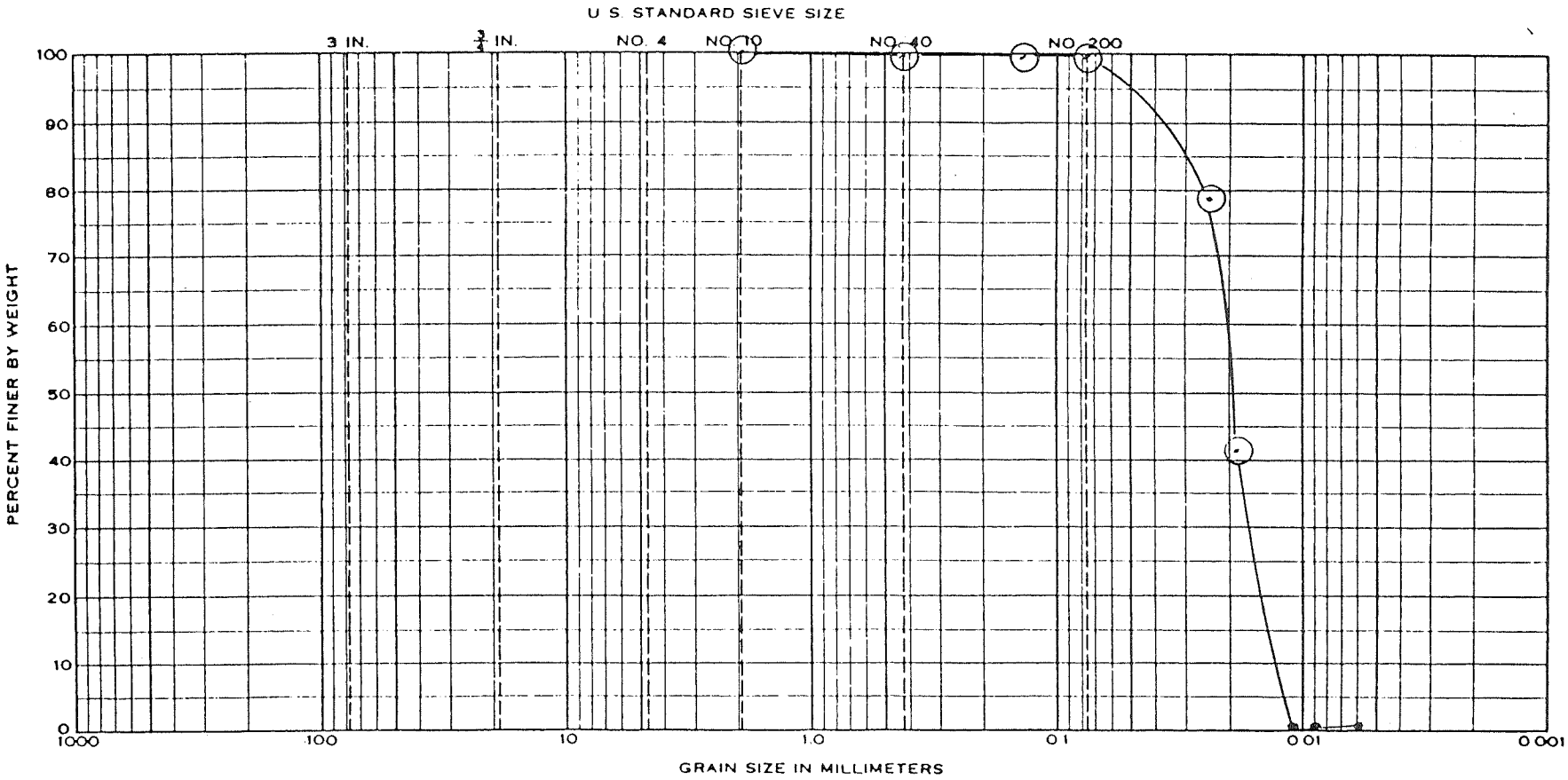
GRADATION CURVES

OOSTERBAAN ASSOCIATES

C1416

SCM Chemicals, Inc.

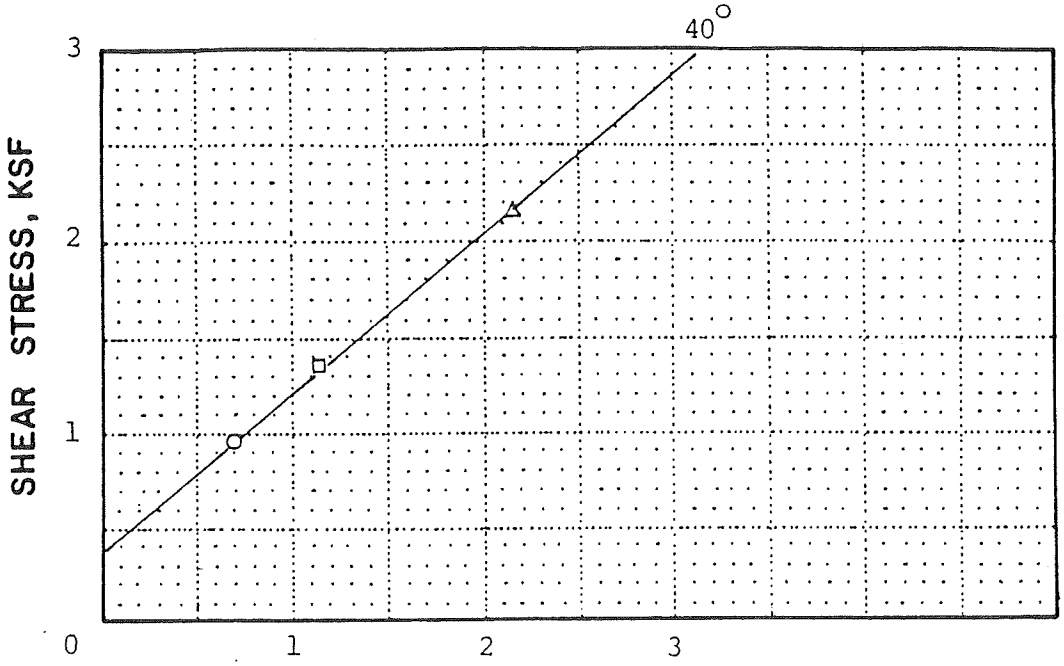
Quarantine Road Landfill

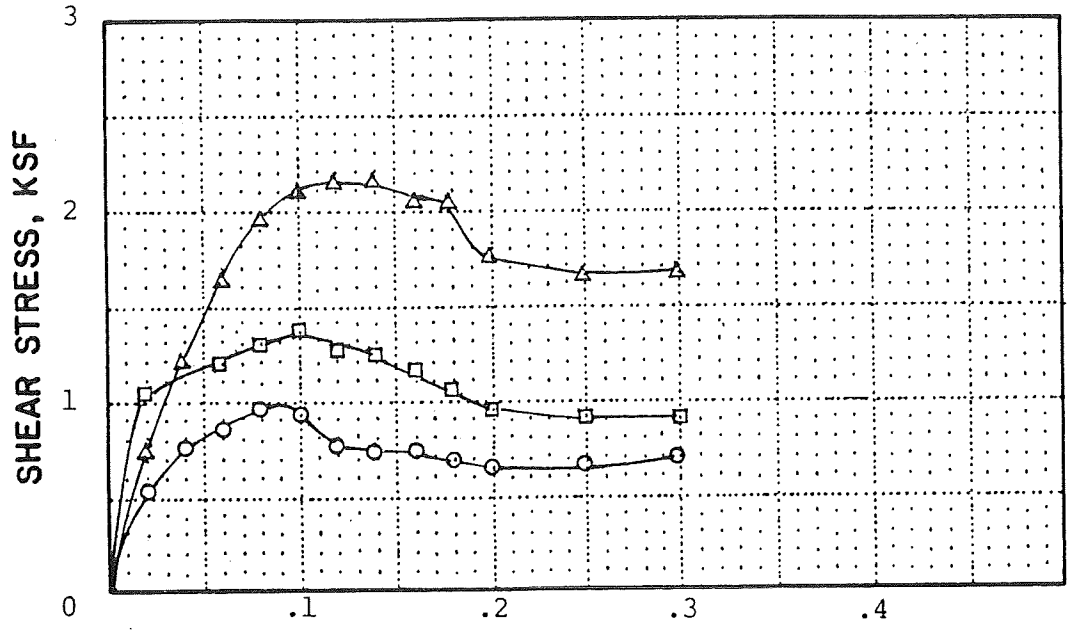


Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI	
B-5, S-2	13.0-14.7'	Reddish Brown SILT	56.6	*		NP	Non Plastic
		(Secondary Gypsum)					
			* 24 hr., 110 degrees C				

GRADATION CURVES

Fig. 2 of 5





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	27.69	27.41	27.13
Wet Density(pcf)	111.8	106.4	112.5
Dry Density(pcf)	87.6	83.5	88.5
Consolidation Pressure(ksf)	.50	1 □	2 △

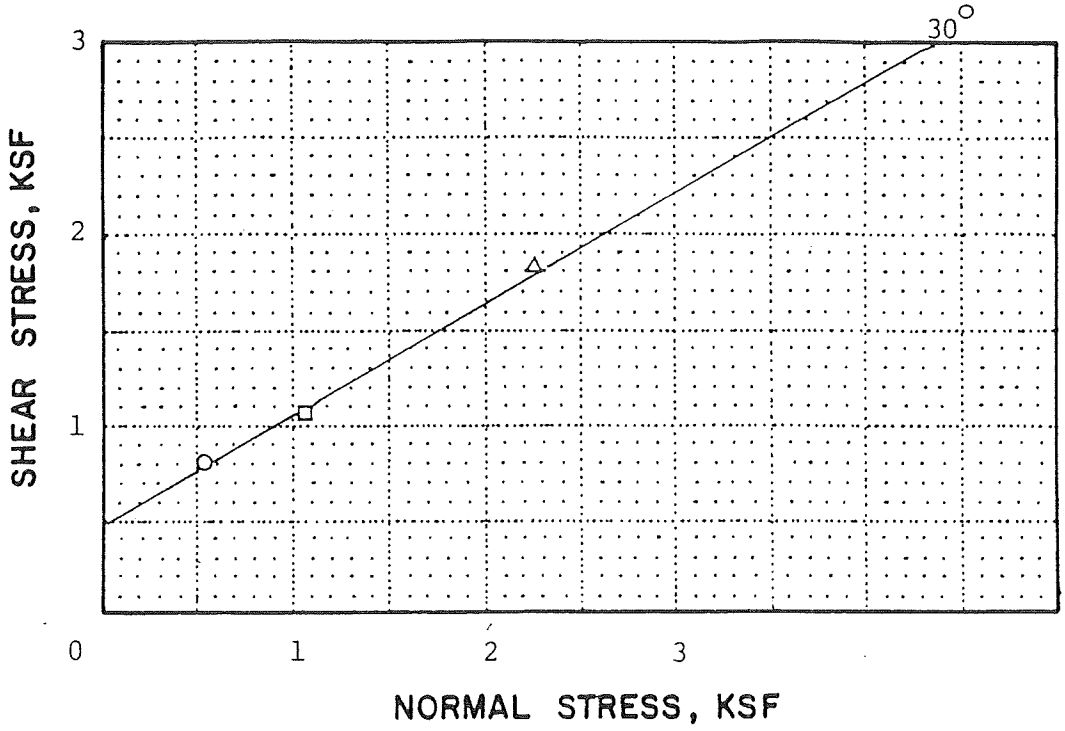
NOTES: Gray moist silty sand with little gravel

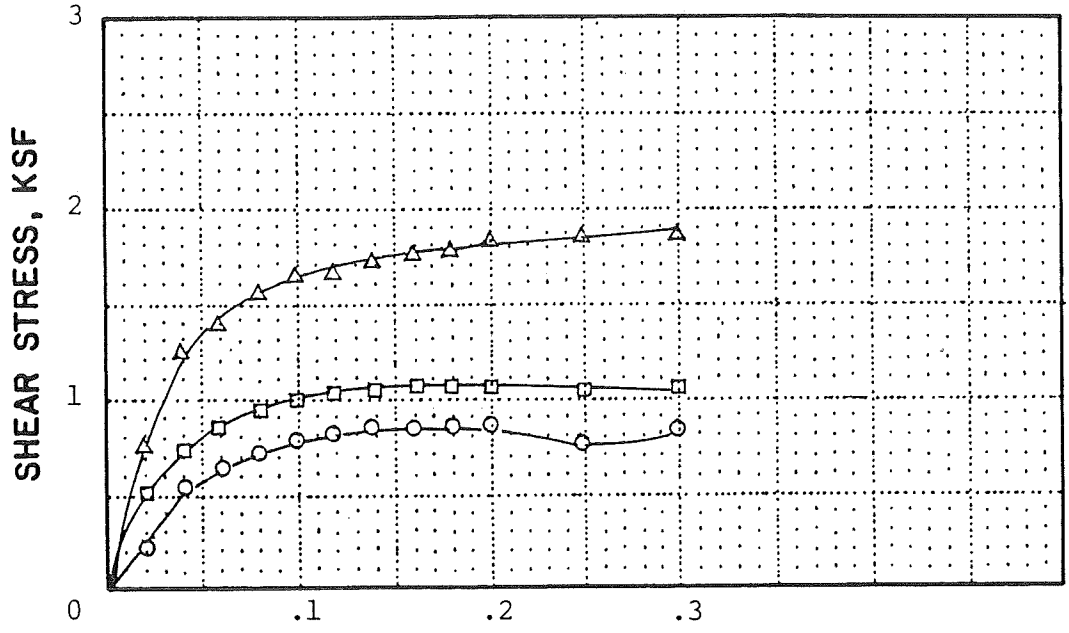
DIRECT SHEAR RESULTS

Job No 5764
Drawn: AEI
Checked: RGH
Date: 11-16-88

Osterbaan Assoc. (SCM-QRL) B-2 10.0-11.3 Ft

W7-5764 (88 C 1416)





SAMPLE NUMBER	1 ○	2 □	3 △
Initial: Water Content (%)	56.60	55.76	55.76
Wet Density (pcf)	108.2	107.8	108.2
Dry Density (pcf)	69.1	69.2	69.5
Consolidation Pressure (ksf)	.5	1	2

NOTES: Reddish brown, semi-moist silty clay, no gravel visible

NOV 21

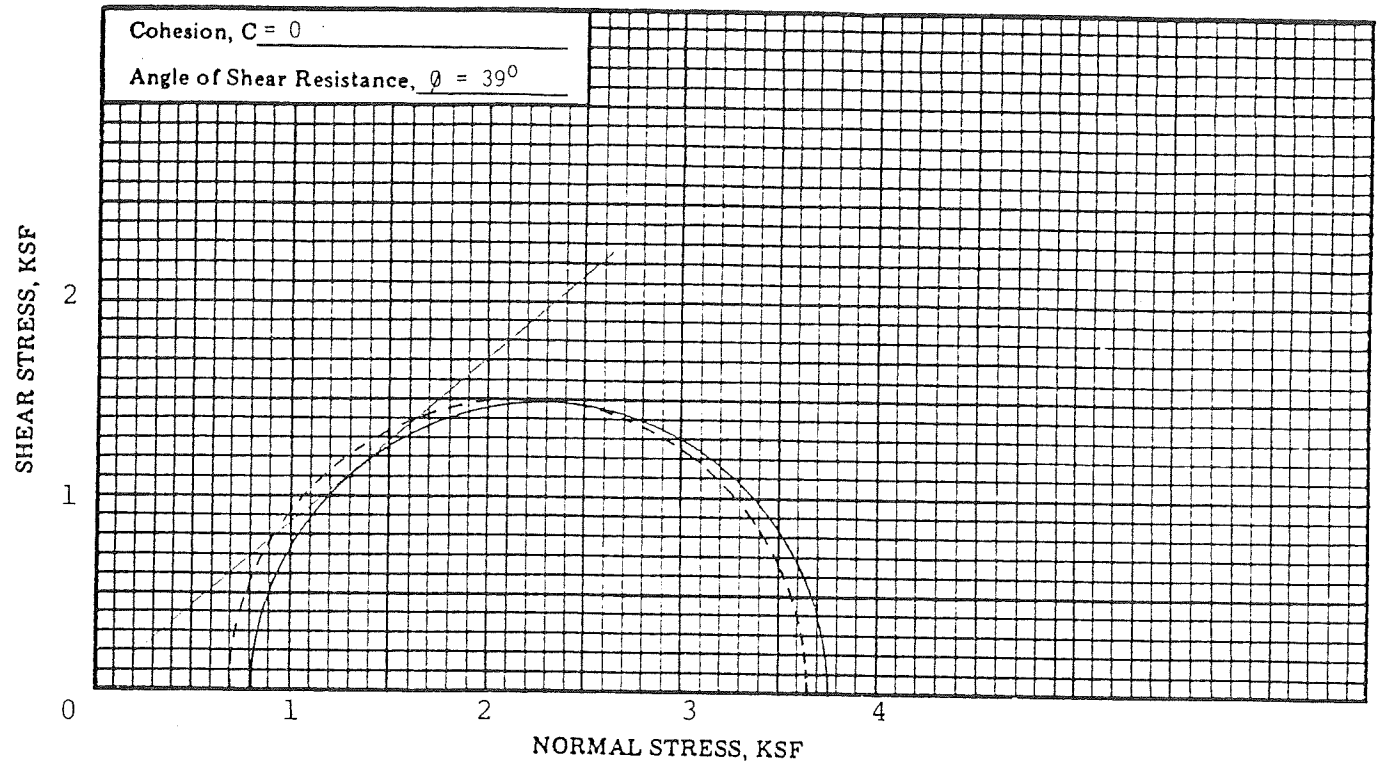
DIRECT SHEAR RESULTS

Job No. 5764
Drawn: AEI
Checked: RGH
Date: 11-16-88

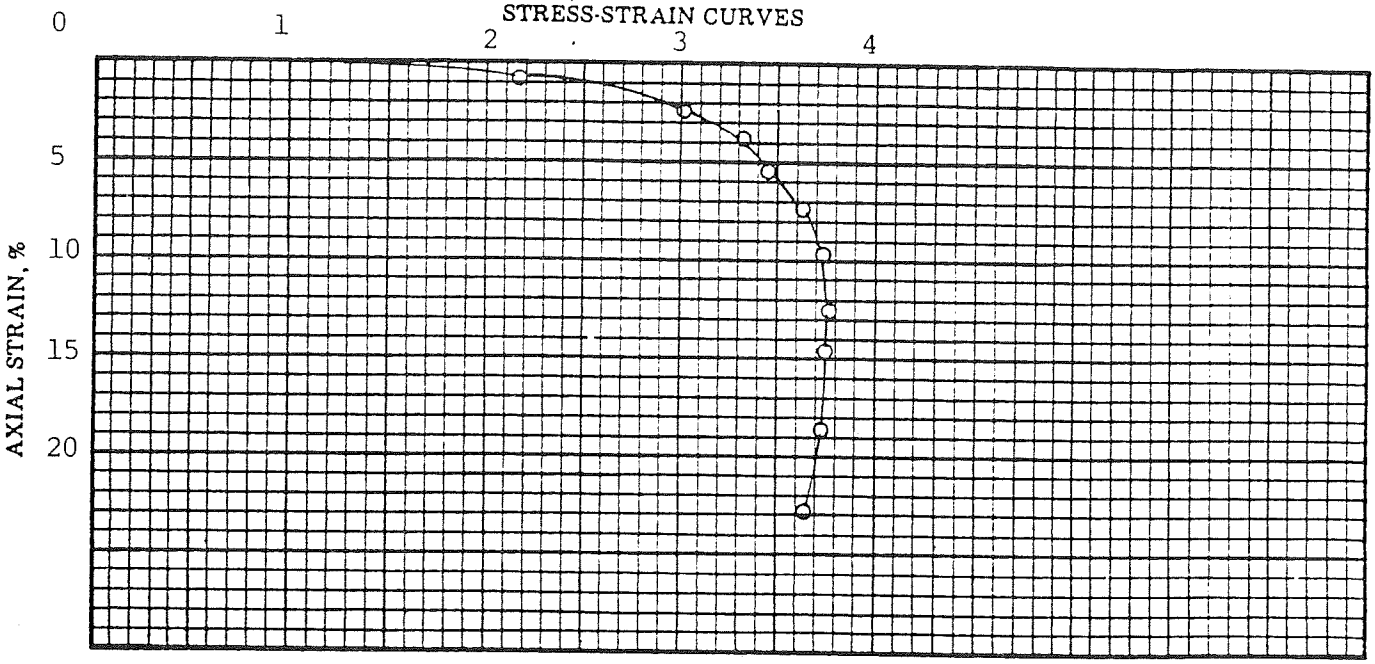
Oosterbaan Assoc. (SCM+QRL) B-5 10.5-13.0 Ft.

W7-5764 (88 C 1416)

MOHR DIAGRAM FOR FAILURE CONDITIONS



STRESS-STRAIN CURVES



Soil Classification F FIRM GRAY SANDY SILTY CLAY

SAMPLE NO.	(1)	(2)	(3)
Confining Pressure, ksf	.8		
Initial Length, In.	5.9		
Initial Diameter, In.	2.85		
Wet Unit Weight, pcf	107.4		
Moisture Content, %	36.4		
Initial Void Ratio	1.17		

TRIAXIAL SHEAR TEST

Type of Test: CU

Type of Specimen: UD

Rate of Shear: .0016 in/min

Boring: B-4 Depth: 20-22

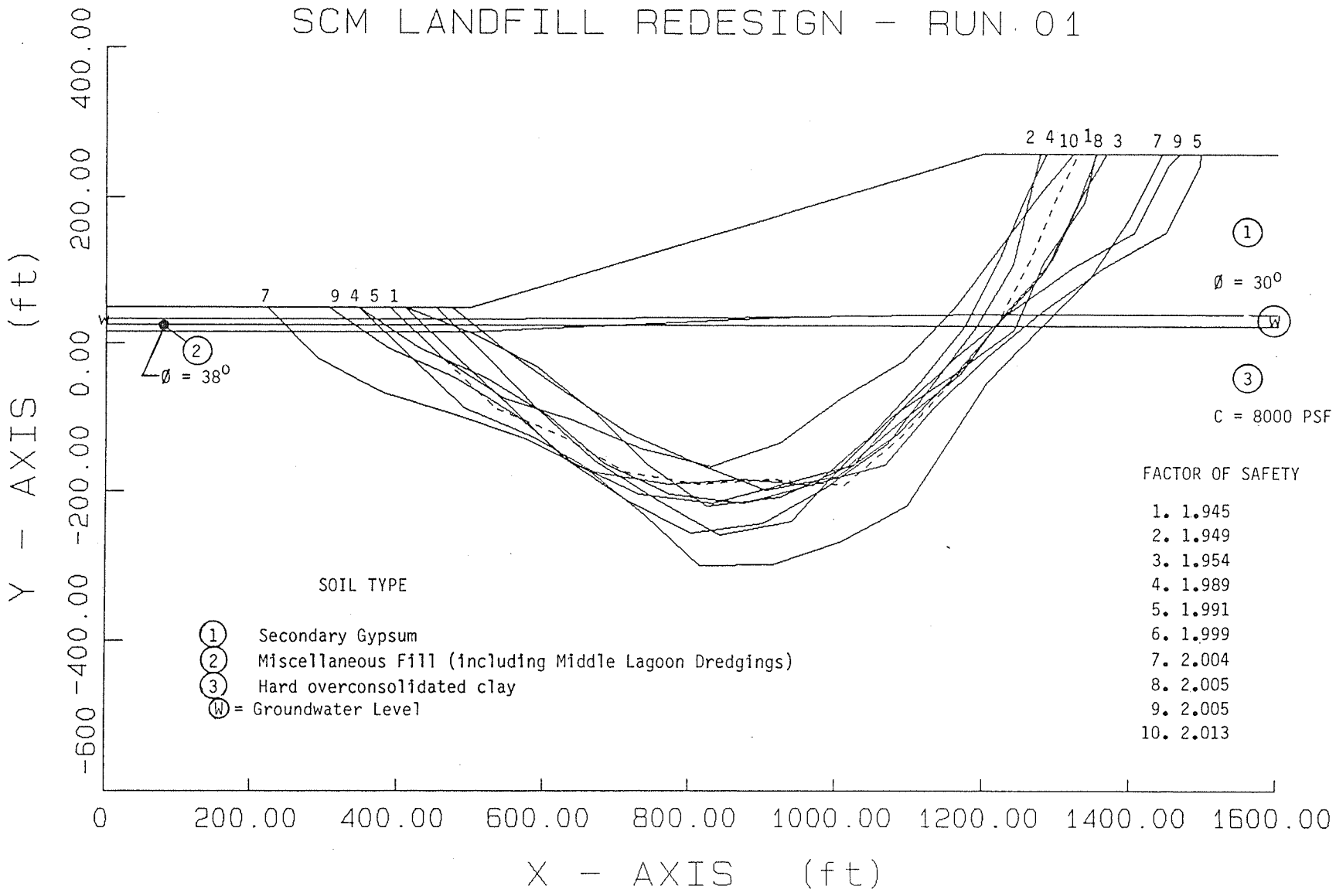
Job No. 5764 Date: 11-18-88

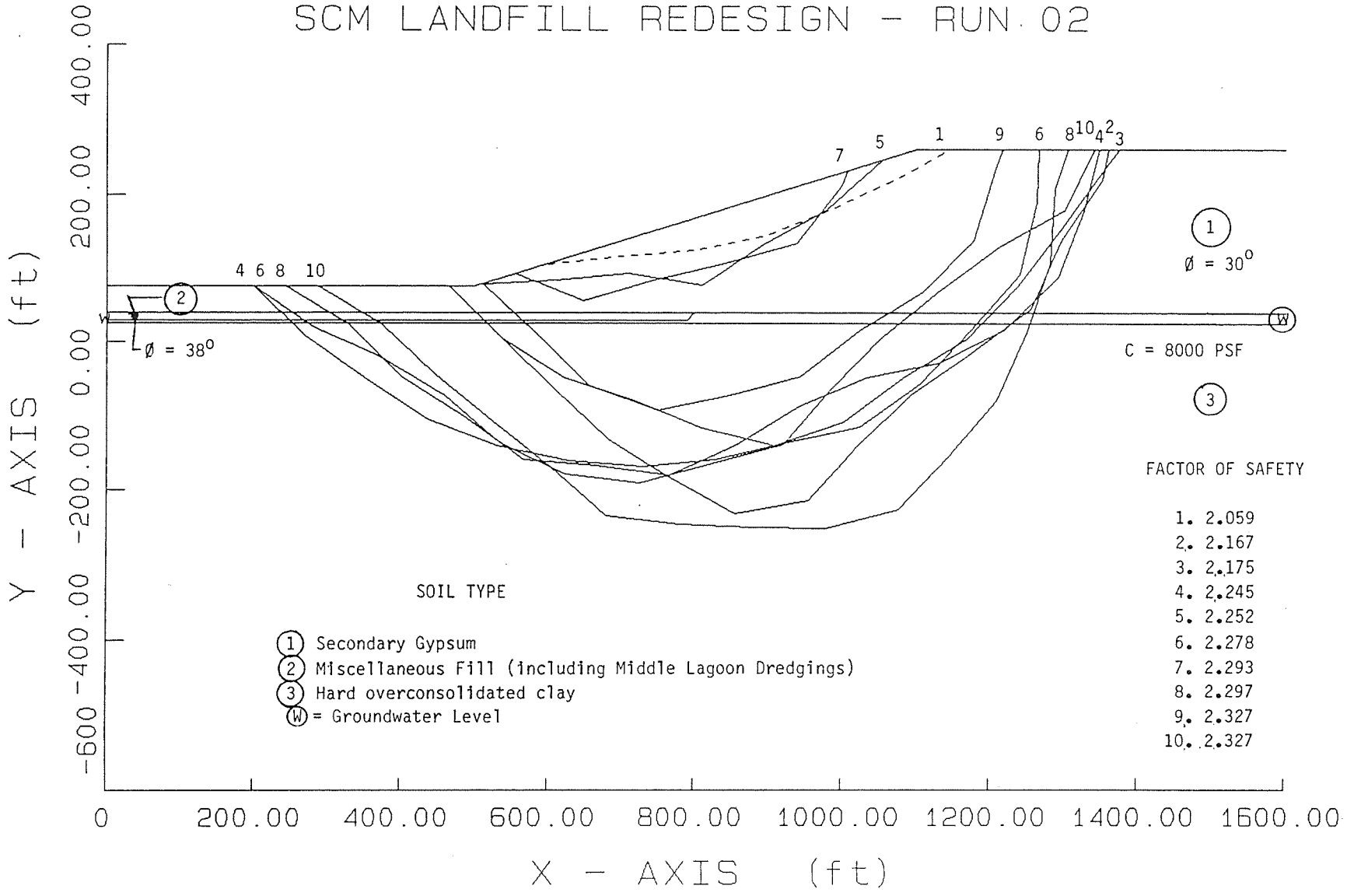
SCM CHEMICALS, QRL

NOV 22

APPENDIX C

SLOPE STABILITY COMPUTATIONS


SCM LANDFILL REDESIGN - RUN 01
Y - AXIS (ft)
400.00
200.00
0.00
-200.00
-400.00
-600
0
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
X - AXIS (ft)
2 4 10 6 8 3 7 9 5
7 9 4 5 1
1
Ø = 30°
W
2
Ø = 38°
3
C = 8000 PSF
FACTOR OF SAFETY
1. 1.945
2. 1.949
3. 1.954
4. 1.989
5. 1.991
6. 1.999
7. 2.004
8. 2.005
9. 2.005
10. 2.013
SOIL TYPE
1 Secondary Gypsum
2 Miscellaneous Fill (including Middle Lagoon Dredgings)
3 Hard overconsolidated clay
W = Groundwater Level


SCM LANDFILL REDESIGN - RUN 02
Y - AXIS (ft)
400.00
200.00
0.00
-200.00
-400.00
-600
0
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
X - AXIS (ft)
7 5 1 9 6 8 10 4 2 3
4 6 8 10
1
Ø = 30°
2
Ø = 38°
W
C = 8000 PSF
3
FACTOR OF SAFETY
1. 2.059
2. 2.167
3. 2.175
4. 2.245
5. 2.252
6. 2.278
7. 2.293
8. 2.297
9. 2.327
10. 2.327
SOIL TYPE
1 Secondary Gypsum
2 Miscellaneous Fill (including Middle Lagoon Dredgings)
3 Hard overconsolidated clay
W = Groundwater Level

DETAILS - RUN 1

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	01-31-89
Time of Run:	3:20 PM
Run By:	AR
Input Data Filename:	C1416.I05
Output Filename:	C1416.O05
Plotted Output Filename:	C141605.PLT

PROBLEM DESCRIPTION C1416 SCM QRL SS-1

BOUNDARY COORDINATES

3 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	650.00	500.00	650.00	1
2	500.00	650.00	1200.00	860.00	1
3	1200.00	860.00	1600.00	860.00	1
4	1200.00	642.00	1600.00	642.00	3
5	950.00	639.00	1200.00	642.00	3
6	.00	635.00	500.00	635.00	2
7	500.00	635.00	950.00	639.00	2
8	.00	615.00	500.00	615.00	3
9	500.00	615.00	950.00	639.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	108.0	108.0	.0	30.0	.00	.0	0
2	113.0	113.0	.0	38.0	.00	.0	1
3	115.0	127.4	8000.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	625.00
2	1600.00	625.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Irregular Surfaces, Has Been Specified.

Janbus Empirical Coef. is being used for the case of c & phi both > 0
400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 200.00 ft.
and X = 600.00 ft.

Each Surface Terminates Between X =1100.00 ft.
and X =1500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	389.47	650.00
2	461.60	580.73
3	534.76	512.56
4	627.32	474.70
5	714.30	425.37
6	813.14	410.13
7	913.00	415.40
8	1012.78	408.79
9	1088.56	474.04
10	1156.83	547.10
11	1218.62	625.73
12	1263.63	715.02
13	1302.55	807.14
14	1329.05	860.00

*** 1.945 ***

Individual data on the 22 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	15.6	12651.0	.0	.0	.0	.0	.0	.0	.0
2	10.4	22751.1	.0	.0	.0	.0	.0	.0	.0
3	10.4	34517.2	.0	4504.3	.0	.0	.0	.0	.0
4	35.7	216330.5	.0	83763.4	.0	.0	.0	.0	.0
5	38.4	404174.3	.0	*******	.0	.0	.0	.0	.0
6	34.8	536869.9	.0	*******	.0	.0	.0	.0	.0
7	92.6	********	.0	*******	.0	.0	.0	.0	.0
8	60.2	********	.0	*******	.0	.0	.0	.0	.0
9	26.8	904201.3	.0	*******	.0	.0	.0	.0	.0
10	98.8	********	.0	*******	.0	.0	.0	.0	.0
11	99.9	********	.0	*******	.0	.0	.0	.0	.0
12	37.0	********	.0	*******	.0	.0	.0	.0	.0
13	62.8	********	.0	*******	.0	.0	.0	.0	.0
14	75.8	********	.0	*******	.0	.0	.0	.0	.0
15	68.3	********	.0	*******	.0	.0	.0	.0	.0
16	43.2	********	.0	*******	.0	.0	.0	.0	.0
17	18.0	486592.9	.0	20930.5	.0	.0	.0	.0	.0
18	.6	14562.0	.0	.0	.0	.0	.0	.0	.0
19	8.2	200788.7	.0	.0	.0	.0	.0	.0	.0
20	36.8	721493.6	.0	.0	.0	.0	.0	.0	.0
21	38.9	415792.5	.0	.0	.0	.0	.0	.0	.0
22	26.5	75637.2	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	410.53	650.00
2	481.76	579.81
3	556.24	513.09
4	629.42	444.94
5	712.67	389.54
6	801.85	344.28
7	900.95	357.69
8	988.48	406.03
9	1069.30	464.93
10	1130.29	544.17
11	1189.19	624.99
12	1240.88	710.60
13	1264.39	807.79
14	1278.00	860.00

*** 1.949 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	473.68	650.00
2	552.83	588.88
3	634.82	531.62
4	718.75	477.25
5	810.32	437.08
6	904.32	402.96
7	1002.70	420.85
8	1084.26	478.72
9	1153.52	550.85
10	1218.83	626.58
11	1284.09	702.36
12	1328.78	791.81
13	1353.97	860.00

*** 1.954 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	347.37	650.00
2	419.49	580.73
3	492.66	512.56
4	585.21	474.70
5	672.20	425.37
6	771.03	410.13
7	870.89	415.40
8	970.67	408.79
9	1046.45	474.04
10	1114.73	547.10
11	1176.51	625.73
12	1221.53	715.02
13	1260.45	807.14
14	1286.94	860.00

*** 1.989 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	347.37	650.00
2	430.20	593.97
3	522.01	554.34
4	607.05	501.73
5	683.71	437.51
6	774.26	395.08
7	873.74	384.85
8	970.52	410.01
9	1067.18	435.65
10	1132.86	511.06
11	1203.43	581.90
12	1280.45	645.68
13	1362.04	703.51
14	1448.54	753.69
15	1493.07	843.23
16	1495.39	860.00

*** 1.991 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	452.63	650.00
2	523.94	579.90
3	594.98	509.51
4	669.11	442.39
5	753.98	389.50
6	842.27	342.56
7	940.77	359.84
8	1008.26	433.63
9	1079.01	504.30
10	1162.05	560.03
11	1242.45	619.48
12	1281.80	711.42
13	1338.09	794.07
14	1351.16	860.00

*** 1.999 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	221.05	650.00
2	292.64	580.18
3	380.94	533.23
4	476.56	503.96
5	571.36	472.13
6	661.02	427.85
7	740.89	367.68
8	814.71	300.22
9	914.70	301.49
10	1009.10	334.49
11	1097.27	381.68
12	1152.06	465.33
13	1206.92	548.94
14	1275.71	621.52
15	1346.69	691.96
16	1399.55	776.85
17	1442.65	860.00

*** 2.004 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	410.53	650.00
2	504.15	614.86
3	592.17	567.41
4	671.33	506.30
5	742.93	436.49
6	824.82	379.09
7	923.89	392.70
8	1015.12	433.64
9	1091.46	498.24
10	1170.58	559.39
11	1227.02	641.94
12	1293.84	716.34
13	1335.78	807.12
14	1367.07	860.00

*** 2.005 ***

Failure Surface Specified By 16 Coordinate Points

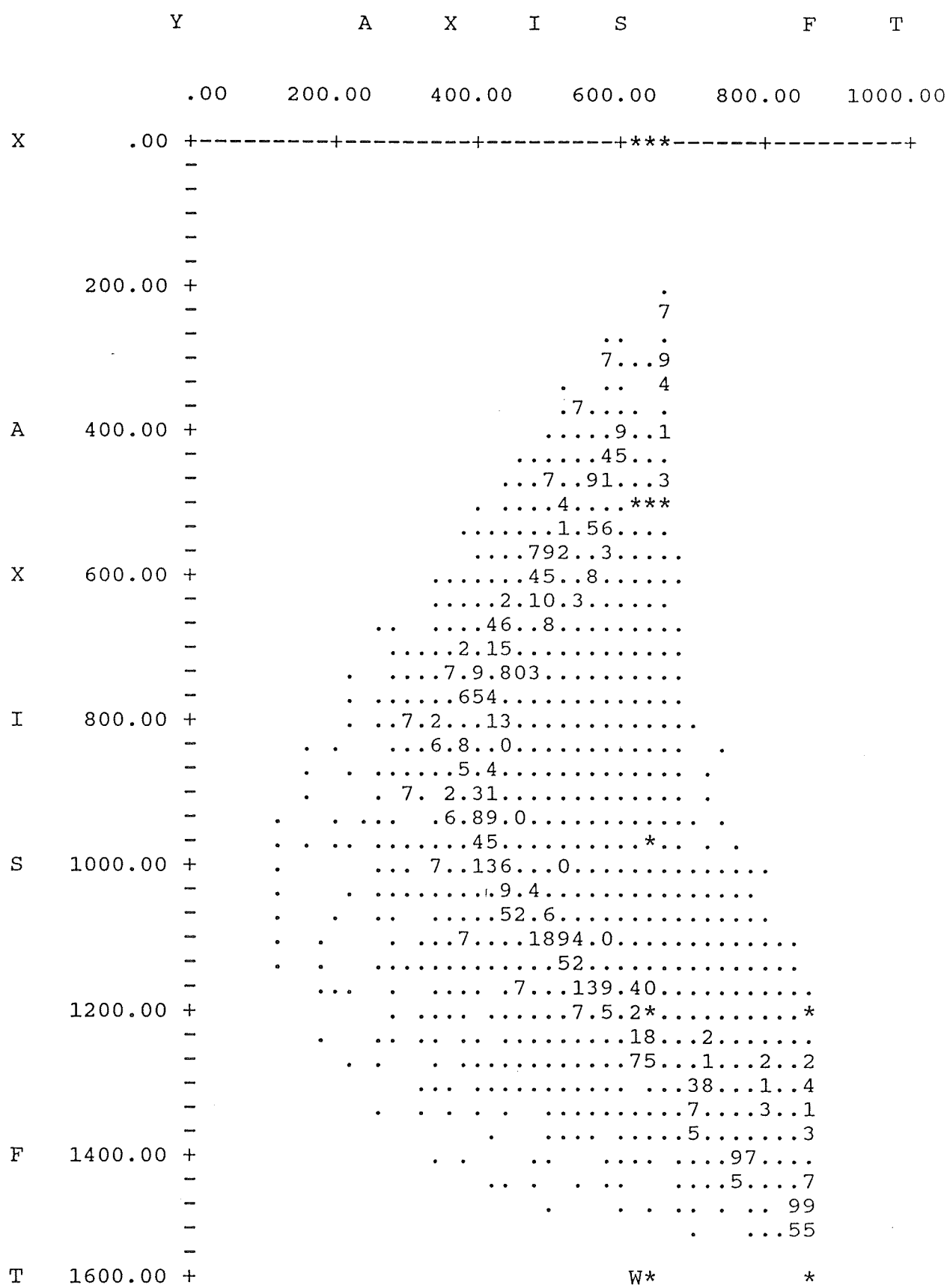
Point No.	X-Surf (ft)	Y-Surf (ft)
1	305.26	650.00
2	388.10	593.97
3	479.90	554.34
4	564.95	501.73
5	641.60	437.51
6	732.16	395.08
7	831.63	384.85
8	928.42	410.01
9	1025.07	435.65
10	1090.75	511.06
11	1161.33	581.90
12	1238.35	645.68
13	1319.93	703.51
14	1406.43	753.69
15	1450.96	843.23
16	1465.46	860.00

*** 2.005 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	389.47	650.00
2	461.35	580.47
3	545.04	525.73
4	640.70	496.61
5	733.35	458.97
6	830.22	434.15
7	924.87	466.42
8	1005.26	525.90
9	1091.10	577.19
10	1160.37	649.31
11	1220.36	729.32
12	1279.77	809.76
13	1321.03	860.00

*** 2.013 ***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200.00
A 400.00
X 600.00
I 800.00
S 1000.00
1200.00
F 1400.00
T 1600.00

DETAILS - RUN 2

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	01-31-89
Time of Run:	3:30 PM
Run By:	AR
Input Data Filename:	C1416.I06
Output Filename:	C1416.O06
Plotted Output Filename:	C141606.PLT

PROBLEM DESCRIPTION C1416 SCM QRL SS-2

BOUNDARY COORDINATES

3 Top Boundaries
7 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	676.00	500.00	676.00	1
2	500.00	676.00	1100.00	860.00	1
3	1100.00	860.00	1600.00	860.00	1
4	.00	640.00	800.00	640.00	2
5	800.00	640.00	1600.00	640.00	3
6	.00	630.00	790.00	630.00	3
7	790.00	630.00	800.00	640.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	108.0	108.0	.0	30.0	.00	.0	0
2	113.0	113.0	.0	38.0	.00	.0	0
3	115.0	127.4	8000.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	625.00
2	1600.00	625.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Irregular Surfaces, Has Been Specified.

Janbus Empirical Coef. is being used for the case of c & phi both > 0
100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 200.00 ft.
and X = 600.00 ft.

Each Surface Terminates Between X =1000.00 ft.
and X =1400.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	600.00	706.67
2	699.61	715.48
3	799.27	723.77
4	897.05	744.71
5	990.06	781.43
6	1080.94	823.15
7	1146.42	860.00

*** 2.059 ***

Individual data on the 7 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	99.6	116910.3	.0	.0	.0	.0	.0	.0	.0
2	99.7	353749.8	.0	.0	.0	.0	.0	.0	.0
3	97.8	512473.3	.0	.0	.0	.0	.0	.0	.0
4	93.0	491751.8	.0	.0	.0	.0	.0	.0	.0
5	90.9	372264.2	.0	.0	.0	.0	.0	.0	.0
6	19.1	58779.7	.0	.0	.0	.0	.0	.0	.0
7	46.4	65473.5	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.67	676.00
2	538.54	606.47
3	622.23	551.73
4	717.89	522.61
5	810.54	484.97
6	907.41	460.15
7	1002.06	492.42
8	1082.45	551.90
9	1168.30	603.19
10	1237.56	675.31
11	1297.56	755.32
12	1356.96	835.76
13	1376.87	860.00

*** 2.167 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.67	676.00
2	537.98	605.90
3	609.01	535.51
4	683.14	468.39
5	768.01	415.50
6	856.31	368.56
7	954.80	385.84
8	1022.29	459.63
9	1093.05	530.30
10	1176.08	586.03
11	1256.49	645.48
12	1295.83	737.42
13	1352.12	820.07
14	1360.04	860.00

*** 2.175 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	200.00	676.00
2	282.83	619.97
3	374.64	580.34
4	459.68	527.73
5	536.34	463.51
6	626.89	421.08
7	726.37	410.85
8	823.15	436.01
9	919.81	461.65
10	985.49	537.06
11	1056.07	607.90
12	1133.09	671.68
13	1214.67	729.51
14	1301.17	779.69
15	1341.11	860.00

*** 2.245 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	511.11	679.41
2	611.00	684.18
3	710.55	693.60
4	809.21	677.26
5	893.53	731.02
6	980.73	779.97
7	1055.56	846.31
8	1055.60	846.38

*** 2.252 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	200.00	676.00
2	272.97	607.62
3	355.11	550.59
4	438.48	495.36
5	532.08	460.16
6	629.88	439.31
7	729.56	431.39
8	828.89	442.96
9	926.64	464.07
10	1023.99	486.92
11	1106.69	543.15
12	1174.72	616.44
13	1239.33	692.76
14	1264.48	789.55
15	1266.33	860.00

*** 2.278 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	555.56	693.04
2	648.41	655.92
3	744.39	683.98
4	841.29	708.72
5	938.17	733.51
6	1000.83	811.43
7	1007.37	831.59

*** 2.293 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	244.44	676.00
2	330.05	624.32
3	401.00	553.84
4	485.01	499.60
5	567.12	442.52
6	666.69	433.31
7	765.68	419.13
8	856.80	460.33
9	941.05	514.20
10	1033.85	551.45
11	1131.78	571.69
12	1220.09	618.61
13	1292.72	687.35
14	1328.20	780.84
15	1348.01	860.00

*** 2.297 ***

Failure Surface Specified By 11 Coordinate Points

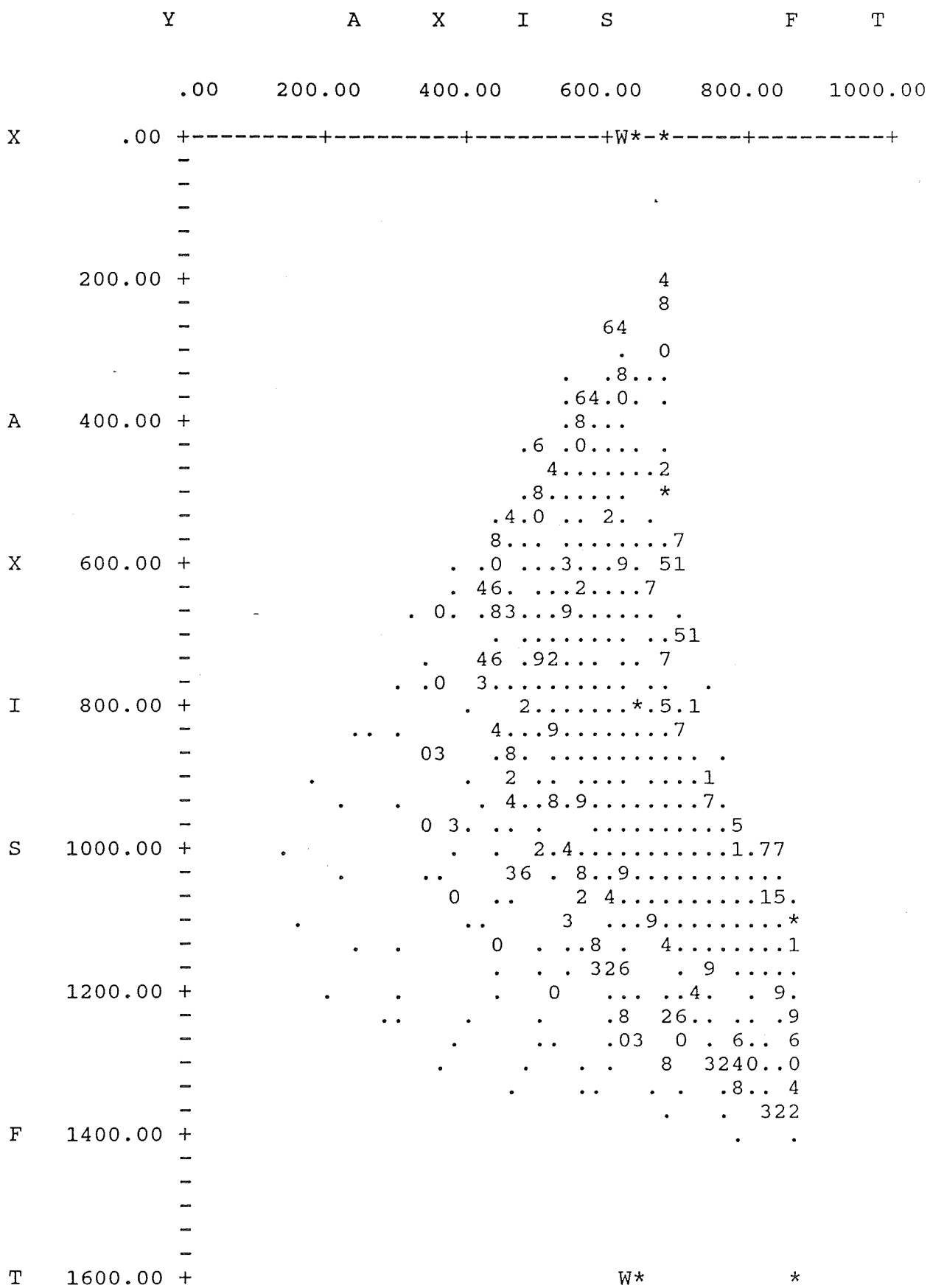
Point No.	X-Surf (ft)	Y-Surf (ft)
1	511.11	679.41
2	584.49	611.47
3	655.76	541.32
4	749.74	507.15
5	847.67	527.39
6	944.02	554.15
7	1023.28	615.12
8	1108.31	667.75
9	1178.77	738.71
10	1207.72	834.43
11	1218.85	860.00

*** 2.327 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	288.89	676.00
2	374.93	625.05
3	447.86	556.62
4	526.19	494.45
5	604.81	432.66
6	680.13	366.88
7	779.24	353.58
8	879.17	349.83
9	979.14	347.35
10	1075.35	374.60
11	1144.50	446.84
12	1210.73	521.76
13	1250.45	613.53
14	1282.12	708.38
15	1287.07	808.26
16	1306.55	860.00

*** 2.327 ***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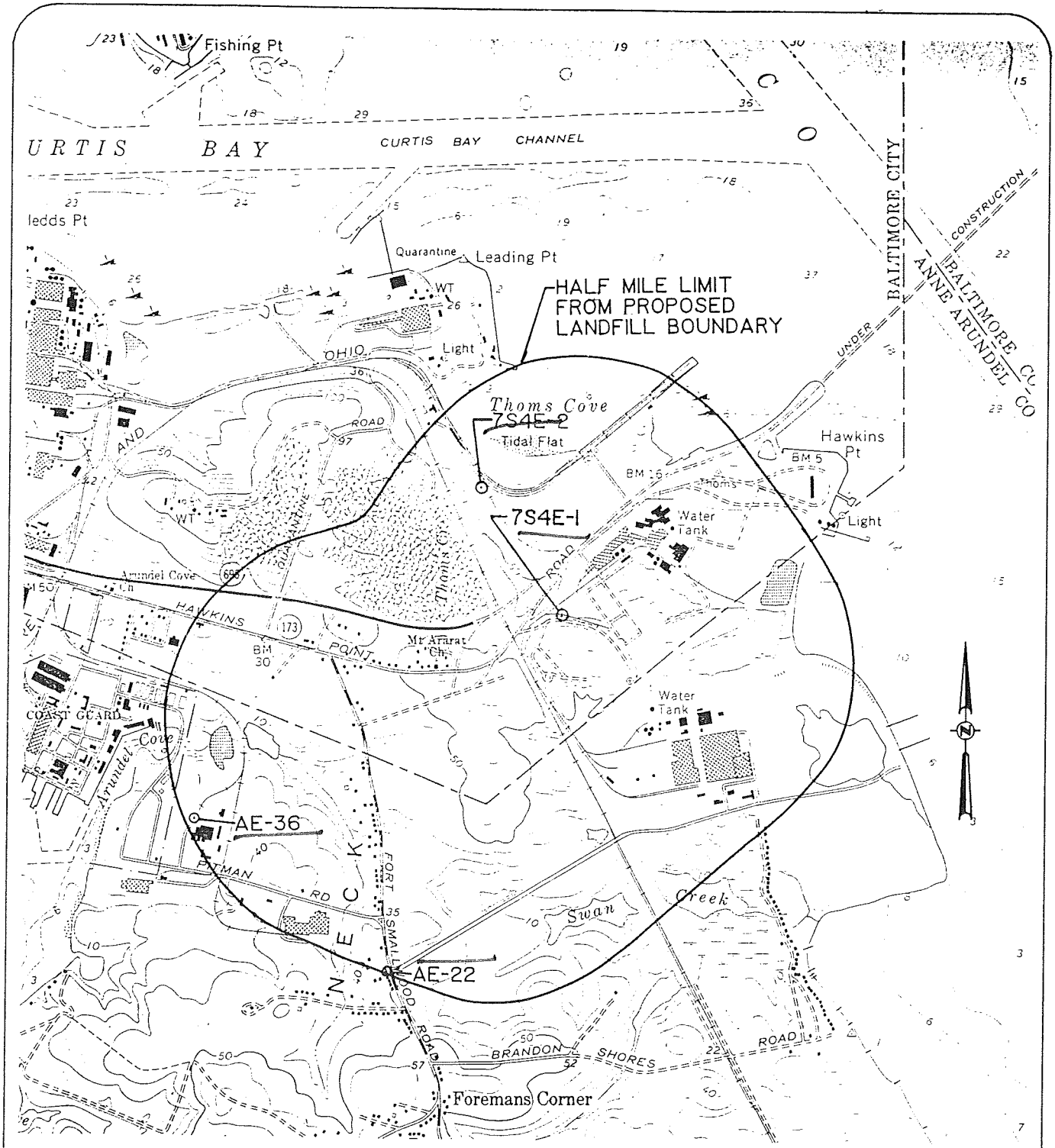
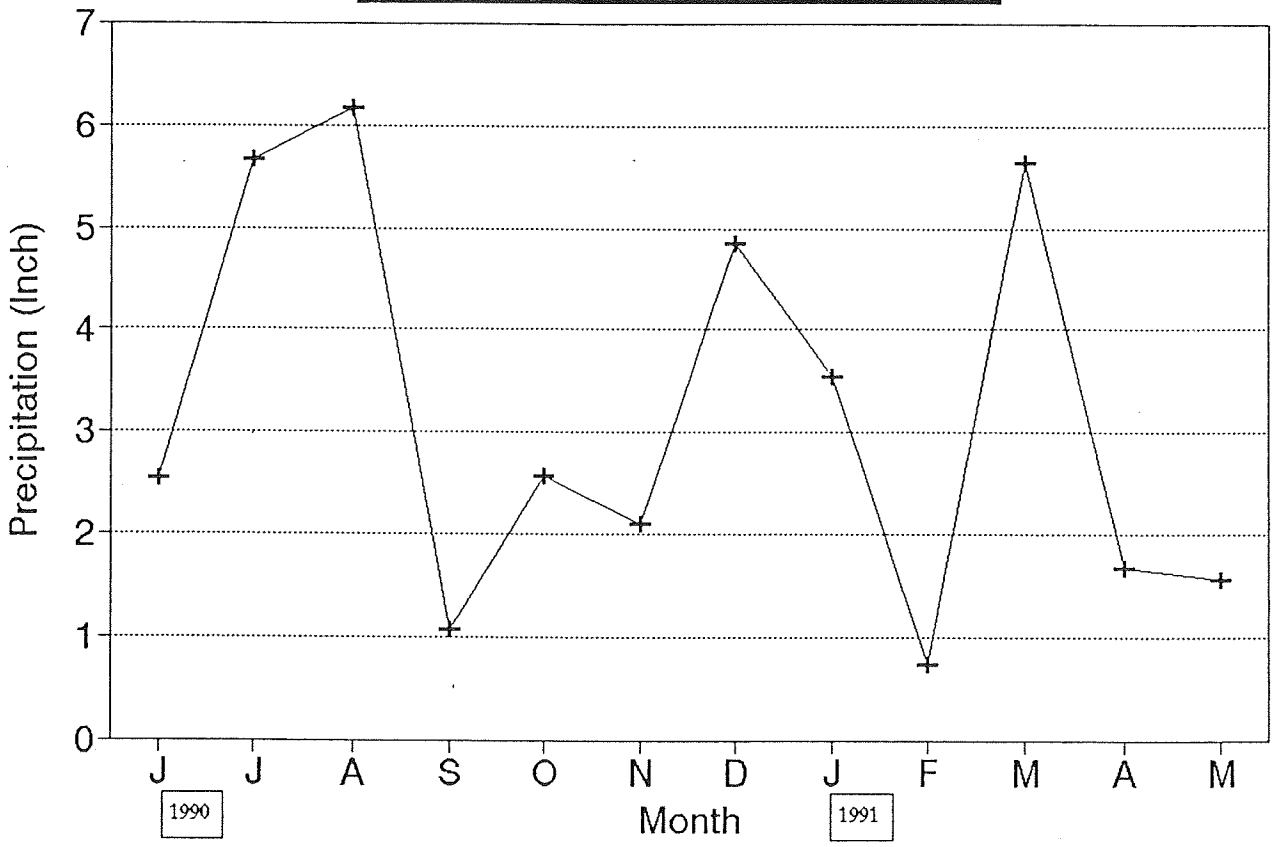


SCALE: 1" = 2000'

Base map taken from U.S.G.S. Curtis Bay, MD. Topographic Map, 1964 (Photorevised 1974)

Prepared by:	Prepared for:	TITLE:
OOSTERBAAN ASSOCIATES, P.C. PROJECT NO: By: HRB Checked:	SCM CHEMICALS 3901 Fort Armistead Road Baltimore, Maryland 21226	VICINITY PRODUCTION WELLS DATE: 6-21-91 FIGURE NO: 2

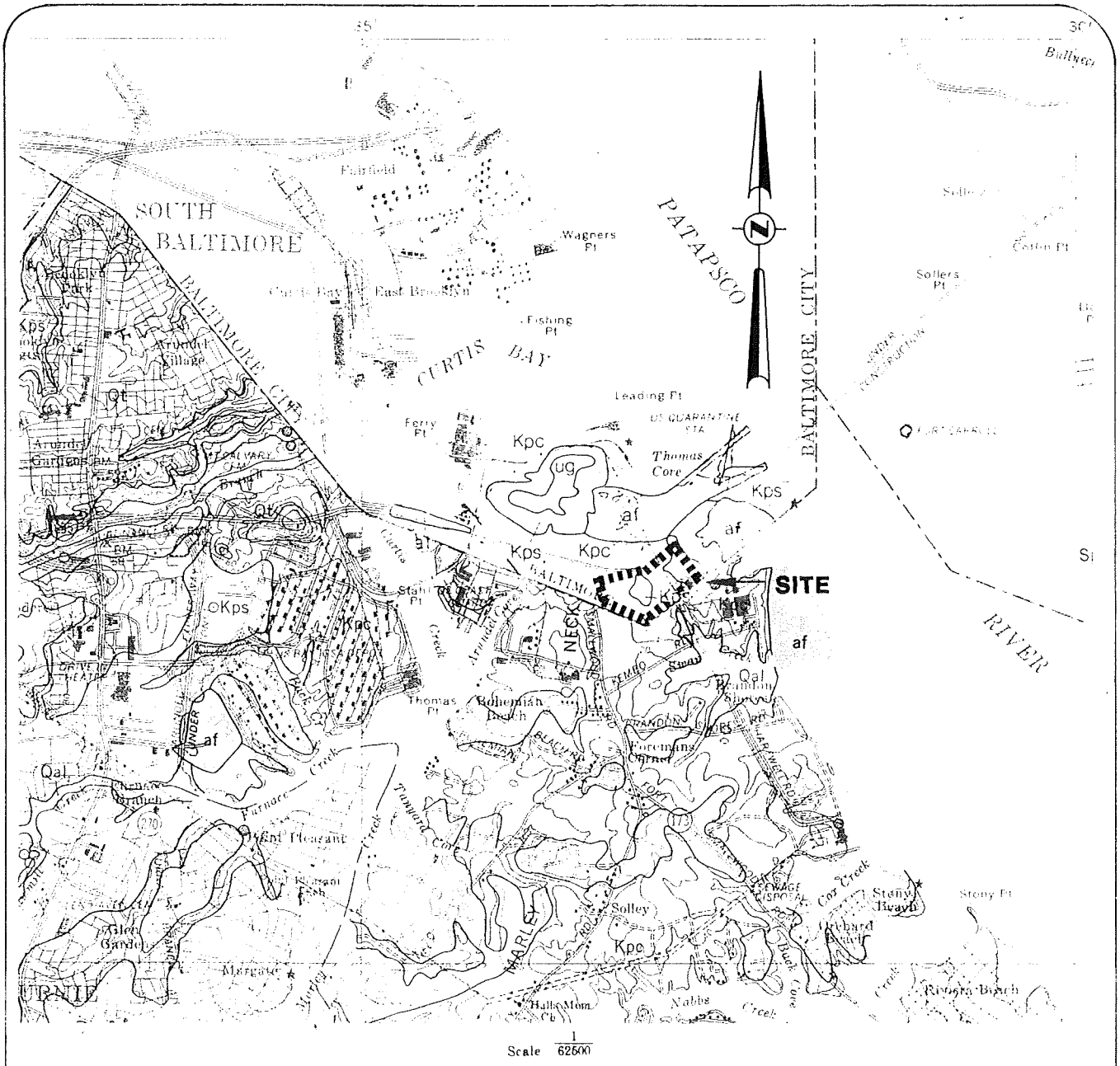
Precipitation Data
1990/91



NOTE

Precipitation Data obtained from National Oceanic and Atmospheric Administration (NOAA) Library in Rockville, Maryland for the station at Baltimore-Washington International (BWI) Airport, Glen Burnie, Maryland.

Prepared by: OOSTERBAAN ASSOCIATES, P.C. PROJECT NO: C1636-02 By: AR Checked: TM	Prepared for: SCM CHEMICALS 3901 Fort Armistead Road Baltimore, Maryland 21226	TITLE: Precipitation Data DATE: 7-16-91 FIGURE NO: 3



LEGEND

POTOMAC GROUP

af	Qal	Qt	Kps	Kpc
Artificial Fill	Alluvium	Terrace Deposits	Sand-gravel facies	Silt-clay facies

ug - Upland gravel

NOTES: Drawing taken from Maryland Geological Survey, Geologic Maps of Anne Arundel County and Baltimore City, 1976.

Prepared by:	Prepared for:	TITLE:
OOSTERBAAN ASSOCIATES, P.C. PROJECT NO: C1636-01 By: TB Checked: TM	SCM CHEMICALS 3901 Fort Armistead Road Baltimore, Maryland 21226	SCM-HPP LANDFILL GEOLOGIC MAP DATE: 1-16-91 FIGURE NO: 4 REV. 1-24-91

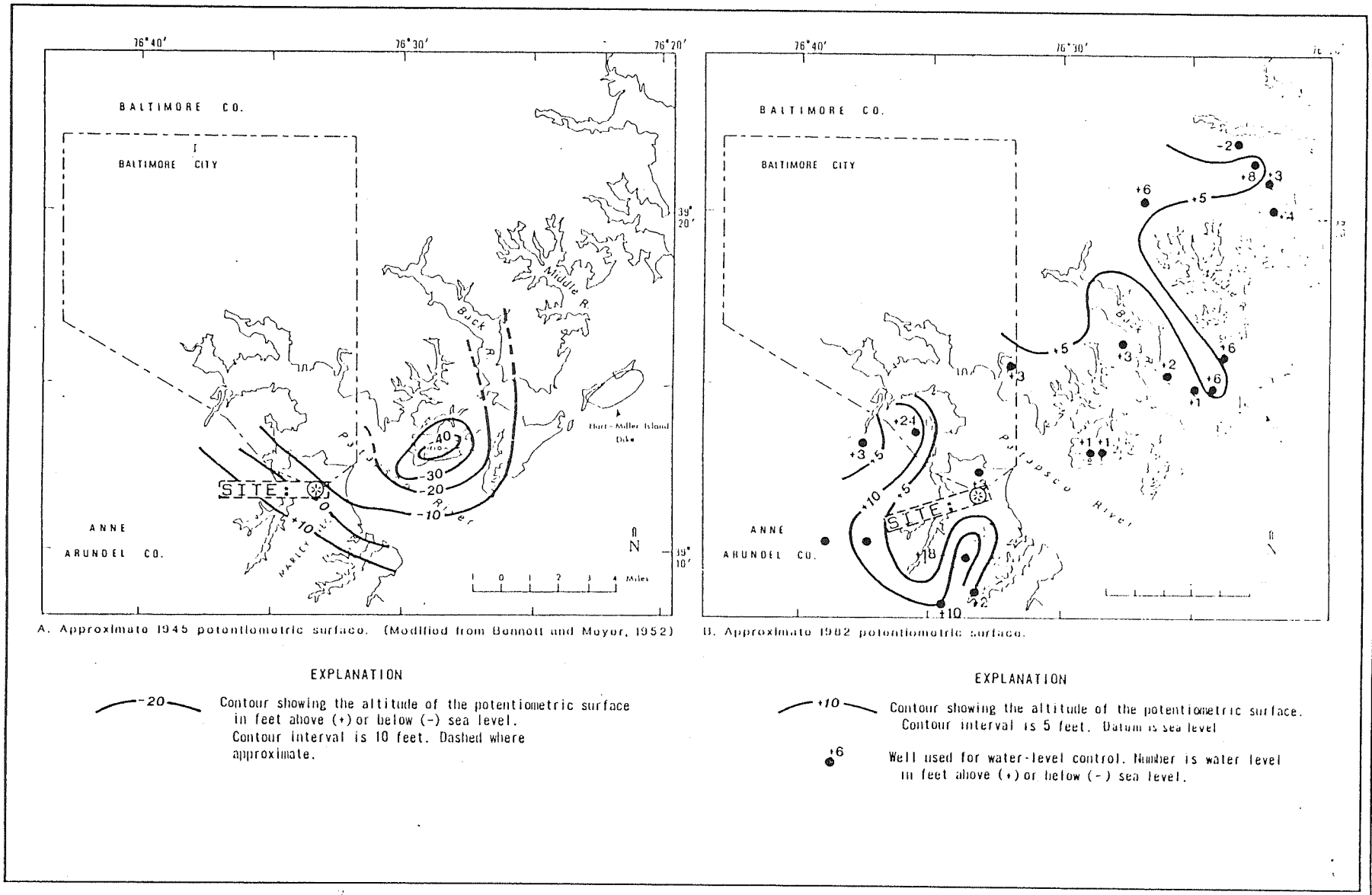
OOSTERBAAN ASSOCIATES

July, 1991

SCM Chemicals, Inc.

POTENTIOMETRIC SURFACE MAP - PATAPSCO FORMATION

Fig. 5



A. Approximate 1945 potentiometric surface. (Modified from Bennett and Meyer, 1952)

B. Approximate 1982 potentiometric surface.

EXPLANATION

-20 Contour showing the altitude of the potentiometric surface in feet above (+) or below (-) sea level. Contour interval is 10 feet. Dashed where approximate.

EXPLANATION

+10 Contour showing the altitude of the potentiometric surface. Contour interval is 5 feet. Datum is sea level

+6 Well used for water-level control. Number is water level in feet above (+) or below (-) sea level.

Figure from Report of Investigation No. 43, by F. Chapelle, Maryland Geological Survey; 1985. Base map from Bennett, R. R. and Meyer, R. R., 1952.

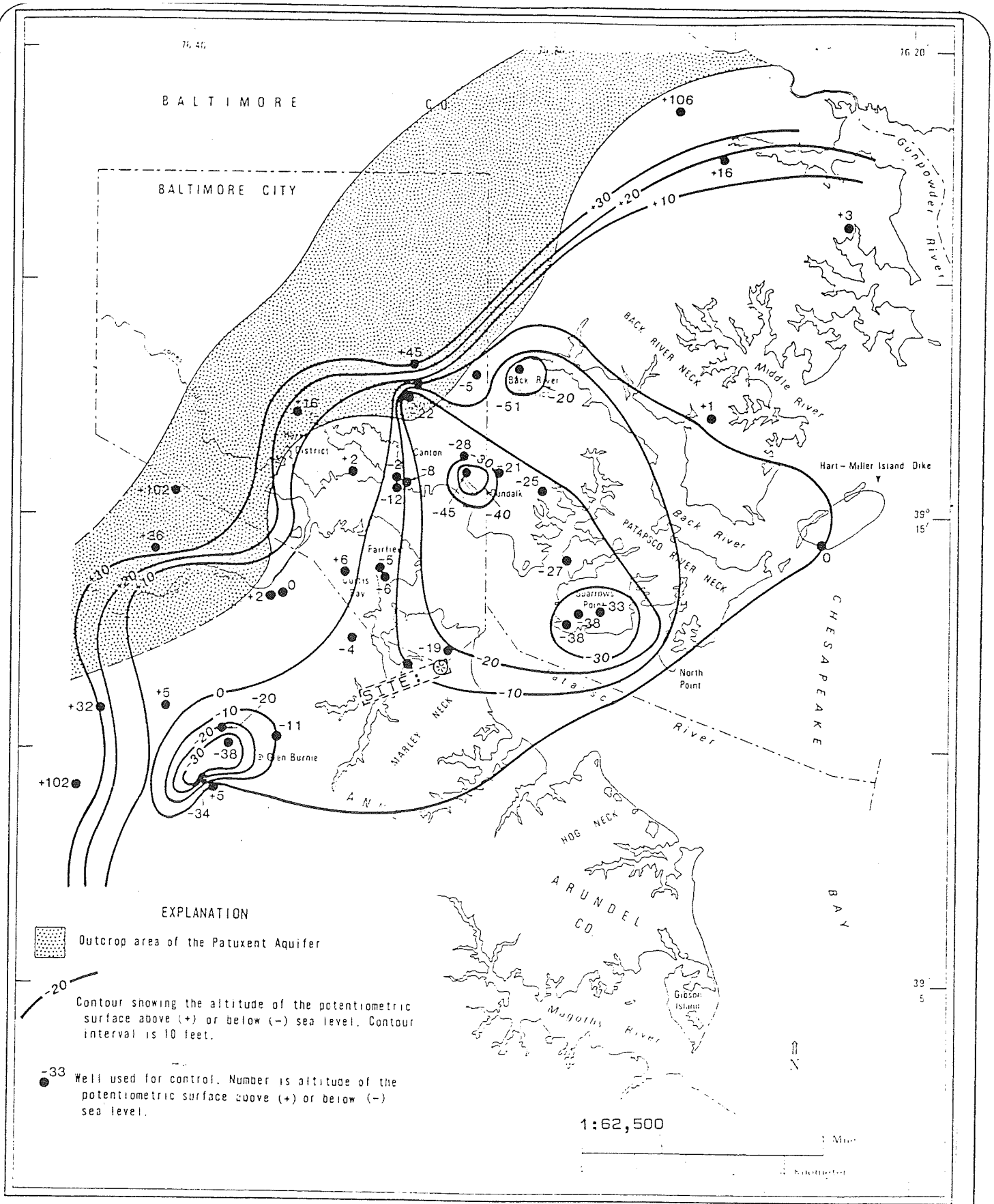


Figure from Report of Investigation No. 43, by F. Chapelle, Maryland Geologic Survey; 1985. Base map from the Maryland Geological Survey County Topographic Map Series.

	July, 1991	SCM Chemicals, Inc.	POTENTIOMETRIC SURFACE MAP - PATUXENT FORMATION	Fig. 6

OOSTERBAAN ASSOCIATES

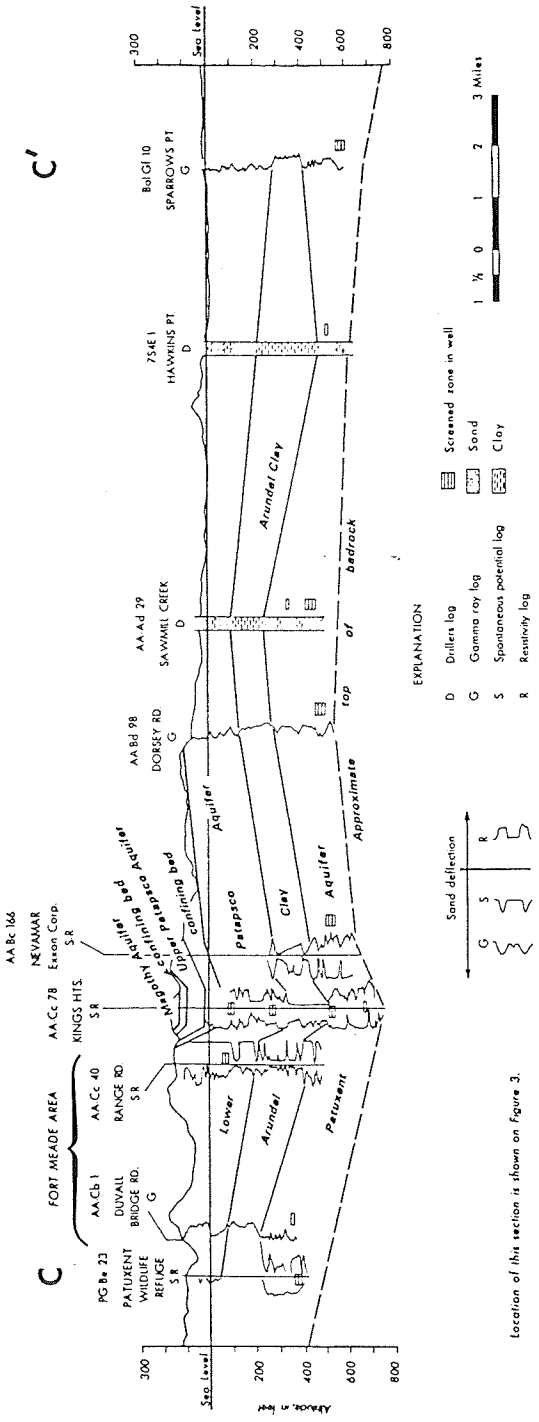


Figure 6. — Hydrogeologic section C-C', from the Patuxent Wildlife Refuge to Sparrows Point.

Prepared by: OOSTERBAAN ASSOCIATES, P.C. PROJECT NO: C1636-02 By: AR Checked: TM	Prepared for: SCM CHEMICALS 3901 Fort Armistead Road Baltimore, Maryland 21226	TITLE: IDEALIZED GEOLOGIC SECTION DATE: 7-16-91 FIGURE NO: 7

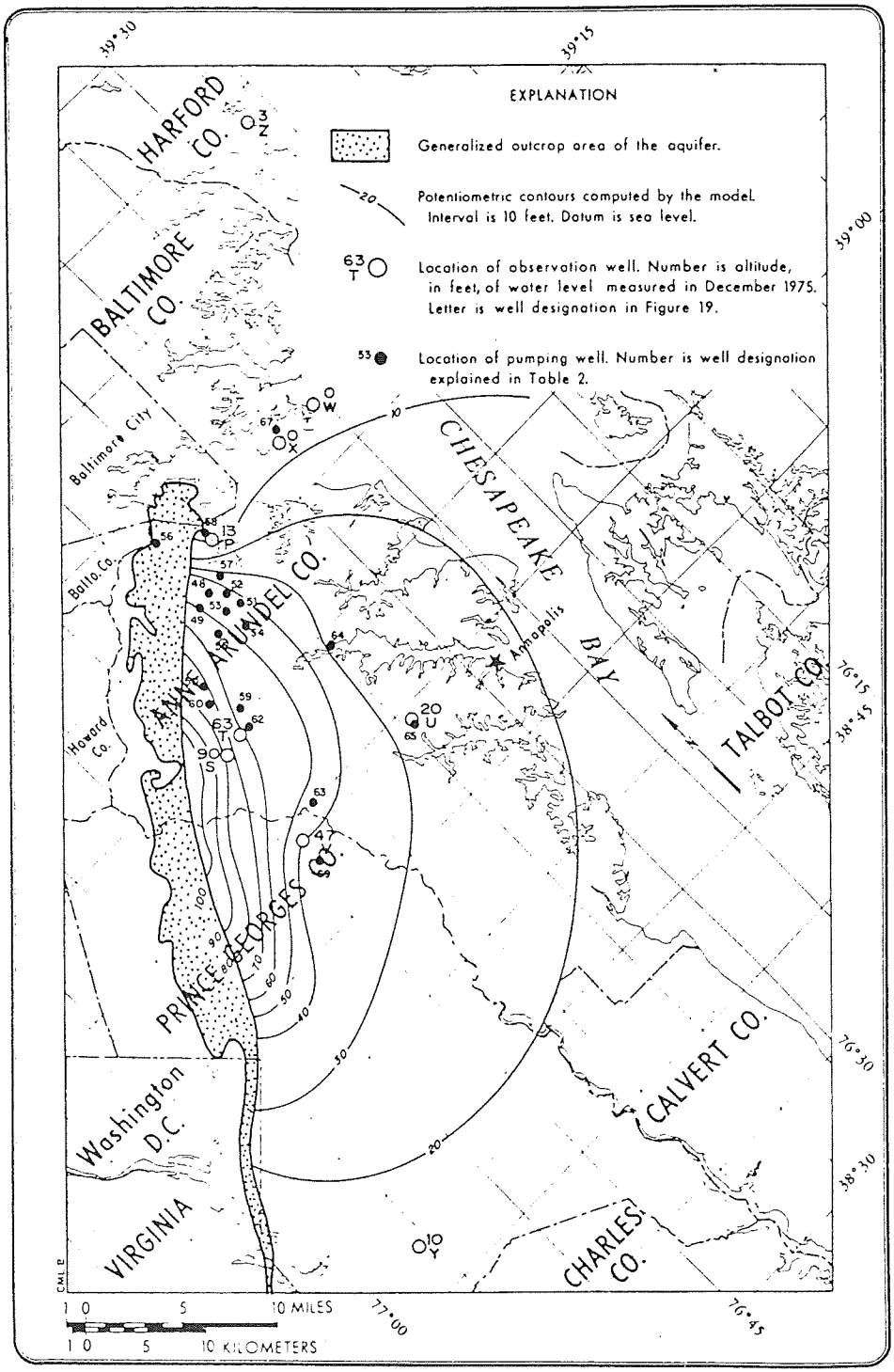


Figure 35. — Computed potentiometric surface of the lower Patapsco aquifer in December 1975 compared with measured water levels from observation wells.

Prepared by: OOSTERBAAN ASSOCIATES, P.C. PROJECT NO: C1636-02 By: AR Checked: TM	Prepared for: SCM CHEMICALS 3901 Fort Armistead Road Baltimore, Maryland 21226	TITLE: PATAPSCO GROUND WATER LEVELS DATE: 7-16-91 FIGURE NO: 8

Prepared for:

MILLENNIUM INORGANIC CHEMICALS
3901 Fort Armistead Road
Baltimore, Maryland 21226

Field Exploration and Laboratory Testing Report

Lot 15 Fort Armistead Road Landfill

Baltimore, Maryland

Prepared by

Geosyntec consultants

10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046

Geosyntec Project No.: ME0668

May 20119

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Table 2: Summary of Index, Compaction, and Hydraulic Conductivity Test Results
Table 3: Summary of Estimated Shear Strength for the Confining Bed (Undisturbed Clay)
Table 4: Summary of Estimated Effective Stress Parameters for Compacted Clay Specimens
Table 5: Summary of Estimated Shear Strength for the Compacted Clay Geosynthetic Material Interface

FIGURE

Figure 1: Sampling Locations

APPENDICES

Appendix A: Index, Compaction, and Hydraulic Conductivity Test
Appendix B: Consolidation Tests
Appendix C: Triaxial Test Results - Undisturbed Samples
Appendix D: Triaxial Test Results – Remolded (or Bulk) Samples
Appendix E: Direct Shear Test with Geosynthetic Material Inclusion

SYMBOLS

Symbol	Quantity Represented
C_c	Compression Index
C_r	Recompression Index
$C_{\alpha\varepsilon}$	Secondary Compression Index
c'	Effective Cohesion
e_o	Initial Void Ratio
ϕ'	Effective Friction Angle
G_s	Specific Gravity
k	Hydraulic Conductivity
LL	Liquid Limit
LI	Liquidity Index
N	Standard Penetration Test (SPT) Value
OMC	Optimum Moisture Content
OCR	Over-Consolidation Ratio
p_a	Atmospheric Pressure
p'_o	Initial Effective Stress
p'_c	Pre-consolidation Pressure
PL	Plastic Limit
PI	Plasticity Index
γ_{dmax}	Maximum Dry Density
γ_{moist}	Moist Unit Weight
γ_{sat}	Saturated Unit Weight
S_u	Undrained Shear Strength
w_n	Natural Water Content

1. INTRODUCTION

Geosyntec Consultants (Geosyntec) conducted a brief field exploration and a reasonably detailed laboratory soil testing program at the proposed site for the Fort Armistead Road Landfill (Lot 15 Landfill) in Baltimore, Maryland. Because of the information contained in the previous study (Oosterbaan, 1991) did not include information regarding the strength and compressibility characteristics of the confining bed unit beneath the site, additional field exploration was conducted. The data was needed to perform settlement and stability calculations for the proposed Lot 15 Landfill and the associated perimeter berm around the landfill.

The remainder of this attachment is organized as follows:

- in Section 2, the field exploration is described;
- in Section 3, the laboratory testing program is described; and
- in Section 4, the results of the field exploration and laboratory testing are summarized.

2. FIELD EXPLORATION

In May 2009, Geosyntec collected limited Shelby tube samples and bulk samples from the Lot 15 site to conduct laboratory tests. Shelby tube samples were collected near the existing ground surface to a depth of 2 feet below. Bulk samples were collected from the cohesive material (confining bed unit) stockpiled at the site as part of the investigation for the potential use of this material as a backfill for the proposed perimeter berm around the landfill. Bulk samples were collected from the top, middle, and bottom of the stockpile. Approximate sampling locations are shown on Figure 1.

3. LABORATORY TESTING

3.1 Introduction

The four Shelby tube samples and bulk samples collected from the site were sent to Golder Associates' Soil Testing Laboratory located in Atlanta, Georgia. The tests were performed following relevant American Society of Testing Materials (ASTM) standards. Laboratory tests comprise the following:

- Atterberg Limits (ASTM D 4318);
- Unit Weight (ASTM D 1556);

- Moisture Content (ASTM D 2216);
- Specific Gravity (ASTM D 422);
- Grain-Size Distribution (ASTM D 421);
- Standard Proctor Compaction (ASTM D 698 Method A);
- Consolidation Test (ASTM 2445 Method B);
- Triaxial Unconsolidated Undrained (UU) (ASTM D 4767) and Consolidated Undrained (CU) (ASTM D 2850);
- Hydraulic Conductivity Test (Flexible Wall) (ASTM D 5084); and
- Direct Shear Tests (with geosynthetic material as inclusion) (ASTM D 5321).

Table 1 summarizes the schedule for the above listed laboratory tests. Test results are presented in Appendices A through E.

3.2 Laboratory Results of Index Test, Compaction and Permeability

Table 2 summarizes the results of index tests, Proctor and hydraulic conductivity tests. Appendix A includes the details of the laboratory test results. The hydraulic conductivity or hydraulic conductivity (k) measured on two undisturbed samples (ST#2 and ST#3) using flexible wall permeameter test method are 1.8×10^{-7} cm/s and 2.7×10^{-6} cm/s respectively. These samples were obtained from shallow depths (clay that was excavated from the 30-acre site and disposed of at this location) and it is anticipated that significantly lower values for the clay hydraulic conductivity will be obtained at greater depths (approximately 50 ft below ground surface).

3.3 Consolidation Tests

A consolidation test was performed on undisturbed sample (ST#4). The test results are presented in Appendix B. From the compression curve (e-logσ'_v) it can be seen that the curve is more or less flat and the volume change for the applied pressure range is minimal. Due to limitation in applying high pressure at the laboratory, the maximum pressure applied was 16 ksf (kilo pounds per square feet). The curve highlights the highly over consolidated nature of the soil. Test results can be used to estimate the compressibility characteristics of the soil recompression index C_r which is calculated to be 0.023.

Preconsolidation pressures (p'_c) can be inferred from the effective stress failure envelop generated from a CU triaxial tests (Appendix C) of an undisturbed soil specimen (see Appendix C). The procedure is also depicted in Figure C.1. Hence, a preconsolidation pressure (see the Mohr's diagram) was estimated to be around 19,000 psf.

3.4 Triaxial Tests – Undisturbed Samples

The effective shear strength parameters of the confining bed unit is estimated from CU test performed at three different confining pressure stresses (3,974 psf, 7,949 psf and 13,896 psf) on Shelby tube sample (ST#1). The test results are presented in Appendix C. The stress path diagram clearly depicts the overconsolidated nature of the sample. The stress path first reaches a maximum principal stress ratio value, then a maximum deviatoric stress (the reverse is the case for normally consolidated soils). The failure envelop of overconsolidated clay shows a very marked curvature before it merges with the envelop corresponding to the normally consolidated condition.

The undrained shear strength (s_u) for short term analysis were estimated from UU tests conducted on two undisturbed soil specimens from ST#2 and ST#4. The test results are presented in Appendix D. The estimated s_u value for samples ST#2 and ST#4 are 2700 psf and 3500 psf respectively. The samples were obtained at very shallow depth. Table 3 summarizes the shear strength parameters for undisturbed confining bed unit material.

3.5 Triaxial Tests – Disturbed Samples

The shear strength properties of the compacted clay is estimated from the CU test on four compacted clay specimen at three different confining pressure stresses (3,974 psf, 7,949 psf and 13,896 psf) for bulk sample obtained from the middle and bottom of the of the stockpile. The specimens were prepared by remolding the sample to approximately 90% and 95% of the maximum dry density on the dry of optimum side. The test results are presented in Appendix E. The estimated effective stress friction (ϕ') and cohesion (c') are summarized in Table 4. The friction angle of remolded clay is similar to that of the undisturbed specimen while cohesion is lower. Generally the remolded strength of the clay is lower than that of the undisturbed strength due to reorientation of clay particles and it depends on the sensitivity of the clay and, for most clays, the sensitivity ranges between 2 and 4 [Terzaghi et.al, 1996].

3.5 Interface Testing

Because a mechanically stabilized earth (MSE) berm will be constructed using the clay material available on site, an interface friction angle between the potential reinforcement and

the clay backfill was performed. Table 5 summarizes the interface frictional properties between compacted clay and geosynthetic material inclusion.

4. SUMMARY OF RESULTS

Based on the results of Atterberg limits testing, the confining bed unit classifies as low-plasticity clay (CL). The natural moisture content of the sample is close to the plasticity index (PI), indicating the in-situ material is in a plastic condition. The average moist and saturated unit weights are 127 pounds per cubic feet (pcf) and 134 pcf, respectively. The index properties and compaction characteristics of the confining bed unit are comparable to the properties of similar soils reported in the literature. The measured hydraulic conductivity ranges between 1.8×10^{-7} and 2.7×10^{-6}. The triaxial CU shows the sample is over consolidated. The estimated shear strength for undisturbed specimen and remolded specimen are summarized on Tables 3 and 4. Similarly, Table 5 summarizes the interface frictional properties between compacted clay and geosynthetic material inclusion.

5. REFERENCE

Oosterbaan Associates, P.C. 1991. Permit Application Phase II Report "*Geology, Hydrogeology, and Landfill Conception Plan for Industrial Solid Waste Disposal Facility, HPP Landfill, Baltimore, Maryland*".

TABLES

Geosyntec consultants

TABLE 1

SUMMARY OF LABORATORY TESTING SCHEDULE (GEOSYNTEC, 2009)

Test Type	Bulk Sample (Stockpile)					Shelby Tube (Undisturbed Samples)					
	Top	Middle (1)	Middle (2)	Bottom (1)	Bottom (2)	ST#1	ST#2	ST#2	ST#3	ST#4	ST#4
Natural Moisture Content	√	√		√		√				√	
Atterberg Limits	√	√		√		√				√	
Grain Size	√	√		√		√					√
Compaction	√	√		√					√	√	
Specific Gravity		√		√		√	√				
Unit Weight	√	√	√	√	√	√	√	√	√	√	√
Hydraulic Conductivity (Flexible Wall)							√		√		
Consolidation										√	
Triaxial		√ (CU 90%)	√ (CU, 95%)	√ (CU 90%)	√ (CU 95%)	CU		UU			UU

CU, 90% – Consolidated Undrained Test and are performed with pore pressure measurement, 90% represents the degree of compaction achieved while remolding the specimen, ST – Shelby Tube, UU-Unconsolidated Undrained Middle (1) and Middle (2) represent two different soil samples from the same bulk sample collected from the middle of the stock pile.

TABLE 2

SUMMARY OF INDEX, COMPACTION, AND HYDRAULIC CONDUCTIVITY TEST RESULTS

Sample Location	Soil Classification (USCS)	w_n (%)	G_s	S_r (%)	e_o	*k (cm/s)*	Atterberg Limits (%)			Unit Weight γ (pcf)			Compaction	
							LL	PI	LI	Dry	Moist	Saturated	γ_{dmax} (pcf)	OMC (%)
Top	SC	17	-	-	-	-	26	11	0.15	-	-	-	121	12.0
Middle (1)	CL	15	2.72	-	-	-	36	15	-0.35	100	117	-	112	16.0
Middle (2)	-	14	-	-	-	-	-	-	-	106	121	-	-	-
Bottom (1)	CL	11	2.67	-	-	-	27	11	-0.38	107	119	-	120	13
Bottom (2)	-	11	-	-	-	-	-	-	-	113	125	-	-	-
ST #1	CL	15	2.75	88	0.47	-	33	15	-0.19	117	135	137	-	-
ST #2	CL	13	2.66	67	0.53	1.8×10^{-7}	-	-	-	110	125	130	-	-
ST #2	-	14	-	89	0.44	-	-	-	-	117	134	136	-	-
ST #3	CL	14	2.7	78	0.49	2.7×10^{-6}	-	-	-	113	129	133	-	-
ST #4 (1)	CL	18	2.72	91.5	0.52	-	38	17	-0.19	111	131	133	-	-
ST #4 (2)	-	17	-	100	0.44	-	-	-	-	117	136	136	-	-
Average		15	2.7	85	0.48	1.44×10^{-6}	32	15	-0.28	111	127	134	118	14

w_n- Natural water content, G_s-Specific gravity, S_r-Degree of saturation, e_0-Initial void ratio, k-Hydraulic Conductivity, LL-Liquid limit, PI-Plasticity index, LI-Liquidity index, OMC-Optimum moisture content.

TABLE 3

SUMMARY OF ESTIMATED SHEAR STRENGTH FOR THE CONFINING BED (UNDISTURBED CLAY)

Property	ST#1	ST#2	ST#4
Effective/Total Friction ϕ'(Degree)	28˚/23.7˚	-	-
Effective/Total Cohesion c′ (psf)	465/0	-	-
Undrained Shear Strength s_u (psf)	-	2,700	3,500

TABLE 4

SUMMARY OF ESTIMATED EFFECTIVE/TOTAL STRESS PARAMETERS FOR COMPACTED CLAY SPECIMENS

Sample Location	Degree of Compaction (%)	Water Content % Less than OMC	Effective Shear Strength		Total Shear Strength	
			ϕ'	c'	ϕ'	c'
Middle of Stockpile	90	2.1	24	0	17.7	0
Middle of Stockpile	95	-2.2	24.5	67.4	19.3	0
Bottom of Stockpile	90	-1.8	26.9	59.2	19.1	0
Bottom of Stockpile	95	-2	28	0.3	19.3	0

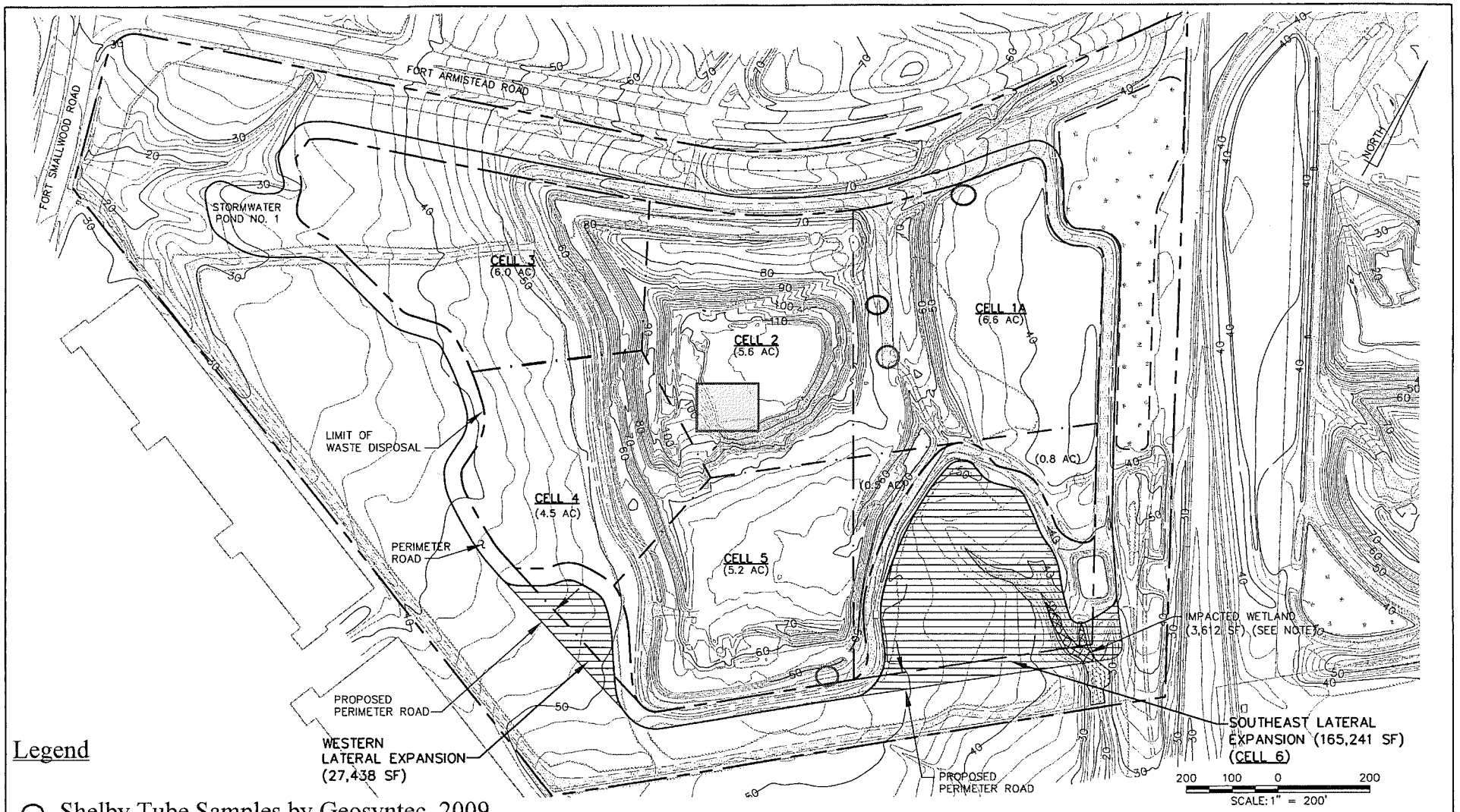
TABLE 5

SUMMARY OF ESTIMATED SHEAR STRENGTH FOR THE COMPACTED CLAY GEOSYNTHETIC MATERIAL INTERFACE

Property	Peak	Large Displacements
Friction δ (Degree)	30	28
Cohesion c (psf)	930	635

FIGURE

P:\Argentina\ME0635-Millennium LF\Drawings\2009 Permit Mod\figures\0635F108.dwg, 2, 7/2/2009 10:00:41 AM, geosyntec consultants, inc. - tsj, geosyntec cons



Legend

- ○ Shelby Tube Samples by Geosyntec, 2009
- ▢ Bulk Samples by Geosyntec, 2009
- = PROPOSED LATERAL EXPANSION AREA
- = WETLAND AREA (WETLAND DELINEATION BY GEOSYNTEC CONSULTANTS, MARCH 2009)

Site Plan

Geosyntec consultants
COLUMBIA, MARYLAND

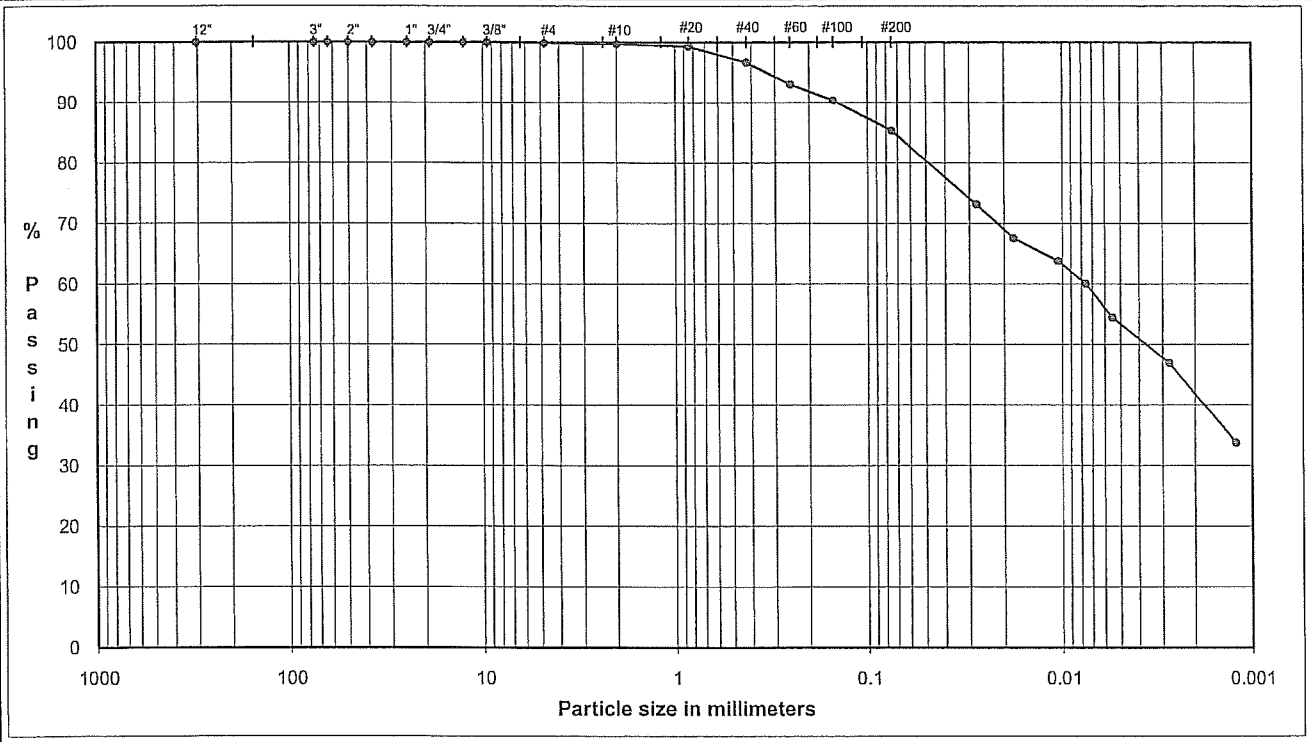
DATE:	JULY 2009
PROJECT NO.	ME0635
DOCUMENT NO.	
FILE NO.	0635F008
FIGURE NO.	1

APPENDIX A
Index, Compaction and Hydraulic Conductivity Testing Results

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
SAMPLE ID: Shelby Tube #1 Depth: Surface
TYPE: UD



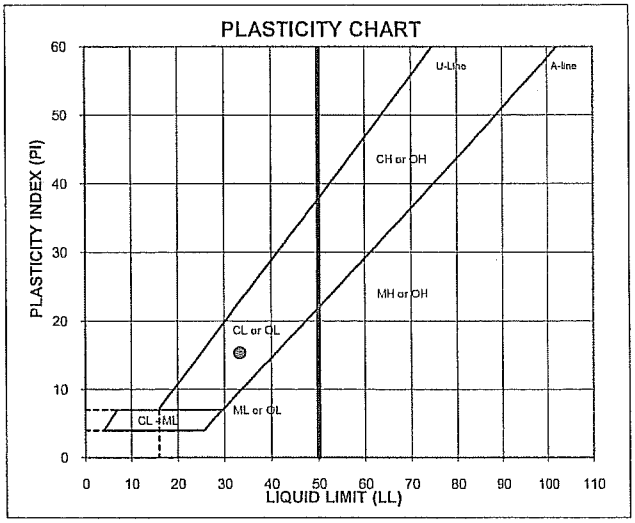
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.00
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	99.9	Fine Gravel	0.10
#10	2.00	99.7	Coarse Sand	0.17
#20	0.85	99.3		
#40	0.43	96.7	Medium Sand	3.04
#60	0.25	93.0		
#100	0.15	90.4		
#200	0.075	85.4	Fine Sand	11.32

Hydrometer Analysis

	(mm)	%Finer		
	0.028	73.2		
	0.018	67.6		
	0.011	63.8	Fines	
	0.0076	60.1	Silt or Clay	85.37
	0.0055	54.4		
	0.0028	46.9		
	0.0012	33.8		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
15.0	33	18	15	-0.19

LL (oven-dried) / LL (not dried) < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Red, SILTY CLAY, some medium to fine sand, trace fine gravel.

USCS: CL

TECH	TW/TJ
DATE	6/5/09
CHECK	AW
REVIEW	PWM

JUNE 2009

093-90136

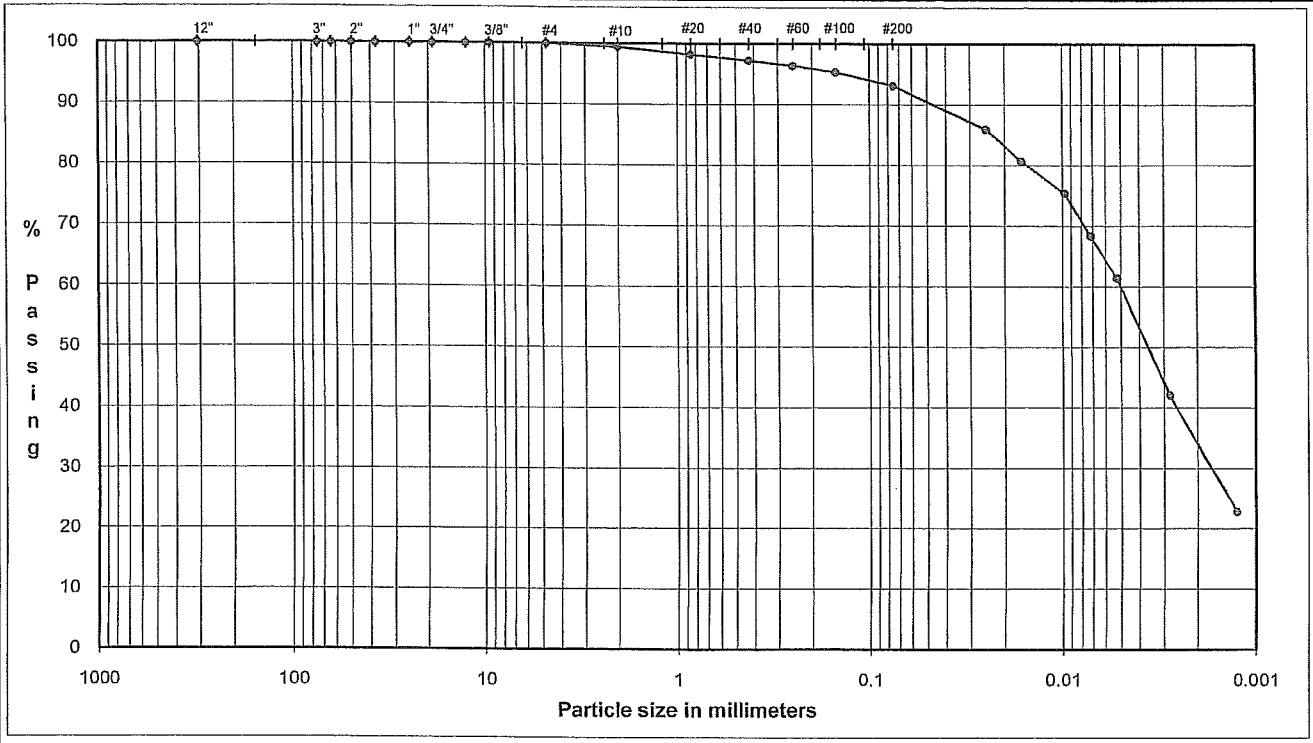
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **GEOSYNTEC/MILLENNIUM/MD**

SAMPLE ID: **Shelby Tube #4** Depth: **Surface**

TYPE: **UD**



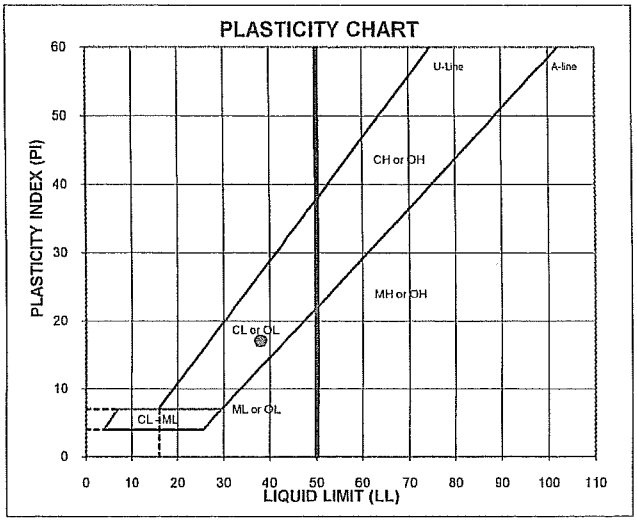
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.00
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.00
#10	2.00	99.4	Coarse Sand	0.60
#20	0.85	98.2		
#40	0.43	97.3	Medium Sand	2.14
#60	0.25	96.4		
#100	0.15	95.3		
#200	0.075	93.1	Fine Sand	4.21

Hydrometer Analysis

(mm)	%Finer		
0.025	86.0		
0.016	80.7		
0.010	75.4	Fines	
0.0071	68.4	Silt or Clay	93.05
0.0052	61.4		
0.0028	42.1		
0.0013	22.8		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
17.7	38	21	17	-0.19

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

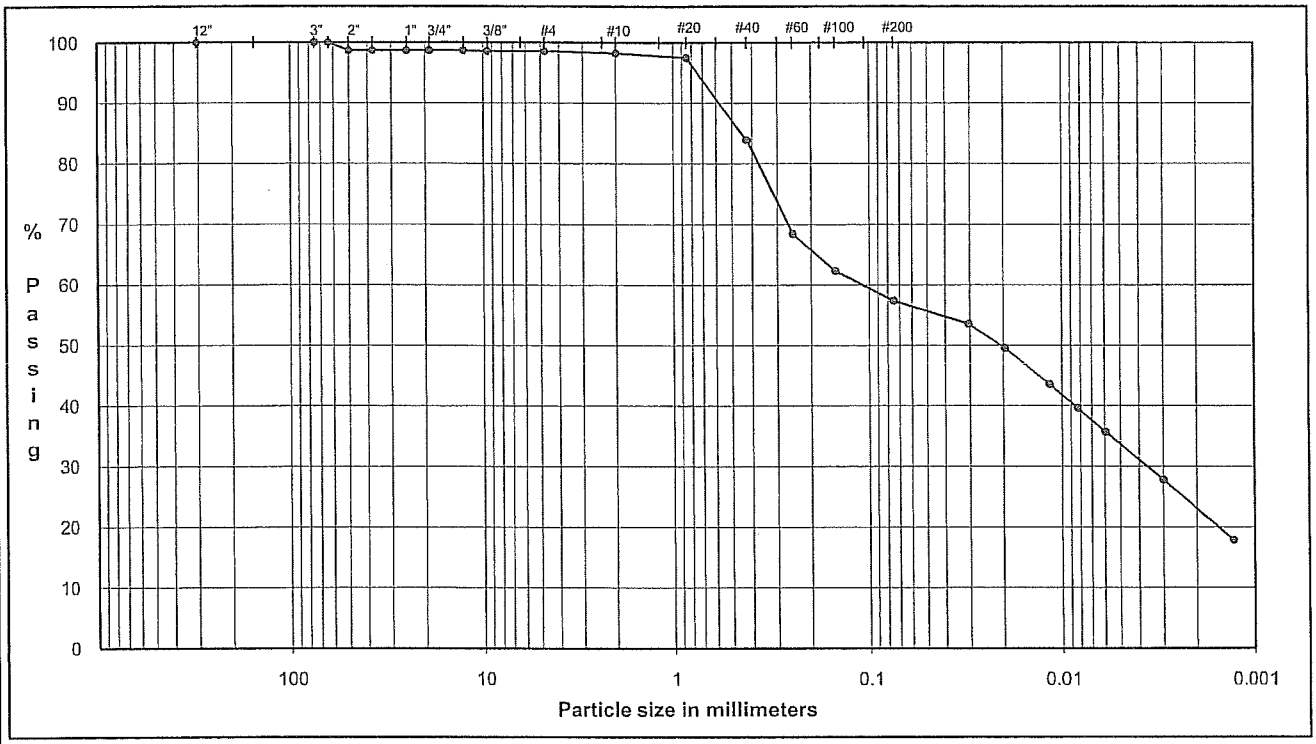
TECH	DW/TJ
DATE	6/9/09
CHECK	AW
REVIEW	DWM

Golder Associates Inc.

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
SAMPLE ID: Bottom of Stockpile Depth: -
TYPE: Bulk



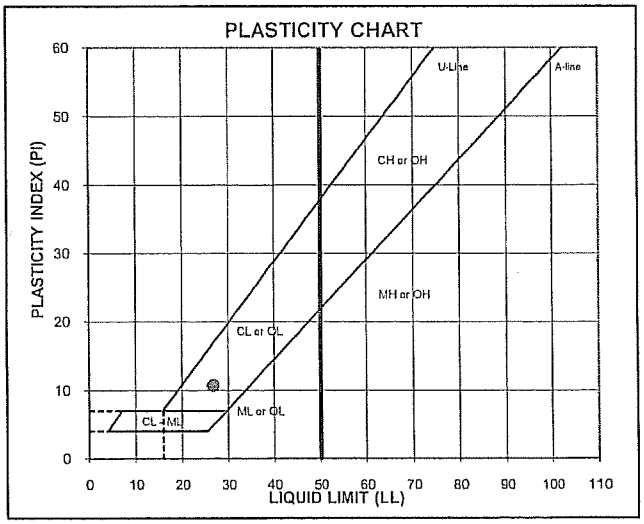
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	98.7		
1.5"	37.5	98.7		
1.0"	25.0	98.7		
0.75"	19.0	98.7	Coarse Gravel	1.31
0.50"	12.7	98.7		
0.375"	9.5	98.6		
#4	4.8	98.6	Fine Gravel	0.10
#10	2.00	98.3	Coarse Sand	0.30
#20	0.85	97.6		
#40	0.43	83.9	Medium Sand	14.39
#60	0.25	68.4		
#100	0.15	62.3		
#200	0.075	57.4	Fine Sand	26.53

Hydrometer Analysis

(mm)	%Finer		
0.031	53.5		
0.020	49.6		
0.012	43.6	Fines	
0.0083	39.7	Silt or Clay	57.37
0.0060	35.7		
0.0030	27.8		
0.0013	17.8		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
11.7	27	16	11	-0.38

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Reddish Brown, SILTY CLAY, and medium to fine sand, trace coarse gravel.

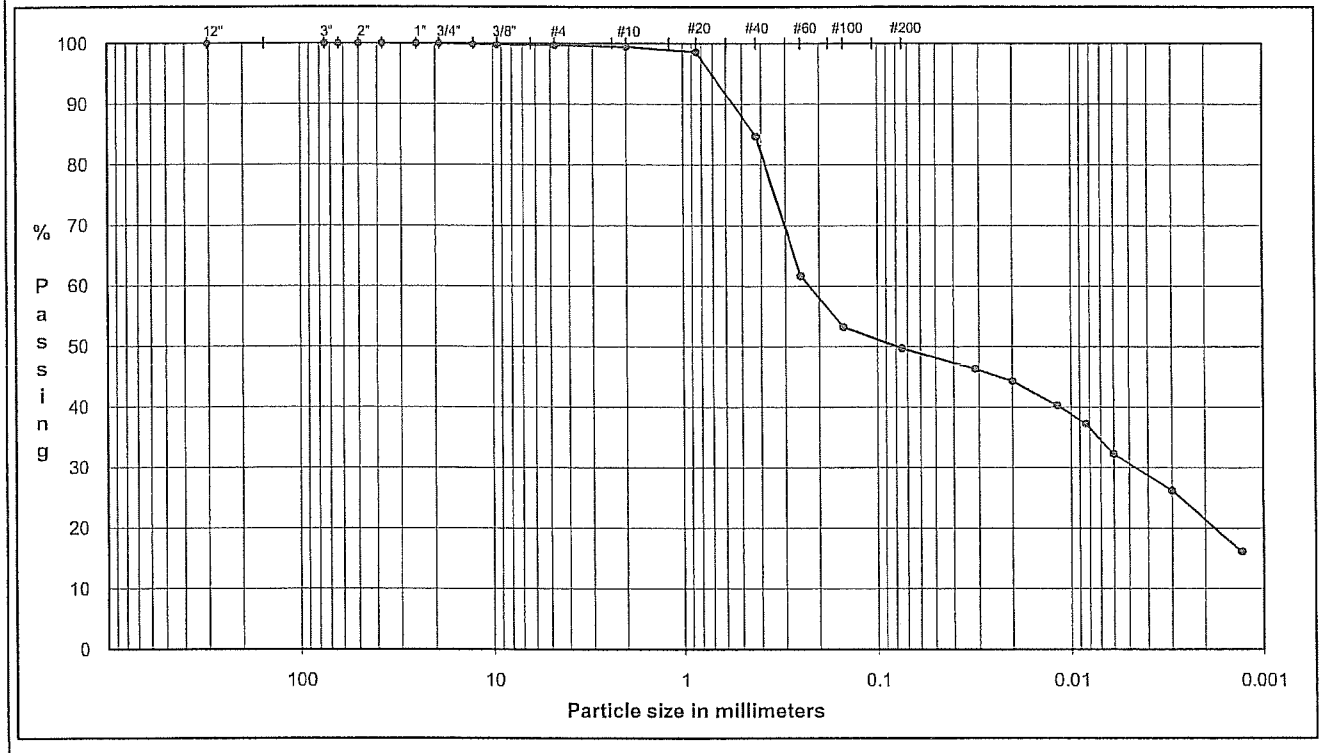
USCS: CL

TECH	TW/SW/TJ
DATE	6/1/09
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
SAMPLE ID: Top of Stockpile Depth: -
TYPE: Bulk



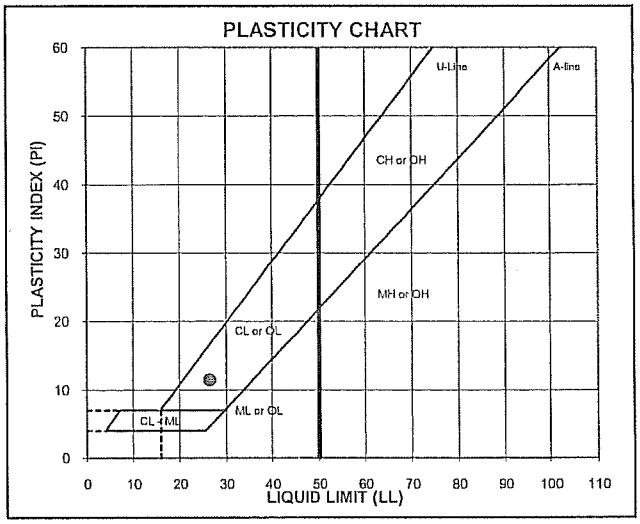
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.00
0.50"	12.7	99.8		
0.375"	9.5	99.8		
#4	4.8	99.7	Fine Gravel	0.32
#10	2.00	99.5	Coarse Sand	0.22
#20	0.85	98.6		
#40	0.43	84.7	Medium Sand	14.78
#60	0.25	61.7		
#100	0.15	53.2		
#200	0.075	49.8	Fine Sand	34.92

Hydrometer Analysis

(mm)	%Finer		
0.032	46.4		
0.020	44.4		
0.012	40.3	Fines	
0.0084	37.3	Silt or Clay	49.76
0.0060	32.3		
0.0030	26.2		
0.0013	16.1		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
16.8	26	15	11	0.15

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Reddish Brown, MEDIUM TO FINE SAND, and silty clay, trace fine gravel.

USCS: SC

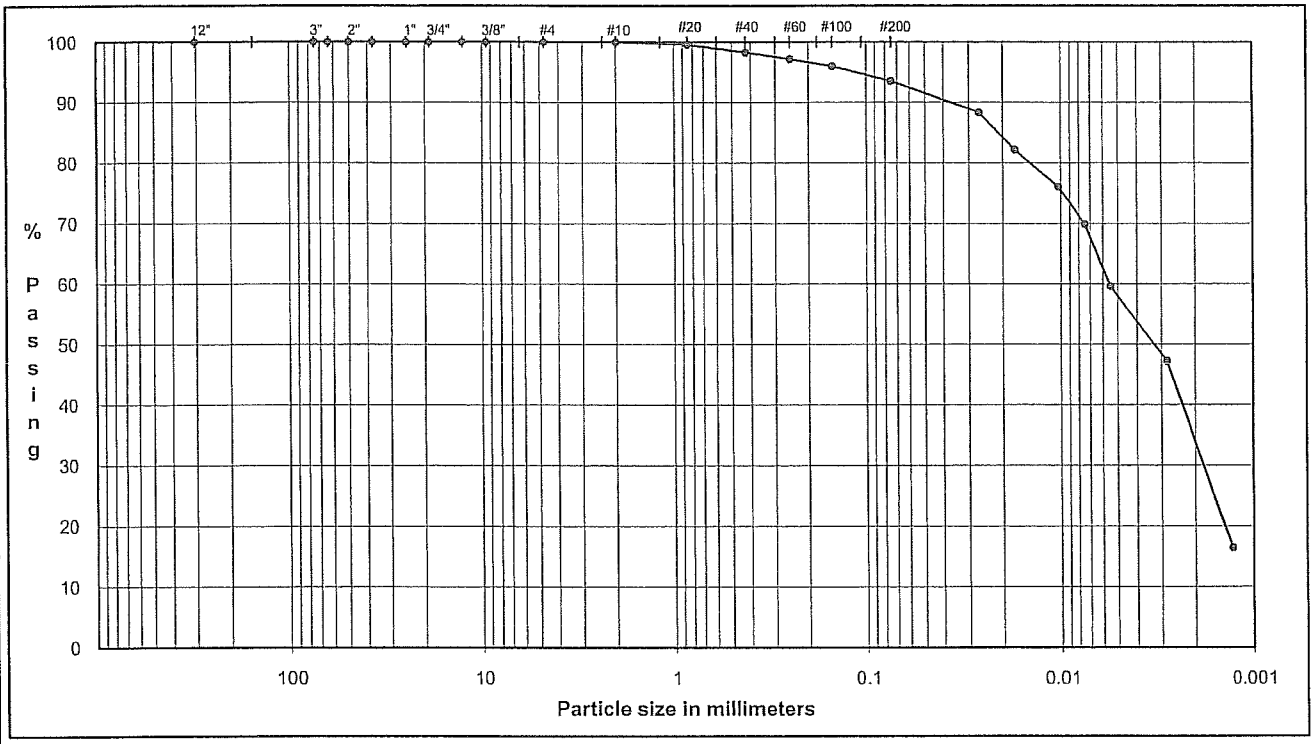
TECH TW/SW/TJ
DATE 6/1/09
CHECK AK
REVIEW DB

JUNE 2009 093-90136

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
SAMPLE ID: Middle of Stockpile Depth: -
TYPE: Bulk



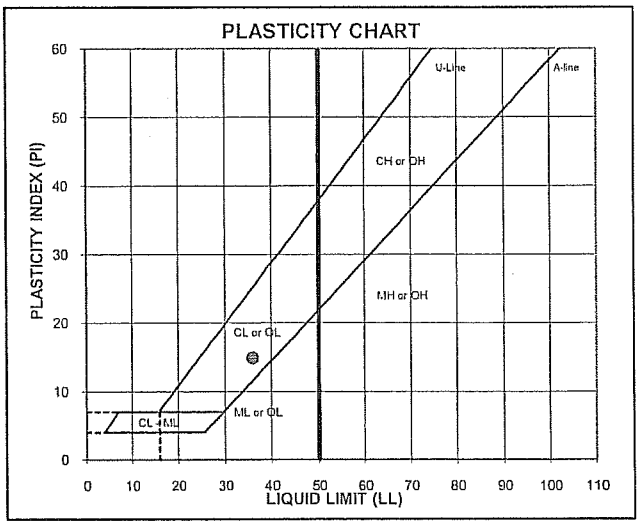
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.00
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.00
#20	0.85	99.6		
#40	0.43	98.3	Medium Sand	1.73
#60	0.25	97.2		
#100	0.15	96.0		
#200	0.075	93.6	Fine Sand	4.72

Hydrometer Analysis

(mm)	%Finer		
0.027	88.3		
0.017	82.2		
0.010	76.0	Fines	
0.0075	69.8	Silt or Clay	93.55
0.0055	59.6		
0.0028	47.2		
0.0013	16.4		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
15.4	36	21	15	-0.35

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

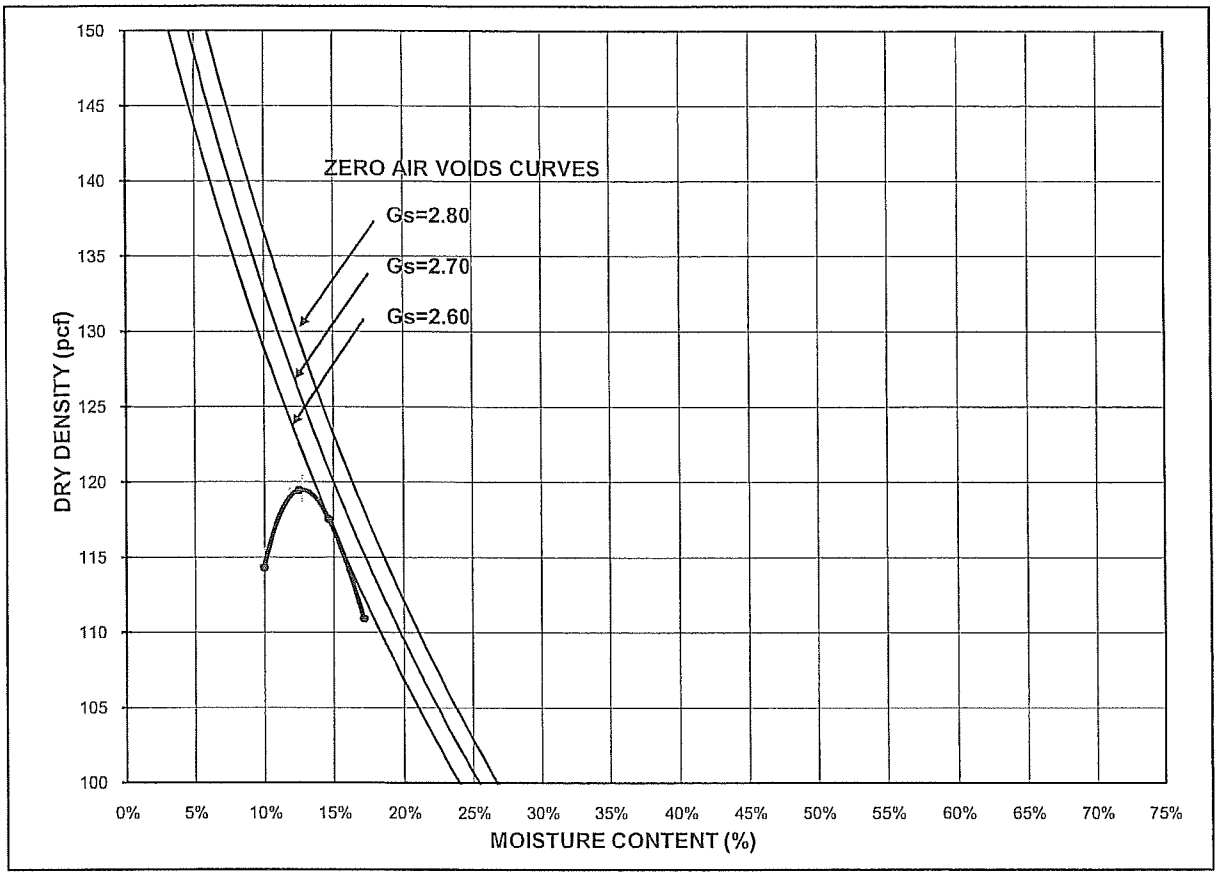
TECH TW/SW/TJ
DATE 6/1/09
CHECK
REVIEW

Golder Associates Inc.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: **Bottom of Stockpile** DEPTH: - SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	114.3	9.9%
2	119.5	12.5%
3	117.5	14.6%
4	110.9	17.1%

Maximum Dry Density (pcf)	119.5
Optimum Moisture (%)	12.7
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	11.7%
% Retained on # 4 sieve	1.4%
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION: Reddish Brown, SILTY CLAY, and medium to fine sand, trace coarse gravel.

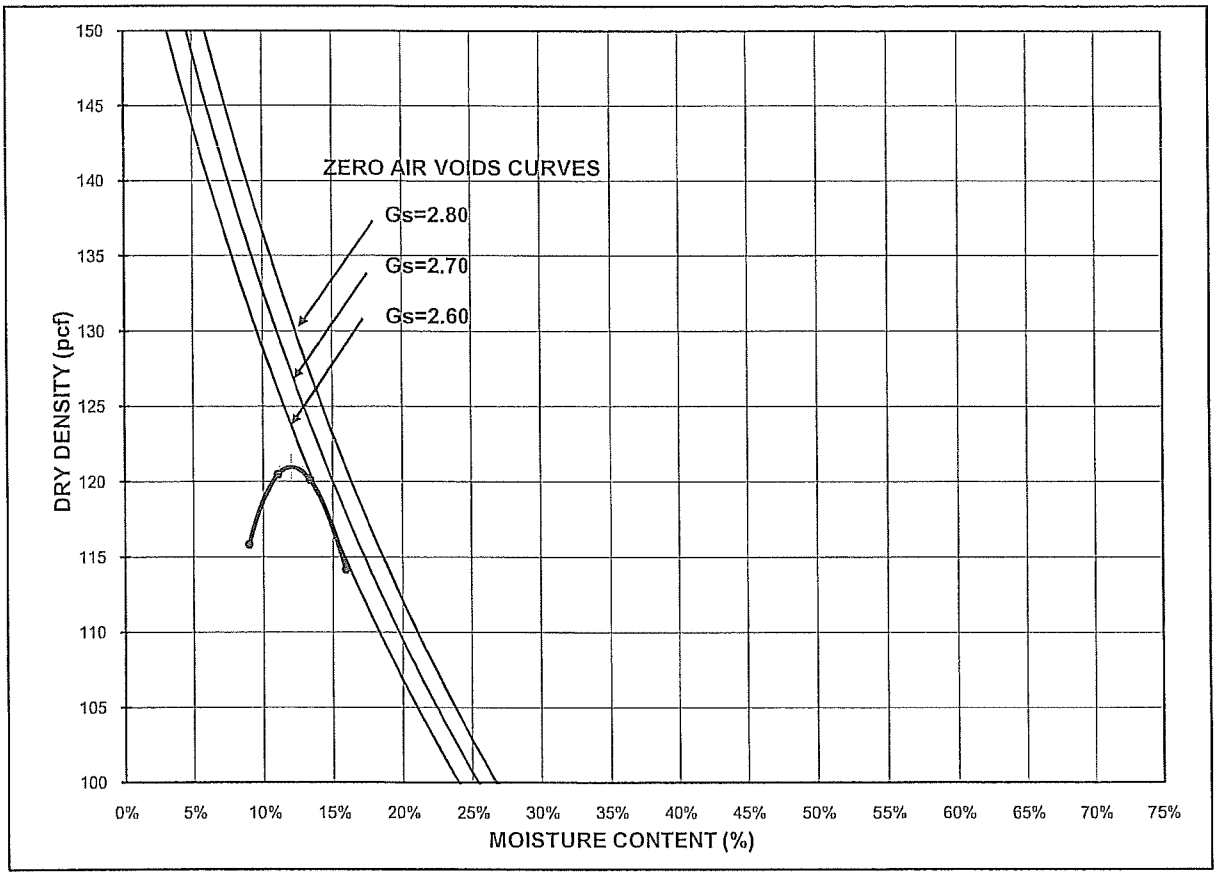
USCS: CL

CHECK: AL
REVIEW: DA

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: **Top of Stockpile** DEPTH: - SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	115.8	9.0%
2	120.4	11.0%
3	120.1	13.3%
4	114.2	15.9%

Maximum Dry Density (pcf)	121.0
Optimum Moisture (%)	12.0
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	16.8%
% Retained on # 4 sieve	0.3%
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION: Reddish Brown, MEDIUM TO FINE SAND, and silty clay, trace fine gravel.

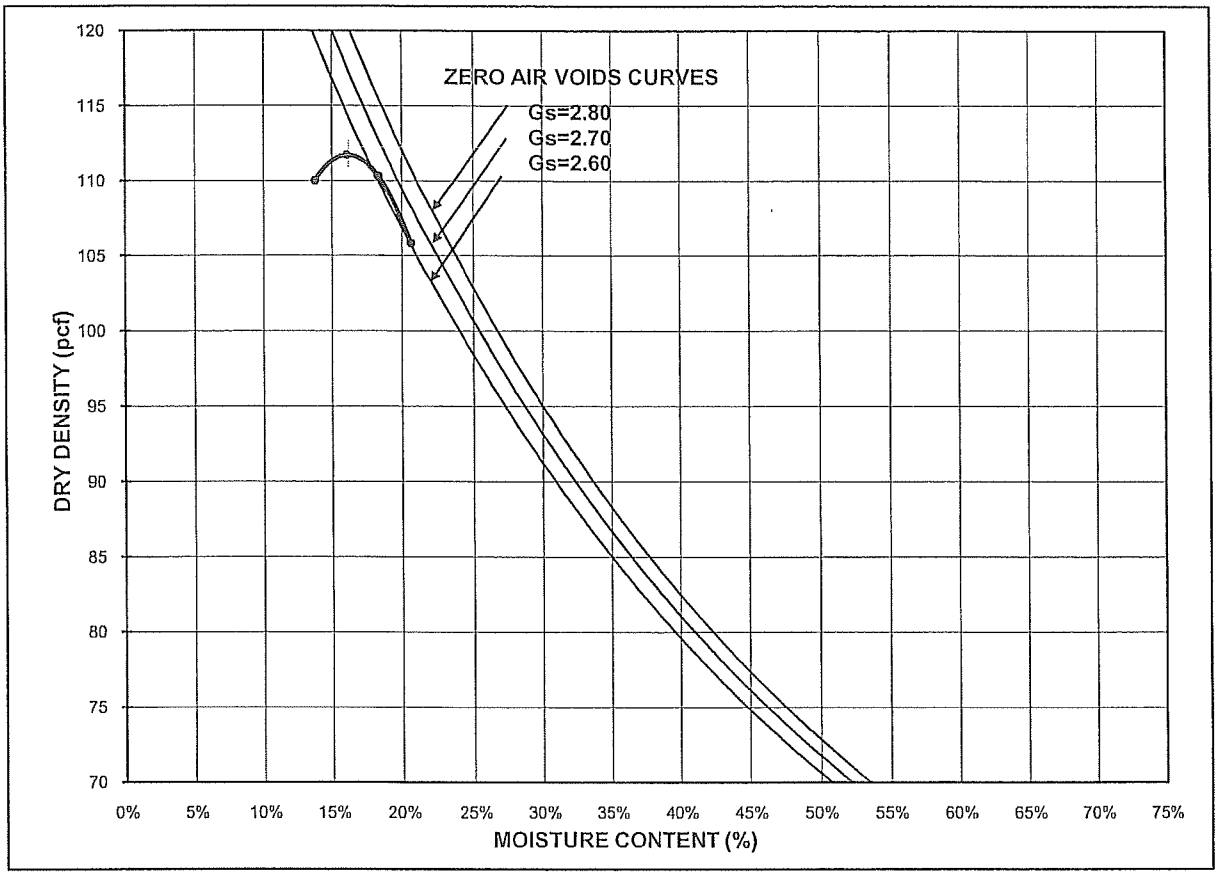
USCS: SC

CHECK: AK
REVIEW: DA

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: Middle of Stockpile DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	110.0	13.7%
2	111.7	16.0%
3	110.3	18.3%
4	105.8	20.6%

Maximum Dry Density (pcf)	111.8
Optimum Moisture (%)	16.2
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	15.4%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

CHECK: AR
REVIEW: DA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/MILLENNIUM/MD		Board #	6	COMMENTS
PROJECT NUMBER	093-90136		Flow Pump	2	
SAMPLE ID	Shelby Tube #3	-	Flow Pump Speed	5	
SAMPLE TYPE	UD		Technician	AK	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.902	B-Value, f	0.99	Height, inches	2.891
Diameter, inches	2.821	Cell Pres.	90.0	Diameter, inches	2.813
Area, cm^2	40.32	Bot. Pres.	80.0	Area, cm^2	40.10
Volume, cm^3	297.23	Top Pres.	80.0	Volume, cm^3	294.43
Mass, g	613.04	Tot. B.P.	80.0	Mass, g	629.02
Moisture Content, %	13.84	Head, max.	78.08	Moisture Content, %	16.81
Dry Density, pcf	113.05	Head, min.	78.08	Dry Density, pcf	114.13
Spec. Gravity	2.704	Max. Grad.	10.63	Volume Solids, cm^3	199.15
Volume Solids, cm^3	199.15	Min. Grad.	10.63	Volume Voids, cm^3	95.28
Volume Voids, cm^3	98.08			Void Ratio	0.48
Void Ratio	0.49			Saturation, %	95.0%
Saturation, %	76.0%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	613.04	637.39
Wt Soil & Tare, f	g	538.50	546.87
Wt Tare	g	0.00	8.38
Wt Moisture Lost	g	74.54	90.52
Wt Dry Soil	g	538.50	538.49
Water Content	%	13.84%	16.81%

Flow Pump Rate: 1.17E-03 cm^3/sec

USCS: (CL)

DESCRIPTION: Reddish Brown, SILTY CLAY, some medium to fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/21/09	39985	15	20	21.6	0	0	0	0	1.11	78.08	10.63	2.7E-06
06/21/09	39985	15	25	21.6	5	5	300	300	1.11	78.08	10.63	2.7E-06
06/21/09	39985	15	30	21.6	5	10	300	600	1.11	78.08	10.63	2.7E-06
06/21/09	39985	15	35	21.6	5	15	300	900	1.11	78.08	10.63	2.7E-06 *
06/21/09	39985	15	40	21.6	5	20	300	1200	1.11	78.08	10.63	2.7E-06 *
06/21/09	39985	15	45	21.6	5	25	300	1500	1.11	78.08	10.63	2.7E-06 *
06/21/09	39985	15	50	21.6	5	30	300	1800	1.11	78.08	10.63	2.7E-06 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.7E-06 cm/sec **

DATE 6/21/09
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/MILLENNIUM/MD		Board #	7	COMMENTS: Sample short due to insufficient sample received, from client.
PROJECT NUMBER	093-90136		Flow Pump	2	
SAMPLE ID	Shelby Tube #2	-	Flow Pump Speed	8	
SAMPLE TYPE	UD		Technician	AK	

Sample Data, Initial				Sample Data, Final	
Height, inches	1.882	B-Value, f	0.99	Height, inches	1.858
Diameter, inches	2.821	Cell Pres.	90.0	Diameter, inches	2.803
Area, cm²	40.32	Bot. Pres.	80.0	Area, cm²	39.81
Volume, cm³	192.76	Top Pres.	80.0	Volume, cm³	187.88
Mass, g	384.65	Tot. B.P.	80.0	Mass, g	396.65
Moisture Content, %	13.44	Head, max.	73.15	Moisture Content, %	16.97
Dry Density, pcf	109.77	Head, min.	73.15	Dry Density, pcf	112.62
Spec. Gravity	2.664	Max. Grad.	15.50	Volume Solids, cm³	127.29
Volume Solids, cm³	127.29	Min. Grad.	15.50	Volume Voids, cm³	60.60
Volume Voids, cm³	65.47			Void Ratio	0.48
Void Ratio	0.51			Saturation, %	95.0%
Saturation, %	69.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	384.65	404.81
Wt Soil & Tare, f	g	339.09	347.26
Wt Tare	g	0.00	8.23
Wt Moisture Lost	g	45.56	57.55
Wt Dry Soil	g	339.09	339.03
Water Content	%	13.44%	16.97%

DESCRIPTION: Reddish Brown, SILTY CLAY, some fine sand, trace fine gravel.

Flow Pump Rate: 1.12E-04 cm³/sec

USCS: (CL)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/21/09	39985	16	10	21.5	0	0	0	0	1.04	73.15	15.50	1.8E-07
06/21/09	39985	16	15	21.5	5	5	300	300	1.04	73.15	15.50	1.8E-07
06/21/09	39985	16	20	21.5	5	10	300	600	1.04	73.15	15.50	1.8E-07
06/21/09	39985	16	25	21.5	5	15	300	900	1.04	73.15	15.50	1.8E-07 *
06/21/09	39985	16	30	21.5	5	20	300	1200	1.04	73.15	15.50	1.8E-07 *
06/21/09	39985	16	35	21.5	5	25	300	1500	1.04	73.15	15.50	1.8E-07 *
06/21/09	39985	16	40	21.5	5	30	300	1800	1.04	73.15	15.50	1.8E-07 *

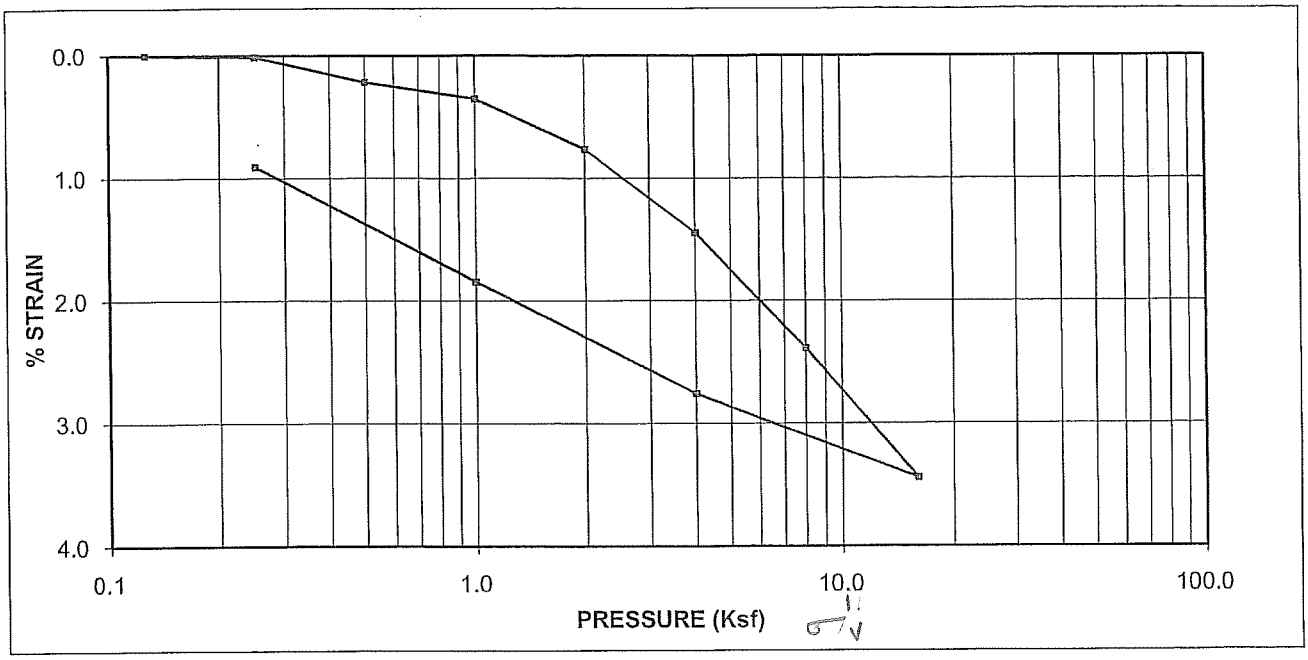
*TRANSCRIBED FROM ORIGINAL DATA SHEETS

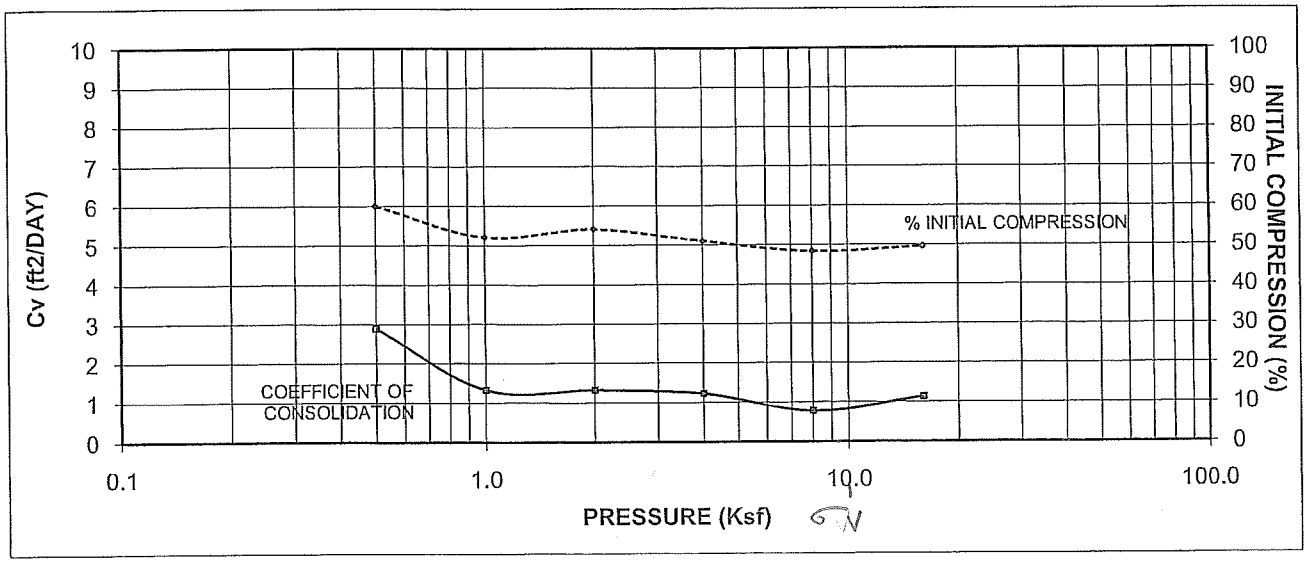
PERMEABILITY REPORTED AS ** 1.8E-07 cm/sec **

DATE 6/21/09
CHECK AK
REVIEW DA

APPENDIX B
Consolidation Testing Results

ONE - DIMENSIONAL CONSOLIDATION
ASTM D 2435 Method B





SAMPLE ID	Shelby Tube #4
SAMPLE TYPE	UD
SAMPLE DEPTH	Surface

LL	38
PL	21
PI	17
Gs	2.72

	Initial	Final
Dry Unit Weight (pcf)	111.3	111.3
Wet Unit Weight (pcf)	130.9	132.7
Moisture Content	17.7%	19.3%
Void Ratio	0.5245	0.5245
Degree of Saturation	91.5%	99.9%

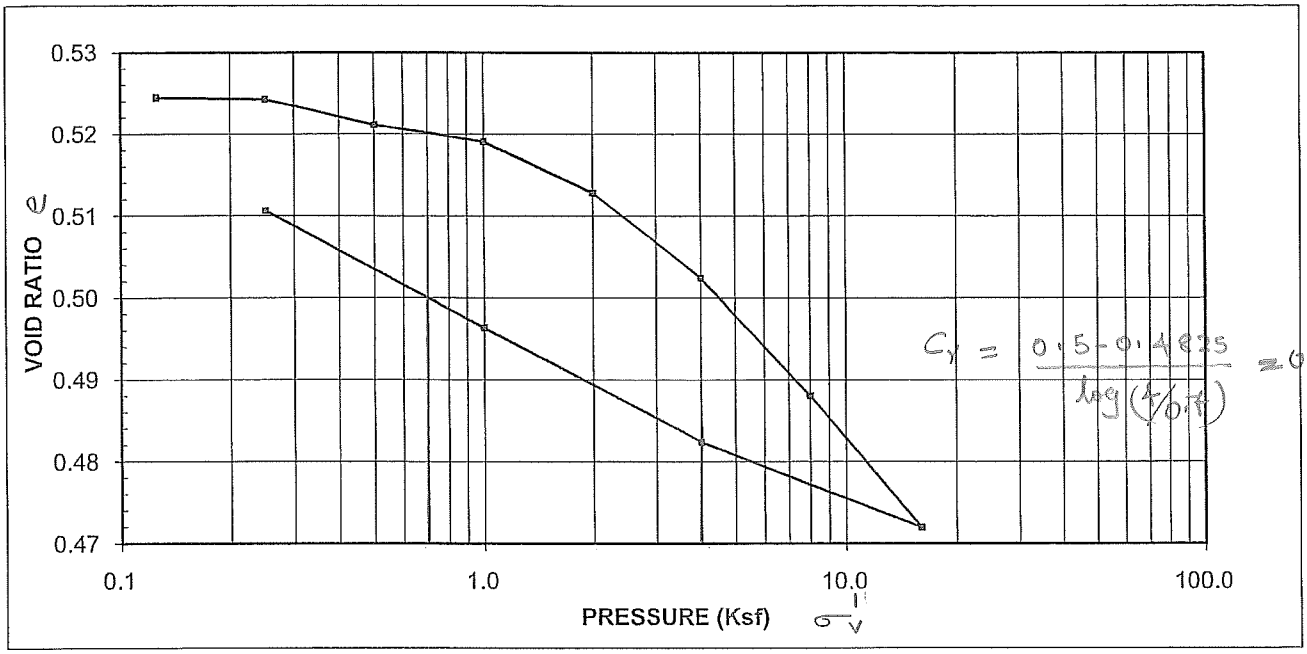
DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

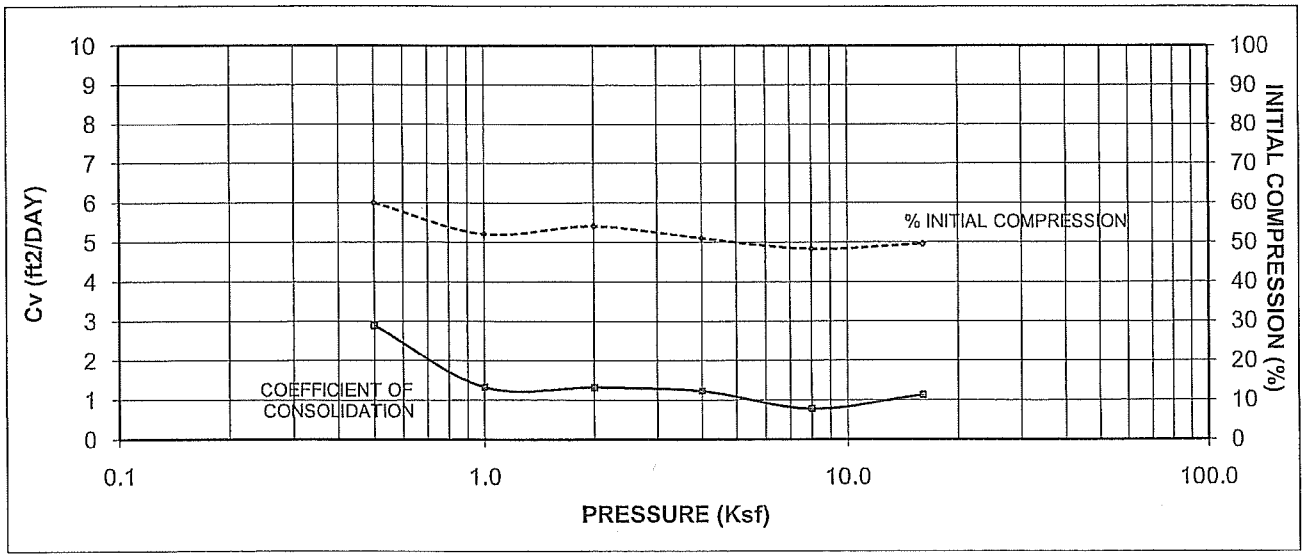
USCS: CL

GEOSYNTEC/MILLENNIUM/MD
093-90136

TECH	SW/TPC/AK
DATE	6/9/09
CHECK	AK
REVIEW	

ONE - DIMENSIONAL CONSOLIDATION
ASTM D 2435 Method B





SAMPLE ID	Shelby Tube #4
SAMPLE TYPE	UD
SAMPLE DEPTH	Surface

LL	38
PL	21
PI	17
Gs	2.72

	Initial	Final
Dry Unit Weight (pcf)	111.3	111.3
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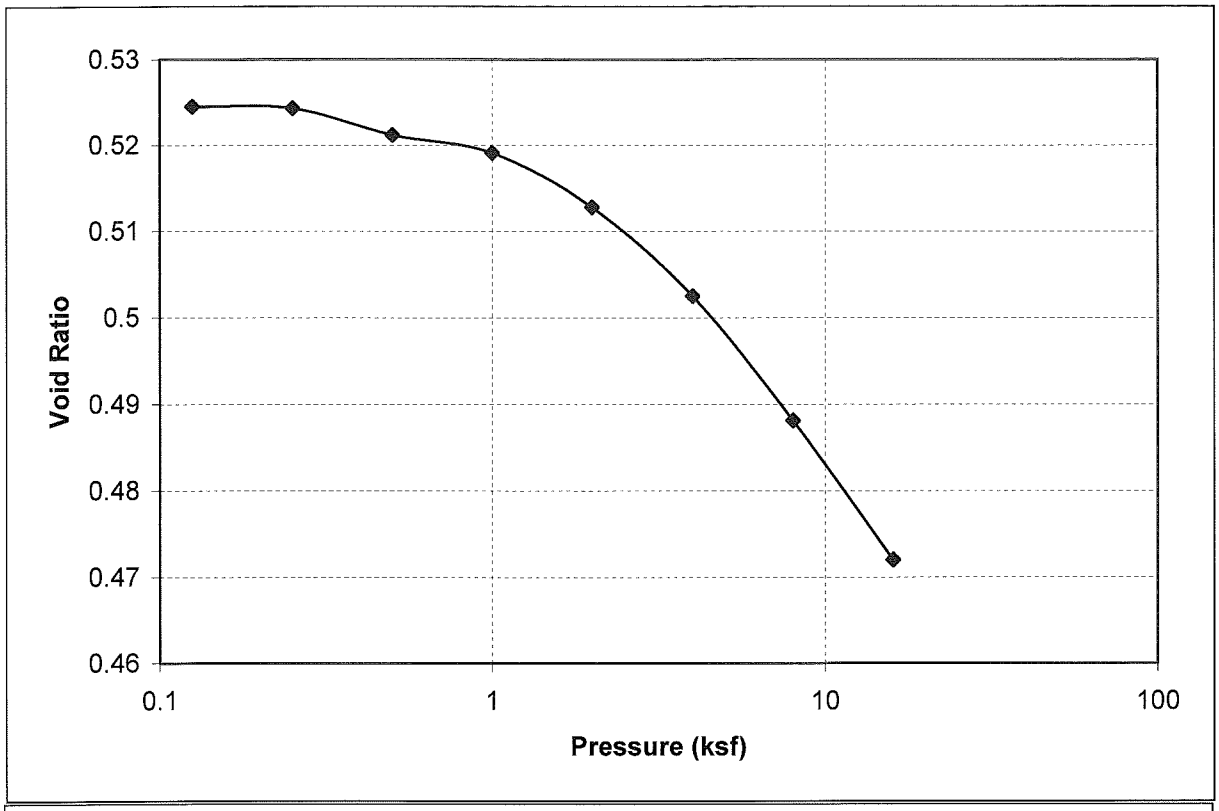
Moisture Content	17.7%	19.3%
Void Ratio	0.5245	0.5245
Degree of Saturation	91.5%	99.9%

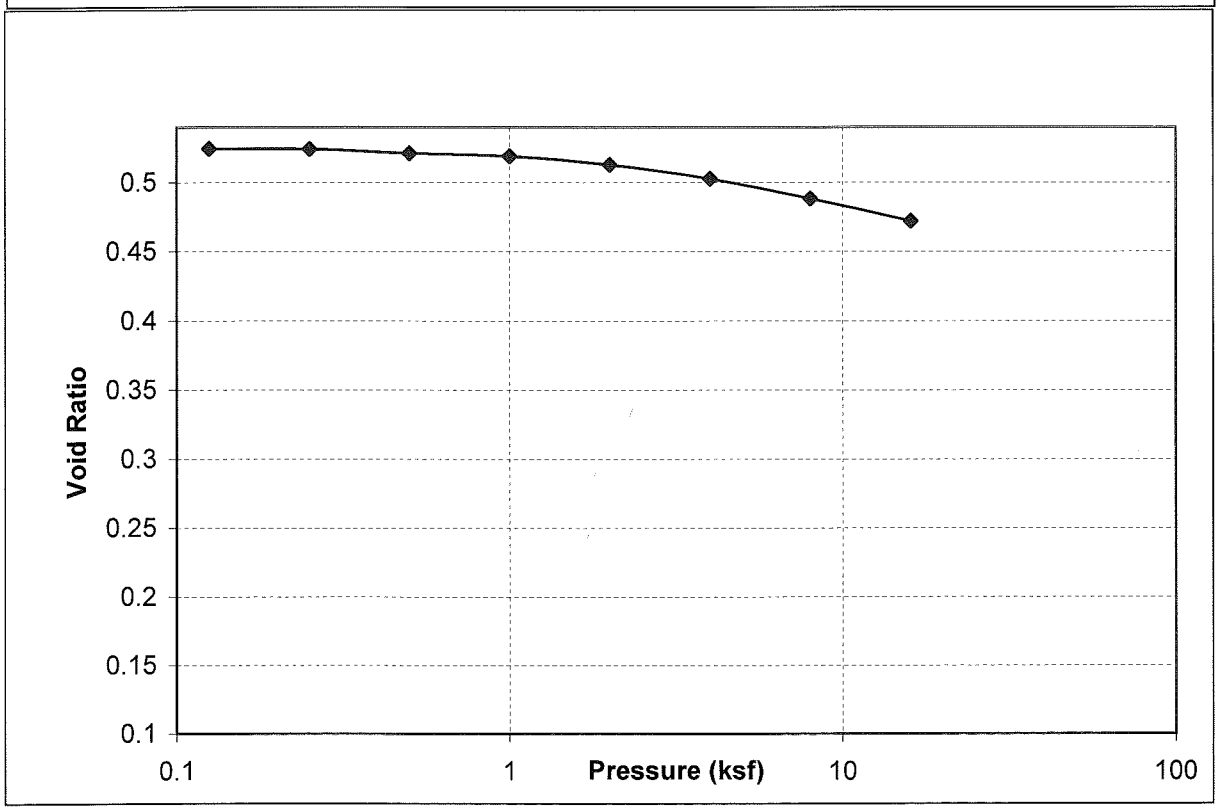
DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

GEOSYNTEC/MILLENNIUM/MD
093-90136

TECH	SW/TPC/AK
DATE	6/9/09
CHECK	AK
REVIEW	

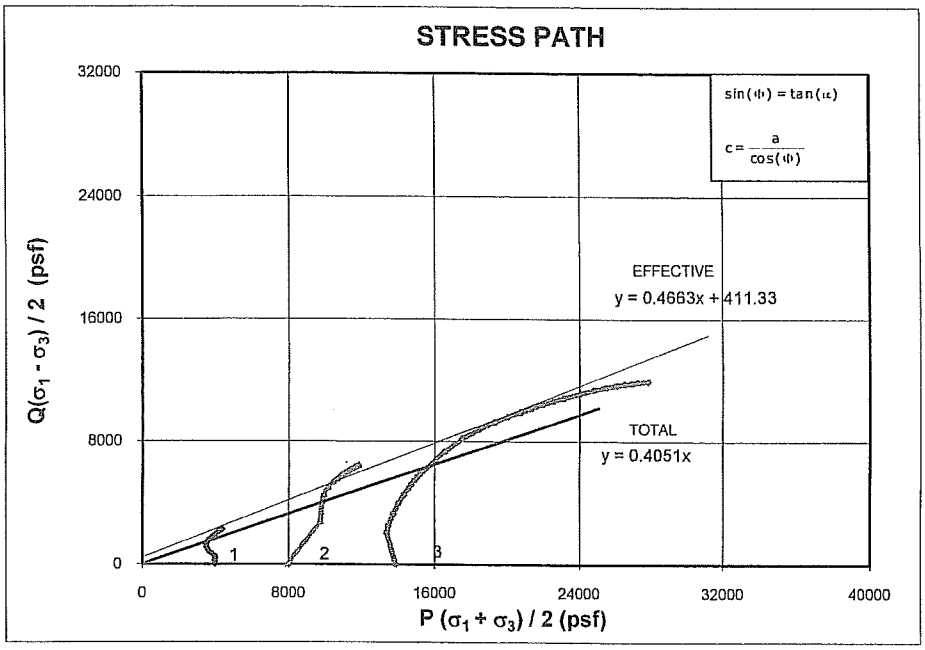

0.53
0.52
0.51
0.5
0.49
0.48
0.47
0.46
Void Ratio
0.1
1
10
100
Pressure (ksf)


0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
Void Ratio
0.1
1
Pressure (ksf)
10
100

APPENDIX C
Triaxial Testing Results-Undisturbed Specimen

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

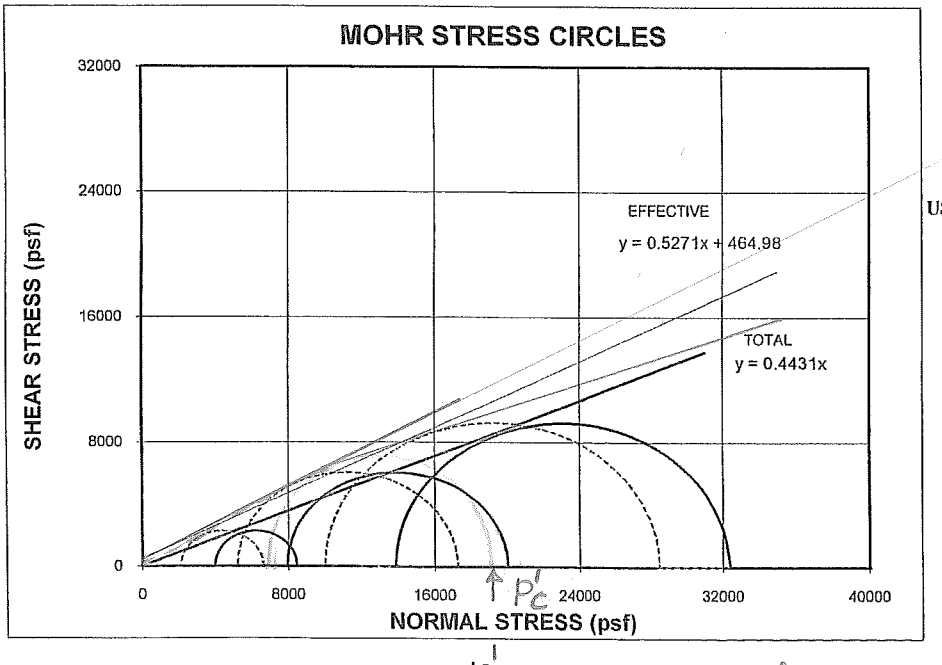
PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Shelby Tube #1** DEPTH: **Surface** Sample Type: **UD**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	117.4	15.0
2	7949	122.1	14.7
3	13896	124.0	14.0

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.02	89.6	100.0
2	0.03	100.0	100.0
3	0.02	100.0	100.0

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	22.1 °	ϕ	=	23.9 °
a	=	0.0 psf	c	=	0.0 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α'	=	25.0 °	ϕ'	=	27.8 °
a'	=	411.3 psf	c'	=	465.0 psf



$P_c' \approx 19000$ psf

Soil Description

Red, SILTY CLAY, some medium to fine sand, trace fine gravel.

USCS: CL

LL	PL	PI
33	18	15

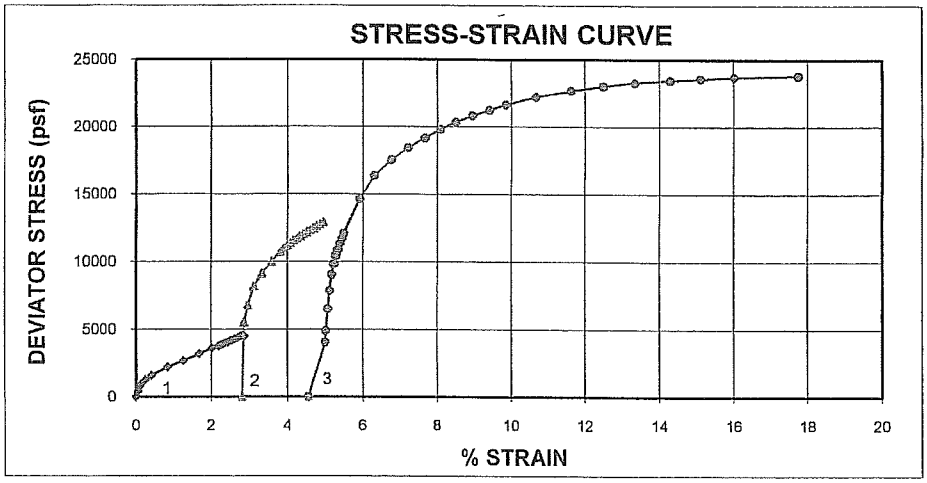
Comments

* **Failure based on effective stress ratio.**

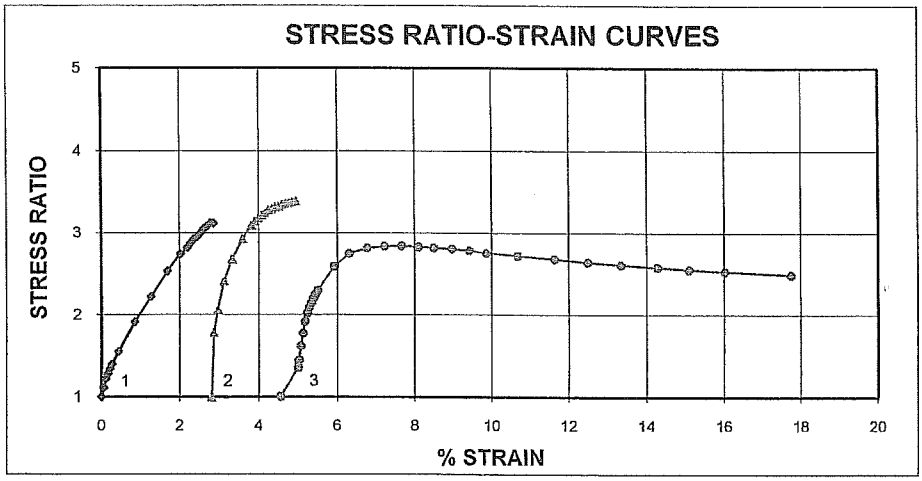
CHECK AW
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

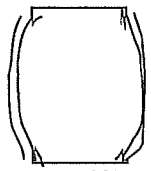
PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Shelby Tube #1** DEPTH: **Surface** Sample Type: **UD**



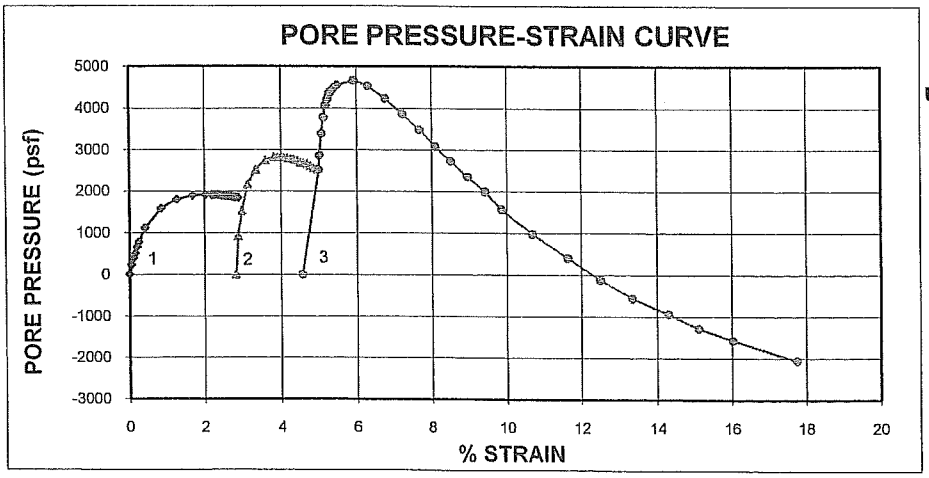
Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	117.4	15.0
2	7949	122.1	14.7
3	13896	124.0	14.0



FAILURE SKETCH



1 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

Red, SILTY CLAY, some medium to fine sand, trace fine gravel.

USCS: CL

LL	PL	PI
33	18	15

Comments

*** Failure based on effective stress ratio.**

CHECK AJL
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Shelby Tube #1
SAMPLE TYPE	UD
DEPTH INTERVAL	Surface
MACHINE SPEED (in/min)	0.0014
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	57.6
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.6
PRESSURE, σ_3 (psf)	3974.4
FINAL "B" VALUE	0.98
t_{50} (minutes)	17.28

Mounting Method: Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.237	5.999	5.913
DIAMETER	7.148	2.814	2.779
AREA	40.12	6.22	6.07
VOLUME	611.39	37.31	35.87
WEIGHT (g)	1323.61		1320.16
% MOISTURE	15.04		14.74
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	135.1		
DRY DENSITY, calc (pcf)	117.4		
VOLUME OF SOLIDS	418.25		
VOLUME OF VOIDS	193.14		
VOID RATIO	0.462		
SATURATION	89.6		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	122.1
VOLUME OF SOLIDS	418.25
VOLUME OF VOIDS	169.54
VOID RATIO	0.405

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1320.16
WT SOIL & TARE, DRY (g)	1150.60
WT TARE (g)	0.00
WT MOISTURE (g)	169.56
WT DRY SOIL (g)	1150.60
% MOISTURE	14.74

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	7	30.3	0.0	0.00	1.00	6.07	5.913	0.0	3974.4	3974.4	3974.4	1.00	3974.4	0.0	0.00
2.1	0.003	25	31.9	230.4	0.05	1.00	6.07	5.910	410.5	4384.9	4154.5	3744.0	1.11	3949.2	205.2	0.56
4.3	0.006	41	33.0	388.8	0.10	1.00	6.07	5.907	792.1	4766.5	4377.7	3585.6	1.22	3981.6	396.0	0.49
6.4	0.009	49	33.8	504.0	0.15	1.00	6.08	5.904	978.9	4953.3	4449.3	3470.4	1.28	3959.8	489.4	0.51
8.6	0.012	55	34.9	662.4	0.20	1.00	6.08	5.901	1130.0	5104.4	4442.0	3312.0	1.34	3877.0	565.0	0.59
10.7	0.015	61	35.7	777.6	0.25	1.00	6.08	5.898	1264.4	5238.8	4461.2	3196.8	1.40	3829.0	632.2	0.61
17.9	0.025	74	38.0	1108.8	0.42	1.00	6.09	5.888	1581.4	5555.8	4447.0	2865.6	1.55	3656.3	790.7	0.70
35.7	0.050	100	41.3	1584.0	0.85	0.99	6.12	5.863	2184.3	6158.7	4574.7	2390.4	1.91	3482.5	1092.1	0.73
53.6	0.075	121	42.8	1800.0	1.27	0.99	6.14	5.838	2660.1	6634.5	4834.5	2174.4	2.22	3504.5	1330.1	0.68
71.4	0.100	144	43.5	1900.8	1.69	0.98	6.17	5.813	3183.1	7157.5	5256.7	2073.6	2.54	3665.2	1591.6	0.60
85.7	0.120	162	43.6	1915.2	2.03	0.98	6.19	5.793	3593.1	7567.5	5652.3	2059.2	2.74	3855.8	1796.6	0.53
92.9	0.130	169	43.6	1915.2	2.20	0.98	6.20	5.783	3751.8	7726.2	5811.0	2059.2	2.82	3935.1	1875.9	0.51
96.4	0.135	174	43.6	1915.2	2.28	0.98	6.21	5.778	3862.2	7836.6	5921.4	2059.2	2.88	3990.3	1931.1	0.50
100.0	0.140	178	43.6	1915.2	2.37	0.98	6.21	5.773	3956.2	7930.6	6015.4	2059.2	2.92	4037.3	1978.1	0.48
103.6	0.145	182	43.5	1900.8	2.45	0.98	6.22	5.768	4047.7	8022.1	6121.3	2073.6	2.95	4097.5	2023.9	0.47
107.1	0.150	188	43.4	1886.4	2.54	0.97	6.22	5.763	4166.8	8141.2	6254.8	2088.0	3.00	4171.4	2083.4	0.45
110.7	0.155	192	43.4	1886.4	2.62	0.97	6.23	5.758	4274.2	8248.6	6362.2	2088.0	3.05	4225.1	2137.1	0.44
114.3	0.160	197	43.3	1872.0	2.71	0.97	6.23	5.753	4376.7	8351.1	6479.1	2102.4	3.08	4290.7	2188.3	0.43
117.9	0.165	202	43.2	1857.6	2.79	0.97	6.24	5.748	4492.9	8467.3	6609.7	2116.8	3.12	4363.2	2246.4	0.41
121.4	0.170	203	43.1	1843.2	2.88	0.97	6.25	5.743	4509.7	8484.1	6640.9	2131.2	3.12	4386.1	2254.9	0.41

DU @ FAILURE	1857.6	DEVIATORIC STRESS @ FAILURE	4492.9	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.12

TECH	TW/AK
DATE	6/9/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Shelby Tube #1
SAMPLE TYPE	UD
DEPTH INTERVAL	Surface
MACHINE SPEED (in/min)	0.0015
STRAIN RATE (%/min)	0.03
CELL PRESSURE (psi)	85.2
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	55.2
PRESSURE, σ_3 (psf)	7948.8
FINAL "B" VALUE	-
t_{50} (minutes)	16.49

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.019	5.913	5.751
DIAMETER	7.059	2.779	2.797
AREA	39.14	6.07	6.15
VOLUME	587.79	35.87	35.34
WEIGHT (g)	1320.16		1311.56
% MOISTURE	14.7		13.99
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	140.1		
DRY DENSITY, calc (pcf)	122.1		
VOLUME OF SOLIDS	418.25		
VOLUME OF VOIDS	169.54		
VOID RATIO	0.405		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	124.0
VOLUME OF SOLIDS	418.25
VOLUME OF VOIDS	160.94
VOID RATIO	0.385

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1311.56
WT SOIL & TARE, DRY (g)	1150.60
WT TARE (g)	0.00
WT MOISTURE (g)	160.96
WT DRY SOIL (g)	1150.60
% MOISTURE	13.99

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.162	13	30.3	0.0	2.82	0.97	6.32	5.751	0.0	7948.8	7948.8	7948.8	1.00	7948.8	0.0	0.00
2.0	0.165	255	36.7	921.6	2.87	0.97	6.33	5.748	5500.7	13449.5	12527.9	7027.2	1.78	9777.6	2750.4	0.17
6.0	0.171	312	40.9	1526.4	2.97	0.97	6.33	5.742	6786.1	14734.9	13208.5	6422.4	2.06	9815.5	3393.1	0.22
12.0	0.180	372	45.3	2160.0	3.13	0.97	6.34	5.733	8148.4	16097.2	13937.2	5788.8	2.41	9863.0	4074.2	0.27
20.0	0.192	415	47.8	2520.0	3.34	0.97	6.36	5.721	9111.5	17060.3	14540.3	5428.8	2.68	9984.5	4555.7	0.28
30.0	0.207	456	49.4	2750.4	3.60	0.96	6.38	5.706	10004.0	17952.8	15202.4	5198.4	2.92	10200.4	5002.0	0.27
38.7	0.220	487	49.9	2822.4	3.83	0.96	6.39	5.693	10690.3	18639.1	15816.7	5126.4	3.09	10471.6	5345.2	0.26
42.0	0.225	500	49.9	2822.4	3.91	0.96	6.40	5.688	10959.8	18908.6	16086.2	5126.4	3.14	10606.3	5479.9	0.26
45.3	0.230	509	49.9	2822.4	4.00	0.96	6.40	5.683	11161.4	19110.2	16287.8	5126.4	3.18	10707.1	5580.7	0.25
48.7	0.235	519	49.8	2808.0	4.09	0.96	6.41	5.678	11371.5	19320.3	16512.3	5140.8	3.21	10826.5	5685.7	0.25
52.0	0.240	527	49.7	2793.6	4.17	0.96	6.41	5.673	11547.5	19496.3	16702.7	5155.2	3.24	10929.0	5773.8	0.24
55.3	0.245	536	49.6	2779.2	4.26	0.96	6.42	5.668	11730.0	19678.8	16899.6	5169.6	3.27	11034.6	5865.0	0.24
58.7	0.250	543	49.5	2764.8	4.35	0.96	6.43	5.663	11871.7	19820.5	17055.7	5184.0	3.29	11119.9	5935.9	0.23
62.0	0.255	551	49.3	2736.0	4.43	0.96	6.43	5.658	12037.8	19986.6	17250.6	5212.8	3.31	11231.7	6018.9	0.23
65.3	0.260	558	49.0	2692.8	4.52	0.95	6.44	5.653	12185.7	20134.5	17441.7	5256.0	3.32	11348.9	6092.9	0.22
68.7	0.265	565	48.9	2678.4	4.61	0.95	6.44	5.648	12344.5	20293.3	17614.9	5270.4	3.34	11442.7	6172.3	0.22
72.0	0.270	571	48.8	2664.0	4.69	0.95	6.45	5.643	12458.3	20407.1	17743.1	5284.8	3.36	11514.0	6229.2	0.21
75.3	0.275	580	48.4	2606.4	4.78	0.95	6.45	5.638	12638.8	20587.6	17981.2	5342.4	3.37	11661.8	6319.4	0.21
78.7	0.280	586	48.1	2563.2	4.87	0.95	6.46	5.633	12769.9	20718.7	18155.5	5385.6	3.37	11770.6	6385.0	0.20
82.0	0.285	593	47.9	2534.4	4.96	0.95	6.47	5.628	12918.6	20867.4	18333.0	5414.4	3.39	11873.7	6459.3	0.20

DU @ FAILURE	2736.0	DEVIATORIC STRESS @ FAILURE	12037.8	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.31

TECH	TW/AK
DATE	6/9/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Shelby Tube #1
SAMPLE TYPE	UD
DEPTH INTERVAL	Surface
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	126.5
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	96.5
PRESSURE, σ_3 (psf)	13896.0
FINAL "B" VALUE	-
t_{50} (minutes)	19.56

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.608	5.751	5.655
DIAMETER	7.105	2.797	2.804
AREA	39.65	6.15	6.17
VOLUME	579.19	35.34	34.91
WEIGHT (g)	1311.56		1304.46
% MOISTURE	14.0		13.37
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	141.3		
DRY DENSITY, calc (pcf)	124.0		
VOLUME OF SOLIDS	418.25		
VOLUME OF VOIDS	160.94		
VOID RATIO	0.385		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	125.5
VOLUME OF SOLIDS	418.25
VOLUME OF VOIDS	153.84
VOID RATIO	0.368

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1304.46
WT SOIL & TARE, DRY (g)	1150.60
WT TARE (g)	0.00
WT MOISTURE (g)	153.86
WT DRY SOIL (g)	1150.60
% MOISTURE	13.37

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.258	13.4	30.3	0.0	4.56	0.95	6.47	5.655	0.0	13896.0	13896.0	13896.0	1.00	13896.0	0.0	0
20.8	0.283	196.1	47.8	2520.0	5.00	0.95	6.50	5.630	4048.3	17944.3	15424.3	11376.0	1.36	13400.2	2024.2	0.62
21.7	0.284	234.4	50.2	2865.6	5.02	0.95	6.50	5.629	4896.1	18792.1	15926.5	11030.4	1.44	13478.4	2448.0	0.59
24.2	0.287	306.6	53.8	3384.0	5.08	0.95	6.50	5.626	6492.0	20388.0	17004.0	10512.0	1.62	13758.0	3246.0	0.52
26.7	0.290	368.3	56.5	3772.8	5.13	0.95	6.51	5.623	7853.7	21749.7	17976.9	10123.2	1.78	14050.1	3926.9	0.48
29.2	0.293	421.3	58.5	4060.8	5.18	0.95	6.51	5.620	9021.5	22917.5	18856.7	9835.2	1.92	14346.0	4510.8	0.45
31.7	0.296	458.5	59.6	4219.2	5.23	0.95	6.51	5.617	9838.8	23734.8	19515.6	9676.8	2.02	14596.2	4919.4	0.43
34.2	0.299	484.4	60.5	4348.8	5.29	0.95	6.52	5.614	10405.5	24301.5	19952.7	9547.2	2.09	14749.9	5202.7	0.42
36.7	0.302	505.5	61.0	4420.8	5.34	0.95	6.52	5.611	10865.5	24761.5	20340.7	9475.2	2.15	14908.0	5432.8	0.41
39.2	0.305	526.2	61.4	4478.4	5.39	0.95	6.53	5.608	11316.2	25212.2	20733.8	9417.6	2.20	15075.7	5658.1	0.40
41.7	0.308	543.5	61.7	4521.6	5.45	0.95	6.53	5.605	11691.4	25587.4	21065.8	9374.4	2.25	15220.1	5845.7	0.39
44.2	0.311	561.5	61.9	4550.4	5.50	0.95	6.53	5.602	12081.6	25977.6	21427.2	9345.6	2.29	15386.4	6040.8	0.38
64.2	0.335	681.8	62.7	4665.6	5.92	0.94	6.56	5.578	14667.2	28563.2	23897.6	9230.4	2.59	16564.0	7333.6	0.32
82.5	0.357	761.9	61.8	4536.0	6.31	0.94	6.59	5.556	16357.0	30253.0	25717.0	9360.0	2.75	17538.5	8178.5	0.28
104.2	0.383	819.8	59.7	4233.6	6.77	0.93	6.62	5.530	17535.8	31431.8	27198.2	9662.4	2.81	18430.3	8767.9	0.24
125.8	0.409	865.6	57.1	3859.2	7.23	0.93	6.65	5.504	18440.4	32336.4	28477.2	10036.8	2.84	19257.0	9220.2	0.21
146.7	0.434	904.0	54.5	3484.8	7.67	0.92	6.69	5.479	19179.4	33075.4	29590.6	10411.2	2.84	20000.9	9589.7	0.18
166.7	0.458	937.4	51.7	3081.6	8.10	0.92	6.72	5.455	19807.3	33703.3	30621.7	10814.4	2.83	20718.0	9903.6	0.16
185.8	0.481	966.4	49.2	2721.6	8.51	0.91	6.75	5.432	20338.5	34234.5	31512.9	11174.4	2.82	21343.6	10169.2	0.13
207.5	0.507	993.8	46.6	2347.2	8.97	0.91	6.78	5.406	20818.1	34714.1	32366.9	11548.8	2.80	21957.9	10409.1	0.11
229.2	0.533	1019.0	44.1	1987.2	9.43	0.91	6.82	5.380	21245.4	35141.4	33154.2	11908.8	2.78	22531.5	10622.7	0.09
250.0	0.558	1042.7	41.2	1569.6	9.87	0.90	6.85	5.355	21639.9	35535.9	33966.3	12326.4	2.76	23146.4	10820.0	0.07
288.3	0.604	1080.3	37.1	979.2	10.68	0.89	6.91	5.309	22228.0	36124.0	35144.8	12916.8	2.72	24030.8	11114.0	0.04
333.3	0.658	1114.8	33.1	403.2	11.64	0.88	6.99	5.255	22701.5	36597.5	36194.3	13492.8	2.68	24843.5	11350.7	0.02
374.2	0.707	1142.3	29.5	-115.2	12.50	0.87	7.06	5.206	23040.1	36936.1	37051.3	14011.2	2.64	25531.3	11520.1	0.00
414.2	0.755	1165.6	26.4	-561.6	13.35	0.87	7.12	5.158	23287.5	37183.5	37745.1	14457.6	2.61	26101.4	11643.8	-0.02
458.3	0.808	1187.4	23.8	-936.0	14.29	0.86	7.20	5.105	23471.5	37367.5	38303.5	14832.0	2.58	26567.7	11735.7	-0.04
496.7	0.854	1204.3	21.4	-1281.6	15.10	0.85	7.27	5.059	23583.4	37479.4	38761.0	15177.6	2.55	26969.3	11791.7	-0.05
540.0	0.906	1223.9	19.4	-1569.6	16.02	0.84	7.35	5.007	23711.9	37607.9	39177.5	15465.6	2.53	27321.6	11856.0	-0.07
621.7	1.004	1254.7	16.0	-2059.2	17.75	0.82	7.51	4.909	23813.5	37709.5	39768.7	15955.2	2.49	27861.9	11906.7	-0.09

DU @ FAILURE	3859.2	DEVIATORIC STRESS @ FAILURE	18440.4	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.84

TECH	TW/AK
DATE	6/9/09
CHECKED	AK
REVIEWED	

ONE-DIMENSIONAL CONSOLIDATION
ASTM D 2435 Method B

PROJECT NAME	GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Shelby Tube #4
SAMPLE DEPTH	Surface
SAMPLE TYPE	UD

DESCRIPTION: Pale Red, SILTY CLAY, little medium to fine sand.

CLASSIFICATION: CL

CONSOLIDOMETER #: 1

ASTM D 2435 Method: B

LL	38
PL	21
PI	17
Gs	2.718

Sample Data	Trimmings	Before Test	After Test
Tare plus wet soil, g	403.19	201.88	203.63
Tare plus dry soil, g	350.48	182.75	182.75
Tare, g	51.97	74.40	74.40
Water, g	52.71	19.13	20.88
Dry soil, g	298.51	108.35	108.35
Water Content	17.7%	17.7%	19.3%

Diameter (in)	2.503
Height of sample (in)	0.754
Area of sample (in^2)	4.921
Volume of sample (in^3)	3.710
Water Content	17.7%
Sample Wt (wet, g)	127.48
Sample Wt (dry, g)	108.35
Water Wt (g)	19.13

Sample Data	Initial	Final
Total Heights (in)	0.754	0.754
Height of solids (in)	0.495	0.495
Height of voids (in)	0.259	0.259
Height of water (in)	0.237	0.259
Void ratio	0.524	0.524
Degree of saturation	91.5%	99.9%
Dry unit wt (pcf)	111.3	111.3
Wet unit wt (pcf)	130.9	132.7

PRESSURE (ksf)	H100 DIAL READING	MACHINE / STONE CORR.	DIAL CHANGE (in)	FITTING TIME (sec) t90	SAMPLE HEIGHT (in)	HEIGHT OF VOIDS Hv	VOID RATIO e	CHANGE IN HEIGHT (accum)	STRAIN %	LENGTH OF DRAINAGE PATH (DOUBLE DRAINAGE) H (in)	LENGTH OF DRAINAGE PATH (DOUBLE DRAINAGE) H^2 (cm^2)	PERCENT INITIAL COMPRESSION	COEFFICIENT OF CONSOLIDATION (ft^2/day)
0.125	0.0004	0.0000	0.0000	0	0.754	0.2594	0.5245	0.0000	0.0	0.000	0.000	0.0	0.0
0.126	0.0004	0.0000	0.0000	6	0.754	0.2594	0.5245	0.0000	0.0	0.377	0.917	0.0	0.0
0.250	0.0005	0.0000	0.0001	6	0.754	0.2593	0.5243	0.0001	0.0	0.377	0.917	100.0	11.8
0.500	0.0020	0.0000	0.0016	25	0.752	0.2578	0.5212	0.0016	0.2	0.377	0.915	60.0	2.9
1.000	0.0031	0.0000	0.0027	54	0.751	0.2567	0.5191	0.0027	0.4	0.376	0.912	52.1	1.3
2.000	0.0062	0.0000	0.0058	54	0.748	0.2536	0.5128	0.0058	0.8	0.375	0.907	54.1	1.3
4.000	0.0113	0.0000	0.0109	58	0.743	0.2485	0.5025	0.0109	1.4	0.373	0.897	51.0	1.2
8.000	0.0184	0.0000	0.0180	89	0.736	0.2414	0.4881	0.0180	2.4	0.370	0.882	48.3	0.8
16.000	0.0264	0.0000	0.0260	60	0.728	0.2334	0.4720	0.0260	3.4	0.366	0.864	49.6	1.1
4.000	0.0212	0.0000	0.0208	98	0.733	0.2386	0.4824	0.0208	2.8	0.365	0.861	59.5	0.7
1.000	0.0143	0.0000	0.0139	265	0.740	0.2455	0.4964	0.0139	1.8	0.368	0.875	24.6	0.3
0.250	0.0073	0.0000	0.0069	611	0.747	0.2526	0.5106	0.0069	0.9	0.372	0.892	14.7	0.1

FINAL DIAL READING = 0.0000

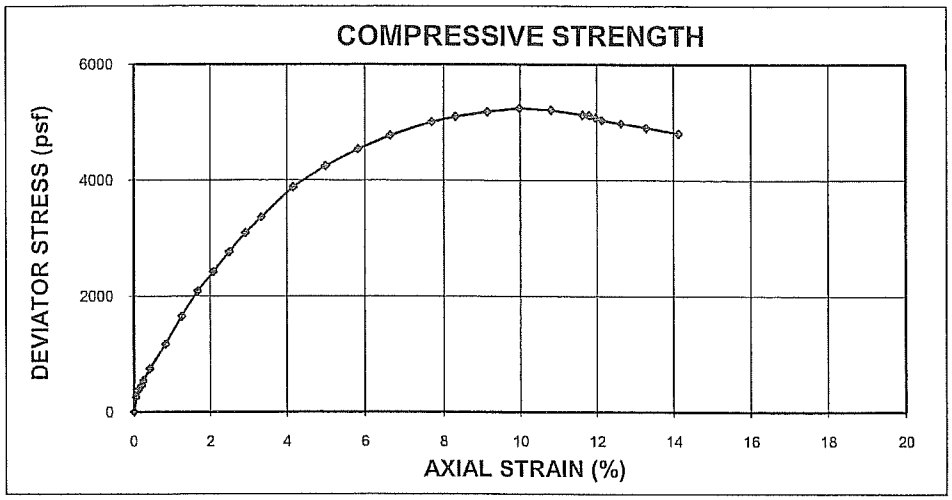
TECH	SW/TPC/AK
DATE	6/9/09
CHECK	AJC
REVIEW	[signature]

JUNE 2009

093-90136

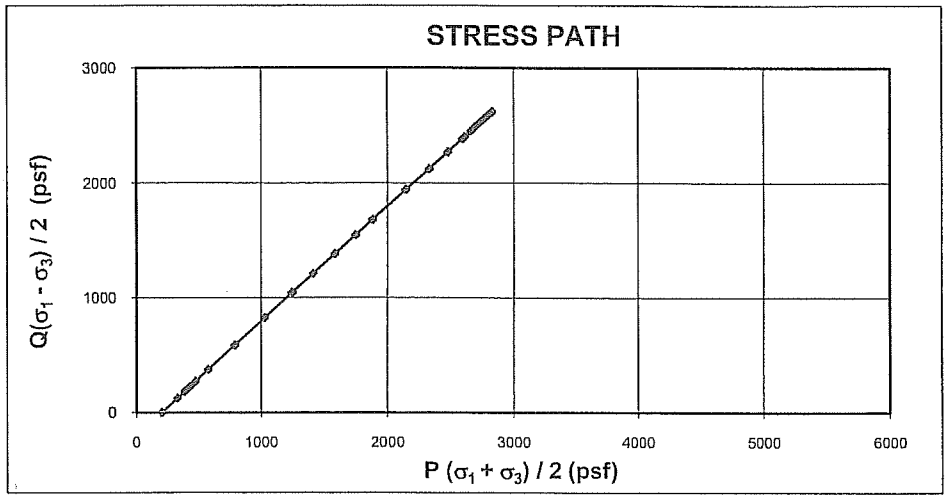
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH OF SOILS
ASTM D 2850

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: Shelby Tube #2 **Depth:** - **Sample Type:** UD

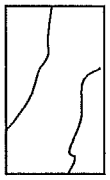


Specimen	Confining Pressure (psf)	Dry Density (pcf)	Moisture Content (%)
1	201.6	117.0	14.1
	AVERAGE	117.0	14.1

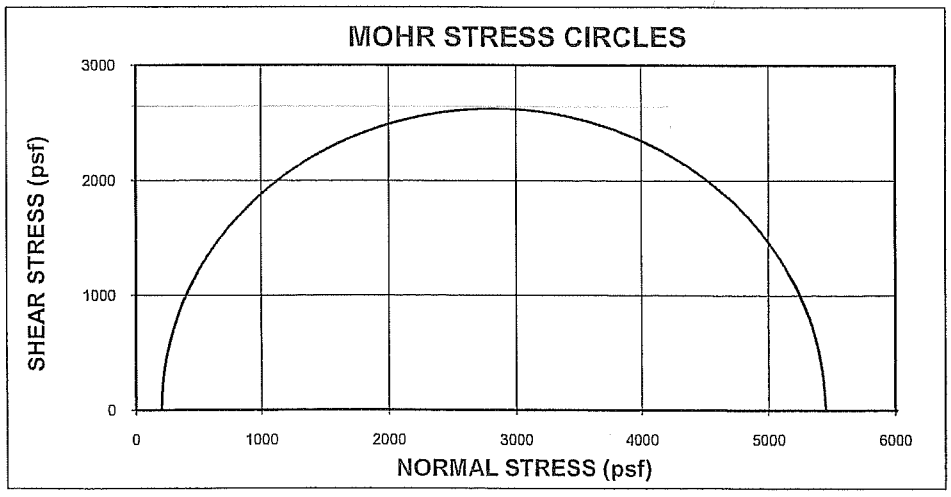
Specimen	Normal Stress @ Failure (psf)	Axial Strain @ Failure (%)	Rate of Axial Strain (in/min.)
1	5446	10.0	0.06



FAILURE SKETCH



STRESS PATH RESULTS		
α	=	°
a	=	psf



MOHR STRESS RESULTS		
ϕ	=	°
C	=	psf

Soil Description

Reddish Brown, SILTY CLAY, some fine sand, trace fine gravel.

USCS (CL)

Comments

TECH	TW
DATE	6/19/09
CHECK	AK
REVIEW	

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH OF SOILS
ASTM D 2850

SPECIMEN 1

DATE	JUNE 2009			
PROJECT NAME:	GEOSYNTEC/MILLENNIUM/MD			
JOB NUMBER	093-90136			
SAMPLE ID	Shelby Tube #2			
Sample Type	UD	Sample Depth	-	

MACHINE SPEED	0.06	in/min
STRAIN RATE	1.00	%/min
CONFINING PRES.	1.4	psi

INITIAL SAMPLE DATA

HEIGHT	6.020	in	15.286	cm
DIAMETER	2.836	in	7.203	cm
AREA	6.32	in^2	40.75	cm^2
VOLUME	38.03	in^3	623.16	cm^3
WEIGHT	1332.99	g		
% MOISTURE	14.15			
SPECIFIC GRAVITY	2.664			
WET DENSITY	133.54	pcf		
DRY DENSITY, calc	116.99	pcf		
VOLUME OF SOLIDS	438.36	cm^3		
VOLUME OF VOIDS	184.80	cm^3		
VOID RATIO	0.42			
% SATURATION	89.39			

CORRECTED SAMPLE DATA

HEIGHT	6.018	in
DIAMETER	2.836	in
AREA	6.32	in^2
VOLUME	38.03	in^3

WATER CONTENT

WT SOIL & TARE, WET	1510.64	g
WT SOIL & TARE, DRY	1345.46	g
WT TARE	177.73	g
WT MOISTURE	165.18	g
WT DRY SOIL	1167.73	g
% MOISTURE	14.15	

TIME (min)	ACCUMULATED DEFLECT (inch)	AXIAL LOAD (lbs)	e % STRAIN (in/in)	CORRECTED AREA (in^2)	DEVIATOR STRESS (psf)	(σ_1) devstr+cp (psf)	$\frac{(\sigma_1+\sigma_3)}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)
0.0	0.000	4.6	0.0	6.32	0.00	201.60	201.60	0.00
0.1	0.003	15.6	0.0	6.32	250.55	452.15	326.87	125.27
0.1	0.006	20.6	0.1	6.33	364.25	565.85	383.73	182.13
0.1	0.009	22.9	0.1	6.33	416.41	618.01	409.81	208.21
0.2	0.012	24.5	0.2	6.33	452.59	654.19	427.89	226.29
0.3	0.015	28.3	0.2	6.33	538.74	740.34	470.97	269.37
0.4	0.025	37.4	0.4	6.35	744.36	945.96	573.78	372.18
0.8	0.050	56.5	0.8	6.37	1172.90	1374.50	788.05	586.45
1.3	0.075	77.9	1.2	6.40	1649.59	1851.19	1026.39	824.79
1.7	0.100	97.7	1.7	6.43	2086.37	2287.97	1244.78	1043.18
2.1	0.125	113.0	2.1	6.45	2418.98	2620.58	1411.09	1209.49
2.5	0.150	129.0	2.5	6.48	2764.25	2965.85	1583.73	1382.13
2.9	0.175	144.3	2.9	6.51	3091.01	3292.61	1747.10	1545.50
3.3	0.200	157.2	3.3	6.54	3361.99	3563.59	1882.60	1681.00
4.2	0.250	182.4	4.2	6.59	3883.53	4085.13	2143.37	1941.77
5.0	0.300	200.7	5.0	6.65	4246.13	4447.73	2324.66	2123.06
5.8	0.350	216.0	5.8	6.71	4537.40	4739.00	2470.30	2268.70
6.7	0.400	229.0	6.6	6.77	4773.96	4975.56	2588.58	2386.98
7.7	0.463	242.7	7.7	6.85	5008.63	5210.23	2705.92	2504.32
8.3	0.500	248.8	8.3	6.89	5102.75	5304.35	2752.97	2551.37
9.2	0.550	254.9	9.1	6.95	5182.84	5384.44	2793.02	2591.42
10.0	0.600	260.2	10.0	7.02	5244.20	5445.80	2823.70	2622.10
10.8	0.650	261.0	10.8	7.08	5212.09	5413.69	2807.64	2606.04
11.7	0.700	259.5	11.6	7.15	5133.35	5334.95	2768.27	2566.67
11.8	0.710	259.5	11.8	7.16	5123.70	5325.30	2763.45	2561.85
12.0	0.720	258.0	12.0	7.18	5083.96	5285.56	2743.58	2541.98
12.2	0.730	256.4	12.1	7.19	5042.32	5243.92	2722.76	2521.16
12.7	0.760	254.9	12.6	7.23	4983.86	5185.46	2693.53	2491.93
13.3	0.800	252.9	13.3	7.29	4906.44	5108.04	2654.82	2453.22
14.2	0.850	250.3	14.1	7.36	4808.56	5010.16	2605.88	2404.28

Time to Failure	10.0
Deflection @ Failure	0.600
% Strain @ Failure	10.0

*NORMAL STRESS @ FAILURE 5445.80 psf

TECH	TW
DATE	6/19/09
CHECK	AIC
REVIEW	DA

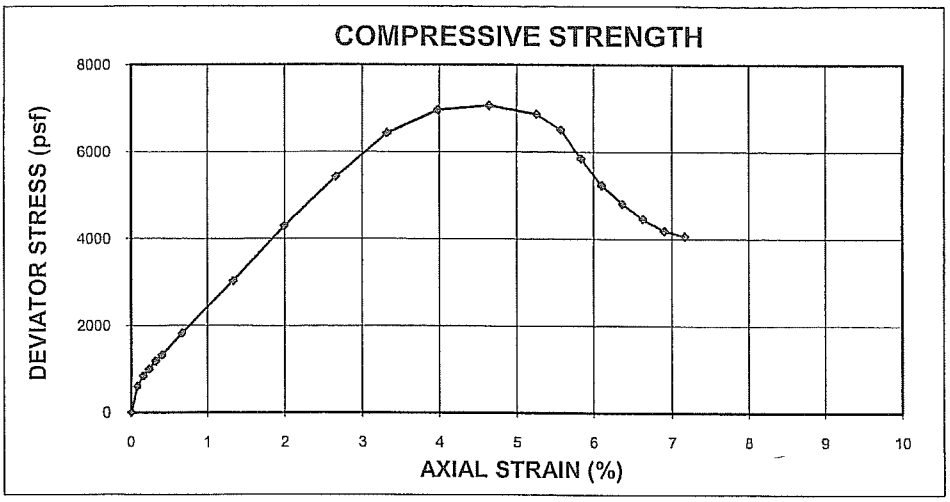
JUNE 2009

093-90136

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH OF SOILS

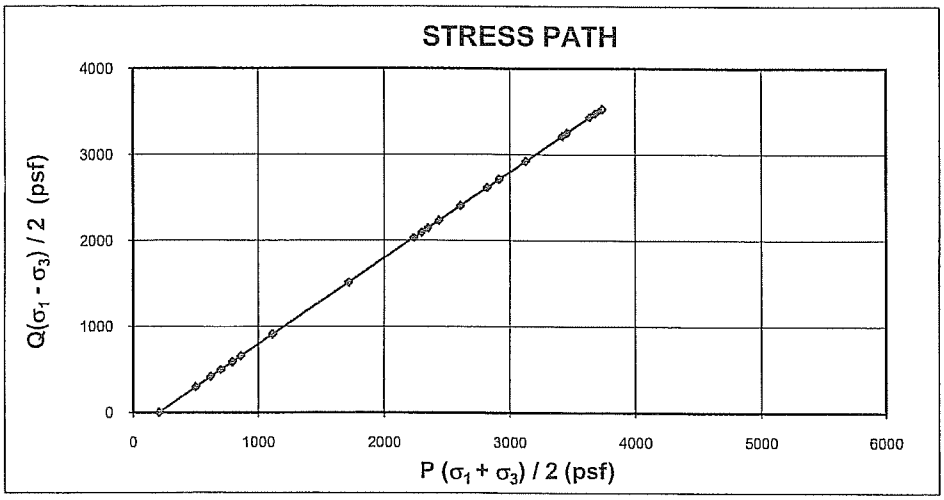
ASTM D 2850

PROJECT NAME: GEOSYNTEC/MILLENNIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: Shelby Tube #4 **Depth:** Surface **Sample Type:** UD



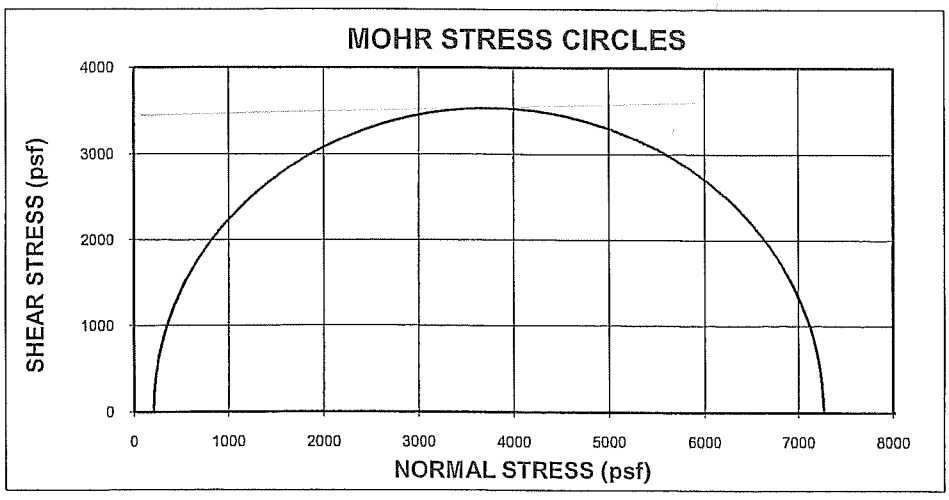
Specimen	Confining Pressure (psf)	Dry Density (pcf)	Moisture Content (%)
1	201.6	117.1	16.5
	AVERAGE	117.1	16.5

Specimen	Normal Stress @ Failure (psf)	Axial Strain @ Failure (%)	Rate of Axial Strain (in/min.)
1	7264	4.6	0.03



FAILURE SKETCH

STRESS PATH RESULTS		
α	=	°
a	=	psf



MOHR STRESS RESULTS		
ϕ	=	°
C	=	psf

Soil Description

Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

Comments

TECH	TW
DATE	6/19/09
CHECK	HV
REVIEW	DA

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH OF SOILS
ASTM D 2850

SPECIMEN 1

DATE	JUNE 2009				
PROJECT NAME:	GEOSYNTEC/MILLENNIUM/MD				
MACHINE SPEED	0.03	in/min	JOB NUMBER	093-90136	
STRAIN RATE	0.80	%/min	SAMPLE ID	Shelby Tube #4	
CONFINING PRES.	1.4	psi	Sample Type	UD	Sample Depth Surface

INITIAL SAMPLE DATA

HEIGHT	3.770	in	9.573	cm
DIAMETER	1.874	in	4.760	cm
AREA	2.76	in^2	17.79	cm^2
VOLUME	10.40	in^3	170.40	cm^3
WEIGHT		372.39	g	
% MOISTURE		16.50		
SPECIFIC GRAVITY		2.718		
WET DENSITY		136.43	pcf	
DRY DENSITY, calc		117.10	pcf	
VOLUME OF SOLIDS		117.60	cm^3	
VOLUME OF VOIDS		52.80	cm^3	
VOID RATIO		0.45		
% SATURATION		99.9		

CORRECTED SAMPLE DATA

HEIGHT	3.769	in
DIAMETER	1.874	in
AREA	2.76	in^2
VOLUME	10.40	in^3

WATER CONTENT

WT SOIL & TARE, WET	372.39	g
WT SOIL & TARE, DRY	319.65	g
WT TARE	0.00	g
WT MOISTURE	52.74	g
WT DRY SOIL	319.65	g
% MOISTURE	16.50	

TIME (min)	ACCUMULATED DEFLECT (inch)	AXIAL LOAD (lbs)	e % STRAIN (in/in)	CORRECTED AREA (in^2)	DEVIATOR STRESS (psf)	(σ_1) devstr+cp (psf)	$\frac{(\sigma_1+\sigma_3)}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)
0.0	0.000	5.4	0.0	2.76	0.00	201.60	201.60	0.00
0.1	0.003	16.8	0.1	2.76	594.53	796.13	498.87	297.27
0.2	0.006	21.4	0.2	2.76	833.77	1035.37	618.49	416.89
0.3	0.009	24.5	0.2	2.77	994.55	1196.15	698.87	497.27
0.4	0.012	28.0	0.3	2.77	1175.82	1377.42	789.51	587.91
0.5	0.015	30.6	0.4	2.77	1310.05	1511.65	856.62	655.02
0.8	0.025	40.5	0.7	2.78	1819.85	2021.45	1111.53	909.93
1.7	0.050	64.1	1.3	2.80	3023.14	3224.74	1713.17	1511.57
2.5	0.075	89.3	2.0	2.81	4291.94	4493.54	2347.57	2145.97
3.3	0.100	112.2	2.7	2.83	5426.43	5628.03	2914.81	2713.21
4.2	0.125	132.8	3.3	2.85	6429.01	6630.61	3416.10	3214.50
5.0	0.150	144.3	4.0	2.87	6961.26	7162.86	3682.23	3480.63
5.8	0.175	147.3	4.6	2.89	7062.50	7264.10	3732.85	3531.25
6.6	0.198	144.3	5.3	2.91	6868.95	7070.55	3636.08	3434.48
7.0	0.210	137.4	5.6	2.92	6505.80	6707.40	3454.50	3252.90
7.3	0.220	124.4	5.8	2.93	5848.60	6050.20	3125.90	2924.30
7.7	0.230	112.2	6.1	2.94	5234.21	5435.81	2818.71	2617.11
8.0	0.240	103.8	6.4	2.95	4808.91	5010.51	2606.06	2404.46
8.3	0.250	97.0	6.6	2.95	4463.91	4665.51	2433.55	2231.95
8.7	0.260	91.6	6.9	2.96	4188.82	4390.42	2296.01	2094.41
9.0	0.270	89.3	7.2	2.97	4065.43	4267.03	2234.32	2032.72

Time to Failure	5.8
Deflection @ Failure	0.175
% Strain @ Failure	4.6

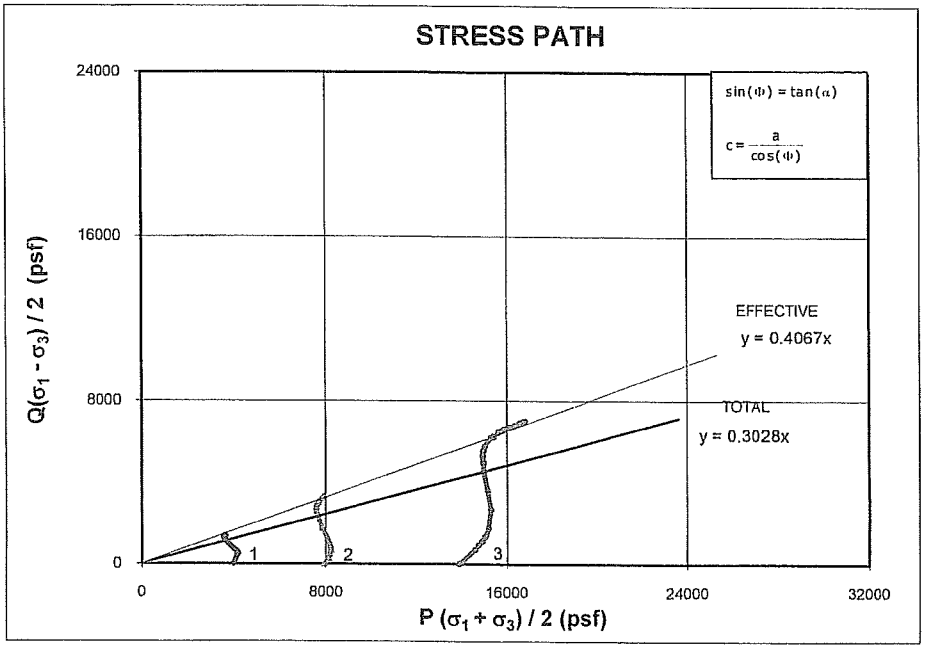
*NORMAL STRESS @ FAILURE 7264.10 psf

TECH	TW
DATE	6/19/09
CHECK	
REVIEW	

APPENDIX D
Triaxial Testing Results-Remolded or Bulk Specimen

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

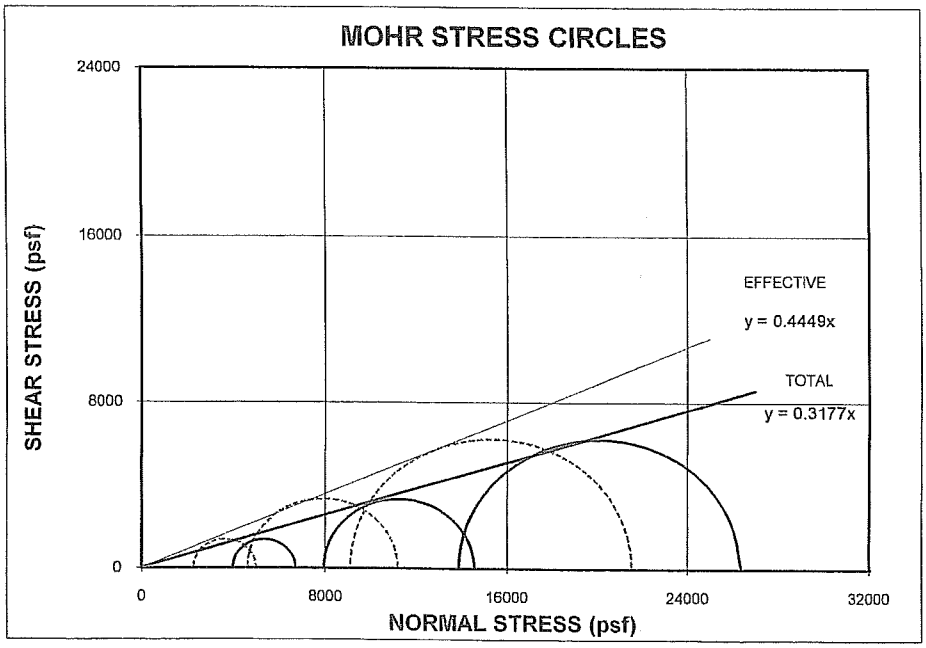
PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Middle of Stockpile 90%** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	100.3	14.1
2	7949	109.3	19.4
3	13896	111.7	18.1

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.04	55.7	95.5
2	0.02	95.5	95.2
3	0.02	95.2	94.9

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	16.8 °	ϕ	=	17.6 °
a	=	0.0 psf	c	=	0.0 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	22.1 °	ϕ '	=	24.0 °
a '	=	0.0 psf	c '	=	0.0 psf



Soil Description

Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

LL	PL	PI
36	21	15

Comments

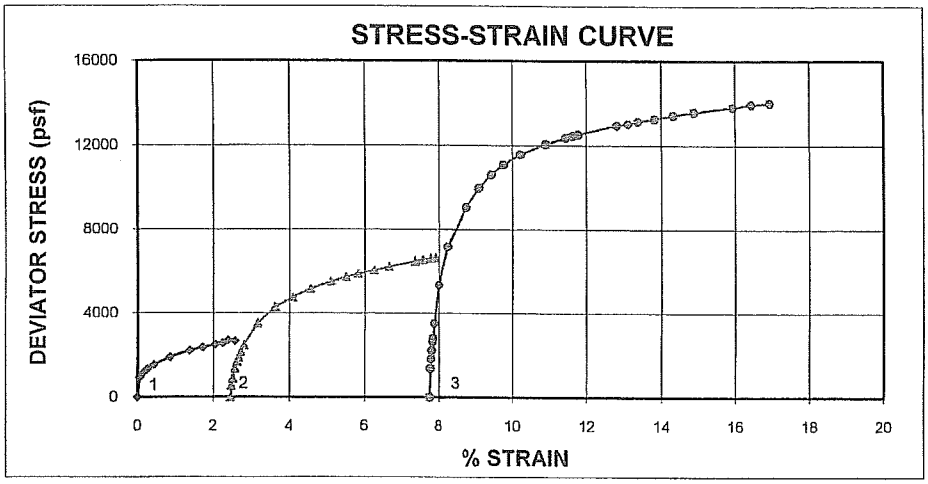
Sample was remolded to approx. 90% of the Max Dry Density, @ -2.1% of Opt. Moisture Content.

*** Failure based on effective stress ratio.**

CHECK AK
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Middle of Stockpile 90%** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
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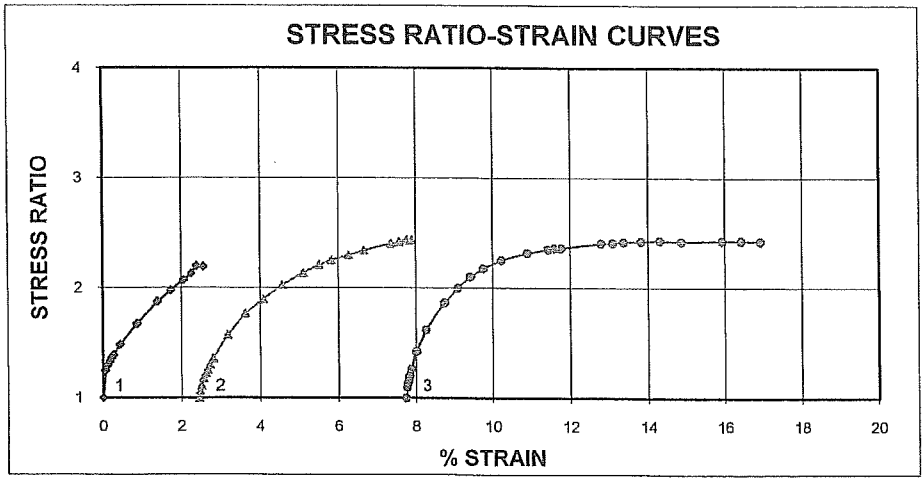
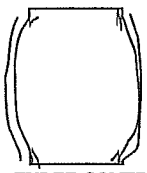
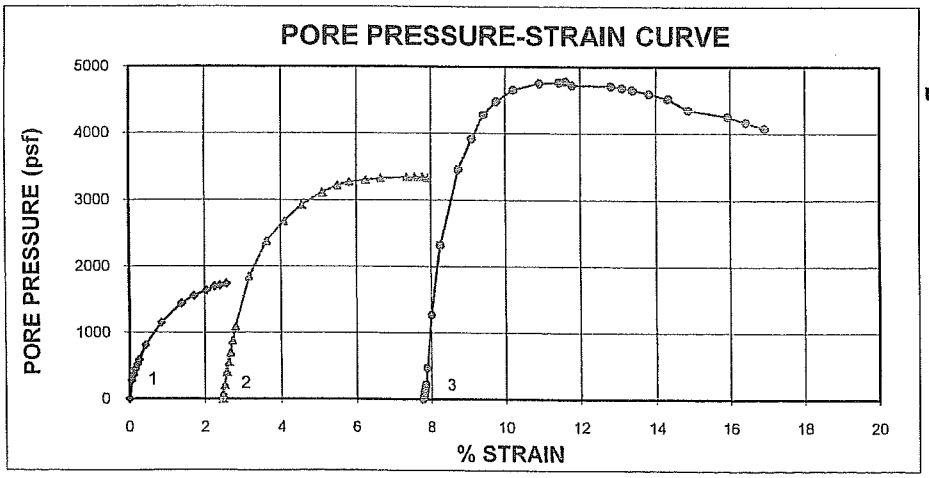
2	7949	109.3	19.4
3	13896	111.7	18.1



FAILURE SKETCH



1 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

LL	PL	PI
36	21	15

Comments

Sample was remolded to approx. 90% of the Max Dry Density, @ -2.1% of Opt. Moisture Content.

*** Failure based on effective stress ratio.**

CHECK
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0024
STRAIN RATE (%/min)	0.04
CELL PRESSURE (psi)	57.6
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.6
PRESSURE, σ_3 (psf)	3974.4
FINAL "B" VALUE	0.97
t_{50} (minutes)	10.02
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.250	6.004	5.840
DIAMETER	7.087	2.790	2.711
AREA	39.44	6.11	5.77
VOLUME	601.51	36.71	33.71
WEIGHT (g)	1103.90		1154.80
% MOISTURE	14.1		19.39
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	114.5		
DRY DENSITY, calc (pcf)	100.3		
VOLUME OF SOLIDS	356.00		
VOLUME OF VOIDS	245.51		
VOID RATIO	0.690		
SATURATION	55.7		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	109.3
VOLUME OF SOLIDS	356.00
VOLUME OF VOIDS	196.41
VOID RATIO	0.552

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1154.80
WT SOIL & TARE, DRY (g)	967.25
WT TARE (g)	0.00
WT MOISTURE (g)	187.55
WT DRY SOIL (g)	967.25
% MOISTURE	19.39

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	4	30.5	0.0	0.00	1.00	5.77	5.840	0.0	3974.4	3974.4	3974.4	1.00	3974.4	0.0	0.00
1.3	0.003	41	32.4	273.6	0.05	1.00	5.78	5.837	917.6	4892.0	4618.4	3700.8	1.25	4159.6	458.8	0.30
2.5	0.006	47	33.0	360.0	0.10	1.00	5.78	5.834	1069.1	5043.5	4683.5	3614.4	1.30	4149.0	534.6	0.34
3.8	0.009	51	33.6	446.4	0.15	1.00	5.78	5.831	1170.7	5145.1	4698.7	3528.0	1.33	4113.4	585.4	0.38
5.0	0.012	54	34.1	518.4	0.21	1.00	5.78	5.828	1254.7	5229.1	4710.7	3456.0	1.36	4083.4	627.4	0.41
6.3	0.015	57	34.6	590.4	0.26	1.00	5.79	5.825	1318.8	5293.2	4702.8	3384.0	1.39	4043.4	659.4	0.45
10.4	0.025	66	36.1	806.4	0.43	1.00	5.80	5.815	1532.6	5507.0	4700.6	3168.0	1.48	3934.3	766.3	0.53
20.8	0.050	81	38.5	1152.0	0.86	0.99	5.82	5.790	1897.1	5871.5	4719.5	2822.4	1.67	3770.9	948.5	0.61
33.8	0.081	94	40.5	1440.0	1.39	0.99	5.85	5.759	2219.0	6193.4	4753.4	2534.4	1.88	3643.9	1109.5	0.65
42.1	0.101	100	41.3	1555.2	1.73	0.98	5.87	5.739	2358.4	6332.8	4777.6	2419.2	1.97	3598.4	1179.2	0.66
50.0	0.120	106	41.9	1641.6	2.05	0.98	5.89	5.720	2499.6	6474.0	4832.4	2332.8	2.07	3582.6	1249.8	0.66
55.0	0.132	110	42.3	1699.2	2.26	0.98	5.91	5.708	2574.9	6549.3	4850.1	2275.2	2.13	3562.6	1287.4	0.66
58.3	0.140	116	42.4	1713.6	2.40	0.98	5.91	5.700	2714.9	6689.3	4975.7	2260.8	2.20	3618.3	1357.5	0.63
62.5	0.150	114	42.6	1742.4	2.57	0.97	5.92	5.690	2668.8	6643.2	4900.8	2232.0	2.20	3566.4	1334.4	0.65

DU @ FAILURE	1713.6	DEVIATORIC STRESS @ FAILURE	2714.9	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.20

TECH	TW/AK
DATE	6/12/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0013
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	85.2
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	55.2
PRESSURE, σ_3 (psf)	7948.8
FINAL "B" VALUE	-
t_{50} (minutes)	18.97

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.834	5.840	5.700
DIAMETER	6.886	2.711	2.713
AREA	37.24	5.77	5.78
VOLUME	552.41	33.71	32.96
WEIGHT (g)	1154.80		1142.50
% MOISTURE	19.4		18.12
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	130.4		
DRY DENSITY, calc (pcf)	109.3		
VOLUME OF SOLIDS	356.00		
VOLUME OF VOIDS	196.41		
VOID RATIO	0.552		
SATURATION	95.5		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	111.7
VOLUME OF SOLIDS	356.00
VOLUME OF VOIDS	184.11
VOID RATIO	0.517

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1142.50
WT SOIL & TARE, DRY (g)	967.25
WT TARE (g)	0.00
WT MOISTURE (g)	175.25
WT DRY SOIL (g)	967.25
% MOISTURE	18.12

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.140	18	30.5	0.0	2.46	0.98	5.93	5.700	0.0	7948.8	7948.8	7948.8	1.00	7948.8	0.0	0.00
0.8	0.141	39	31.0	72.0	2.47	0.98	5.93	5.699	512.5	8461.3	8389.3	7876.8	1.07	8133.0	256.2	0.14
2.3	0.143	54	31.9	201.6	2.51	0.97	5.93	5.697	878.9	8827.7	8626.1	7747.2	1.11	8186.6	439.4	0.23
4.6	0.146	74	33.3	403.2	2.56	0.97	5.93	5.694	1358.9	9307.7	8904.5	7545.6	1.18	8225.0	679.4	0.30
6.9	0.149	86	34.3	547.2	2.61	0.97	5.94	5.691	1658.9	9607.7	9060.5	7401.6	1.22	8231.0	829.4	0.33
9.2	0.152	95	35.3	691.2	2.67	0.97	5.94	5.688	1878.5	9827.3	9136.1	7257.6	1.26	8196.9	939.3	0.37
11.5	0.155	106	36.6	878.4	2.72	0.97	5.94	5.685	2141.6	10090.4	9212.0	7070.4	1.30	8141.2	1070.8	0.41
15.4	0.160	120	38.1	1094.4	2.81	0.97	5.95	5.680	2466.4	10415.2	9320.8	6854.4	1.36	8087.6	1233.2	0.44
31.5	0.181	163	43.3	1843.2	3.18	0.97	5.97	5.659	3508.4	11457.2	9614.0	6105.6	1.57	7859.8	1754.2	0.53
51.5	0.207	196	47.0	2376.0	3.63	0.96	6.00	5.633	4276.6	12225.4	9849.4	5572.8	1.77	7711.1	2138.3	0.56
71.5	0.233	216	49.1	2678.4	4.09	0.96	6.03	5.607	4731.7	12680.5	10002.1	5270.4	1.90	7636.3	2365.9	0.57
92.3	0.260	234	50.8	2923.2	4.56	0.95	6.06	5.580	5138.5	13087.3	10164.1	5025.6	2.02	7594.9	2569.3	0.57
116.2	0.291	250	52.1	3110.4	5.11	0.95	6.09	5.549	5489.7	13438.5	10328.1	4838.4	2.13	7583.3	2744.9	0.57
133.8	0.314	261	52.8	3211.2	5.51	0.94	6.12	5.526	5715.8	13664.6	10453.4	4737.6	2.21	7595.5	2857.9	0.56
147.7	0.332	268	53.2	3268.8	5.82	0.94	6.14	5.508	5863.2	13812.0	10543.2	4680.0	2.25	7611.6	2931.6	0.56
166.9	0.357	276	53.4	3297.6	6.26	0.94	6.17	5.483	6029.7	13978.5	10680.9	4651.2	2.30	7666.0	3014.8	0.55
184.6	0.380	284	53.6	3326.4	6.67	0.93	6.20	5.460	6194.3	14143.1	10816.7	4622.4	2.34	7719.6	3097.2	0.54
215.4	0.420	298	53.7	3340.8	7.37	0.93	6.24	5.420	6470.7	14419.5	11078.7	4608.0	2.40	7843.3	3235.3	0.52
224.6	0.432	302	53.7	3340.8	7.58	0.92	6.26	5.408	6541.2	14490.0	11149.2	4608.0	2.42	7878.6	3270.6	0.51
233.1	0.443	306	53.7	3340.8	7.77	0.92	6.27	5.397	6614.8	14563.6	11222.8	4608.0	2.44	7915.4	3307.4	0.51
239.2	0.451	307	53.6	3326.4	7.91	0.92	6.28	5.389	6634.5	14583.3	11256.9	4622.4	2.44	7939.7	3317.3	0.50

DU @ FAILURE	3340.8	DEVIATORIC STRESS @ FAILURE	6614.8	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.44

TECH	TW/AK
DATE	6/12/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0011
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	126.5
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	96.5
PRESSURE, σ_3 (psf)	13896.0
FINAL "B" VALUE	-
t_{50} (minutes)	21.31

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.478	5.700	5.420
DIAMETER	6.892	2.713	2.752
AREA	37.31	5.78	5.95
VOLUME	540.11	32.96	32.23
WEIGHT (g)	1142.50		1130.60
% MOISTURE	18.1		16.89
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	132.0		
DRY DENSITY, calc (pcf)	111.7		
VOLUME OF SOLIDS	356.00		
VOLUME OF VOIDS	184.11		
VOID RATIO	0.517		
SATURATION	95.2		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	114.3
VOLUME OF SOLIDS	356.00
VOLUME OF VOIDS	172.21
VOID RATIO	0.484

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1130.60
WT SOIL & TARE, DRY (g)	967.25
WT TARE (g)	0.00
WT MOISTURE (g)	163.35
WT DRY SOIL (g)	967.25
% MOISTURE	16.89

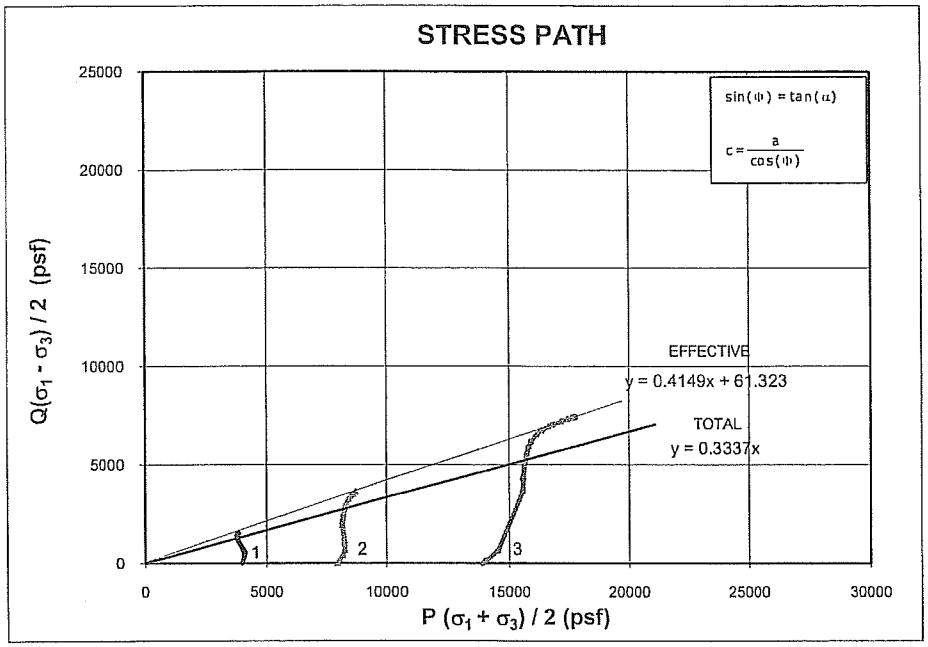
TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.420	19.0	30.5	0.0	7.75	0.92	6.45	5.420	0.0	13896.0	13896.0	13896.0	1.00	13896.0	0.0	0
0.9	0.421	79.9	30.5	0.0	7.77	0.92	6.45	5.419	1360.1	15256.1	15256.1	13896.0	1.10	14576.0	680.0	0.00
1.8	0.422	100.6	30.9	57.6	7.79	0.92	6.45	5.418	1822.0	15718.0	15660.4	13838.4	1.13	14749.4	911.0	0.03
2.7	0.423	119.0	31.3	115.2	7.80	0.92	6.45	5.417	2232.4	16128.4	16013.2	13780.8	1.16	14897.0	1116.2	0.05
3.6	0.424	136.7	31.8	187.2	7.82	0.92	6.45	5.416	2627.0	16523.0	16335.8	13708.8	1.19	15022.3	1313.5	0.07
4.5	0.425	145.0	32.0	216.0	7.84	0.92	6.45	5.415	2811.7	16707.7	16491.7	13680.0	1.21	15085.8	1405.8	0.08
6.4	0.427	175.8	33.7	460.8	7.88	0.92	6.46	5.413	3497.6	17393.6	16932.8	13435.2	1.26	15184.0	1748.8	0.13
12.7	0.434	258.9	39.3	1267.2	8.01	0.92	6.46	5.406	5343.7	19239.7	17972.5	12628.8	1.42	15300.7	2671.9	0.24
24.5	0.447	341.2	46.6	2318.4	8.25	0.92	6.48	5.393	7158.2	21054.2	18735.8	11577.6	1.62	15156.7	3579.1	0.32
49.1	0.474	428.4	54.5	3456.0	8.75	0.91	6.52	5.366	9046.1	22942.1	19486.1	10440.0	1.87	14963.1	4523.1	0.38
66.4	0.493	472.0	57.7	3916.8	9.10	0.91	6.54	5.347	9971.0	23867.0	19950.2	9979.2	2.00	14964.7	4985.5	0.39
82.7	0.511	502.9	60.2	4276.8	9.43	0.91	6.57	5.329	10612.3	24508.3	20231.5	9619.2	2.10	14925.3	5306.1	0.40
99.1	0.529	526.2	61.6	4478.4	9.76	0.90	6.59	5.311	11082.5	24978.5	20500.1	9417.6	2.18	14958.8	5541.2	0.40
121.8	0.554	551.3	62.8	4651.2	10.22	0.90	6.62	5.286	11571.5	25467.5	20816.3	9244.8	2.25	15030.5	5785.7	0.40
155.5	0.591	578.0	63.5	4752.0	10.90	0.89	6.67	5.249	12059.5	25955.5	21203.5	9144.0	2.32	15173.7	6029.7	0.39
181.8	0.620	595.0	63.6	4766.4	11.44	0.89	6.72	5.220	12351.6	26247.6	21481.2	9129.6	2.35	15305.4	6175.8	0.39
190.0	0.629	599.8	63.7	4780.8	11.61	0.88	6.73	5.211	12431.2	26327.2	21546.4	9115.2	2.36	15330.8	6215.6	0.38
198.2	0.638	604.3	63.3	4723.2	11.77	0.88	6.74	5.202	12504.0	26400.0	21676.8	9172.8	2.36	15424.8	6252.0	0.38
249.1	0.694	631.8	63.2	4708.8	12.80	0.87	6.82	5.146	12938.2	26834.2	22125.4	9187.2	2.41	15656.3	6469.1	0.36
263.6	0.710	637.8	63.0	4680.0	13.10	0.87	6.84	5.130	13020.6	26916.6	22236.6	9216.0	2.41	15726.3	6510.3	0.36
277.3	0.725	644.9	62.8	4651.2	13.38	0.87	6.87	5.115	13128.1	27024.1	22372.9	9244.8	2.42	15808.8	6564.0	0.35
299.1	0.749	654.0	62.4	4593.6	13.82	0.86	6.90	5.091	13250.8	27146.8	22553.2	9302.4	2.42	15927.8	6625.4	0.35
323.6	0.776	665.6	61.9	4521.6	14.32	0.86	6.94	5.064	13414.9	27310.9	22789.3	9374.4	2.43	16081.9	6707.5	0.34
350.9	0.806	676.9	60.7	4348.8	14.87	0.85	6.99	5.034	13561.2	27457.2	23108.4	9547.2	2.42	16327.8	6780.6	0.32
403.6	0.864	696.8	60.0	4248.0	15.94	0.84	7.07	4.976	13795.8	27691.8	23443.8	9648.0	2.43	16545.9	6897.9	0.31
428.2	0.891	707.0	59.4	4161.6	16.44	0.84	7.12	4.949	13920.4	27816.4	23654.8	9734.4	2.43	16694.6	6960.2	0.30
452.7	0.918	714.5	58.8	4075.2	16.94	0.83	7.16	4.922	13988.2	27884.2	23809.0	9820.8	2.42	16814.9	6994.1	0.29

DU @ FAILURE	4780.8	DEVIATORIC STRESS @ FAILURE	12431.2	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.36

TECH	TW/AK
DATE	6/12/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

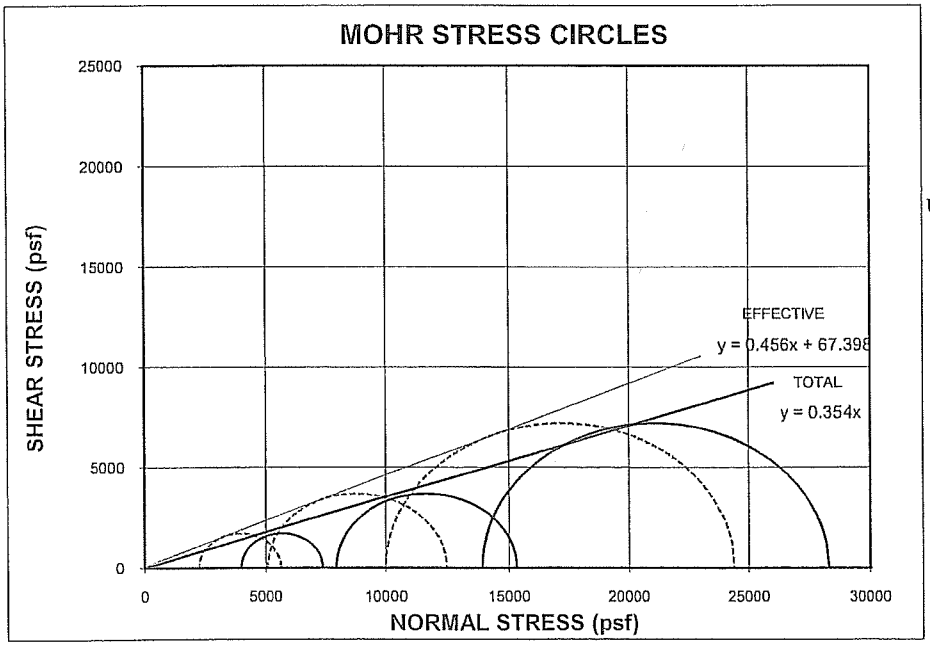
PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Middle of Stockpile 95%** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	106.0	14.0
2	7949	113.9	18.0
3	13896	116.9	16.6

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.02	63.2	100.0
2	0.02	100.0	100.0
3	0.02	100.0	100.0

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	18.5 °	ϕ	=	19.5 °
a	=	0.0 psf	c	=	0.0 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	22.5 °	ϕ '	=	24.5 °
a '	=	61.3 psf	c '	=	67.4 psf



Soil Description

Pale Red, SILTY CLAY, little medium to fine sand.

USCS: CL

LL	PL	PI
36	21	15

Comments

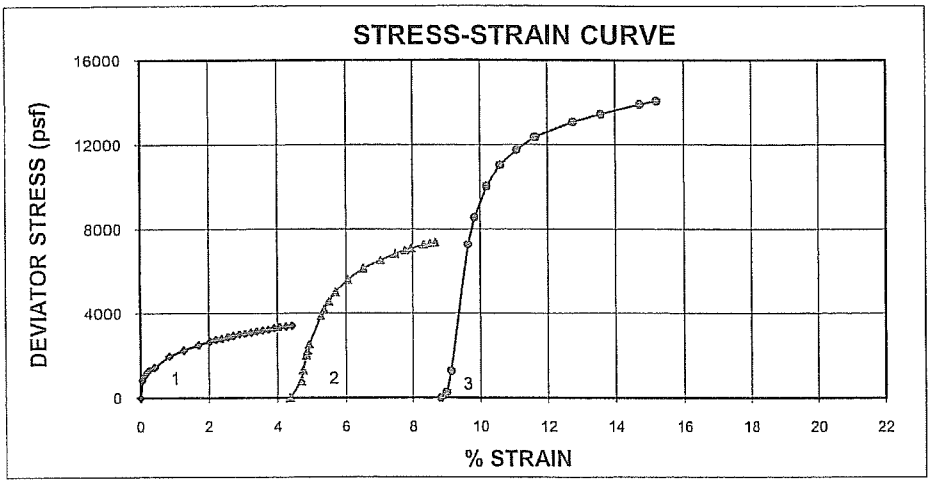
Sample was remolded to approx. 94.8% of the Max. Dry Density, @ -2.2% ofOpt. Moisture Content

*** Failure based on effective stress ratio.**

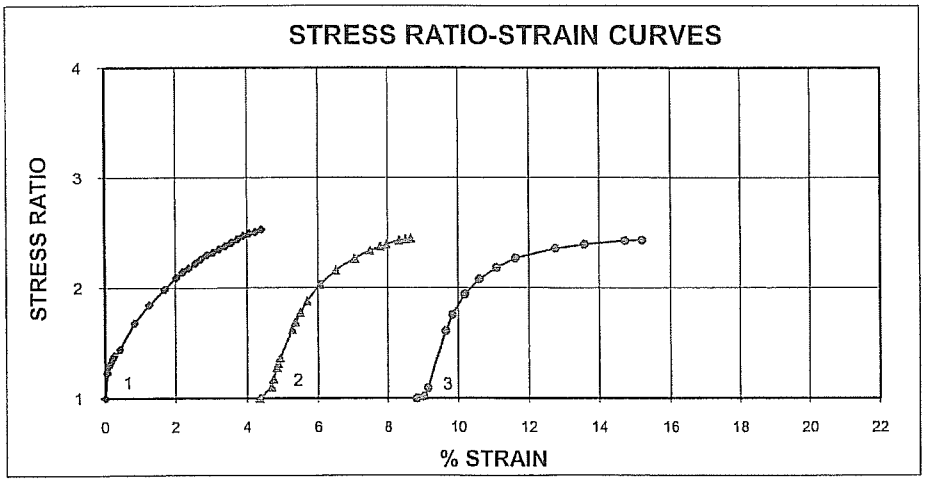
CHECK DH
REVIEW RWM

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

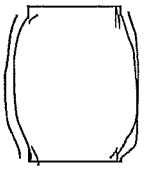
PROJECT NAME: GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: Middle of Stockpile 95% DEPTH: - Sample Type: Bulk



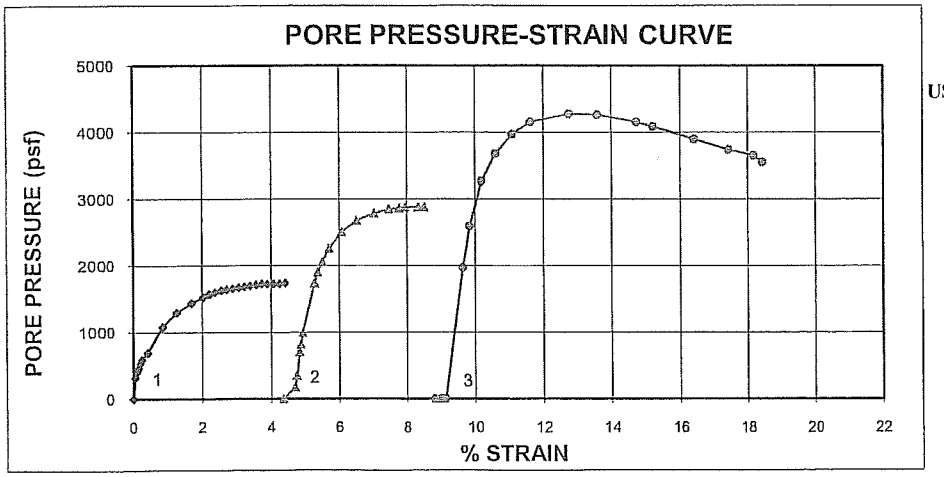
Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	106.0	14.0
2	7949	113.9	18.0
3	13896	116.9	16.6



FAILURE SKETCH



1 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

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Comments

Sample was remolded to approx. 94.8% of the Max. Dry Density, @ -2.2% ofOpt. Moisture Content

*** Failure based on effective stress ratio.**

CHECK DA
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	57.6
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.6
PRESSURE, σ_3 (psf)	3974.4
FINAL "B" VALUE	0.97
t_{50} (minutes)	16.72
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.263	6.009	5.905
DIAMETER	7.087	2.790	2.715
AREA	39.44	6.11	5.79
VOLUME	602.01	36.74	34.19
WEIGHT (g)	1165.17		1206.47
% MOISTURE	14.0		17.99
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	120.8		
DRY DENSITY, calc (pcf)	106.0		
VOLUME OF SOLIDS	376.34		
VOLUME OF VOIDS	225.66		
VOID RATIO	0.600		
SATURATION	63.2		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	113.9
VOLUME OF SOLIDS	376.34
VOLUME OF VOIDS	183.96
VOID RATIO	0.489

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1206.47
WT SOIL & TARE, DRY (g)	1022.53
WT TARE (g)	0.00
WT MOISTURE (g)	183.94
WT DRY SOIL (g)	1022.53
% MOISTURE	17.99

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	10	30.6	0.0	0.00	1.00	5.79	5.905	0.0	3974.4	3974.4	3974.4	1.00	3974.4	0.0	0.00
2.5	0.003	44	32.8	316.8	0.05	1.00	5.79	5.902	832.7	4807.1	4490.3	3657.6	1.23	4073.9	416.3	0.38
5.0	0.006	52	33.4	403.2	0.10	1.00	5.80	5.899	1041.0	5015.4	4612.2	3571.2	1.29	4091.7	520.5	0.39
7.5	0.009	56	33.8	460.8	0.15	1.00	5.80	5.896	1134.8	5109.2	4648.4	3513.6	1.32	4081.0	567.4	0.41
10.0	0.012	60	34.3	532.8	0.20	1.00	5.80	5.893	1231.0	5205.4	4672.6	3441.6	1.36	4057.1	615.5	0.43
12.5	0.015	63	34.7	590.4	0.25	1.00	5.81	5.890	1304.8	5279.2	4688.8	3384.0	1.39	4036.4	652.4	0.45
20.8	0.025	69	35.4	691.2	0.42	1.00	5.81	5.880	1453.6	5428.0	4736.8	3283.2	1.44	4010.0	726.8	0.48
41.7	0.050	90	38.1	1080.0	0.85	0.99	5.84	5.855	1975.1	5949.5	4869.5	2894.4	1.68	3882.0	987.6	0.55
62.5	0.075	102	39.6	1296.0	1.27	0.99	5.86	5.830	2266.2	6240.6	4944.6	2678.4	1.85	3811.5	1133.1	0.57
83.3	0.100	112	40.6	1440.0	1.69	0.98	5.89	5.805	2498.6	6473.0	5033.0	2534.4	1.99	3783.7	1249.3	0.58
100.0	0.120	120	41.2	1526.4	2.03	0.98	5.91	5.785	2675.1	6649.5	5123.1	2448.0	2.09	3785.6	1337.6	0.57
108.3	0.130	123	41.5	1569.6	2.20	0.98	5.92	5.775	2745.9	6720.3	5150.7	2404.8	2.14	3777.7	1372.9	0.57
116.7	0.140	125	41.7	1598.4	2.37	0.98	5.93	5.765	2797.0	6771.4	5173.0	2376.0	2.18	3774.5	1398.5	0.57
125.8	0.151	128	41.9	1627.2	2.56	0.97	5.94	5.754	2864.3	6838.7	5211.5	2347.2	2.22	3779.4	1432.2	0.57
133.3	0.160	131	42.0	1641.6	2.71	0.97	5.95	5.745	2934.9	6909.3	5267.7	2332.8	2.26	3800.2	1467.4	0.56
141.7	0.170	134	42.1	1656.0	2.88	0.97	5.96	5.735	3002.2	6976.6	5320.6	2318.4	2.29	3819.5	1501.1	0.55
150.0	0.180	136	42.2	1670.4	3.05	0.97	5.97	5.725	3035.6	7010.0	5339.6	2304.0	2.32	3821.8	1517.8	0.55
158.3	0.190	138	42.3	1684.8	3.22	0.97	5.98	5.715	3085.6	7060.0	5375.2	2289.6	2.35	3832.4	1542.8	0.55
166.7	0.200	140	42.4	1699.2	3.39	0.97	5.99	5.705	3133.1	7107.5	5408.3	2275.2	2.38	3841.7	1566.5	0.54
175.0	0.210	143	42.5	1713.6	3.56	0.96	6.00	5.695	3182.7	7157.1	5443.5	2260.8	2.41	3852.2	1591.4	0.54
183.3	0.220	145	42.6	1728.0	3.73	0.96	6.01	5.685	3232.2	7206.6	5478.6	2246.4	2.44	3862.5	1616.1	0.53
191.7	0.230	148	42.6	1728.0	3.90	0.96	6.03	5.675	3300.6	7275.0	5547.0	2246.4	2.47	3896.7	1650.3	0.52
200.0	0.240	150	42.6	1728.0	4.06	0.96	6.04	5.665	3349.7	7324.1	5596.1	2246.4	2.49	3921.2	1674.8	0.52
208.3	0.250	152	42.6	1728.0	4.23	0.96	6.05	5.655	3379.5	7353.9	5625.9	2246.4	2.50	3936.2	1689.8	0.51
216.7	0.260	153	42.7	1742.4	4.40	0.96	6.06	5.645	3409.2	7383.6	5641.2	2232.0	2.53	3936.6	1704.6	0.51

DU @ FAILURE	1742.4	DEVIATORIC STRESS @ FAILURE	3409.2	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.53

TECH	AK/TW
DATE	6/11/09
CHECKED	DW
REVIEWED	JAM

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	85.2
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	55.2
PRESSURE, σ_3 (psf)	7948.8
FINAL "B" VALUE	-
t_{50} (minutes)	17.32

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.999	5.905	5.659
DIAMETER	6.897	2.715	2.738
AREA	37.36	5.79	5.89
VOLUME	560.31	34.19	33.31
WEIGHT (g)	1206.47		1192.07
% MOISTURE	18.0		16.58
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	134.4		
DRY DENSITY, calc (pcf)	113.9		
VOLUME OF SOLIDS	376.34		
VOLUME OF VOIDS	183.96		
VOID RATIO	0.489		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	116.9
VOLUME OF SOLIDS	376.34
VOLUME OF VOIDS	169.56
VOID RATIO	0.451

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1192.07
WT SOIL & TARE, DRY (g)	1022.53
WT TARE (g)	0.00
WT MOISTURE (g)	169.54
WT DRY SOIL (g)	1022.53
% MOISTURE	16.58

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.246	18	30.6	0.0	4.35	0.96	6.15	5.659	0.0	7948.8	7948.8	7948.8	1.00	7948.8	0.0	0.00
15.8	0.265	51	31.8	172.8	4.68	0.95	6.18	5.640	785.8	8734.6	8561.8	7776.0	1.10	8168.9	392.9	0.22
18.3	0.268	74	33.0	345.6	4.74	0.95	6.18	5.637	1316.6	9265.4	8919.8	7603.2	1.17	8261.5	658.3	0.26
22.5	0.273	104	35.5	705.6	4.82	0.95	6.19	5.632	2009.2	9958.0	9252.4	7243.2	1.28	8247.8	1004.6	0.35
24.2	0.275	113	36.3	820.8	4.86	0.95	6.19	5.630	2217.9	10166.7	9345.9	7128.0	1.31	8237.0	1109.0	0.37
26.7	0.278	127	37.5	993.6	4.91	0.95	6.19	5.627	2537.7	10486.5	9492.9	6955.2	1.36	8224.0	1268.8	0.39
43.3	0.298	185	42.7	1742.4	5.27	0.95	6.21	5.607	3876.9	11825.7	10083.3	6206.4	1.62	8144.9	1938.5	0.45
47.5	0.303	198	43.8	1900.8	5.35	0.95	6.22	5.602	4185.9	12134.7	10233.9	6048.0	1.69	8140.9	2092.9	0.45
54.2	0.311	215	44.9	2059.2	5.50	0.95	6.23	5.594	4568.0	12516.8	10457.6	5889.6	1.78	8173.6	2284.0	0.45
63.3	0.322	235	46.3	2260.8	5.69	0.94	6.24	5.583	5017.7	12966.5	10705.7	5688.0	1.88	8196.8	2508.8	0.45
80.8	0.343	262	48.0	2505.6	6.06	0.94	6.27	5.562	5611.5	13560.3	11054.7	5443.2	2.03	8248.9	2805.7	0.45
101.7	0.368	285	49.2	2678.4	6.50	0.93	6.30	5.537	6124.8	14073.6	11395.2	5270.4	2.16	8332.8	3062.4	0.44
126.7	0.398	305	50.0	2793.6	7.03	0.93	6.33	5.507	6524.4	14473.2	11679.6	5155.2	2.27	8417.4	3262.2	0.43
147.5	0.423	319	50.4	2851.2	7.47	0.93	6.36	5.482	6821.6	14770.4	11919.2	5097.6	2.34	8508.4	3410.8	0.42
161.7	0.440	327	50.5	2865.6	7.78	0.92	6.38	5.465	6989.0	14937.8	12072.2	5083.2	2.37	8577.7	3494.5	0.41
170.0	0.450	332	50.6	2880.0	7.95	0.92	6.40	5.455	7079.2	15028.0	12148.0	5068.8	2.40	8608.4	3539.6	0.41
187.5	0.471	341	50.6	2880.0	8.32	0.92	6.42	5.434	7254.7	15203.5	12323.5	5068.8	2.43	8696.1	3627.3	0.40
195.8	0.481	344	50.6	2880.0	8.50	0.92	6.43	5.424	7310.1	15258.9	12378.9	5068.8	2.44	8723.8	3655.0	0.39
203.3	0.490	347	50.5	2865.6	8.66	0.91	6.44	5.415	7364.4	15313.2	12447.6	5083.2	2.45	8765.4	3682.2	0.39

DU @ FAILURE	2865.6	DEVIATORIC STRESS @ FAILURE	7364.4	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.45

TECH	AK/TW
DATE	6/11/09
CHECKED	DA
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Middle of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	126.5
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	96.5
PRESSURE, σ_3 (psf)	13896.0
FINAL "B" VALUE	-
t_{50} (minutes)	20.21

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.374	5.659	5.427
DIAMETER	6.954	2.738	2.772
AREA	37.98	5.89	6.04
VOLUME	545.91	33.31	32.76
WEIGHT (g)	1192.07		1182.97
% MOISTURE	16.6		15.69
SPECIFIC GRAVITY	2.72		
MOIST DENSITY (pcf)	136.3		
DRY DENSITY, calc (pcf)	116.9		
VOLUME OF SOLIDS	376.34		
VOLUME OF VOIDS	169.56		
VOID RATIO	0.451		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	118.9
VOLUME OF SOLIDS	376.34
VOLUME OF VOIDS	160.46
VOID RATIO	0.426

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1182.97
WT SOIL & TARE, DRY (g)	1022.53
WT TARE (g)	0.00
WT MOISTURE (g)	160.44
WT DRY SOIL (g)	1022.53
% MOISTURE	15.69

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.478	17	30.6	0.0	8.81	0.91	6.62	5.427	0.0	13896.0	13896.0	13896.0	1.00	13896.0	0.0	0
8.3	0.488	28	30.6	0.0	8.99	0.91	6.63	5.417	249.7	14145.7	14145.7	13896.0	1.02	14020.8	124.8	0.00
14.2	0.495	76	30.6	0.0	9.12	0.91	6.64	5.410	1274.8	15170.8	15170.8	13896.0	1.09	14533.4	637.4	0.00
37.5	0.523	354	44.3	1972.8	9.64	0.90	6.68	5.382	7271.3	21167.3	19194.5	11923.2	1.61	15558.9	3635.7	0.27
46.7	0.534	414	48.6	2592.0	9.84	0.90	6.69	5.371	8552.0	22448.0	19856.0	11304.0	1.76	15580.0	4276.0	0.30
62.5	0.553	485	53.3	3268.8	10.19	0.90	6.72	5.352	10022.8	23918.8	20650.0	10627.2	1.94	15638.6	5011.4	0.33
80.8	0.575	534	56.2	3686.4	10.60	0.89	6.75	5.330	11035.5	24931.5	21245.1	10209.6	2.08	15727.4	5517.8	0.33
103.3	0.602	571	58.2	3974.4	11.09	0.89	6.79	5.303	11750.4	25646.4	21672.0	9921.6	2.18	15796.8	5875.2	0.34
127.5	0.631	603	59.5	4161.6	11.63	0.88	6.83	5.274	12356.5	26252.5	22090.9	9734.4	2.27	15912.7	6178.3	0.34
178.3	0.692	645	60.3	4276.8	12.75	0.87	6.92	5.213	13071.5	26967.5	22690.7	9619.2	2.36	16154.9	6535.7	0.33
215.8	0.737	669	60.2	4262.4	13.58	0.86	6.98	5.168	13450.3	27346.3	23083.9	9633.6	2.40	16358.8	6725.2	0.32
267.5	0.799	701	59.5	4161.6	14.72	0.85	7.08	5.106	13909.3	27805.3	23643.7	9734.4	2.43	16689.0	6954.6	0.30
289.2	0.825	712	59.0	4089.6	15.20	0.85	7.12	5.080	14063.8	27959.8	23870.2	9806.4	2.43	16838.3	7031.9	0.29
343.3	0.890	739	57.7	3902.4	16.40	0.84	7.22	5.015	14401.6	28297.6	24395.2	9993.6	2.44	17194.4	7200.8	0.27
390.0	0.946	760	56.6	3744.0	17.43	0.83	7.31	4.959	14641.5	28537.5	24793.5	10152.0	2.44	17472.7	7320.7	0.26
423.3	0.986	775	56.0	3657.6	18.17	0.82	7.38	4.919	14793.8	28689.8	25032.2	10238.4	2.44	17635.3	7396.9	0.25
435.0	1.000	778	55.3	3556.8	18.43	0.82	7.40	4.905	14813.4	28709.4	25152.6	10339.2	2.43	17745.9	7406.7	0.24

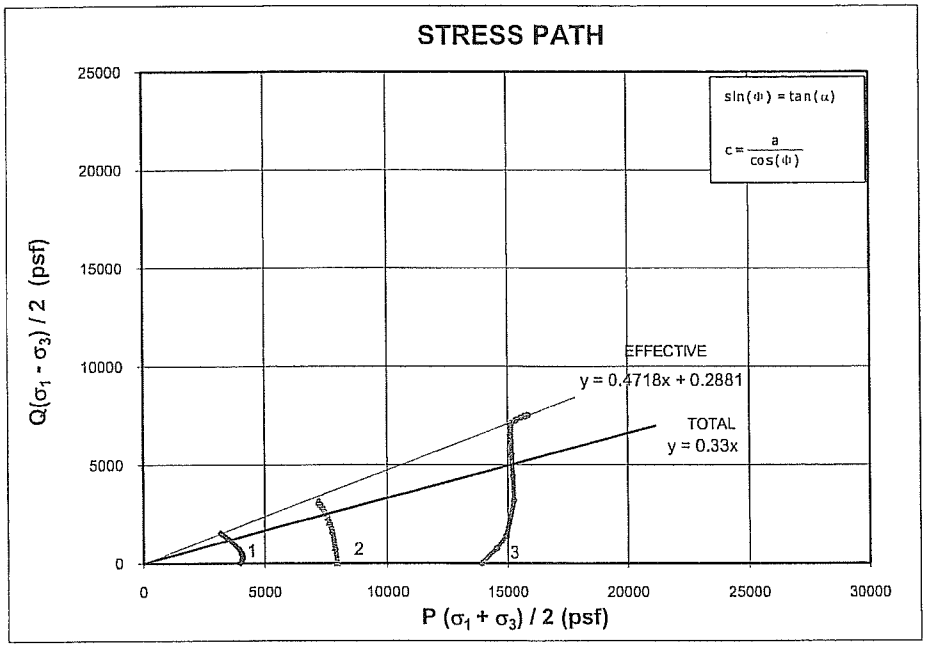
DU @ FAILURE	3902.4	DEVIATORIC STRESS @ FAILURE	14401.6	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.44

TECH	AK/TW
DATE	6/11/09
CHECKED	DJB
REVIEWED	

Golder Associates Inc.

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

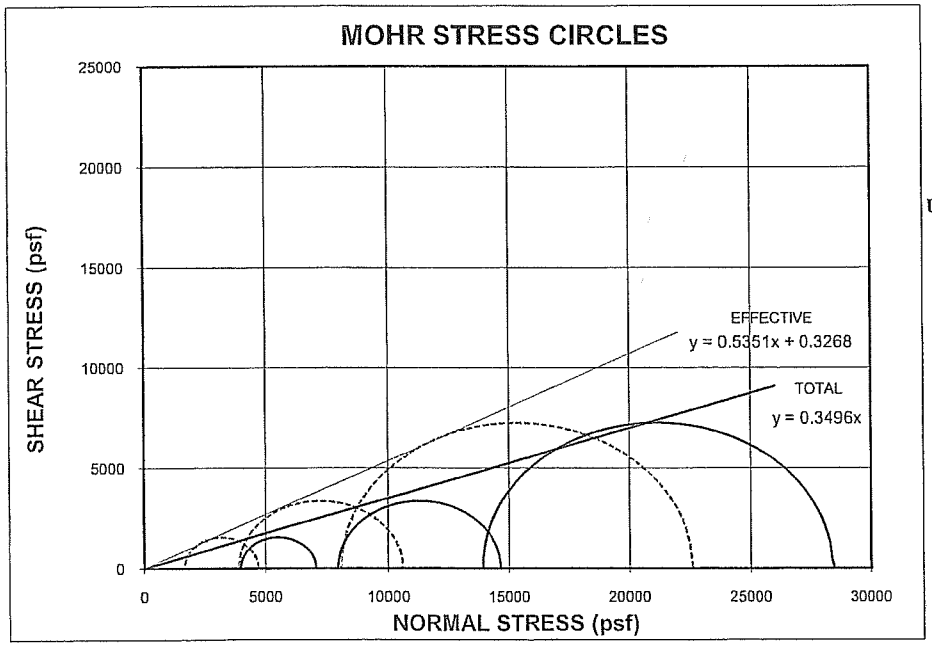
PROJECT NAME: GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: **Bottom of Stockpile 95%** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	113.4	10.7
2	7949	121.7	13.8
3	13896	125.3	12.4

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.08	60.9	100.0
2	0.03	100.0	100.0
3	0.02	100.0	100.0

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	18.3 °	ϕ	=	19.3 °
a	=	0.0 psf	c	=	0.0 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	25.3 °	ϕ '	=	28.2 °
a '	=	0.3 psf	c '	=	0.3 psf



Soil Description

Reddish Brown, SILTY CLAY, and medium to fine sand, trace fine gravel.

USCS: CL

LL	PL	PI
27	16	11

Comments

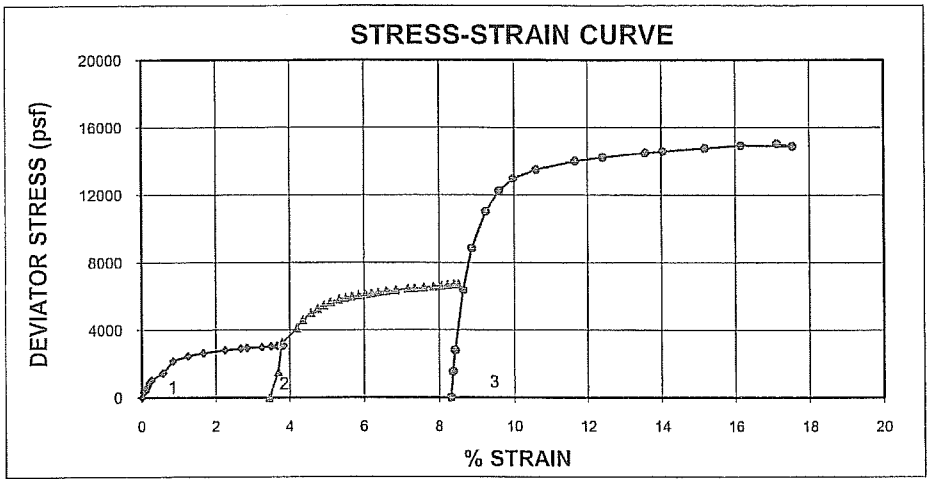
Sample was remolded to approx. 95% of the Max. Dry Density, @ -2% of Opt. Moisture Content

*** Failure based on effective stress ratio.**

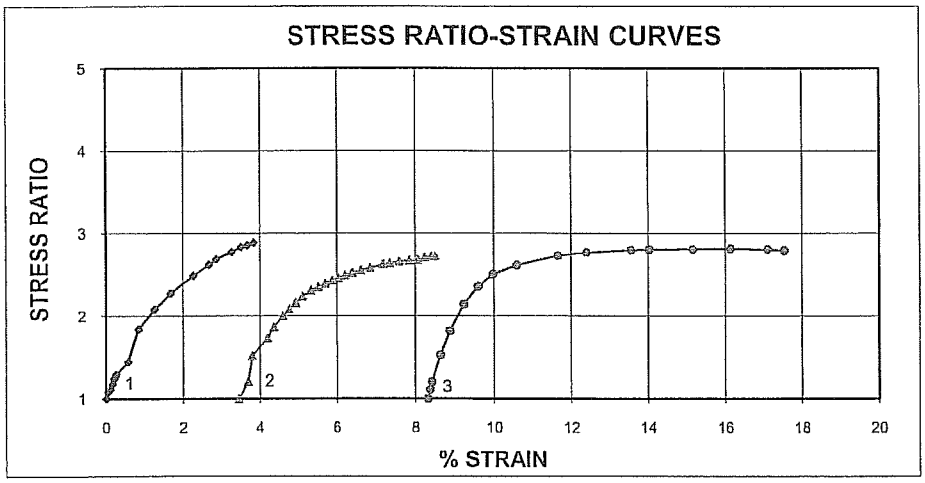
CHECK
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

PROJECT NAME: GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: **Bottom of Stockpile 95%** DEPTH: - Sample Type: **Bulk**

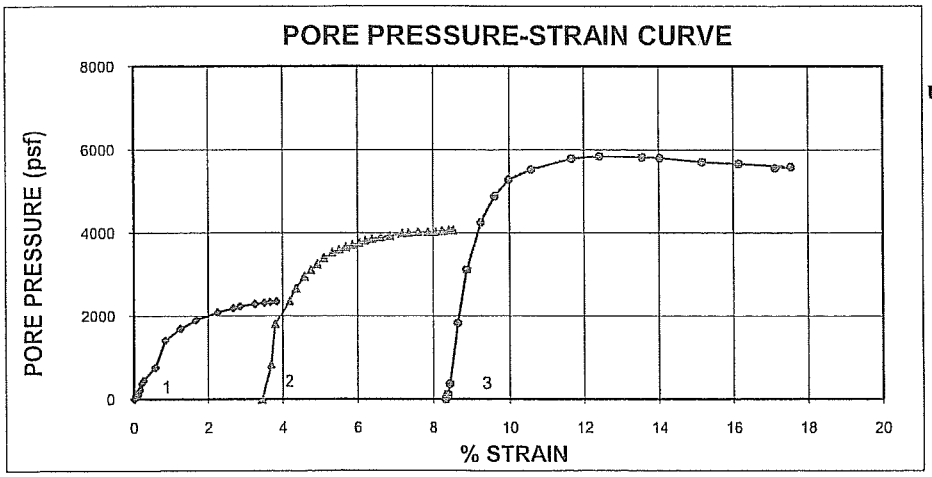


Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	113.4	10.7
2	7949	121.7	13.8
3	13896	125.3	12.4



FAILURE SKETCH

1 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

Reddish Brown, SILTY CLAY, and medium to fine sand, trace fine gravel.

USCS: CL

LL	PL	PI
27	16	11

Comments

Sample was remolded to approx. 95% of the Max. Dry Density, @ -2% of Opt. Moisture Content

*** Failure based on effective stress ratio.**

CHECK DA
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0046
STRAIN RATE (%/min)	0.08
CELL PRESSURE (psi)	57.6
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.6
PRESSURE, σ_3 (psf)	3974.4
FINAL "B" VALUE	0.96
t_{50} (minutes)	5.21
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.250	6.004	5.992
DIAMETER	7.087	2.790	2.695
AREA	39.44	6.11	5.71
VOLUME	601.51	36.71	34.19
WEIGHT (g)	1210.12		1244.12
% MOISTURE	10.7		13.83
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	125.5		
DRY DENSITY, calc (pcf)	113.4		
VOLUME OF SOLIDS	409.04		
VOLUME OF VOIDS	192.47		
VOID RATIO	0.471		
SATURATION	60.9		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	121.7
VOLUME OF SOLIDS	409.04
VOLUME OF VOIDS	151.17
VOID RATIO	0.370

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1244.12
WT SOIL & TARE, DRY (g)	1092.95
WT TARE (g)	0.00
WT MOISTURE (g)	151.17
WT DRY SOIL (g)	1092.95
% MOISTURE	13.83

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	6	30.4	0.0	0.00	1.00	5.71	5.992	0.0	3974.4	3974.4	3974.4	1.00	3974.4	0.0	0.00
0.7	0.003	19	31.0	86.4	0.05	1.00	5.71	5.989	320.4	4294.8	4208.4	3888.0	1.08	4048.2	160.2	0.27
1.3	0.006	23	31.1	100.8	0.10	1.00	5.71	5.986	416.0	4390.4	4289.6	3873.6	1.11	4081.6	208.0	0.24
2.0	0.009	32	31.9	216.0	0.15	1.00	5.71	5.983	660.3	4634.7	4418.7	3758.4	1.18	4088.5	330.1	0.33
2.6	0.012	41	33.0	374.4	0.20	1.00	5.72	5.980	886.7	4861.1	4486.7	3600.0	1.25	4043.3	443.3	0.42
3.3	0.015	47	33.5	446.4	0.25	1.00	5.72	5.977	1029.7	5004.1	4557.7	3528.0	1.29	4042.9	514.9	0.43
7.4	0.034	63	35.7	763.2	0.57	0.99	5.74	5.958	1440.5	5414.9	4651.7	3211.2	1.45	3931.5	720.3	0.53
10.9	0.050	92	40.2	1411.2	0.83	0.99	5.75	5.942	2152.5	6126.9	4715.7	2563.2	1.84	3639.5	1076.3	0.66
16.3	0.075	105	42.2	1699.2	1.25	0.99	5.78	5.917	2462.5	6436.9	4737.7	2275.2	2.08	3506.4	1231.2	0.69
21.7	0.100	112	43.6	1900.8	1.67	0.98	5.80	5.892	2638.2	6612.6	4711.8	2073.6	2.27	3392.7	1319.1	0.72
29.3	0.135	120	44.9	2088.0	2.25	0.98	5.84	5.857	2807.6	6782.0	4694.0	1886.4	2.49	3290.2	1403.8	0.74
34.8	0.160	124	45.6	2188.8	2.67	0.97	5.86	5.832	2896.3	6870.7	4681.9	1785.6	2.62	3233.8	1448.2	0.76
37.2	0.171	126	45.9	2232.0	2.85	0.97	5.87	5.821	2937.4	6911.8	4679.8	1742.4	2.69	3211.1	1468.7	0.76
42.4	0.195	128	46.3	2289.6	3.25	0.97	5.90	5.797	2988.8	6963.2	4673.6	1684.8	2.77	3179.2	1494.4	0.77
45.7	0.210	131	46.5	2318.4	3.50	0.96	5.91	5.782	3037.1	7011.5	4693.1	1656.0	2.83	3174.6	1518.6	0.76
47.8	0.220	131	46.6	2332.8	3.67	0.96	5.92	5.772	3048.9	7023.3	4690.5	1641.6	2.86	3166.0	1524.4	0.77
50.0	0.230	133	46.7	2347.2	3.84	0.96	5.93	5.762	3072.7	7047.1	4699.9	1627.2	2.89	3163.6	1536.4	0.76

DU @ FAILURE	2347.2	DEVIATORIC STRESS @ FAILURE	3072.7	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.89

TECH	TW/AK
DATE	6/15/09
CHECKED	DJA
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0018
STRAIN RATE (%/min)	0.03
CELL PRESSURE (psi)	85.2
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	55.2
PRESSURE, σ_3 (psf)	7948.8
FINAL "B" VALUE	-
t_{50} (minutes)	13.14

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.220	5.992	5.792
DIAMETER	6.846	2.695	2.702
AREA	36.81	5.71	5.74
VOLUME	560.21	34.19	33.22
WEIGHT (g)	1244.12		1228.32
% MOISTURE	13.8		12.39
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	138.6		
DRY DENSITY, calc (pcf)	121.7		
VOLUME OF SOLIDS	409.04		
VOLUME OF VOIDS	151.17		
VOID RATIO	0.370		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	125.3
VOLUME OF SOLIDS	409.04
VOLUME OF VOIDS	135.37
VOID RATIO	0.331

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1228.32
WT SOIL & TARE, DRY (g)	1092.95
WT TARE (g)	0.00
WT MOISTURE (g)	135.37
WT DRY SOIL (g)	1092.95
% MOISTURE	12.39

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.200	45	30.4	0.0	3.45	0.97	5.94	5.792	0.0	7948.8	7948.8	7948.8	1.00	7948.8	0.0	0.00
7.8	0.214	108	36.2	835.2	3.69	0.96	5.96	5.778	1508.7	9457.5	8622.3	7113.6	1.21	7868.0	754.4	0.55
11.1	0.220	178	42.9	1800.0	3.80	0.96	5.96	5.772	3212.2	11161.0	9361.0	6148.8	1.52	7754.9	1606.1	0.56
23.9	0.243	216	46.8	2361.6	4.20	0.96	5.99	5.749	4103.3	12052.1	9690.5	5587.2	1.73	7638.9	2051.7	0.58
29.4	0.253	236	48.9	2664.0	4.37	0.96	6.00	5.739	4583.3	12532.1	9868.1	5284.8	1.87	7576.4	2291.6	0.58
36.7	0.266	254	50.9	2952.0	4.59	0.95	6.01	5.726	4996.5	12945.3	9993.3	4996.8	2.00	7495.0	2498.2	0.59
42.2	0.276	265	52.0	3110.4	4.77	0.95	6.02	5.716	5248.1	13196.9	10086.5	4838.4	2.08	7462.4	2624.0	0.59
47.8	0.286	274	53.0	3254.4	4.94	0.95	6.03	5.706	5453.3	13402.1	10147.7	4694.4	2.16	7421.1	2726.7	0.60
53.3	0.296	282	54.0	3398.4	5.11	0.95	6.04	5.696	5631.6	13580.4	10182.0	4550.4	2.24	7366.2	2815.8	0.60
60.6	0.309	289	54.9	3528.0	5.33	0.95	6.06	5.683	5796.6	13745.4	10217.4	4420.8	2.31	7319.1	2898.3	0.61
66.7	0.320	294	55.4	3600.0	5.52	0.94	6.07	5.672	5884.6	13833.4	10233.4	4348.8	2.35	7291.1	2942.3	0.61
72.2	0.330	298	55.8	3657.6	5.70	0.94	6.08	5.662	5970.9	13919.7	10262.1	4291.2	2.39	7276.6	2985.4	0.61
77.8	0.340	301	56.2	3715.2	5.87	0.94	6.09	5.652	6040.3	13989.1	10273.9	4233.6	2.43	7253.7	3020.1	0.62
83.3	0.350	304	56.5	3758.4	6.04	0.94	6.10	5.642	6109.4	14058.2	10299.8	4190.4	2.46	7245.1	3054.7	0.62
88.9	0.360	307	56.9	3816.0	6.22	0.94	6.12	5.632	6159.4	14108.2	10292.2	4132.8	2.49	7212.5	3079.7	0.62
94.4	0.370	310	57.2	3859.2	6.39	0.94	6.13	5.622	6218.6	14167.4	10308.2	4089.6	2.52	7198.9	3109.3	0.62
101.7	0.383	314	57.5	3902.4	6.61	0.93	6.14	5.609	6292.7	14241.5	10339.1	4046.4	2.56	7192.8	3146.4	0.62
109.4	0.397	317	57.7	3931.2	6.85	0.93	6.16	5.595	6346.6	14295.4	10364.2	4017.6	2.58	7190.9	3173.3	0.62
120.0	0.416	322	58.1	3988.8	7.18	0.93	6.18	5.576	6438.4	14387.2	10398.4	3960.0	2.63	7179.2	3219.2	0.62
125.6	0.426	323	58.2	4003.2	7.35	0.93	6.19	5.566	6461.4	14410.2	10407.0	3945.6	2.64	7176.3	3230.7	0.62
133.3	0.440	326	58.3	4017.6	7.60	0.92	6.21	5.552	6514.1	14462.9	10445.3	3931.2	2.66	7188.2	3257.0	0.62
141.7	0.455	329	58.4	4017.6	7.86	0.92	6.22	5.537	6565.2	14514.0	10496.4	3931.2	2.67	7213.8	3282.6	0.61
148.3	0.467	332	58.5	4017.6	8.06	0.92	6.24	5.525	6610.5	14559.3	10541.7	3931.2	2.68	7236.4	3305.2	0.61
153.9	0.477	334	58.5	4046.4	8.24	0.92	6.25	5.515	6658.0	14606.8	10560.4	3902.4	2.71	7231.4	3329.0	0.61
159.4	0.487	337	58.6	4060.8	8.41	0.92	6.26	5.505	6698.3	14647.1	10586.3	3888.0	2.72	7237.2	3349.2	0.61
162.8	0.493	337	58.6	4060.8	8.51	0.91	6.27	5.499	6699.9	14648.7	10587.9	3888.0	2.72	7238.0	3350.0	0.61

DU @ FAILURE	4060.8	DEVIATORIC STRESS @ FAILURE	6698.3	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.72

TECH	TW/AK
DATE	6/15/09
CHECKED	DA
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 95%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	126.5
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	96.5
PRESSURE, σ_3 (psf)	13896.0
FINAL "B" VALUE	-
t_{50} (minutes)	15.71

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.712	5.792	5.532
DIAMETER	6.864	2.702	2.728
AREA	37.01	5.74	5.85
VOLUME	544.41	33.22	32.34
WEIGHT (g)	1228.32		1213.82
% MOISTURE	12.4		11.06
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	140.8		
DRY DENSITY, calc (pcf)	125.3		
VOLUME OF SOLIDS	409.04		
VOLUME OF VOIDS	135.37		
VOID RATIO	0.331		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	128.7
VOLUME OF SOLIDS	409.04
VOLUME OF VOIDS	120.87
VOID RATIO	0.295

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1213.82
WT SOIL & TARE, DRY (g)	1092.95
WT TARE (g)	0.00
WT MOISTURE (g)	120.87
WT DRY SOIL (g)	1092.95
% MOISTURE	11.06

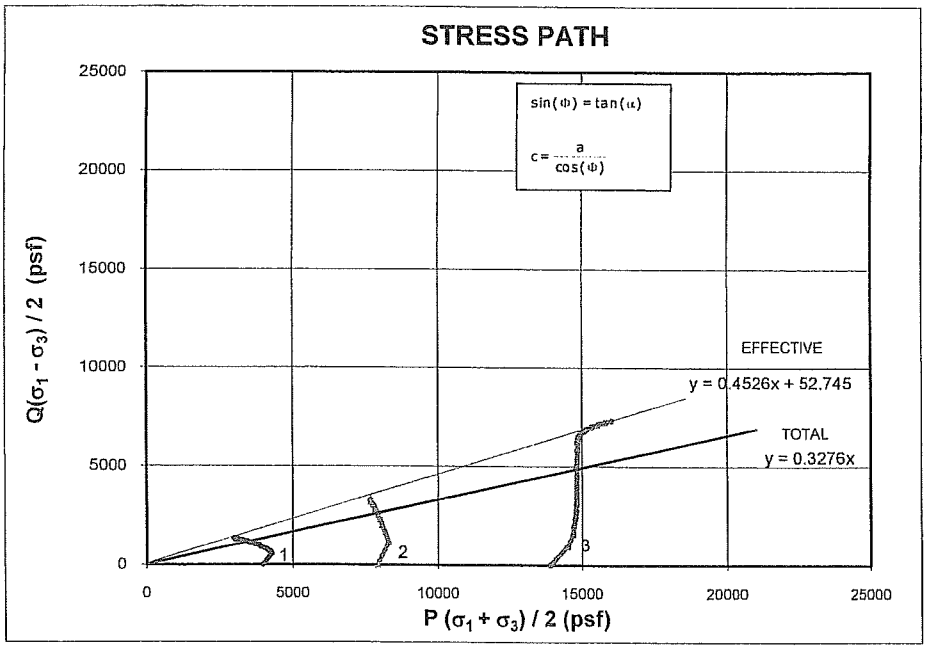
TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.460	19	30.4	0.0	8.32	0.92	6.38	5.532	0.0	13896.0	13896.0	13896.0	1.00	13896.0	0.0	0
2.5	0.463	87	31.2	115.2	8.37	0.92	6.38	5.529	1528.2	15424.2	15309.0	13780.8	1.11	14544.9	764.1	0.08
5.0	0.466	144	32.9	360.0	8.42	0.92	6.38	5.526	2808.7	16704.7	16344.7	13536.0	1.21	14940.3	1404.3	0.13
15.0	0.478	302	43.1	1828.8	8.64	0.91	6.40	5.514	6371.5	20267.5	18438.7	12067.2	1.53	15252.9	3185.7	0.29
25.8	0.491	413	52.0	3110.4	8.88	0.91	6.41	5.501	8844.6	22740.6	19630.2	10785.6	1.82	15207.9	4422.3	0.35
42.5	0.511	512	59.9	4248.0	9.24	0.91	6.44	5.481	11027.5	24923.5	20675.5	9648.0	2.14	15161.8	5513.8	0.39
59.2	0.531	569	64.3	4881.6	9.60	0.90	6.47	5.461	12257.4	26153.4	21271.8	9014.4	2.36	15143.1	6128.7	0.40
76.7	0.552	605	67.1	5284.8	9.98	0.90	6.49	5.440	12988.8	26884.8	21600.0	8611.2	2.51	15105.6	6494.4	0.41
105.0	0.586	633	68.8	5529.6	10.59	0.89	6.54	5.406	13512.4	27408.4	21878.8	8366.4	2.62	15122.6	6756.2	0.41
154.2	0.645	663	70.6	5788.8	11.66	0.88	6.62	5.347	14023.7	27919.7	22130.9	8107.2	2.73	15119.0	7011.8	0.41
188.3	0.686	680	71.0	5846.4	12.40	0.88	6.67	5.306	14253.5	28149.5	22303.1	8049.6	2.77	15176.3	7126.7	0.41
241.7	0.750	701	70.8	5817.6	13.56	0.86	6.76	5.242	14514.6	28410.6	22593.0	8078.4	2.80	15335.7	7257.3	0.40
263.3	0.776	709	70.7	5803.2	14.03	0.86	6.80	5.216	14603.0	28499.0	22695.8	8092.8	2.80	15394.3	7301.5	0.40
315.8	0.839	727	70.0	5702.4	15.17	0.85	6.89	5.153	14794.1	28690.1	22987.7	8193.6	2.81	15590.6	7397.0	0.39
360.8	0.893	743	69.7	5659.2	16.14	0.84	6.97	5.099	14950.2	28846.2	23187.0	8236.8	2.82	15711.9	7475.1	0.38
425.0	0.970	753	69.2	5587.2	17.53	0.82	7.09	5.022	14901.2	28797.2	23210.0	8308.8	2.79	15759.4	7450.6	0.37
405.8	0.947	757	69.0	5558.4	17.12	0.83	7.05	5.045	15060.0	28956.0	23397.6	8337.6	2.81	15867.6	7530.0	0.37

DU @ FAILURE	5817.6	DEVIATORIC STRESS @ FAILURE	14514.6	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.80

TECH	TW/AK
DATE	6/15/09
CHECKED	
REVIEWED	

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

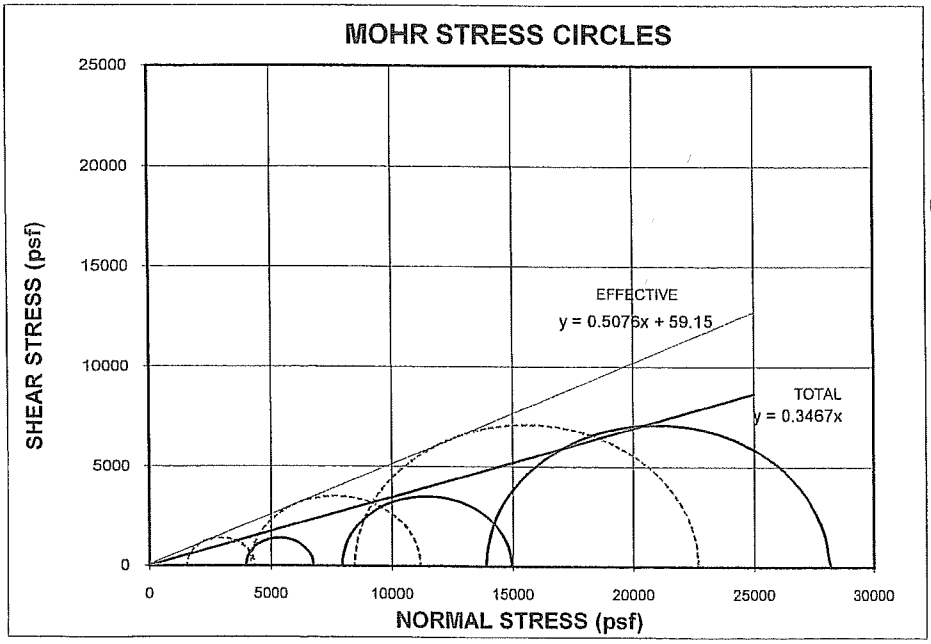
PROJECT NAME: **GEOSYNTEC/MILLENIUM/MD**
PROJECT NUMBER: **093-90136**
SAMPLE ID: **Bottom of Stockpile 90%** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	107.3	10.9
2	7949	113.7	16.7
3	13896	117.0	15.1

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.068	52.5	95.5
2	0.021	95.5	95.0
3	0.022	95.0	94.7

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	18.1 °	ϕ	=	19.1 °
a	=	0.0 psf	c	=	0.0 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	24.4 °	ϕ '	=	26.9 °
a '	=	52.7 psf	c '	=	59.2 psf



Soil Description

Reddish Brown, SILTY CLAY, and medium to fine sand, trace coarse gravel.

USCS: CL

LL	PL	PI
27	16	11

Comments

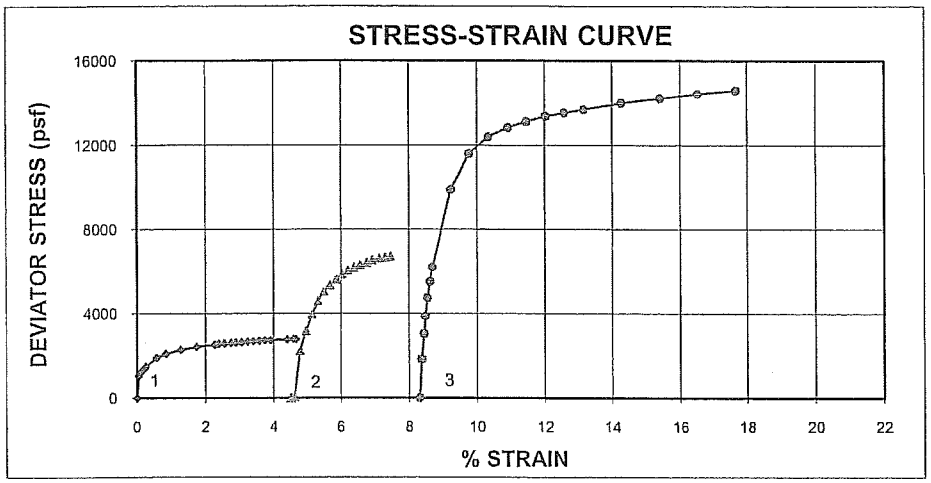
Sample was remolded to approx. 89.8% of the Max. Dry Density, @ -1.8 Opt. Moisture Content.

*** Failure based on effective stress ratio.**

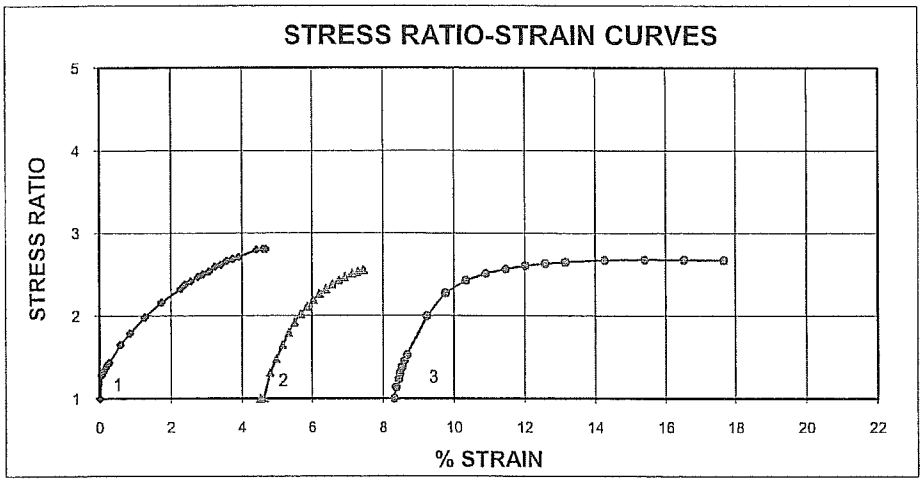
CHECK RA
REVIEW MM

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

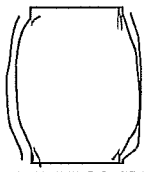
PROJECT NAME: GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER: 093-90136
SAMPLE ID: **Bottom of Stockpile 90%** DEPTH: - Sample Type: **Bulk**



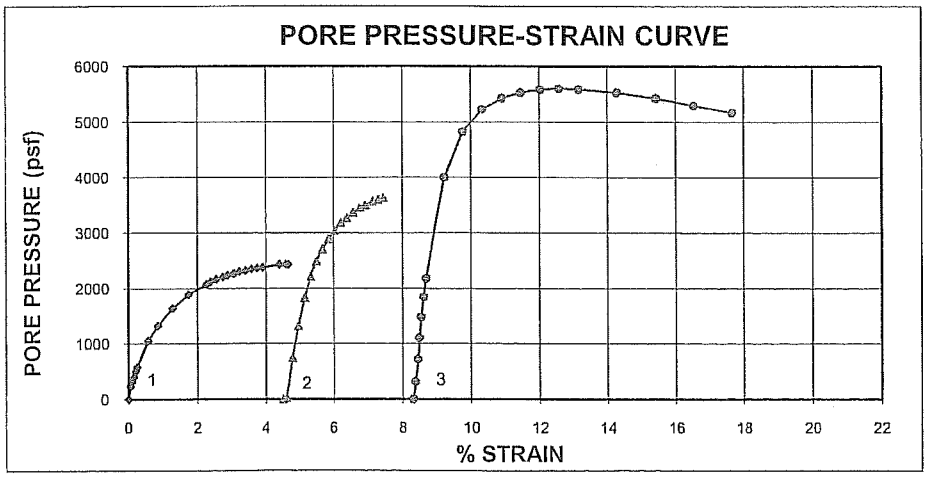
Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	3974	107.3	10.9
2	7949	113.7	16.7
3	13896	117.0	15.1



FAILURE SKETCH



1 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

Reddish Brown, SILTY CLAY, and medium to fine sand, trace coarse gravel.

USCS: CL

LL	PL	PI
27	16	11

Comments

Sample was remolded to approx. 89.8% of the Max. Dry Density, @ -1.8 Opt. Moisture Content.

*** Failure based on effective stress ratio.**

CHECK AK
REVIEW

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.004
STRAIN RATE (%/min)	0.07
CELL PRESSURE (psi)	57.6
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.6
PRESSURE, σ_3 (psf)	3974.4
FINAL "B" VALUE	0.95
t_{50} (minutes)	5.84
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.243	6.001	5.891
DIAMETER	7.087	2.790	2.736
AREA	39.44	6.11	5.88
VOLUME	601.21	36.69	34.63
WEIGHT (g)	1146.13		1202.33
% MOISTURE	10.9		16.33
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	119.0		
DRY DENSITY, calc (pcf)	107.3		
VOLUME OF SOLIDS	386.82		
VOLUME OF VOIDS	214.38		
VOID RATIO	0.554		
SATURATION	52.5		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	113.7
VOLUME OF SOLIDS	386.82
VOLUME OF VOIDS	180.58
VOID RATIO	0.467

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1202.33
WT SOIL & TARE, DRY (g)	1033.59
WT TARE (g)	0.00
WT MOISTURE (g)	168.74
WT DRY SOIL (g)	1033.59
% MOISTURE	16.33

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	8	30.4	0.0	0.00	1.00	5.88	5.891	0.0	3974.4	3974.4	3974.4	1.00	3974.4	0.0	0.00
0.8	0.003	52	32.0	230.4	0.05	1.00	5.88	5.888	1065.2	5039.6	4809.2	3744.0	1.28	4276.6	532.6	0.22
1.5	0.006	57	32.6	316.8	0.10	1.00	5.88	5.885	1196.8	5171.2	4854.4	3657.6	1.33	4256.0	598.4	0.26
2.3	0.009	62	33.2	403.2	0.15	1.00	5.89	5.882	1308.7	5283.1	4879.9	3571.2	1.37	4225.6	654.4	0.31
3.0	0.012	66	33.9	504.0	0.20	1.00	5.89	5.879	1401.0	5375.4	4871.4	3470.4	1.40	4170.9	700.5	0.36
3.8	0.015	69	34.4	576.0	0.25	1.00	5.89	5.876	1473.6	5448.0	4872.0	3398.4	1.43	4135.2	736.8	0.39
8.5	0.034	86	37.7	1051.2	0.58	0.99	5.91	5.857	1897.5	5871.9	4820.7	2923.2	1.65	3872.0	948.8	0.55
12.5	0.050	95	39.6	1324.8	0.85	0.99	5.93	5.841	2096.4	6070.8	4746.0	2649.6	1.79	3697.8	1048.2	0.63
18.8	0.075	103	41.8	1641.6	1.27	0.99	5.95	5.816	2290.6	6265.0	4623.4	2332.8	1.98	3478.1	1145.3	0.72
25.5	0.102	109	43.5	1886.4	1.73	0.98	5.98	5.789	2426.8	6401.2	4514.8	2088.0	2.16	3301.4	1213.4	0.78
33.3	0.133	114	44.8	2073.6	2.26	0.98	6.01	5.758	2521.6	6496.0	4422.4	1900.8	2.33	3161.6	1260.8	0.82
35.0	0.140	115	45.1	2116.8	2.38	0.98	6.02	5.751	2556.8	6531.2	4414.4	1857.6	2.38	3136.0	1278.4	0.83
37.5	0.150	116	45.4	2160.0	2.55	0.97	6.03	5.741	2569.0	6543.4	4383.4	1814.4	2.42	3098.9	1284.5	0.84
40.5	0.162	118	45.7	2203.2	2.75	0.97	6.04	5.729	2601.8	6576.2	4373.0	1771.2	2.47	3072.1	1300.9	0.85
42.5	0.170	118	45.9	2232.0	2.89	0.97	6.05	5.721	2614.8	6589.2	4357.2	1742.4	2.50	3049.8	1307.4	0.85
45.0	0.180	119	46.1	2260.8	3.06	0.97	6.06	5.711	2629.2	6603.6	4342.8	1713.6	2.53	3028.2	1314.6	0.86
47.5	0.190	121	46.4	2304.0	3.23	0.97	6.07	5.701	2660.2	6634.6	4330.6	1670.4	2.59	3000.5	1330.1	0.87
50.0	0.200	121	46.5	2318.4	3.40	0.97	6.08	5.691	2674.5	6648.9	4330.5	1656.0	2.62	2993.2	1337.2	0.87
52.5	0.210	123	46.7	2347.2	3.56	0.96	6.09	5.681	2705.2	6679.6	4332.4	1627.2	2.66	2979.8	1352.6	0.87
55.0	0.220	124	46.8	2361.6	3.73	0.96	6.11	5.671	2719.3	6693.7	4332.1	1612.8	2.69	2972.5	1359.7	0.87
57.5	0.230	124	46.9	2376.0	3.90	0.96	6.12	5.661	2731.0	6705.4	4329.4	1598.4	2.71	2963.9	1365.5	0.87
64.8	0.259	127	47.3	2433.6	4.40	0.96	6.15	5.632	2770.9	6745.3	4311.7	1540.8	2.80	2926.2	1385.4	0.88
67.5	0.270	128	47.3	2433.6	4.58	0.95	6.16	5.621	2784.2	6758.6	4325.0	1540.8	2.81	2932.9	1392.1	0.87
68.8	0.275	128	47.3	2433.6	4.67	0.95	6.17	5.616	2781.7	6756.1	4322.5	1540.8	2.81	2931.6	1390.8	0.87

DU @ FAILURE	2433.6	DEVIATORIC STRESS @ FAILURE	2784.2	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.81

TECH	TW/AK
DATE	6/15/09
CHECKED	AK
REVIEWED	

Golder Associates Inc.

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	85.2
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	55.2
PRESSURE, σ_3 (psf)	7948.8
FINAL "B" VALUE	-
t_{50} (minutes)	15.33

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.963	5.891	5.637
DIAMETER	6.948	2.736	2.756
AREA	37.92	5.88	5.97
VOLUME	567.41	34.63	33.64
WEIGHT (g)	1206.03		1189.83
% MOISTURE	16.7		15.12
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	132.6		
DRY DENSITY, calc (pcf)	113.7		
VOLUME OF SOLIDS	386.82		
VOLUME OF VOIDS	180.58		
VOID RATIO	0.467		
SATURATION	95.5		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	117.0
VOLUME OF SOLIDS	386.82
VOLUME OF VOIDS	164.38
VOID RATIO	0.425

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1189.83
WT SOIL & TARE, DRY (g)	1033.59
WT TARE (g)	0.00
WT MOISTURE (g)	156.24
WT DRY SOIL (g)	1033.59
% MOISTURE	15.12

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.254	16	30.4	0.0	4.51	0.95	6.25	5.637	0.0	7948.8	7948.8	7948.8	1.00	7948.8	0.0	0.00
5.0	0.260	18	30.6	28.8	4.61	0.95	6.26	5.631	52.9	8001.7	7972.9	7920.0	1.01	7946.5	26.5	0.54
13.3	0.270	114	35.6	748.8	4.79	0.95	6.27	5.621	2242.5	10191.3	9442.5	7200.0	1.31	8321.2	1121.2	0.33
21.7	0.280	155	39.6	1324.8	4.97	0.95	6.28	5.611	3176.3	11125.1	9800.3	6624.0	1.48	8212.1	1588.1	0.42
30.0	0.290	189	43.1	1828.8	5.14	0.95	6.29	5.601	3964.7	11913.5	10084.7	6120.0	1.65	8102.3	1982.3	0.46
38.3	0.300	217	45.8	2217.6	5.32	0.95	6.30	5.591	4585.6	12534.4	10316.8	5731.2	1.80	8024.0	2292.8	0.48
46.7	0.310	237	47.7	2491.2	5.50	0.95	6.31	5.581	5028.5	12977.3	10486.1	5457.6	1.92	7971.9	2514.3	0.50
55.0	0.320	251	49.2	2707.2	5.68	0.94	6.33	5.571	5349.1	13297.9	10590.7	5241.6	2.02	7916.2	2674.6	0.51
63.3	0.330	263	50.5	2894.4	5.85	0.94	6.34	5.561	5616.3	13565.1	10670.7	5054.4	2.11	7862.5	2808.1	0.52
71.7	0.340	275	51.5	3038.4	6.03	0.94	6.35	5.551	5864.2	13813.0	10774.6	4910.4	2.19	7842.5	2932.1	0.52
80.0	0.350	283	52.5	3182.4	6.21	0.94	6.36	5.541	6043.2	13992.0	10809.6	4766.4	2.27	7788.0	3021.6	0.53
88.3	0.360	290	53.1	3268.8	6.39	0.94	6.37	5.531	6187.7	14136.5	10867.7	4680.0	2.32	7773.8	3093.8	0.53
96.7	0.370	296	53.8	3369.6	6.56	0.93	6.39	5.521	6313.5	14262.3	10892.7	4579.2	2.38	7736.0	3156.8	0.53
105.8	0.381	301	54.4	3456.0	6.76	0.93	6.40	5.510	6415.1	14363.9	10907.9	4492.8	2.43	7700.3	3207.5	0.54
113.3	0.390	307	54.7	3499.2	6.92	0.93	6.41	5.501	6529.9	14478.7	10979.5	4449.6	2.47	7714.5	3264.9	0.54
123.3	0.402	311	55.2	3571.2	7.13	0.93	6.43	5.489	6618.1	14566.9	10995.7	4377.6	2.51	7686.6	3309.0	0.54
130.8	0.411	314	55.4	3600.0	7.29	0.93	6.44	5.480	6658.1	14606.9	11006.9	4348.8	2.53	7677.9	3329.1	0.54
138.3	0.420	317	55.6	3628.8	7.45	0.93	6.45	5.471	6713.7	14662.5	11033.7	4320.0	2.55	7676.8	3356.8	0.54
148.3	0.432	321	56.0	3686.4	7.66	0.92	6.46	5.459	6782.9	14731.7	11045.3	4262.4	2.59	7653.8	3391.4	0.54
155.0	0.440	324	56.1	3700.8	7.81	0.92	6.47	5.451	6841.4	14790.2	11089.4	4248.0	2.61	7668.7	3420.7	0.54
163.3	0.450	326	56.3	3729.6	7.98	0.92	6.48	5.441	6879.4	14828.2	11098.6	4219.2	2.63	7658.9	3439.7	0.54
172.5	0.461	328	56.4	3729.6	8.18	0.92	6.50	5.430	6915.7	14864.5	11134.9	4219.2	2.64	7677.1	3457.9	0.54
182.5	0.473	331	56.6	3729.6	8.39	0.92	6.51	5.418	6966.0	14914.8	11185.2	4219.2	2.65	7702.2	3483.0	0.54
189.2	0.481	334	56.7	3787.2	8.53	0.91	6.52	5.410	7006.0	14954.8	11167.6	4161.6	2.68	7664.6	3503.0	0.54
196.7	0.490	335	56.7	3787.2	8.69	0.91	6.54	5.401	7026.8	14975.6	11188.4	4161.6	2.69	7675.0	3513.4	0.54

DU @ FAILURE	3787.2	DEVIATORIC STRESS @ FAILURE	7006.0	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.68

TECH	TW/AK
DATE	6/15/09
CHECKED	AK
REVIEWED	

Golder Associates Inc.

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	GEOSYNTEC/MILLENIUM/MD
PROJECT NUMBER	093-90136
SAMPLE ID	Bottom of Stockpile 90%
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.0012
STRAIN RATE (%/min)	0.02
CELL PRESSURE (psi)	126.5
SAMPLE PRESSURE (psi)	30.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	96.5
PRESSURE, σ_3 (psf)	13896.0
FINAL "B" VALUE	-
t_{50} (minutes)	18.84

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	14.318	5.637	5.439
DIAMETER	7.001	2.756	2.779
AREA	38.50	5.97	6.06
VOLUME	551.21	33.64	32.98
WEIGHT (g)	1189.83		1179.13
% MOISTURE	15.1		14.08
SPECIFIC GRAVITY	2.67		
MOIST DENSITY (pcf)	134.7		
DRY DENSITY, calc (pcf)	117.0		
VOLUME OF SOLIDS	386.82		
VOLUME OF VOIDS	164.38		
VOID RATIO	0.425		
SATURATION	95.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	119.3
VOLUME OF SOLIDS	386.82
VOLUME OF VOIDS	153.68
VOID RATIO	0.397

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1179.13
WT SOIL & TARE, DRY (g)	1033.59
WT TARE (g)	0.00
WT MOISTURE (g)	145.54
WT DRY SOIL (g)	1033.59
% MOISTURE	14.08

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.452	20	30.4	0.0	8.31	0.92	6.61	5.439	0.0	13896.0	13896.0	13896.0	1.00	13896.0	0.0	0
2.5	0.455	105	32.6	316.8	8.37	0.92	6.62	5.436	1840.8	15736.8	15420.0	13579.2	1.14	14499.6	920.4	0.17
5.8	0.459	160	35.4	720.0	8.44	0.92	6.62	5.432	3050.4	16946.4	16226.4	13176.0	1.23	14701.2	1525.2	0.24
7.5	0.461	198	38.1	1108.8	8.48	0.92	6.63	5.430	3877.2	17773.2	16664.4	12787.2	1.30	14725.8	1938.6	0.29
10.0	0.464	238	40.7	1483.2	8.53	0.91	6.63	5.427	4737.1	18633.1	17149.9	12412.8	1.38	14781.3	2368.5	0.31
13.3	0.468	274	43.2	1843.2	8.60	0.91	6.64	5.423	5512.4	19408.4	17565.2	12052.8	1.46	14809.0	2756.2	0.33
16.7	0.472	306	45.5	2174.4	8.68	0.91	6.64	5.419	6201.9	20097.9	17923.5	11721.6	1.53	14822.5	3100.9	0.35
41.7	0.502	479	58.2	4003.2	9.23	0.91	6.68	5.389	9882.5	23778.5	19775.3	9892.8	2.00	14834.0	4941.2	0.41
65.8	0.531	561	63.9	4824.0	9.76	0.90	6.72	5.360	11590.0	25486.0	20662.0	9072.0	2.28	14867.0	5795.0	0.42
91.7	0.562	602	66.7	5227.2	10.33	0.90	6.76	5.329	12394.1	26290.1	21062.9	8668.8	2.43	14865.8	6197.0	0.42
117.5	0.593	627	68.1	5428.8	10.90	0.89	6.81	5.298	12831.5	26727.5	21298.7	8467.2	2.52	14883.0	6415.8	0.42
142.5	0.623	644	68.8	5529.6	11.45	0.89	6.85	5.268	13122.1	27018.1	21488.5	8366.4	2.57	14927.5	6561.1	0.42
168.3	0.654	660	69.2	5587.2	12.02	0.88	6.89	5.237	13371.9	27267.9	21680.7	8308.8	2.61	14994.8	6686.0	0.42
193.3	0.684	672	69.3	5601.6	12.58	0.87	6.94	5.207	13541.3	27437.3	21835.7	8294.4	2.63	15065.1	6770.7	0.41
219.2	0.715	685	69.2	5587.2	13.15	0.87	6.98	5.176	13704.7	27600.7	22013.5	8308.8	2.65	15161.1	6852.3	0.41
270.0	0.776	707	68.8	5529.6	14.27	0.86	7.07	5.115	13993.9	27889.9	22360.3	8366.4	2.67	15363.3	6996.9	0.40
321.7	0.838	728	68.1	5428.8	15.41	0.85	7.17	5.053	14221.6	28117.6	22688.8	8467.2	2.68	15578.0	7110.8	0.38
372.5	0.899	748	67.2	5299.2	16.53	0.83	7.27	4.992	14425.5	28321.5	23022.3	8596.8	2.68	15809.6	7212.8	0.37
424.2	0.961	767	66.3	5169.6	17.67	0.82	7.37	4.930	14601.9	28497.9	23328.3	8726.4	2.67	16027.4	7301.0	0.35

DU @ FAILURE	5428.8	DEVIATORIC STRESS @ FAILURE	14221.6	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	2.68

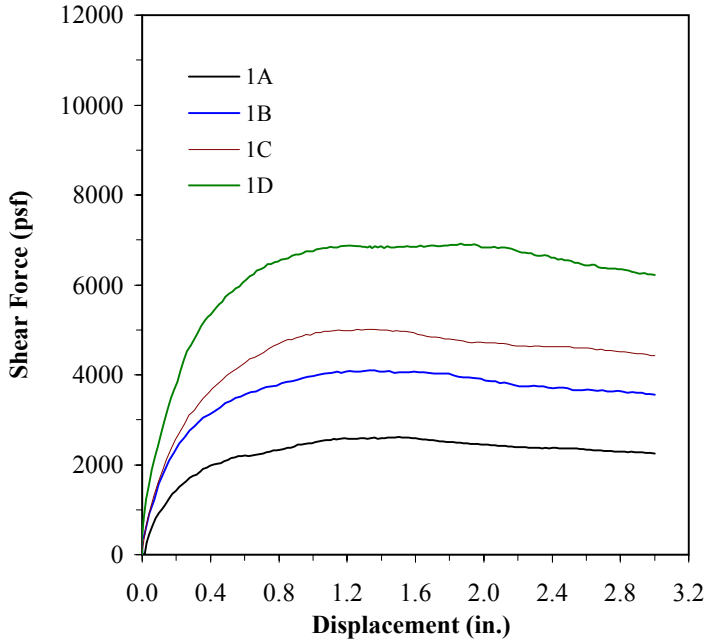
TECH	TW/AK
DATE	6/15/09
CHECKED	AIL
REVIEWED	

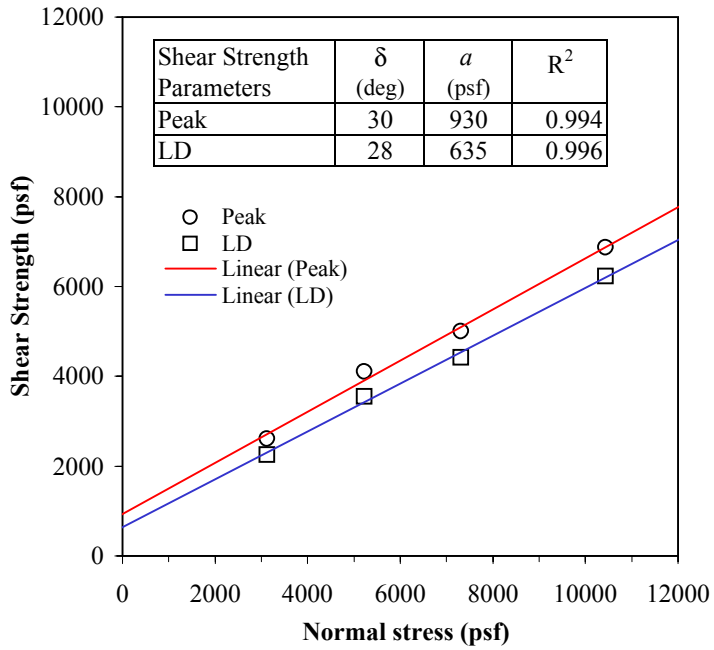
APPENDIX E
Direct Shear Test with Geosynthetic Material Inclusion

GEOSYNTEC CONSULTANTS
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Clay soil compacted to approximately 95% of maximum standard Proctor density at 2% dry of optimum moisture content against Miragrid 20XT geogrid against

Lower Shear Box: Clay soil compacted to approximately 95% of maximum standard Proctor density at 2% dry of optimum moisture cont





Shear Strength Parameters	δ (deg)	*a* (psf)	R^2
Peak	30	930	0.994
LD	28	635	0.996

Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Clay Soil								Shear Strength		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ω_i (%)	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
1A	12 x 12	3130	0.04	-	-	3130	24	106.1	14.3	-	-	-	-			2605	2255	(1)
1B	12 x 12	5220	0.04	-	-	5220	24	105.9	14.5	-	-	-	-			4105	3552	(1)
1C	12 x 12	7310	0.04	-	-	7310	24	105.7	14.7	-	-	-	-			5005	4422	(1)
1D	12 x 12	10440	0.04	-	-	10440	24	106.6	13.8	-	-	-	-			6866	6225	(1)

NOTES:

(1) Sliding (i.e., shear failure) occurred at the interface between the clay soil and geogrid.

(2) Each geogrid specimen was tested in the machine direction (i.e., direction of shearing parallel to MD)

SGI TESTING SERVICES, LLC

DATE OF REPORT:	7/18/2009
FIGURE NO.	C-1
PROJECT NO.	SGI8028
DOCUMENT NO.	
FILE NO.	

ATTACHMENT 6.5

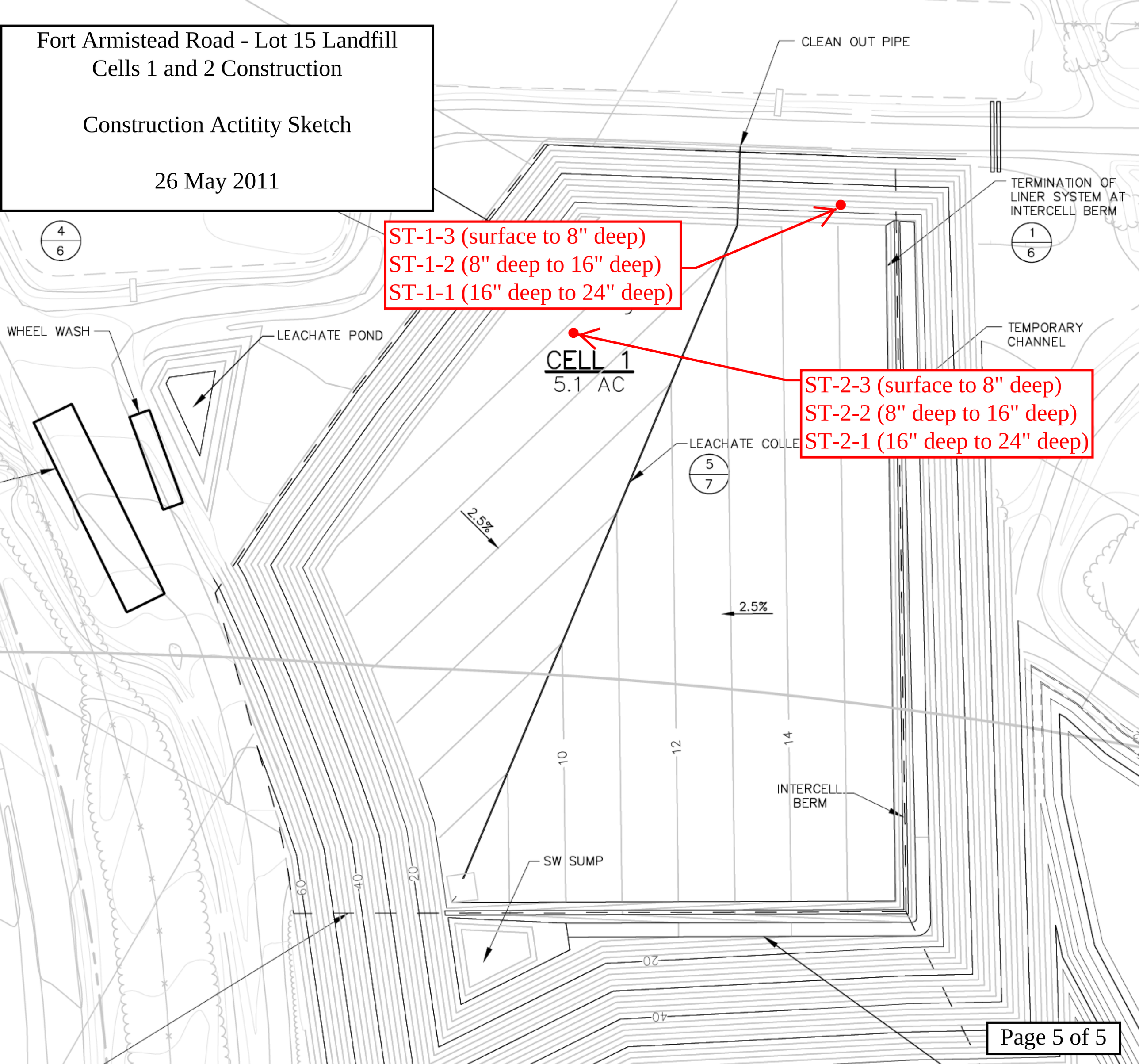
Laboratory Data from Cell 1 and Leachate Pond Construction,

Geosyntec [2011]

Fort Armistead Road - Lot 15 Landfill
Cells 1 and 2 Construction

Construction Actitity Sketch

26 May 2011



Fort Armistead Road - Lot 15 Landfill
Cells 1 and 2 Construction
Construction Actitity Sketch
20 July 2011

CLEAN OUT PIPE

TERMINATION OF LINER SYSTEM AT INTERCELL BERM

4/6

1/6

ST-1-3R (surface to 8" deep)

WHEEL WASH

LEACHATE POND

CELL 1
5.1 AC

TEMPORARY CHANNEL

ST-2-3R (surface to 8" deep)

LEACHATE COLLECTION DRAIN

5/7

2.5%

ST-3-3 (surface to 8" deep)
ST-3-2 (8" deep to 16" deep)
ST-3-1 (16" deep to 24" deep)

ST-4-3 (surface to 8" deep)
ST-4-2 (8" deep to 16" deep)
ST-4-1 (16" deep to 24" deep)

2.5%

10

12

14

ST-5-3 (surface to 8" deep)
ST-5-2 (8" deep to 16" deep)
ST-5-1 (16" deep to 24" deep)

SW SUMP

ST-6-3 (surface to 8" deep)
ST-6-2 (8" deep to 16" deep)
ST-6-1 (16" deep to 24" deep)

20

40

Fort Armistead Road - Lot 15 Landfill
Cells 1 and 2 Construction
Construction Actitity Sketch
26 July 2011

CLEAN OUT PIPE

TERMINATION OF LINER SYSTEM AT INTERCELL BERM

4/6

1/6

WHEEL WASH

LEACHATE POND

CELL 1
5.1 AC

TEMPORARY CHANNEL

ST-2-3R (surface to 8" deep)

LEACHATE COLLECTION DRAIN

5/7

2.5%

ST-4-3R (surface to 8" deep)

2.5%

10

12

14

INTERCELL BERM

SW SUMP

60

40

20

20

40

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD	Board #	2
PROJECT NUMBER	113-90133	Flow Pump	1
SAMPLE ID	ST-1-1	Flow Pump Speed	10
SAMPLE TYPE	UD	Technician	TW

COMMENTS

Sample Data, Initial			
Height, inches	1.657	B-Value, f	0.99
Diameter, inches	2.854	Cell Pres.	90.0
Area, cm²	41.27	Bot. Pres.	80.0
Volume, cm³	173.71	Top Pres.	80.0
Mass, g	374.80	Tot. B.P.	80.0
Moisture Content, %	18.81	Head, max.	110.43
Dry Density, pcf	113.32	Head, min.	110.43
Spec. Gravity (assumed)	2.800	Max. Grad.	25.52
Volume Solids, cm³	112.67	Min. Grad.	25.52
Volume Voids, cm³	61.04		
Void Ratio	0.54		
Saturation, %	97.2%		

Sample Data, Final	
Height, inches	1.704
Diameter, inches	2.890
Area, cm²	42.32
Volume, cm³	183.17
Mass, g	387.33
Moisture Content, %	22.78
Dry Density, pcf	107.47
Volume Solids, cm³	112.67
Volume Voids, cm³	70.50
Void Ratio	0.63
Saturation, %	101.9%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	374.80	395.77
Wt Soil & Tare, f	g	315.47	323.93
Wt Tare	g	0.00	8.57
Wt Moisture Lost	g	59.33	71.84
Wt Dry Soil	g	315.47	315.36
Water Content	%	18.81%	22.78%

DESCRIPTION: Reddish Brown and Gray, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/01/11	40695	8	0	21.8	0	0	0	0	1.57	110.43	25.52	2.2E-08
06/01/11	40695	8	5	21.8	5	5	300	300	1.57	110.43	25.52	2.2E-08
06/01/11	40695	8	10	21.8	5	10	300	600	1.57	110.43	25.52	2.2E-08
06/01/11	40695	8	15	21.8	5	15	300	900	1.57	110.43	25.52	2.2E-08 *
06/01/11	40695	8	20	21.8	5	20	300	1200	1.57	110.43	25.52	2.2E-08 *
06/01/11	40695	8	25	21.8	5	25	300	1500	1.57	110.43	25.52	2.2E-08 *
06/01/11	40695	8	30	21.8	5	30	300	1800	1.57	110.43	25.52	2.2E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.2E-08 cm/sec **

DATE 06/01/11
CHECK DH
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD	Board #	3
PROJECT NUMBER	113-90133	Flow Pump	1
SAMPLE ID	ST-1-2 -	Flow Pump Speed	10
SAMPLE TYPE	UD	Technician	TW

COMMENTS

Sample Data, Initial			
Height, inches	0.958	B-Value, f	1.00
Diameter, inches	2.859	Cell Pres.	90.0
Area, cm²	41.42	Bot. Pres.	80.0
Volume, cm³	100.78	Top Pres.	80.0
Mass, g	222.86	Tot. B.P.	80.0
Moisture Content, %	12.64	Head, max.	103.40
Dry Density, pcf	122.50	Head, min.	103.40
Spec. Gravity (assumed)	2.750	Max. Grad.	41.75
Volume Solids, cm³	71.94	Min. Grad.	41.75
Volume Voids, cm³	28.84		
Void Ratio	0.40		
Saturation, %	86.7%		

Sample Data, Final	
Height, inches	0.975
Diameter, inches	2.894
Area, cm²	42.44
Volume, cm³	105.10
Mass, g	230.37
Moisture Content, %	16.44
Dry Density, pcf	117.47
Volume Solids, cm³	71.94
Volume Voids, cm³	33.15
Void Ratio	0.46
Saturation, %	98.1%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	222.86	238.54
Wt Soil & Tare, f	g	197.84	206.04
Wt Tare	g	0.00	8.35
Wt Moisture Lost	g	25.02	32.50
Wt Dry Soil	g	197.84	197.69
Water Content	%	12.64%	16.44%

DESCRIPTION: Reddish Brown and Gray, SILTY CLAY, some fine sand.

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/01/11	40695	9	40	21.8	0	0	0	0	1.47	103.40	41.75	1.3E-08
06/01/11	40695	9	45	21.8	5	5	300	300	1.47	103.40	41.75	1.3E-08
06/01/11	40695	9	50	21.8	5	10	300	600	1.47	103.40	41.75	1.3E-08
06/01/11	40695	9	55	21.8	5	15	300	900	1.47	103.40	41.75	1.3E-08 *
06/01/11	40695	10	0	21.8	5	20	300	1200	1.47	103.40	41.75	1.3E-08 *
06/01/11	40695	10	5	21.8	5	25	300	1500	1.47	103.40	41.75	1.3E-08 *
06/01/11	40695	10	10	21.8	5	30	300	1800	1.47	103.40	41.75	1.3E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 1.3E-08 cm/sec **

DATE 06/01/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	8	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-1-3R	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.784	B-Value, f	0.98	Height, inches	2.852
Diameter, inches	2.862	Cell Pres.	90.0	Diameter, inches	2.903
Area, cm^2	41.50	Bot. Pres.	80.0	Area, cm^2	42.70
Volume, cm^3	293.49	Top Pres.	80.0	Volume, cm^3	309.34
Mass, g	621.93	Tot. B.P.	80.0	Mass, g	642.94
Moisture Content, %	18.70	Head, max.	132.24	Moisture Content, %	22.71
Dry Density, pcf	111.40	Head, min.	132.24	Dry Density, pcf	105.69
Spec. Gravity (assumed)	2.750	Max. Grad.	18.25	Volume Solids, cm^3	190.53
Volume Solids, cm^3	190.53	Min. Grad.	18.25	Volume Voids, cm^3	118.81
Volume Voids, cm^3	102.96			Void Ratio	0.62
Void Ratio	0.54			Saturation, %	100.1%
Saturation, %	95.1%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	621.93	651.09
Wt Soil & Tare, f	g	523.97	532.15
Wt Tare	g	0.00	8.33
Wt Moisture Lost	g	97.96	118.94
Wt Dry Soil	g	523.97	523.82
Water Content	%	18.70%	22.71%

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (^{0}C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	11	0	22.4	0	0	0	0	1.88	132.24	18.25	3.0E-08
07/25/11	40749	11	5	22.4	5	5	300	300	1.88	132.24	18.25	3.0E-08
07/25/11	40749	11	10	22.4	5	10	300	600	1.88	132.24	18.25	3.0E-08
07/25/11	40749	11	15	22.4	5	15	300	900	1.88	132.24	18.25	3.0E-08 *
07/25/11	40749	11	20	22.4	5	20	300	1200	1.88	132.24	18.25	3.0E-08 *
07/25/11	40749	11	25	22.4	5	25	300	1500	1.88	132.24	18.25	3.0E-08 *
07/25/11	40749	11	30	22.4	5	30	300	1800	1.88	132.24	18.25	3.0E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.0E-08 cm/sec **

DATE 07/25/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	2	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-2-1	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.922	B-Value, f	1.00	Height, inches	2.904
Diameter, inches	2.862	Cell Pres.	90.0	Diameter, inches	2.897
Area, cm^2	41.50	Bot. Pres.	80.0	Area, cm^2	42.53
Volume, cm^3	308.04	Top Pres.	80.0	Volume, cm^3	313.68
Mass, g	666.78	Tot. B.P.	80.0	Mass, g	684.62
Moisture Content, %	14.33	Head, max.	128.02	Moisture Content, %	17.39
Dry Density, pcf	118.14	Head, min.	128.02	Dry Density, pcf	116.02
Spec. Gravity (assumed)	2.750	Max. Grad.	17.36	Volume Solids, cm^3	212.07
Volume Solids, cm^3	212.07	Min. Grad.	17.36	Volume Voids, cm^3	101.60
Volume Voids, cm^3	95.97			Void Ratio	0.48
Void Ratio	0.45			Saturation, %	99.8%
Saturation, %	87.1%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	666.78	693.47
Wt Soil & Tare, f	g	583.20	592.09
Wt Tare	g	0.00	9.10
Wt Moisture Lost	g	83.58	101.38
Wt Dry Soil	g	583.20	582.99
Water Content	%	14.33%	17.39%

DESCRIPTION
Reddish Brown and Gray, SILTY CLAY, little medium to fine sand.

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
05/31/11	40694	7	55	21.7	0	0	0	0	1.82	128.02	17.36	3.2E-08
05/31/11	40694	8	0	21.7	5	5	300	300	1.82	128.02	17.36	3.2E-08
05/31/11	40694	8	5	21.7	5	10	300	600	1.82	128.02	17.36	3.2E-08
05/31/11	40694	8	10	21.7	5	15	300	900	1.82	128.02	17.36	3.2E-08 *
05/31/11	40694	8	15	21.7	5	20	300	1200	1.82	128.02	17.36	3.2E-08 *
05/31/11	40694	8	20	21.7	5	25	300	1500	1.82	128.02	17.36	3.2E-08 *
05/31/11	40694	8	25	21.7	5	30	300	1800	1.82	128.02	17.36	3.2E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.2E-08 cm/sec **

DATE 05/31/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD	Board #	3
PROJECT NUMBER	113-90133	Flow Pump	1
SAMPLE ID	ST-2-2 -	Flow Pump Speed	10
SAMPLE TYPE	UD	Technician	TW

COMMENTS

Sample Data, Initial			
Height, inches	2.924	B-Value, f	0.98
Diameter, inches	2.866	Cell Pres.	90.0
Area, cm²	41.62	Bot. Pres.	80.0
Volume, cm³	309.12	Top Pres.	80.0
Mass, g	674.21	Tot. B.P.	80.0
Moisture Content, %	14.19	Head, max.	149.12
Dry Density, pcf	119.19	Head, min.	149.12
Spec. Gravity (assumed)	2.750	Max. Grad.	20.02
Volume Solids, cm³	214.71	Min. Grad.	20.02
Volume Voids, cm³	94.41		
Void Ratio	0.44		
Saturation, %	88.7%		

Sample Data, Final	
Height, inches	2.933
Diameter, inches	2.897
Area, cm²	42.53
Volume, cm³	316.81
Mass, g	691.12
Moisture Content, %	17.05
Dry Density, pcf	116.30
Volume Solids, cm³	214.71
Volume Voids, cm³	102.10
Void Ratio	0.48
Saturation, %	98.6%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	674.21	699.32
Wt Soil & Tare, f	g	590.44	598.67
Wt Tare	g	0.00	8.39
Wt Moisture Lost	g	83.77	100.65
Wt Dry Soil	g	590.44	590.28
Water Content	%	14.19%	17.05%

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Reddish Brown and Gray, SILTY CLAY, little medium to fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
05/31/11	40694	8	30	21.7	0	0	0	0	2.12	149.12	20.02	2.8E-08
05/31/11	40694	8	35	21.7	5	5	300	300	2.12	149.12	20.02	2.8E-08
05/31/11	40694	8	40	21.7	5	10	300	600	2.12	149.12	20.02	2.8E-08
05/31/11	40694	8	45	21.7	5	15	300	900	2.12	149.12	20.02	2.8E-08 *
05/31/11	40694	8	50	21.7	5	20	300	1200	2.12	149.12	20.02	2.8E-08 *
05/31/11	40694	8	55	21.7	5	25	300	1500	2.12	149.12	20.02	2.8E-08 *
05/31/11	40694	9	0	21.7	5	30	300	1800	2.12	149.12	20.02	2.8E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.8E-08 cm/sec **

DATE 05/31/11
CHECK DA
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	4	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-2-3	-	Flow Pump Speed	8	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.919	B-Value, f	1.00	Height, inches	2.951
Diameter, inches	2.861	Cell Pres.	90.0	Diameter, inches	2.894
Area, cm²	41.48	Bot. Pres.	80.0	Area, cm²	42.44
Volume, cm³	307.51	Top Pres.	80.0	Volume, cm³	318.10
Mass, g	683.97	Tot. B.P.	80.0	Mass, g	704.55
Moisture Content, %	13.49	Head, max.	102.70	Moisture Content, %	16.91
Dry Density, pcf	122.29	Head, min.	102.70	Dry Density, pcf	118.22
Spec. Gravity	2.796	Max. Grad.	13.70	Volume Solids, cm³	215.55
Volume Solids, cm³	215.55	Min. Grad.	13.70	Volume Voids, cm³	102.55
Volume Voids, cm³	91.97			Void Ratio	0.48
Void Ratio	0.43			Saturation, %	99.4%
Saturation, %	88.4%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	683.97	712.48
Wt Soil & Tare, f	g	602.67	610.65
Wt Tare	g	0.00	8.30
Wt Moisture Lost	g	81.30	101.83
Wt Dry Soil	g	602.67	602.35
Water Content	%	13.49%	16.91%

DESCRIPTION: Reddish Brown and Gray, SILTY CLAY, little medium to fine sand.

Flow Pump Rate: 1.27E-04 cm³/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
05/31/11	40694	9	35	21.7	0	0	0	0	1.46	102.70	13.70	2.1E-07
05/31/11	40694	9	40	21.7	5	5	300	300	1.46	102.70	13.70	2.1E-07
05/31/11	40694	9	45	21.7	5	10	300	600	1.46	102.70	13.70	2.1E-07
05/31/11	40694	9	50	21.7	5	15	300	900	1.46	102.70	13.70	2.1E-07 *
05/31/11	40694	9	55	21.7	5	20	300	1200	1.46	102.70	13.70	2.1E-07 *
05/31/11	40694	10	0	21.7	5	25	300	1500	1.46	102.70	13.70	2.1E-07 *
05/31/11	40694	10	5	21.7	5	30	300	1800	1.46	102.70	13.70	2.1E-07 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.1E-07 cm/sec **

DATE 05/31/11
CHECK DW
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	1	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-2-3R	-	Flow Pump Speed	11	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.952	B-Value, f	1.00	Height, inches	2.998
Diameter, inches	2.863	Cell Pres.	90.0	Diameter, inches	2.942
Area, cm²	41.53	Bot. Pres.	80.0	Area, cm²	43.86
Volume, cm³	311.42	Top Pres.	80.0	Volume, cm³	333.97
Mass, g	689.74	Tot. B.P.	80.0	Mass, g	717.19
Moisture Content, %	12.71	Head, max.	125.91	Moisture Content, %	17.20
Dry Density, pcf	122.61	Head, min.	125.91	Dry Density, pcf	114.34
Spec. Gravity	2.745	Max. Grad.	16.53	Volume Solids, cm³	222.93
Volume Solids, cm³	222.93	Min. Grad.	16.53	Volume Voids, cm³	111.04
Volume Voids, cm³	88.50			Void Ratio	0.50
Void Ratio	0.40			Saturation, %	94.8%
Saturation, %	87.9%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	689.74	725.20
Wt Soil & Tare, f	g	611.93	619.99
Wt Tare	g	0.00	8.33
Wt Moisture Lost	g	77.81	105.21
Wt Dry Soil	g	611.93	611.66
Water Content	%	12.71%	17.20%

Flow Pump Rate: 1.27E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Reddish Brown, SILTY CLAY, trace medium to fine sand, trace fine gravel.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/28/11	40752	9	45	21.6	0	0	0	0	1.79	125.91	16.53	1.7E-08
07/28/11	40752	9	50	21.6	5	5	300	300	1.79	125.91	16.53	1.7E-08
07/28/11	40752	9	55	21.6	5	10	300	600	1.79	125.91	16.53	1.7E-08
07/28/11	40752	10	0	21.6	5	15	300	900	1.79	125.91	16.53	1.7E-08 *
07/28/11	40752	10	5	21.6	5	20	300	1200	1.79	125.91	16.53	1.7E-08 *
07/28/11	40752	10	10	21.6	5	25	300	1500	1.79	125.91	16.53	1.7E-08 *
07/28/11	40752	10	15	21.6	5	30	300	1800	1.79	125.91	16.53	1.7E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 1.7E-08 cm/sec **

DATE 07/28/11
CHECK AK
REVIEW JA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	8	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-3-1	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.090	B-Value, f	0.99	Height, inches	2.113
Diameter, inches	2.871	Cell Pres.	90.0	Diameter, inches	2.903
Area, cm^2	41.77	Bot. Pres.	80.0	Area, cm^2	42.70
Volume, cm^3	221.72	Top Pres.	80.0	Volume, cm^3	229.18
Mass, g	483.46	Tot. B.P.	80.0	Mass, g	494.60
Moisture Content, %	15.70	Head, max.	75.97	Moisture Content, %	18.36
Dry Density, pcf	117.60	Head, min.	75.97	Dry Density, pcf	113.77
Spec. Gravity	2.756	Max. Grad.	14.15	Volume Solids, cm^3	151.62
Volume Solids, cm^3	151.62	Min. Grad.	14.15	Volume Voids, cm^3	77.56
Volume Voids, cm^3	70.10			Void Ratio	0.51
Void Ratio	0.46			Saturation, %	98.9%
Saturation, %	93.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	483.46	502.83
Wt Soil & Tare, f	g	417.87	426.12
Wt Tare	g	0.00	8.36
Wt Moisture Lost	g	65.59	76.71
Wt Dry Soil	g	417.87	417.76
Water Content	%	15.70%	18.36%

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/24/11	40748	12	45	23.5	0	0	0	0	1.08	75.97	14.15	3.7E-08
07/24/11	40748	12	50	23.5	5	5	300	300	1.08	75.97	14.15	3.7E-08
07/24/11	40748	12	55	23.5	5	10	300	600	1.08	75.97	14.15	3.7E-08
07/24/11	40748	13	0	23.5	5	15	300	900	1.08	75.97	14.15	3.7E-08 *
07/24/11	40748	13	5	23.5	5	20	300	1200	1.08	75.97	14.15	3.7E-08 *
07/24/11	40748	13	10	23.5	5	25	300	1500	1.08	75.97	14.15	3.7E-08 *
07/24/11	40748	13	15	23.5	5	30	300	1800	1.08	75.97	14.15	3.7E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.7E-08 cm/sec **

DATE 07/24/11
CHECK DA
REVIEW AWH

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	11	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-3-2	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.917	B-Value, f	0.99	Height, inches	2.945
Diameter, inches	2.860	Cell Pres.	90.0	Diameter, inches	2.902
Area, cm²	41.45	Bot. Pres.	80.0	Area, cm²	42.67
Volume, cm³	307.09	Top Pres.	80.0	Volume, cm³	319.21
Mass, g	683.50	Tot. B.P.	80.0	Mass, g	696.83
Moisture Content, %	14.31	Head, max.	69.64	Moisture Content, %	16.54
Dry Density, pcf	121.50	Head, min.	69.64	Dry Density, pcf	116.89
Spec. Gravity(assumed)	2.750	Max. Grad.	9.31	Volume Solids, cm³	217.43
Volume Solids, cm³	217.43	Min. Grad.	9.31	Volume Voids, cm³	101.77
Volume Voids, cm³	89.65			Void Ratio	0.47
Void Ratio	0.41			Saturation, %	97.2%
Saturation, %	95.4%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	683.50	704.98
Wt Soil & Tare, f	g	597.94	606.10
Wt Tare	g	0.00	8.22
Wt Moisture Lost	g	85.56	98.88
Wt Dry Soil	g	597.94	597.88
Water Content	%	14.31%	16.54%

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/24/11	40748	11	30	23.5	0	0	0	0	0.99	69.64	9.31	5.7E-08
07/24/11	40748	11	35	23.5	5	5	300	300	0.99	69.64	9.31	5.7E-08
07/24/11	40748	11	40	23.5	5	10	300	600	0.99	69.64	9.31	5.7E-08
07/24/11	40748	11	45	23.5	5	15	300	900	0.99	69.64	9.31	5.7E-08 *
07/24/11	40748	11	50	23.5	5	20	300	1200	0.99	69.64	9.31	5.7E-08 *
07/24/11	40748	11	55	23.5	5	25	300	1500	0.99	69.64	9.31	5.7E-08 *
07/24/11	40748	12	0	23.5	5	30	300	1800	0.99	69.64	9.31	5.7E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.7E-08 cm/sec **

DATE 07/24/11
CHECK JB
REVIEW AWH

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	3	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-3-3	-	Flow Pump Speed	11	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.904	B-Value, f	0.98	Height, inches	2.927
Diameter, inches	2.844	Cell Pres.	90.0	Diameter, inches	2.867
Area, cm^2	40.98	Bot. Pres.	80.0	Area, cm^2	41.65
Volume, cm^3	302.31	Top Pres.	80.0	Volume, cm^3	309.65
Mass, g	661.96	Tot. B.P.	80.0	Mass, g	675.71
Moisture Content, %	14.10	Head, max.	111.14	Moisture Content, %	16.47
Dry Density, pcf	119.75	Head, min.	111.14	Dry Density, pcf	116.91
Spec. Gravity(assumed)	2.750	Max. Grad.	14.95	Volume Solids, cm^3	210.97
Volume Solids, cm^3	210.97	Min. Grad.	14.95	Volume Voids, cm^3	98.68
Volume Voids, cm^3	91.34			Void Ratio	0.47
Void Ratio	0.43			Saturation, %	96.8%
Saturation, %	89.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	661.96	684.32
Wt Soil & Tare, f	g	580.16	588.79
Wt Tare	g	0.00	8.78
Wt Moisture Lost	g	81.80	95.53
Wt Dry Soil	g	580.16	580.01
Water Content	%	14.10%	16.47%

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

Flow Pump Rate: 1.27E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/24/11	40748	10	45	23.5	0	0	0	0	1.58	111.14	14.95	1.9E-08
07/24/11	40748	10	50	23.5	5	5	300	300	1.58	111.14	14.95	1.9E-08
07/24/11	40748	10	55	23.5	5	10	300	600	1.58	111.14	14.95	1.9E-08
07/24/11	40748	11	0	23.5	5	15	300	900	1.58	111.14	14.95	1.9E-08 *
07/24/11	40748	11	5	23.5	5	20	300	1200	1.58	111.14	14.95	1.9E-08 *
07/24/11	40748	11	10	23.5	5	25	300	1500	1.58	111.14	14.95	1.9E-08 *
07/24/11	40748	11	15	23.5	5	30	300	1800	1.58	111.14	14.95	1.9E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 1.9E-08 cm/sec **

DATE 07/24/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	6	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-4-1	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.922	B-Value, f	1.00	Height, inches	2.970
Diameter, inches	2.868	Cell Pres.	90.0	Diameter, inches	2.895
Area, cm^2	41.68	Bot. Pres.	80.0	Area, cm^2	42.47
Volume, cm^3	309.34	Top Pres.	80.0	Volume, cm^3	320.36
Mass, g	710.48	Tot. B.P.	80.0	Mass, g	726.46
Moisture Content, %	13.55	Head, max.	151.93	Moisture Content, %	16.11
Dry Density, pcf	126.21	Head, min.	151.93	Dry Density, pcf	121.87
Spec. Gravity(assumed)	2.800	Max. Grad.	20.14	Volume Solids, cm^3	223.45
Volume Solids, cm^3	223.45	Min. Grad.	20.14	Volume Voids, cm^3	96.91
Volume Voids, cm^3	85.88			Void Ratio	0.43
Void Ratio	0.38			Saturation, %	104.0%
Saturation, %	98.7%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	710.48	734.61
Wt Soil & Tare, f	g	625.67	633.86
Wt Tare	g	0.00	8.41
Wt Moisture Lost	g	84.81	100.75
Wt Dry Soil	g	625.67	625.45
Water Content	%	13.55%	16.11%

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/24/11	40748	12	10	23.5	0	0	0	0	2.16	151.93	20.14	2.6E-08
07/24/11	40748	12	15	23.5	5	5	300	300	2.16	151.93	20.14	2.6E-08
07/24/11	40748	12	20	23.5	5	10	300	600	2.16	151.93	20.14	2.6E-08
07/24/11	40748	12	25	23.5	5	15	300	900	2.16	151.93	20.14	2.6E-08 *
07/24/11	40748	12	30	23.5	5	20	300	1200	2.16	151.93	20.14	2.6E-08 *
07/24/11	40748	12	35	23.5	5	25	300	1500	2.16	151.93	20.14	2.6E-08 *
07/24/11	40748	12	40	23.5	5	30	300	1800	2.16	151.93	20.14	2.6E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.6E-08 cm/sec **

DATE 07/24/11
CHECK DA
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD	Board #	9
PROJECT NUMBER	113-90133	Flow Pump	1
SAMPLE ID	ST-4-2 -	Flow Pump Speed	10
SAMPLE TYPE	UD	Technician	SDM

COMMENTS

Sample Data, Initial			
Height, inches	2.616	B-Value, f	1.00
Diameter, inches	2.877	Cell Pres.	90.0
Area, cm²	41.94	Bot. Pres.	80.0
Volume, cm³	278.68	Top Pres.	80.0
Mass, g	613.35	Tot. B.P.	80.0
Moisture Content, %	12.18	Head, max.	161.78
Dry Density, pcf	122.42	Head, min.	161.78
Spec. Gravity	2.663	Max. Grad.	24.04
Volume Solids, cm³	205.31	Min. Grad.	24.04
Volume Voids, cm³	73.37		
Void Ratio	0.36		
Saturation, %	90.8%		

Sample Data, Final	
Height, inches	2.650
Diameter, inches	2.903
Area, cm²	42.70
Volume, cm³	287.43
Mass, g	629.80
Moisture Content, %	15.19
Dry Density, pcf	118.70
Volume Solids, cm³	205.31
Volume Voids, cm³	82.12
Void Ratio	0.40
Saturation, %	101.1%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	613.35	637.93
Wt Soil & Tare, f	g	546.75	554.91
Wt Tare	g	0.00	8.36
Wt Moisture Lost	g	66.60	83.02
Wt Dry Soil	g	546.75	546.55
Water Content	%	12.18%	15.19%

DESCRIPTION
Red and Pale Yellow, SILTY CLAY, trace fine sand.

Flow Pump Rate 2.45E-05 cm³/sec

USCS (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	11	30	22.4	0	0	0	0	2.30	161.78	24.04	2.3E-08
07/25/11	40749	11	35	22.4	5	5	300	300	2.30	161.78	24.04	2.3E-08
07/25/11	40749	11	40	22.4	5	10	300	600	2.30	161.78	24.04	2.3E-08
07/25/11	40749	11	45	22.4	5	15	300	900	2.30	161.78	24.04	2.3E-08 *
07/25/11	40749	11	50	22.4	5	20	300	1200	2.30	161.78	24.04	2.3E-08 *
07/25/11	40749	11	55	22.4	5	25	300	1500	2.30	161.78	24.04	2.3E-08 *
07/25/11	40749	12	0	22.4	5	30	300	1800	2.30	161.78	24.04	2.3E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.3E-08 cm/sec **

DATE 07/25/11
CHECK DA
REVIEW [illegible]

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	4	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-4-3R	-	Flow Pump Speed	9	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.932	B-Value, f	0.98	Height, inches	2.965
Diameter, inches	2.860	Cell Pres.	90.0	Diameter, inches	2.920
Area, cm^2	41.45	Bot. Pres.	80.0	Area, cm^2	43.20
Volume, cm^3	308.66	Top Pres.	80.0	Volume, cm^3	325.37
Mass, g	654.65	Tot. B.P.	80.0	Mass, g	676.44
Moisture Content, %	15.57	Head, max.	146.31	Moisture Content, %	19.42
Dry Density, pcf	114.51	Head, min.	146.31	Dry Density, pcf	108.63
Spec. Gravity (assumed)	2.700	Max. Grad.	19.43	Volume Solids, cm^3	209.79
Volume Solids, cm^3	209.79	Min. Grad.	19.43	Volume Voids, cm^3	115.58
Volume Voids, cm^3	98.88			Void Ratio	0.55
Void Ratio	0.47			Saturation, %	95.2%
Saturation, %	89.2%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	654.65	684.32
Wt Soil & Tare, f	g	566.43	574.38
Wt Tare	g	0.00	8.31
Wt Moisture Lost	g	88.22	109.94
Wt Dry Soil	g	566.43	566.07
Water Content	%	15.57%	19.42%

DESCRIPTION
Reddish Brown, SILTY CLAY, trace medium to fine sand, trace fine gravel.

Flow Pump Rate 5.04E-05 cm^3/sec

USCS (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/28/11	40752	10	35	21.6	0	0	0	0	2.08	146.31	19.43	5.8E-08
07/28/11	40752	10	40	21.6	5	5	300	300	2.08	146.31	19.43	5.8E-08
07/28/11	40752	10	45	21.6	5	10	300	600	2.08	146.31	19.43	5.8E-08
07/28/11	40752	10	50	21.6	5	15	300	900	2.08	146.31	19.43	5.8E-08 *
07/28/11	40752	10	55	21.6	5	20	300	1200	2.08	146.31	19.43	5.8E-08 *
07/28/11	40752	11	0	21.6	5	25	300	1500	2.08	146.31	19.43	5.8E-08 *
07/28/11	40752	11	5	21.6	5	30	300	1800	2.08	146.31	19.43	5.8E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.8E-08 cm/sec **

DATE 07/28/11
CHECK AK
REVIEW JW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	13	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-5-1	-	Flow Pump Speed	11	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.792	B-Value, f	1.00	Height, inches	2.848
Diameter, inches	2.871	Cell Pres.	90.0	Diameter, inches	2.901
Area, cm^2	41.77	Bot. Pres.	80.0	Area, cm^2	42.64
Volume, cm^3	296.19	Top Pres.	80.0	Volume, cm^3	308.48
Mass, g	647.56	Tot. B.P.	80.0	Mass, g	666.65
Moisture Content, %	16.71	Head, max.	124.50	Moisture Content, %	20.15
Dry Density, pcf	116.90	Head, min.	124.50	Dry Density, pcf	112.24
Spec. Gravity (assumed)	2.800	Max. Grad.	17.21	Volume Solids, cm^3	198.17
Volume Solids, cm^3	198.17	Min. Grad.	17.21	Volume Voids, cm^3	110.31
Volume Voids, cm^3	98.03			Void Ratio	0.56
Void Ratio	0.49			Saturation, %	101.3%
Saturation, %	94.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	647.56	674.73
Wt Soil & Tare, f	g	554.87	563.00
Wt Tare	g	0.00	8.40
Wt Moisture Lost	g	92.69	111.73
Wt Dry Soil	g	554.87	554.60
Water Content	%	16.71%	20.15%

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

Flow Pump Rate: 1.27E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/26/11	40750	8	15	22.2	0	0	0	0	1.77	124.50	17.21	1.6E-08
07/26/11	40750	8	20	22.2	5	5	300	300	1.77	124.50	17.21	1.6E-08
07/26/11	40750	8	25	22.2	5	10	300	600	1.77	124.50	17.21	1.6E-08
07/26/11	40750	8	30	22.2	5	15	300	900	1.77	124.50	17.21	1.6E-08 *
07/26/11	40750	8	35	22.2	5	20	300	1200	1.77	124.50	17.21	1.6E-08 *
07/26/11	40750	8	40	22.2	5	25	300	1500	1.77	124.50	17.21	1.6E-08 *
07/26/11	40750	8	45	22.2	5	30	300	1800	1.77	124.50	17.21	1.6E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 1.6E-08 cm/sec **

DATE 07/26/11
CHECK DA
REVIEW [illegible]

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	10	COMMENTS: Sample contained wax, intial and final mass and moisture content may be in error.
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-5-2	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.901	B-Value, f	0.99	Height, inches	2.934
Diameter, inches	2.840	Cell Pres.	90.0	Diameter, inches	2.855
Area, cm^2	40.87	Bot. Pres.	80.0	Area, cm^2	41.30
Volume, cm^3	301.14	Top Pres.	80.0	Volume, cm^3	307.80
Mass, g	685.66	Tot. B.P.	80.0	Mass, g	700.00
Moisture Content, %	16.52	Head, max.	163.89	Moisture Content, %	18.95
Dry Density, pcf	121.93	Head, min.	163.89	Dry Density, pcf	119.30
Spec. Gravity	2.880	Max. Grad.	21.99	Volume Solids, cm^3	204.33
Volume Solids, cm^3	204.33	Min. Grad.	21.99	Volume Voids, cm^3	103.47
Volume Voids, cm^3	96.82			Void Ratio	0.51
Void Ratio	0.47			Saturation, %	107.8%
Saturation, %	100.4%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	685.66	708.10
Wt Soil & Tare, f	g	588.46	596.59
Wt Tare	g	0.00	8.29
Wt Moisture Lost	g	97.20	111.51
Wt Dry Soil	g	588.46	588.30
Water Content	%	16.52%	18.95%

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (^{0}C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	12	15	22.6	0	0	0	0	2.33	163.89	21.99	2.5E-08
07/25/11	40749	12	20	22.6	5	5	300	300	2.33	163.89	21.99	2.5E-08
07/25/11	40749	12	25	22.6	5	10	300	600	2.33	163.89	21.99	2.5E-08
07/25/11	40749	12	30	22.6	5	15	300	900	2.33	163.89	21.99	2.5E-08 *
07/25/11	40749	12	35	22.6	5	20	300	1200	2.33	163.89	21.99	2.5E-08 *
07/25/11	40749	12	40	22.6	5	25	300	1500	2.33	163.89	21.99	2.5E-08 *
07/25/11	40749	12	45	22.6	5	30	300	1800	2.33	163.89	21.99	2.5E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.5E-08 cm/sec **

DATE 07/25/11
CHECK DA
REVIEW TWH

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	1	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-5-3	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.920	B-Value, f	0.99	Height, inches	2.955
Diameter, inches	2.873	Cell Pres.	90.0	Diameter, inches	2.913
Area, cm²	41.82	Bot. Pres.	80.0	Area, cm²	43.00
Volume, cm³	310.20	Top Pres.	80.0	Volume, cm³	322.72
Mass, g	673.53	Tot. B.P.	80.0	Mass, g	684.80
Moisture Content, %	14.70	Head, max.	163.19	Moisture Content, %	16.62
Dry Density, pcf	118.12	Head, min.	163.19	Dry Density, pcf	113.54
Spec. Gravity (assumed)	2.650	Max. Grad.	21.74	Volume Solids, cm³	221.59
Volume Solids, cm³	221.59	Min. Grad.	21.74	Volume Voids, cm³	101.13
Volume Voids, cm³	88.61			Void Ratio	0.46
Void Ratio	0.40			Saturation, %	96.5%
Saturation, %	97.4%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	673.53	693.40
Wt Soil & Tare, f	g	587.21	595.83
Wt Tare	g	0.00	8.74
Wt Moisture Lost	g	86.32	97.57
Wt Dry Soil	g	587.21	587.09
Water Content	%	14.70%	16.62%

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	13	0	22.7	0	0	0	0	2.32	163.19	21.74	2.5E-08
07/25/11	40749	13	5	22.7	5	5	300	300	2.32	163.19	21.74	2.5E-08
07/25/11	40749	13	10	22.7	5	10	300	600	2.32	163.19	21.74	2.5E-08
07/25/11	40749	13	15	22.7	5	15	300	900	2.32	163.19	21.74	2.5E-08 *
07/25/11	40749	13	20	22.7	5	20	300	1200	2.32	163.19	21.74	2.5E-08 *
07/25/11	40749	13	25	22.7	5	25	300	1500	2.32	163.19	21.74	2.5E-08 *
07/25/11	40749	13	30	22.7	5	30	300	1800	2.32	163.19	21.74	2.5E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.5E-08 cm/sec **

DATE 07/25/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	6	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-6-1	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.917	B-Value, f	0.99	Height, inches	2.983
Diameter, inches	2.847	Cell Pres.	90.0	Diameter, inches	2.873
Area, cm²	41.07	Bot. Pres.	80.0	Area, cm²	41.82
Volume, cm³	304.30	Top Pres.	80.0	Volume, cm³	316.90
Mass, g	668.35	Tot. B.P.	80.0	Mass, g	687.64
Moisture Content, %	14.70	Head, max.	132.24	Moisture Content, %	18.01
Dry Density, pcf	119.49	Head, min.	132.24	Dry Density, pcf	114.74
Spec. Gravity (assumed)	2.750	Max. Grad.	17.45	Volume Solids, cm³	211.89
Volume Solids, cm³	211.89	Min. Grad.	17.45	Volume Voids, cm³	105.00
Volume Voids, cm³	92.41			Void Ratio	0.50
Void Ratio	0.44			Saturation, %	99.9%
Saturation, %	92.7%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	668.35	695.81
Wt Soil & Tare, f	g	582.71	590.91
Wt Tare	g	0.00	8.36
Wt Moisture Lost	g	85.64	104.90
Wt Dry Soil	g	582.71	582.55
Water Content	%	14.70%	18.01%

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	10	15	22.4	0	0	0	0	1.88	132.24	17.45	3.2E-08
07/25/11	40749	10	20	22.4	5	5	300	300	1.88	132.24	17.45	3.2E-08
07/25/11	40749	10	25	22.4	5	10	300	600	1.88	132.24	17.45	3.2E-08
07/25/11	40749	10	30	22.4	5	15	300	900	1.88	132.24	17.45	3.2E-08 *
07/25/11	40749	10	35	22.4	5	20	300	1200	1.88	132.24	17.45	3.2E-08 *
07/25/11	40749	10	40	22.4	5	25	300	1500	1.88	132.24	17.45	3.2E-08 *
07/25/11	40749	10	45	22.4	5	30	300	1800	1.88	132.24	17.45	3.2E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.2E-08 cm/sec **

DATE 07/25/11
CHECK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	3	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-6-2	-	Flow Pump Speed	9	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.675	B-Value, f	0.98	Height, inches	2.734
Diameter, inches	2.868	Cell Pres.	90.0	Diameter, inches	2.906
Area, cm²	41.68	Bot. Pres.	80.0	Area, cm²	42.79
Volume, cm³	283.19	Top Pres.	80.0	Volume, cm³	297.15
Mass, g	614.87	Tot. B.P.	80.0	Mass, g	631.27
Moisture Content, %	17.78	Head, max.	143.49	Moisture Content, %	20.92
Dry Density, pcf	115.03	Head, min.	143.49	Dry Density, pcf	109.62
Spec. Gravity	2.795	Max. Grad.	20.66	Volume Solids, cm³	186.77
Volume Solids, cm³	186.77	Min. Grad.	20.66	Volume Voids, cm³	110.38
Volume Voids, cm³	96.41			Void Ratio	0.59
Void Ratio	0.52			Saturation, %	99.0%
Saturation, %	96.3%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	614.87	639.45
Wt Soil & Tare, f	g	522.04	530.25
Wt Tare	g	0.00	8.38
Wt Moisture Lost	g	92.83	109.20
Wt Dry Soil	g	522.04	521.87
Water Content	%	17.78%	20.92%

Flow Pump Rate: 5.04E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	9	40	22.4	0	0	0	0	2.04	143.49	20.66	5.4E-08
07/25/11	40749	9	45	22.4	5	5	300	300	2.04	143.49	20.66	5.4E-08
07/25/11	40749	9	50	22.4	5	10	300	600	2.04	143.49	20.66	5.4E-08
07/25/11	40749	9	55	22.4	5	15	300	900	2.04	143.49	20.66	5.4E-08 *
07/25/11	40749	10	0	22.4	5	20	300	1200	2.04	143.49	20.66	5.4E-08 *
07/25/11	40749	10	5	22.4	5	25	300	1500	2.04	143.49	20.66	5.4E-08 *
07/25/11	40749	10	10	22.4	5	30	300	1800	2.04	143.49	20.66	5.4E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.4E-08 cm/sec **

DATE 07/25/11
CHECK DR
REVIEW TMW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	11	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-6-3	-	Flow Pump Speed	9	
SAMPLE TYPE	UD		Technician	TW	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.538	B-Value, f	1.00	Height, inches	2.573
Diameter, inches	2.860	Cell Pres.	90.0	Diameter, inches	2.881
Area, cm²	41.45	Bot. Pres.	80.0	Area, cm²	42.06
Volume, cm³	267.19	Top Pres.	80.0	Volume, cm³	274.86
Mass, g	571.22	Tot. B.P.	80.0	Mass, g	588.81
Moisture Content, %	14.84	Head, max.	176.55	Moisture Content, %	18.37
Dry Density, pcf	116.17	Head, min.	176.55	Dry Density, pcf	112.93
Spec. Gravity (assumed)	2.750	Max. Grad.	27.01	Volume Solids, cm³	180.88
Volume Solids, cm³	180.88	Min. Grad.	27.01	Volume Voids, cm³	93.98
Volume Voids, cm³	86.30			Void Ratio	0.52
Void Ratio	0.48			Saturation, %	97.2%
Saturation, %	85.5%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	571.22	631.79
Wt Soil & Tare, f	g	497.43	540.44
Wt Tare	g	0.00	43.20
Wt Moisture Lost	g	73.79	91.35
Wt Dry Soil	g	497.43	497.24
Water Content	%	14.84%	18.37%

Flow Pump Rate: 5.04E-05 cm³/sec

USCS: (CH)

DESCRIPTION: Red and Pale Yellow, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
07/25/11	40749	16	10	23.3	0	0	0	0	2.51	176.55	27.01	4.1E-08
07/25/11	40749	16	15	23.3	5	5	300	300	2.51	176.55	27.01	4.1E-08
07/25/11	40749	16	20	23.3	5	10	300	600	2.51	176.55	27.01	4.1E-08
07/25/11	40749	16	25	23.3	5	15	300	900	2.51	176.55	27.01	4.1E-08 *
07/25/11	40749	16	30	23.3	5	20	300	1200	2.51	176.55	27.01	4.1E-08 *
07/25/11	40749	16	35	23.3	5	25	300	1500	2.51	176.55	27.01	4.1E-08 *
07/25/11	40749	16	40	23.3	5	30	300	1800	2.51	176.55	27.01	4.1E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

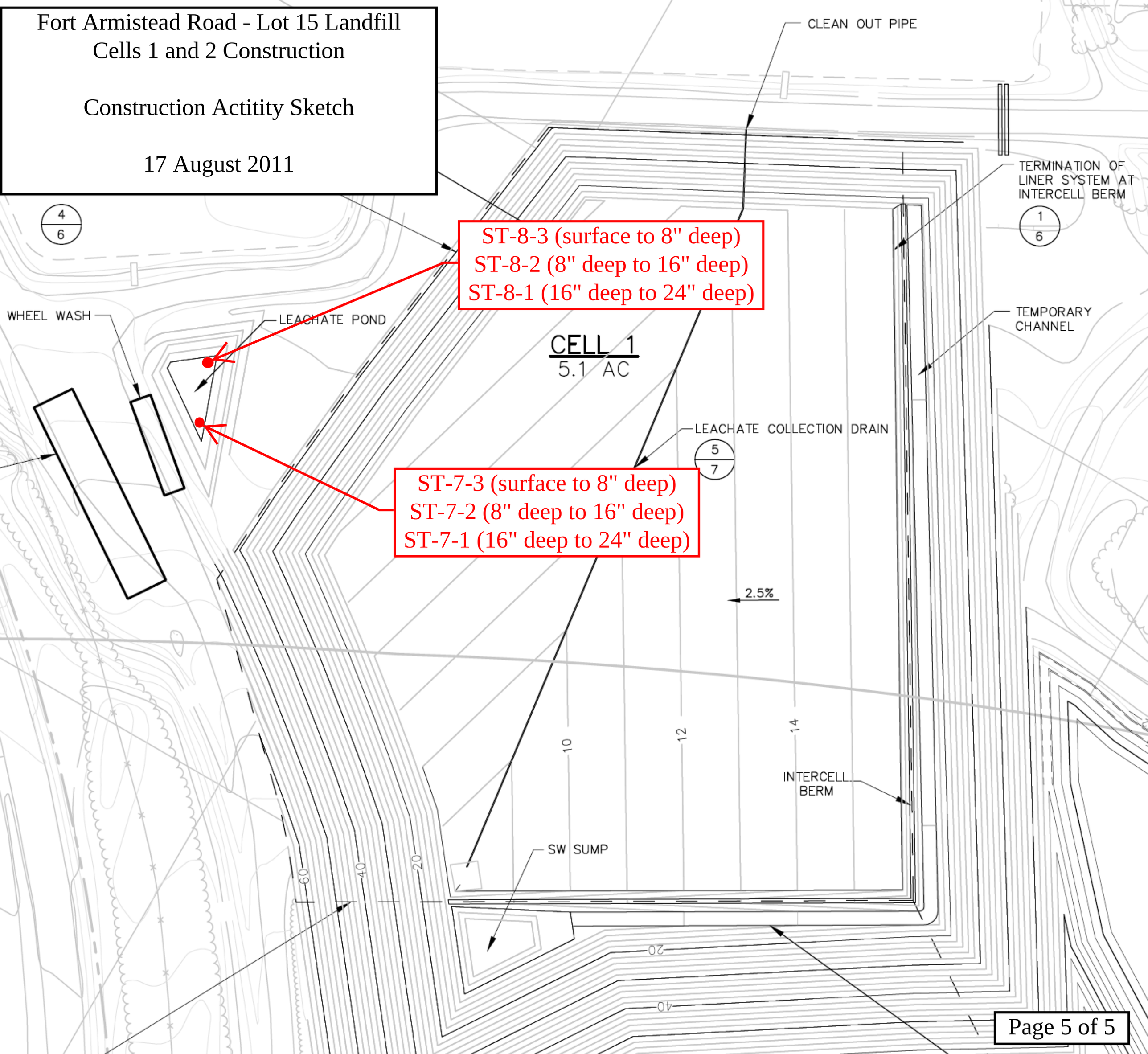
PERMEABILITY REPORTED AS ** 4.1E-08 cm/sec **

DATE 07/25/11
CHECK
REVIEW

Fort Armistead Road - Lot 15 Landfill
Cells 1 and 2 Construction

Construction Actitity Sketch

17 August 2011



FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	3	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-7-1	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.930	B-Value, f	0.99	Height, inches	2.942
Diameter, inches	2.860	Cell Pres.	90.0	Diameter, inches	2.886
Area, cm²	41.45	Bot. Pres.	80.0	Area, cm²	42.20
Volume, cm³	308.45	Top Pres.	80.0	Volume, cm³	315.37
Mass, g	674.24	Tot. B.P.	80.0	Mass, g	682.84
Moisture Content, %	17.45	Head, max.	143.49	Moisture Content, %	18.95
Dry Density, pcf	116.13	Head, min.	143.49	Dry Density, pcf	113.58
Spec. Gravity(assumed)	2.750	Max. Grad.	19.20	Volume Solids, cm³	208.75
Volume Solids, cm³	208.75	Min. Grad.	19.20	Volume Voids, cm³	106.63
Volume Voids, cm³	99.71			Void Ratio	0.51
Void Ratio	0.48			Saturation, %	102.0%
Saturation, %	100.5%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	674.24	691.07
Wt Soil & Tare, f	g	574.05	582.31
Wt Tare	g	0.00	8.39
Wt Moisture Lost	g	100.19	108.76
Wt Dry Soil	g	574.05	573.92
Water Content	%	17.45%	18.95%

DESCRIPTION: Yellowish Brown, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm³/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/19/11	40774	9	0	20.8	0	0	0	0	2.04	143.49	19.20	3.0E-08
08/19/11	40774	9	5	20.8	5	5	300	300	2.04	143.49	19.20	3.0E-08
08/19/11	40774	9	10	20.8	5	10	300	600	2.04	143.49	19.20	3.0E-08
08/19/11	40774	9	15	20.8	5	15	300	900	2.04	143.49	19.20	3.0E-08 *
08/19/11	40774	9	20	20.8	5	20	300	1200	2.04	143.49	19.20	3.0E-08 *
08/19/11	40774	9	25	20.8	5	25	300	1500	2.04	143.49	19.20	3.0E-08 *
08/19/11	40774	9	30	20.8	5	30	300	1800	2.04	143.49	19.20	3.0E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.0E-08 cm/sec **

DATE 08/19/11
CHECK AW
REVIEW JA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	7	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-7-2	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.933	B-Value, f	0.99	Height, inches	2.960
Diameter, inches	2.856	Cell Pres.	90.0	Diameter, inches	2.883
Area, cm^2	41.33	Bot. Pres.	80.0	Area, cm^2	42.12
Volume, cm^3	307.91	Top Pres.	80.0	Volume, cm^3	316.64
Mass, g	671.15	Tot. B.P.	80.0	Mass, g	680.17
Moisture Content, %	16.08	Head, max.	164.60	Moisture Content, %	17.64
Dry Density, pcf	117.17	Head, min.	164.60	Dry Density, pcf	113.94
Spec. Gravity(assumed)	2.750	Max. Grad.	21.89	Volume Solids, cm^3	210.25
Volume Solids, cm^3	210.25	Min. Grad.	21.89	Volume Voids, cm^3	106.40
Volume Voids, cm^3	97.66			Void Ratio	0.51
Void Ratio	0.46			Saturation, %	95.9%
Saturation, %	95.2%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	671.15	688.43
Wt Soil & Tare, f	g	578.18	586.46
Wt Tare	g	0.00	8.40
Wt Moisture Lost	g	92.97	101.97
Wt Dry Soil	g	578.18	578.06
Water Content	%	16.08%	17.64%

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

DESCRIPTION: Dusky Red, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP					
DATE	DAY	HOUR	MIN	TEMP (^oC)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)	
08/19/11	40774	11	0	21.3	0	0	0	0	2.34	164.60	21.89	2.6E-08	
08/19/11	40774	11	5	21.3	5	5	300	300	2.34	164.60	21.89	2.6E-08	
08/19/11	40774	11	10	21.3	5	10	300	600	2.34	164.60	21.89	2.6E-08	
08/19/11	40774	11	15	21.3	5	15	300	900	2.34	164.60	21.89	2.6E-08	*
08/19/11	40774	11	20	21.3	5	20	300	1200	2.34	164.60	21.89	2.6E-08	*
08/19/11	40774	11	25	21.3	5	25	300	1500	2.34	164.60	21.89	2.6E-08	*
08/19/11	40774	11	30	21.3	5	30	300	1800	2.34	164.60	21.89	2.6E-08	*

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.6E-08 cm/sec **

DATE 08/19/11
CHECK AK
REVIEW JA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	8	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-7-3	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.929	B-Value, f	1.00	Height, inches	2.958
Diameter, inches	2.859	Cell Pres.	90.0	Diameter, inches	2.870
Area, cm^2	41.42	Bot. Pres.	80.0	Area, cm^2	41.74
Volume, cm^3	308.13	Top Pres.	80.0	Volume, cm^3	313.58
Mass, g	662.89	Tot. B.P.	80.0	Mass, g	668.94
Moisture Content, %	17.81	Head, max.	146.31	Moisture Content, %	18.88
Dry Density, pcf	113.95	Head, min.	146.31	Dry Density, pcf	111.97
Spec. Gravity(assumed)	2.750	Max. Grad.	19.47	Volume Solids, cm^3	204.62
Volume Solids, cm^3	204.62	Min. Grad.	19.47	Volume Voids, cm^3	108.97
Volume Voids, cm^3	103.52			Void Ratio	0.53
Void Ratio	0.51			Saturation, %	97.5%
Saturation, %	96.8%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	662.89	677.23
Wt Soil & Tare, f	g	562.69	571.01
Wt Tare	g	0.00	8.47
Wt Moisture Lost	g	100.20	106.22
Wt Dry Soil	g	562.69	562.54
Water Content	%	17.81%	18.88%

DESCRIPTION: Dusky Red, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/19/11	40774	11	0	21.3	0	0	0	0	2.08	146.31	19.47	2.9E-08
08/19/11	40774	11	5	21.3	5	5	300	300	2.08	146.31	19.47	2.9E-08
08/19/11	40774	11	10	21.3	5	10	300	600	2.08	146.31	19.47	2.9E-08
08/19/11	40774	11	15	21.3	5	15	300	900	2.08	146.31	19.47	2.9E-08 *
08/19/11	40774	11	20	21.3	5	20	300	1200	2.08	146.31	19.47	2.9E-08 *
08/19/11	40774	11	25	21.3	5	25	300	1500	2.08	146.31	19.47	2.9E-08 *
08/19/11	40774	11	30	21.3	5	30	300	1800	2.08	146.31	19.47	2.9E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.9E-08 cm/sec **

DATE 08/19/11
CHECK AIL
REVIEW DJG

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	9	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-8-1	-	Flow Pump Speed	9	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.940	B-Value, f	1.00	Height, inches	2.943
Diameter, inches	2.854	Cell Pres.	90.0	Diameter, inches	2.888
Area, cm^2	41.27	Bot. Pres.	80.0	Area, cm^2	42.26
Volume, cm^3	308.21	Top Pres.	80.0	Volume, cm^3	315.92
Mass, g	661.73	Tot. B.P.	80.0	Mass, g	670.88
Moisture Content, %	15.56	Head, max.	105.51	Moisture Content, %	17.16
Dry Density, pcf	115.93	Head, min.	105.51	Dry Density, pcf	113.10
Spec. Gravity(assumed)	2.700	Max. Grad.	14.11	Volume Solids, cm^3	212.08
Volume Solids, cm^3	212.08	Min. Grad.	14.11	Volume Voids, cm^3	103.83
Volume Voids, cm^3	96.13			Void Ratio	0.49
Void Ratio	0.45			Saturation, %	94.6%
Saturation, %	92.7%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	661.73	678.97
Wt Soil & Tare, f	g	572.63	580.76
Wt Tare	g	0.00	8.38
Wt Moisture Lost	g	89.10	98.21
Wt Dry Soil	g	572.63	572.38
Water Content	%	15.56%	17.16%

DESCRIPTION: Dark Red, SILTY CLAY, trace fine sand.

Flow Pump Rate: 5.04E-05 cm^3/sec USCS: (CH)

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/19/11	40774	13	0	22	0	0	0	0	1.50	105.51	14.11	8.1E-08
08/19/11	40774	13	5	22	5	5	300	300	1.50	105.51	14.11	8.1E-08
08/19/11	40774	13	10	22	5	10	300	600	1.50	105.51	14.11	8.1E-08
08/19/11	40774	13	15	22	5	15	300	900	1.50	105.51	14.11	8.1E-08 *
08/19/11	40774	13	20	22	5	20	300	1200	1.50	105.51	14.11	8.1E-08 *
08/19/11	40774	13	25	22	5	25	300	1500	1.50	105.51	14.11	8.1E-08 *
08/19/11	40774	13	30	22	5	30	300	1800	1.50	105.51	14.11	8.1E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 8.1E-08 cm/sec **

DATE 08/19/11
CHECK AIC
REVIEW JA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	4	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-8-2	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.516	B-Value, f	0.98	Height, inches	2.537
Diameter, inches	2.852	Cell Pres.	90.0	Diameter, inches	2.879
Area, cm^2	41.22	Bot. Pres.	80.0	Area, cm^2	42.00
Volume, cm^3	263.39	Top Pres.	80.0	Volume, cm^3	270.64
Mass, g	574.70	Tot. B.P.	80.0	Mass, g	582.27
Moisture Content, %	15.71	Head, max.	106.92	Moisture Content, %	17.24
Dry Density, pcf	117.66	Head, min.	106.92	Dry Density, pcf	114.51
Spec. Gravity(assumed)	2.750	Max. Grad.	16.59	Volume Solids, cm^3	180.60
Volume Solids, cm^3	180.60	Min. Grad.	16.59	Volume Voids, cm^3	90.04
Volume Voids, cm^3	82.79			Void Ratio	0.50
Void Ratio	0.46			Saturation, %	95.1%
Saturation, %	94.3%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	574.70	590.43
Wt Soil & Tare, f	g	496.66	504.84
Wt Tare	g	0.00	8.32
Wt Moisture Lost	g	78.04	85.59
Wt Dry Soil	g	496.66	496.52
Water Content	%	15.71%	17.24%

DESCRIPTION: Dark Red, SILTY CLAY, trace fine sand.

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

TIME FUNCTIONS, SECONDS								dP					
DATE	DAY	HOUR	MIN	TEMP (^oC)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)	
08/19/11	40774	9	45	21.1	0	0	0	0	1.52	106.92	16.59	3.4E-08	
08/19/11	40774	9	50	21.1	5	5	300	300	1.52	106.92	16.59	3.4E-08	
08/19/11	40774	9	55	21.1	5	10	300	600	1.52	106.92	16.59	3.4E-08	
08/19/11	40774	10	0	21.1	5	15	300	900	1.52	106.92	16.59	3.4E-08	*
08/19/11	40774	10	5	21.1	5	20	300	1200	1.52	106.92	16.59	3.4E-08	*
08/19/11	40774	10	10	21.1	5	25	300	1500	1.52	106.92	16.59	3.4E-08	*
08/19/11	40774	10	15	21.1	5	30	300	1800	1.52	106.92	16.59	3.4E-08	*

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.4E-08 cm/sec **

DATE 08/19/11
CHECK AIL
REVIEW DJA

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	GEOSYNTEC/FORT ARMISTEAD ROAD - LOT 15 LF/MD		Board #	5	COMMENTS
PROJECT NUMBER	113-90133		Flow Pump	1	
SAMPLE ID	ST-8-3	-	Flow Pump Speed	10	
SAMPLE TYPE	UD		Technician	PWM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.932	B-Value, f	1.00	Height, inches	2.955
Diameter, inches	2.848	Cell Pres.	90.0	Diameter, inches	2.880
Area, cm^2	41.10	Bot. Pres.	80.0	Area, cm^2	42.03
Volume, cm^3	306.08	Top Pres.	80.0	Volume, cm^3	315.45
Mass, g	673.49	Tot. B.P.	80.0	Mass, g	681.19
Moisture Content, %	16.23	Head, max.	155.45	Moisture Content, %	17.55
Dry Density, pcf	118.14	Head, min.	155.45	Dry Density, pcf	114.63
Spec. Gravity(assumed)	2.750	Max. Grad.	20.71	Volume Solids, cm^3	210.72
Volume Solids, cm^3	210.72	Min. Grad.	20.71	Volume Voids, cm^3	104.74
Volume Voids, cm^3	95.36			Void Ratio	0.50
Void Ratio	0.45			Saturation, %	97.1%
Saturation, %	98.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	673.49	689.40
Wt Soil & Tare, f	g	579.47	587.70
Wt Tare	g	0.00	8.36
Wt Moisture Lost	g	94.02	101.70
Wt Dry Soil	g	579.47	579.34
Water Content	%	16.23%	17.55%

Flow Pump Rate: 2.45E-05 cm^3/sec

USCS: (CH)

DESCRIPTION: Dark Red, SILTY CLAY, trace fine sand.

TIME FUNCTIONS, SECONDS								dP					
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)	
08/19/11	40774	10	20	21.3	0	0	0	0	2.21	155.45	20.71	2.7E-08	
08/19/11	40774	10	25	21.3	5	5	300	300	2.21	155.45	20.71	2.7E-08	
08/19/11	40774	10	30	21.3	5	10	300	600	2.21	155.45	20.71	2.7E-08	
08/19/11	40774	10	35	21.3	5	15	300	900	2.21	155.45	20.71	2.7E-08	*
08/19/11	40774	10	40	21.3	5	20	300	1200	2.21	155.45	20.71	2.7E-08	*
08/19/11	40774	10	45	21.3	5	25	300	1500	2.21	155.45	20.71	2.7E-08	*
08/19/11	40774	10	50	21.3	5	30	300	1800	2.21	155.45	20.71	2.7E-08	*

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.7E-08 cm/sec **

DATE 08/19/11
CHECK AJC
REVIEW DJA

APPENDIX C
February 2021 Groundwater Monitoring Report

ANALYSIS OF GROUNDWATER ANALYTICAL DATA

HAWKINS LANDFILL, LLC

HAWKINS LANDFILL

for the

FEBRUARY 2021 SAMPLING EVENT

Prepared for

HAWKINS LANDFILL, LLC
(Formerly: TRONOX, CRISTAL, INC. - MILLENNIUM, INC.)
3901 Fort Armistead Road
Baltimore, Maryland 21226

Prepared by

TM Engineering, Inc.
2501 Westminster Drive
Olney, Maryland 20832

May 25, 2021

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FIGURE 1. GROUNDWATER ELEVATIONS VS TIME

APPENDIX A. ANALYTICAL DATABASE AND GRAPHS

Drawing 1 of 1. MONITORING WELL LOCATION MAP - 30 ACRE SITE

TM Engineering, Inc.

2501 Westminster Drive
Olney, Maryland 20832
(410) 206-1442

May 25, 2021

Mr. Joseph Bittner
Hawkins Landfill, LLC
5419 Wilkins Avenue
Baltimore, Maryland 21223

Dear Mr. Bittner:

RE: Evaluation of Groundwater Analytical Test Data – 1st Semi-Annual Report
Hawkins Landfill, Fort Armistead Road
Baltimore, Maryland

In accordance with your authorization, the review and analysis of analytical test data has been completed for the above-referenced facility. The data reviewed consisted of the semi-annual data from groundwater monitoring wells at the Hawkins Landfill currently owned by Hawkins Landfill, LLC for the February 2021 sampling event. The facility was formerly owned in succession by Millennium Inorganic Chemicals, Inc., Crystal Chemicals, Inc., Tronox and recently administered by the Maryland Environmental Service. The data are contained in a report from Caliber Analytical Services for samples collected on February 17, 2021 and submitted to the Maryland Department of the Environment under separate cover. The wells analyzed consist of five (5) monitoring wells, M-1 through M-5, located on the landfill site. It should be noted that the prefix "M", "MW" and "HPP" in various reports all refer to the same wells.

The parameters tested and analyzed are in accordance with the requirements of Refuse Disposal Permit 2019-WIF-0527A as issued to Hawkins Point LLC by the Maryland Department of the Environment, issued January 17, 2020 and expiring on January 16, 2025. The scope of TME's services consists of entering the data into the data base, performing statistical analyses, comparing the data to maximum concentration levels (MCL's) set forth in the U.S. EPA National Primary Drinking Water Regulations (DWR) and reviewing and commenting on the data. A copy of the historic data base for each parameter tested is included in Appendix A, Analytical Data

In order to create the data base, the computer code Excel was utilized. Parameters which were indicated to be "non-detected" in the analytical reports were entered into the database as "0" (zero). Test results which were indicated to be below the detection limit were entered as the value of the detection limit. Where samples were missing, the place of the data point was left blank. In cases where several detection limits were indicated, the limits were shown on the graphs. Where results of replicate samples were reported, the average was entered into the data base. If the parameter was present but below the detection limit, one half the detection limit was entered for statistical analyses.

The graphs in Appendix A were reviewed to detect trends in the data over time and similarities and differences in data at each well location with time and between well locations. Primary and secondary drinking water regulations/standards set forth by the U.S. Environmental Protection Agency were used as a basis for discussing the data.

A statistical analysis of the data was performed using the Student "t" Test comparing the most recent value to the historic background record which consists of the sampling events generally through January 2009 or as indicated for the individual parameter in the following discussion. The background data will be updated as independent data unaffected by the landfill becomes available. The analysis considered a two-tailed test with the degrees of freedom commensurate with the data set and levels of significance of .05 and .01. Where the majority of the data set was reported as non-detect or below the detection level, the statistical analysis was considered invalid and not performed.

The following discussion of observations of the tabular and graphical data follow the order of each parameter as it appears in the data base. The numbers in each heading refer to the Appendix A page number. The results of the statistical analyses are shown at the bottom of the tabular data sheets. The term "probably significant" indicates a value different from the data set (a change has occurred) valid at the .05 level of significance but not at the .01 level.

I. Groundwater Analytical Data Review

Alkalinity (p. 1 of 35)

Alkalinity (as CaCO3) is below the reporting limit of 1 ppm for wells M-2, M-3 and M-5. Values for wells M-1 and M-4 are 2.2 and 17.9 mg/l respectively. Drinking Water Regulation (DWR) limits for alkalinity are not known to have been promulgated. Since the majority of values are below detection levels, statistical evaluation has not been performed.

Ammonia (p. 2 0f 35)

Ammonia is below the reporting limit of 0.1 mg/l for all wells except well M-2 which exhibits a value of 0.3 mg/l and M-3 which has a value of 0.12 mg/l. Drinking Water Regulation (DWR) limits for ammonia are not known to have been promulgated. Insufficient data exists for statistical evaluation.

Antimony (p. 3 of 35)

Antimony was not found above the reporting limit of 0.002 mg/l in any of the wells. DWR limits for antimony are 0.006 mg/l.

Arsenic (p. 4 and 4a of 35)

Arsenic was not found above the reporting limit of 0.002 mg/l except well M-3 which exhibited a value of 0.0082 mg/l. Insufficient data exists statistical analyses. The DWR limit for arsenic is .01 mg/l. The natural background arsenic content indicated by data from the wells of Reference 1 is between less than .001 to .002 mg/l.

Barium (pp. 5 and 5a of 35)

Barium was detected in all wells and ranged between 0.008 mg/l and 0.053 mg/l. The values of 0.031 mg/l in well M-1, 0.032 in M-3, and 0.053 in M-4 indicate statistically significant increases. All values are below the DWR limit of 2.0 mg/l. Reference 1 indicates Barium levels to range from 0.01 to 0.4 mg/l for wells in the Patapsco and Patuxent aquifers.

Beryllium (p. 6 of 35)

Beryllium values are below the reporting limit of 0.002 mg/l in all the wells except M-1 which has a value of 0.0025 mg/l and M-4 which shows a value of 0.0024 mg/l. All values are below the DWR limit of 0.004 mg/l. Insufficient quantified data is available for statistical analyses.

Cadmium (p. 7 of 35)

Cadmium levels for all wells are below the reporting limit of 0.004 mg/l for this sampling event. All values are below the DWR limit of 0.005 mg/l. Cadmium levels in the wells of Reference 1 are less than .001 to .01 mg/l. Since all but a few values in the entire data set are below the reporting limits, statistical evaluation has not been performed.

Calcium (pp. 8 and 8a of 35)

Calcium was found to range from 1.6 to 17.0 mg/l in the samples from the monitoring wells. The DWR has not set limits on calcium. Student "T" tests indicate significant increases in all the wells.

Chloride (pp. 9 and 9a of 35)

Chloride concentrations range from 2.3 in well M-5 mg/l to 8.9 mg/l in well M-3. All values are considerably below the secondary limit of 250 mg/l. Student "T" tests indicate significant increases in wells M-1, M-3 and M-4. Chloride concentration for the regional wells listed in Reference 1 range from 1.1 to 6000 mg/l.

Chromium (pp. 10 and 10a of 35)

Concentrations of chromium in all wells are below the reporting limit of 0.005 mg/l except well M-1 which is at the reporting limit of 0.035 mg/l. The DWR limit for chromium is 0.1 mg/l. Values in the regional background wells of Reference 1 range from less than .001 to .012 mg/l. The majority of values are below the reporting limit and statistical evaluation has not been performed.

Cobalt (p. 11 of 35)

Cobalt values are reported for wells M-1, M-2, and M-4 to be 0.018, 0.0096 and 0.016 mg/l , respectively. Cobalt in wells M-3 and M-5 is below a reporting limit of 0.005 mg/l. The DWR has not established an upper threshold for cobalt. The Student "T" tests indicate significant increases in wells M-1 and M-4 and a significant decrease in well M-2.

COD (Chemical Oxygen Demand) (p. 12 of 35)

COD values for the February 2021 sampling event are below the reporting limit of 5 mg/l. COD limits are not known to have been promulgated for DWR. Since most all values in the data set are below the reporting limit, statistical evaluation has not been performed.

Copper (p. 13 of 35)

Test results for copper were below the reporting limit of 0.005 mg/l in all wells except M-1 which exhibits a value of 0.015 mg/l. The DWR limit for copper is 1.3 mg/l. Statistics were not performed since most of the data set is below the reporting limit.

Hardness (as CaCO3) (pp. 14 and 14a of 35)

Hardness was measured in all wells and ranged from 5.16 to 48.0 mg/l. Hardness limits are not known to be promulgated for DWR. The student "T" tests show a significant increase in well M-4, a probable significant increase in well M-3 and probable significant decreases in wells M-2 and M-5.

Iron (pp. 15 and 15a of 35)

Iron ranged from 0.12 mg/l in well M-5 to 36 mg/l in well M-1. Secondary drinking water limits are 0.3 mg/l for iron. The Student "T" tests show significant increases in all wells. It should be noted that iron was not required to be tested from January 2000 to January 2007 and the conclusions are based on updated background data from January 2007 through July 2013.

Lead (p. 16 of 35)

Lead is not above the reporting limit of .002 mg/l in all wells except M-1 which exhibits a value of 0.0021 mg/l. The DWR limit for lead is .015 mg/l. Natural background lead levels are indicated by Reference 1 to be in the range of less than .001 to 0.1 mg/l. The data is mostly below reporting levels and statistical evaluation has not been performed.

Magnesium (pp. 17 and 17a of 35)

Magnesium concentrations range from 0.25 mg/l in well M-5 to 1.70 mg/l in well M-1. Magnesium limits have not been set by the DWR. The Student "T" test shows significant increases for wells M-1, M-3 and M-4. A significant decrease occurs in well M-5. Values in the regional background wells of Reference 1 range from less than 0.6 to 340 mg/l for magnesium.

Manganese (pp. 18 and 18a of 35)

Manganese values range between .014 and 0.88 mg/l. The secondary limit for manganese is 0.05 mg/l. The Student "T" tests indicate significant increases for wells M-1, M-3 and M-4. Significant decreases occur in wells M-2 and M-5. Values in the regional background wells of Reference 1 range from 0.053 to 18 mg/l for manganese.

Mercury (p. 19 of 35)

Mercury was not detected above the reporting limit of .0002 in any of the wells. The DWS limit for mercury is .002 mg/l. Mercury levels were not reported in the regional data of Reference 1. Since all values for this sampling event are below the reporting limit, statistical evaluation was not performed.

Nickel (p. 20 and 20a of 35)

Test values for nickel are reported between 0.0055 mg/l to 0.032 mg/l. Nickel limits have not been set by the DWR. Student "T" tests indicate significant increases for M-1 and M-4, a significant decrease in M-2 and probable significant decrease in M-5. The regional wells (Reference 1) range from .004 to 0.610 mg/l.

Nitrate (p. 21 of 35)

Nitrate was found to range from 0.02 mg/l to 0.14 mg/l. All values are well below the DWR limit of 10 ppm. Since most values in the data set are below the reporting limit, no statistical analyses were performed.

Nitrite (p. 22 of 35)

Under the current landfill permit, Nitrite (N) is not analyzed.

Field pH (p. 23 of 35)

Values of field pH range between 3.58 and 6.65 in the moderately acidic to neutral range. These values generally conform to the natural background conditions for the Patapsco Aquifer as indicated by data from wells reported by the U.S. Geological Survey (Reference 1). Four of the five pH values are below the lower threshold of 6.5 for DWR. The Student "T" tests indicate significant increases in wells M-1and M-2 and significant decreases in wells M-3, M-4 and M-5.

Laboratory pH (p. 24 and 24a of 35)

Laboratory pH values were not performed for the July 2020 sampling event. Refer to the field pH data.

Potassium (pp.25 and 25a of 35)

Potassium values ranged from 0.35 mg/l in well M-5 to 0.79 mg/l in M-4. The DWR has set no limit for potassium. The Student "T" test indicate significant increases for wells M-2, M-3, and M-4. A significant decrease occurs in M-5. Values of potassium in the regional background wells of Reference 1 range from 0.4 to 85 mg/l.

Selenium (p. 26 of 35)

Values for selenium were all below the reporting limit of 0.005 mg/l. Since the data set is mostly below the reporting limit, statistical evaluation was not performed. The DWR limit for selenium is 0.05 mg/l.

Silver (p. 27 of 35)

Values for silver were all below the reporting limit level of .005 mg/l. Since the data set is mostly below the reporting limit, statistical evaluation was not performed. The secondary limit for silver is 0.1 mg/l.

Sodium (pp.28 and 28a of 35)

Analytical test values for sodium ranged between 1.0 and 3.4 mg/l. The DWR limit for sodium is 20 mg/l. The Student "T" tests indicate significant increases for wells M-1, M-3 and M-4 and a significant decreases in wells M-2 and M-5.

Specific Conductance (pp. 29 and 29a of 35)

Specific Conductance varies between 37 and 222 umhos/cm. It should be noted that the units on the field data sheet appear to have been written as mhos, not umhos. No limit for specific conductance has been established for DWR. Regional wells listed in Reference 1 exhibit specific conductance values between 26 and 14,300 umhos/cm. The Student "T" Tests indicate significant increases in wells M-3 and M-4. Significant decreases occur in wells M-2 and M-5.

Sulfate (pp. 30 and 30a of 35)

Sulfate concentrations occur between 7.87 and 121.00 mg/l in the wells for this sampling event. All values are considerably less than the 250 mg/l secondary limit. The Student "T" tests indicate significant increases in wells M-1, M-3 and M-4 and a significant decrease in well M-2. Regional wells reported in Reference 1 indicate a natural range of sulfate from 1 to 180 mg/l.

Thallium (p. 31 of 35)

Thallium was not found above the reporting limit of 0.002 mg/l in any of the wells. The DWR limit for thallium is 0.002 mg/l. Since the data set is all below the reporting limit, statistical evaluation was not performed.

Total Dissolved Solids - TDS (pp. 32 and 32a of 35)

Total Dissolved Solids range from 23 mg/l to 254 mg/l. The secondary limit is 500 mg/l. The results of the Student "T" tests indicate significant increases in wells M-1, M-2 and M-4. A probable significant decrease occurs in M-5. Regional wells reported in Reference 1 show a natural range of TDS from 31 to 9960 mg/l.

Turbidity (p. 33 and 33a of 35)

Turbidity values measured in the field range between 10.8 NTU's in well M-2 to 57.3 NTU's in M-3. The DWR has set no limit for turbidity. The Student "T" test indicates significant increases in wells M-1 and M-3.

Vanadium (p. 34 of 35)

Vanadium was found to be below a reporting limit of 0.005 mg/l in wells M-2, M-4 and M-5. Values for M-1 and M-3 are 0.019 and 0.020, respectively. The DWR has not set a limit for vanadium. Since most of the data are below the reporting limits, statistical evaluation was not performed.

Zinc (p. 35 and 35a of 35)

Test results for zinc range from below the reporting limit of .01 mg/l in wells M-2 and M-3 to 0.096 mg/l in well M-1. The secondary limit for zinc is 5.0 mg/l. The Student "t" tests indicate significant increases in wells M-1 and M-4.

I. Geohydrologic Data Review

The geologic setting of the landfill is the Atlantic Coastal Plain and the site is underlain by unconsolidated sediments of the Potomac Group which consists of the Patapsco formation overlying the Arundel Clay, which in turn, overlies the Patuxent formation. The Patapsco formation in the vicinity of the Hawkins Landfill is exposed at the ground surface and is mapped as the clay facies, or confining layer, by the Maryland Geologic Survey.

Groundwater in the Patapsco formation occurs primarily within upper and lower sand facies which are separated by a clay confining layer. Locally, the sand layers can be discreet and discontinuous, but when extensive, form the upper regional aquifer. Groundwater within the clay facies rarely occurs as free moisture in occasional sand pockets and this portion of the formation is generally impervious with a thickness of approaching and exceeding one hundred feet in the vicinity of the landfill site. The monitoring wells at the Hawkins Landfill facility appear to terminate within the sand layers and pockets of the lower Patapsco sand formation approximately 80 to 120 feet (between approximate elevations -60 and -110) below the base of the landfill. Groundwater in these pockets and layers occurs under confined conditions and the phreatic surface ranges between elevation 2.12 and 5.31 (ft. – msl) in the current period of measurement. The record of groundwater level measurements from the monitoring wells for the period of study between January 1993 and February 2021 is contained in Table 1 and shown graphically in Figure 1. Note that the reference point for water level measurements is the top of casing.

III. Conclusions and Recommendations

A. Conclusions:

Based on a review of the record of analytical testing contained in Appendix A and the groundwater level data of Table 1 and Figure 1, the following conclusions appear valid:

1. Nearly all groundwater samples from the monitoring wells for the HPP Landfill exhibited analytical test values below limits established by the U.S. Environmental Protection Agency for parameters of the primary Drinking Water Regulations (DWR). Exceptions are pH values which are routinely below the lower DWR limit of 6.5. All these pH values are within the natural range of concentrations for the geologic formation as reported in Reference 1.

   Overall, analytical data from monitoring wells are reasonably consistent and reflect natural groundwater conditions.

2. Based on a review of the graph in Figure 1 showing groundwater level variation with time, all wells appear to fluctuate in unison indicating hydraulic communication between the strata the wells penetrate. Groundwater in the strata penetrated by the monitoring wells occurs under confined conditions and the phreatic surface varies by no more than about 4 feet between all the wells. The highest groundwater elevations are generally recorded in wells M-1 at el. 5.31 ft.-msl and M-5 at 4.30 ft.-msl which are aligned along the railroad. Groundwater beneath the site seeps in an approximate south-easterly direction toward wells M-2 at el. 3.32 ft.-msl, M-3 at el. 2.12 ft.-msl and M-4 at el. 2.31 ft.-msl. The estimated piezometric contour lines are shown on the enclosed Drawing 1 of 1, Area A.

B. Recommendations: Continue the monitoring as presently being conducted in accordance with the recently updated Groundwater Monitoring Plan, October 2019.

If you have any questions concerning this report, please do not hesitate to call. Thank you for allowing TM Engineering, Inc. to be of service in this study.

Yours Truly,

TM Engineering

Thomas J. Moynahan, P.E.

C:\HLLLCW2.WPD

Hawkins Management, LLC
HAWKINS LANDFILL
TABLE 1: GROUNDWATER ELEVATIONS

ELEVATION (ft. msl)
Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 93	3.5	1.2	1.2	0.2	2.4
Jul 93	3.9	2.2	1.1	0.8	2.9
Jan 94	3.2	1.7	0.5	0.2	2.3
Jul 94	3.7	1.9	0.6	0.5	2.6
Jan 95	2.8	0.8	-0.4	-0.7	1.6
Jul 95	3.2	1.5	0.3	-0.1	2.2
Jan 96	3.3	1.4	0.2	0	2
Jul 96	3.8	1	0.8	0.5	2.7
Jan 97	3.8	2.2	0.9	0.5	2.8
Jul 97	3.5	1.9	1.1	0.3	2.6
Jan 98	3	1.1	0	-0.3	1.7
Jul 98	3.9	2.2	0.9	0.6	2.8
Jan 99	2.7	1.1	-0.2	-0.5	1.6
Jul 99	3.3	1.6	0.4	0	2
Jan 00	3.5	1.2	0.1	-0.1	2.2
Jul 00	3.3	0.9	0	-0.2	2
Jan 01	2.8	0.7	-0.2	-0.4	1.7
Jul 01	3.5	1.9	0.7	0.3	2.4
Jan 02	3.08	1.45	0.16	-0.1	1.95
Jul 02	3.02	1.22	-0.05	-0.25	1.85
Jan 03	3.56	1.93	0.7	0.4	2.16
Jul 03	5.05	2.29	1	0.76	2.95
Jan 04	4.00	2.02	0.83	0.64	2.95
Jul 04	4.31	2.46	1.25	1.00	3.10
Jan 05	3.60	1.91	0.57	0.28	2.50
Jul 05	4.07	2.40	1.15	0.91	3.01
Jan 06	3.47	1.56	0.34	0.15	2.38
Jul 06	3.70	1.80	0.77	0.53	2.58
Jan 07	3.34	1.36	0.17	0.02	2.68
Jul 07	3.85	2.11	0.87	0.72	2.80
Jan 08	3.58	1.87	0.67	0.44	2.42
Jul 08	3.87	2.18	0.90	0.69	2.73
Jan 09	3.16	1.36	0.23	-0.03	2.07
Jul 09	4.39	2.67	1.50	1.29	3.32
Jan 10	3.99	2.01	0.90	0.70	2.88
Jul 10	3.75	0.00	1.01	0.86	2.91
Jan 11	3.02	2.26	0.57	0.38	2.44
Jul 11	3.92	1.84	1.45	1.25	3.28
Jan 12	3.35	2.65	0.74	0.54	2.66
Jul 12	3.80	1.92	1.37	1.15	3.19
Jan 13	3.41	2.66	0.84	0.68	2.80
Jul 13	4.20	2.10	1.73	1.57	3.61
Jan 14	3.50	1.75	0.51	0.36	2.44
Jul 14	4.82	3.00	1.79	1.62	3.73
Jan 15	3.83	1.37	0.72	-0.02	2.71
Jul 15	5.05	3.30	2.34	2.12	4.17
Jan 16	4.53	2.69	1.55	1.30	3.34
Jul 16	4.70	2.86	1.79	1.55	3.56
Jan 17	3.92	2.18	1.02	0.73	2.72
Jul 17	4.33	2.50	1.41	1.25	3.10
Jan 18	3.20	1.34	0.25	0.08	1.93
Jul 18	4.66	2.71	1.67	1.50	47.80
Jan 19	5.35	3.45	2.45	2.30	5.20
Aug 19	5.18	3.28	2.45	2.13	3.98
Jan 20	4.11	2.24	1.17	1.04	2.88
Jul 20	5.30	3.65	2.40	2.40	4.20
Feb 21	5.31	3.32	2.12	2.31	4.30

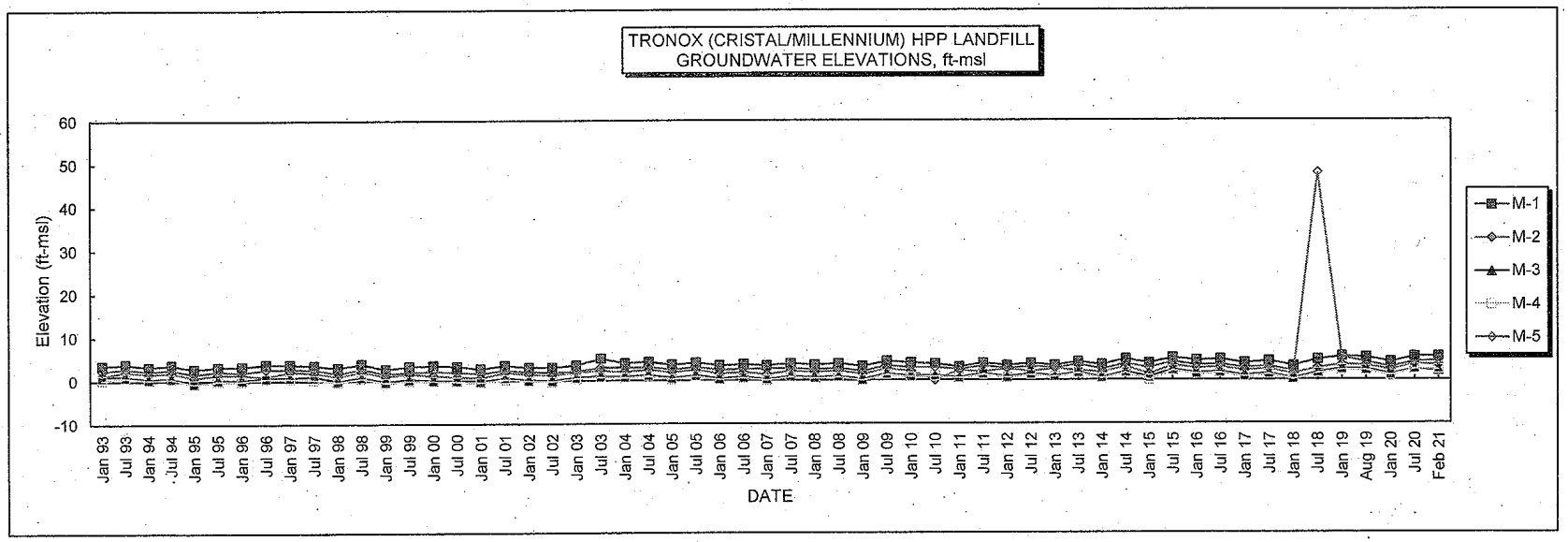


FIGURE 1

HMLFW0221

REFERENCES

1. Chapelle, Francis H., Report of Investigations No. 43, Hydrogeology, Digital Solute-Transport Simulation, and Geochemistry of the Lower Cretaceous Aquifer System near Baltimore, Maryland. Department of Natural Resources, Maryland Geological Survey in cooperation with the United States Department of the Interior, Geologic Survey, 1985.

APPENDIX A

ANALYTICAL DATABASE AND GRAPHS

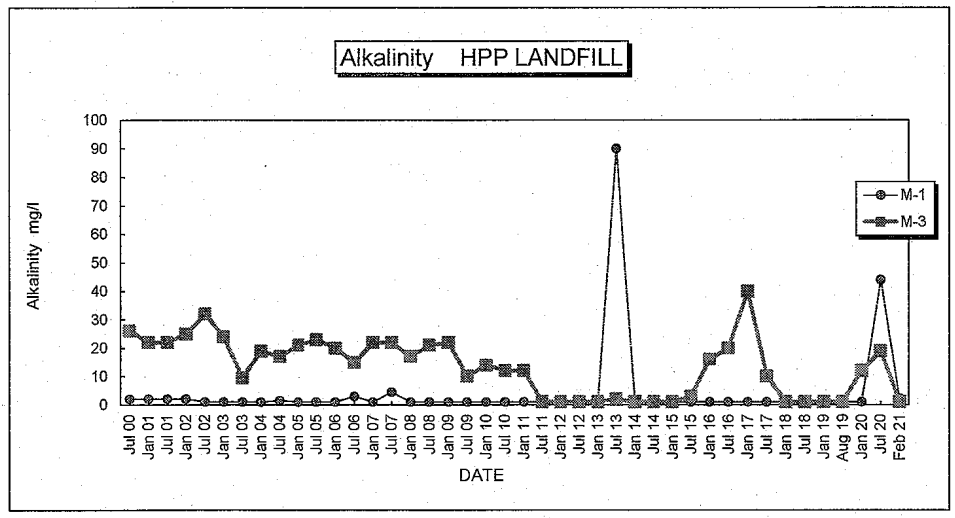
HAWKINS LANDFILL, LLC

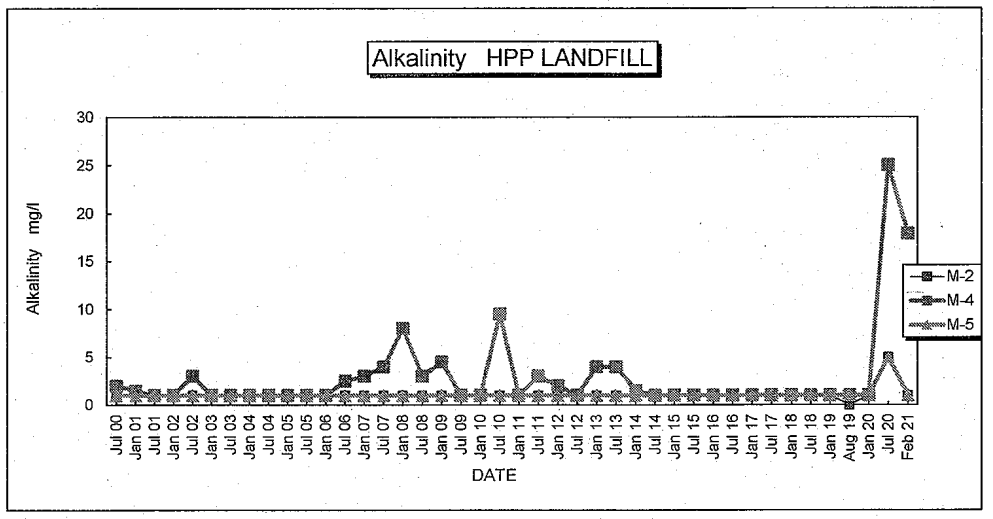
Alkalinity as (CaCo3) mg/l — Shaded Values < Detection Limit — Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	2	1	26	2	1
Jan 01	2	1	22	1.5	1
Jul 01	2	1	22	1	1
Jan 02	2	1	25	1	1
Jul 02	1	1	32	3	1
Jan 03	1	1	24	1	1
Jul 03	1	1	9.5	1	1
Jan 04	1	1	19	1	1
Jul 04	1.5	1	17	1	1
Jan 05	1	1	21	1	1
Jul 05	1	1	23	1	1
Jan 06	1	1	20	1	1
Jul 06	3	1	15	2.5	1
Jan 07	1	1	22	3	1
Jul 07	4.5	1	22	4	1
Jan 08	1	1	17	8	1
Jul 08	1	1	21	3	1
Jan 09	1	1	22	4.5	1
Jul 09	1	1	10	1	1
Jan 10	1	1	14	1	1
Jul 10	1	1	12	9.5	1
Jan 11	1	1	12	1	1
Jul 11	1	1	1	3	1
Jan 12	1	1	1	2	1
Jul 12	1	1	1	1	1
Jan 13	1	1	1	4	1
Jul 13	90	1	2	4	1
Jan 14	1	1	1	1.5	1
Jul 14	1	1	1	1	1
Jan 15	1	1	1	1	1
Jul 15	1	1	3	1	1
Jan 16	1	1	16	1	1
Jul 16	1	1	20	1	1
Jan 17	1	1	40	1	1
Jul 17	1	1	10	1	1
Jan 18	1	1	1	1	1
Jul 18	1	1	1	1	1
Jan 19	1	1	1	1	1
Aug 19	1	N/A	1	1	1
Jan 20	1	1	12	1	1
Jul 20	44	5	19	25	5
Feb 21	2.2	1	1	17.9	1

Note: Aug 19 M-3 sample obtained October 22, 2019

		Mean	N/A	N/A	N/A	N/A	N/A
		Std Dev.	N/A	N/A	N/A	N/A	N/A
		N1	N/A	N/A	N/A	N/A	N/A
T.05	1.90	N2	N/A	N/A	N/A	N/A	N/A
T.90	3.00	T hist	N/A	N/A	N/A	N/A	N/A


Alkalinity HPP LANDFILL
Alkalinity mg/l
DATE
M-1
M-3


Alkalinity HPP LANDFILL
Alkalinity mg/l
DATE
M-2
M-4
M-5

HAWKINS LANDFILL, LLC

Ammonia (N) mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	1.0	1.0	1.0	1.0	1.0
Jul 07	1.0	1.0	1.0	1.0	1.0
Jan 08	1.0	1.0	1.0	1.0	1.0
Jul 08	0.1	0.19	0.12	0.1	0.25
Jan 09	0.1	0.32	0.1	0.1	0.1
Jul 09	0.1	0.1	0.1	0.1	0.1
Jan 10	0.1	0.1	0.13	0.1	0.1
Jul 10	0.11	0.1	0.16	0.25	0.1
Jan 11	0.70	0.25	0.16	0.12	0.1
Jul 11	0.1	0.16	0.13	0.11	0.1
Jan 12	0.1	0.1	0.1	0.58	0.1
Jul 12	0.24	0.1	0.21	0.1	0.1
Jan 13	0.1	0.1	0.12	0.1	0.1
Jul 13	0.1	0.1	0.11	0.1	0.1
Jan 14	0.1	0.1	0.1	0.1	0.1
Jul 14	0.1	0.1	0.1	0.1	0.1
Jan 15	0.1	0.1	0.11	0.1	0.1
Jul 15	0.18	0.1	0.1	0.1	0.1
Jan 16	0.1	0.1	0.12	0.1	0.1
Jul 16	0.1	0.1	0.12	0.1	0.1
Jan 17	0.1	0.1	0.18	0.1	0.1
Jul 17	0.1	0.1	0.2	0.1	0.1
Jan 18	0.1	0.1	0.1	0.1	0.1
Jul 18	0.1	0.1	0.25	0.1	0.1
Jan 19	0.1	0.1	0.19	0.1	0.1
Aug 19	0.2	0.2	0.2	0.2	0.2
Jan 20	0.2	0.2	0.2	0.2	0.2
Jul 20	0.1	0.41	0.1	0.1	0.1
Feb 21	0.1	0.3	0.12	0.1	0.1

Note: Aug 19 M-3 sample obtained October 22, 2019

		M-1	M-2	M-3	M-4	M-5
Mean		N/A	N/A	N/A	N/A	N/A
Std Dev.		N/A	N/A	N/A	N/A	N/A
N1		N/A	N/A	N/A	N/A	N/A
N2		N/A	N/A	N/A	N/A	N/A
T hist		N/A	N/A	N/A	N/A	N/A
T.05	T.90					

HAWKINS LANDFILL, LLC

Antimony mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.005	0.005	0.005	0.005	0.005
Jul 07	0.005	0.005	0.005	0.005	0.005
Jan 08	0.005	0.005	0.005	0.005	0.005
Jul 08	0.01	0.01	0.01	0.01	0.01
Jan 09	0.01	0.01	0.01	0.01	0.01
Jul 09	0.005	0.005	0.005	0.005	0.005
Jan 10	0.005	0.005	0.005	0.005	0.005
Jul 10	0.005	0.005	0.005	0.005	0.005
Jan 11	0.01	0.01	0.01	0.01	0.01
Jul 11	0.001	0.001	0.001	0.001	0.001
Jan 12	0.005	0.005	0.005	0.005	0.005
Jul 12	0.005	0.005	0.005	0.005	0.005
Jan 13	0.005	0.005	0.005	0.005	0.005
Jul 13	0.005	0.005	0.005	0.005	0.005
Jan 14	0.002	0.002	0.002	0.002	0.002
Jul 14	0.002	0.002	0.002	0.002	0.002
Jan 15	0.002	0.002	0.002	0.002	0.002
Jul 15	0.002	0.002	0.002	0.002	0.002
Jan 16	0.002	0.002	0.002	0.002	0.002
Jul 16	0.002	0.002	0.002	0.002	0.002
Jan 17	0.002	0.002	0.002	0.002	0.002
Jul 17	0.002	0.002	0.002	0.002	0.002
Jan 18	0.002	0.002	0.002	0.002	0.002
Jul 18	0.001	0.001	0.001	0.001	0.001
Jan 19	0.001	0.001	0.001	0.001	0.001
Aug 19	0.001	0.001	0.005	0.001	0.001
Jan 20	0.002	0.002	0.002	0.002	0.002
Jul 20	0.0022	0.0022	0.0022	0.0022	0.0022
Feb 21	0.002	0.002	0.002	0.002	0.002

Note: Aug 19 M-3 sample obtained October 22, 2019

		Mean	N/A	N/A	N/A	N/A	N/A
		Std Dev.	N/A	N/A	N/A	N/A	N/A
		N1	N/A	N/A	N/A	N/A	N/A
		N2	N/A	N/A	N/A	N/A	N/A
T.05	T.90	T hist	N/A	N/A	N/A	N/A	N/A

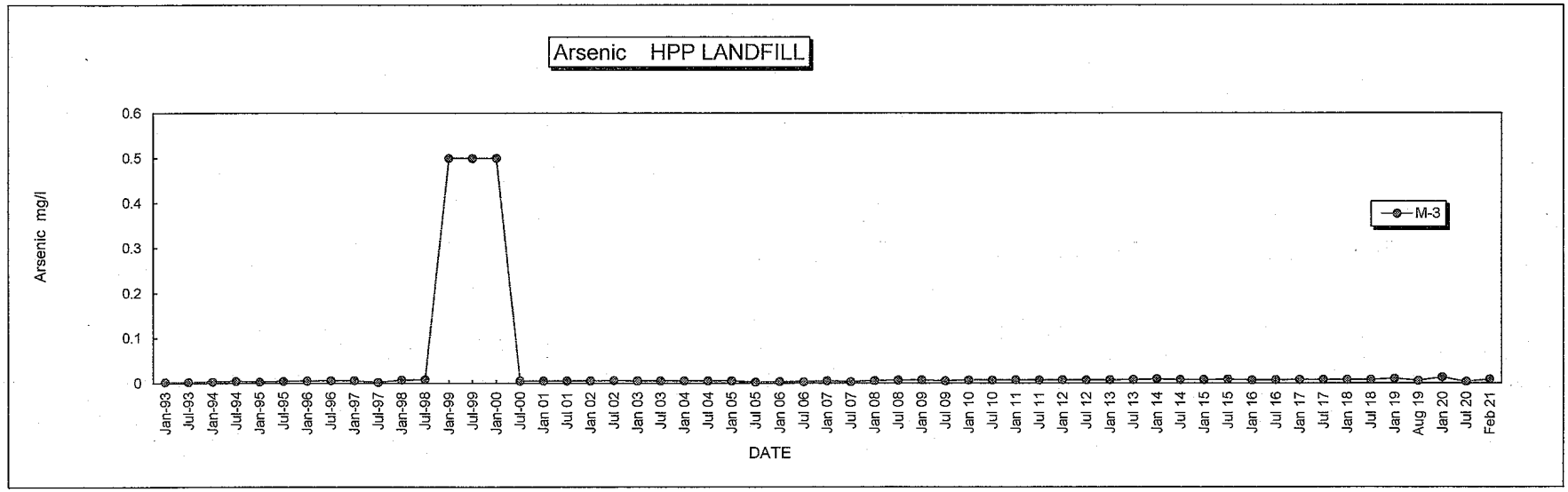
HAWKINS LANDFILL, LLC

Arsenic mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.002	0.002	0.002	0.002	0.002
Jul-93	0.002	0.002	0.002	0.002	0.002
Jan-94	0.002	0.002	0.003	0.002	0.002
Jul-94	0.002	0.002	0.004	0.002	0.002
Jan-95	0.002	0.002	0.003	0.002	0.002
Jul-95	0.002	0.002	0.004	0.002	0.002
Jan-96	0.002	0.002	0.005	0.002	0.002
Jul-96	0.002	0.002	0.006	0.002	0.002
Jan-97	0.001	0.001	0.006	0.001	0.001
Jul-97	0.014	0.026	0.002	0.002	0.002
Jan-98	0.001	0.001	0.007	0.001	0.001
Jul-98	0.001	0.001	0.008	0.001	0.001
Jan-99	0.5	0.5	0.5	0.5	0.5
Jul-99	0.5	0.5	0.5	0.5	0.5
Jan-00	0.5	0.5	0.5	0.5	0.5
Jul-00	0.005	0.005	0.005	0.005	0.005
Jan 01	0.005	0.005	0.005	0.005	0.005
Jul 01	0.005	0.005	0.005	0.005	0.005
Jan 02	0.005	0.005	0.005	0.005	0.005
Jul 02	0.005	0.005	0.0057	0.005	0.005
Jan 03	0.005	0.005	0.005	0.005	0.005
Jul 03	0.005	0.005	0.005	0.005	0.005
Jan 04	0.005	0.005	0.0052	0.005	0.005
Jul 04	0.005	0.005	0.0052	0.005	0.005
Jan 05	0.005	0.005	0.005	0.005	0.005
Jul 05	0.002	0.002	0.002	0.002	0.002
Jan 06	0.002	0.002	0.0035	0.002	0.002
Jul 06	0.002	0.002	0.0029	0.002	0.002
Jan 07	0.002	0.002	0.005	0.002	0.002
Jul 07	0.002	0.002	0.0031	0.002	0.002
Jan 08	0.002	0.002	0.0054	0.002	0.002
Jul 08	0.005	0.005	0.0064	0.005	0.005
Jan 09	0.005	0.005	0.0069	0.005	0.005
Jul 09	0.005	0.005	0.005	0.005	0.005
Jan 10	0.005	0.005	0.0068	0.005	0.005
Jul 10	0.005	0.005	0.0065	0.005	0.005
Jan 11	0.002	0.002	0.0072	0.002	0.002
Jul 11	0.002	0.002	0.0066	0.002	0.002
Jan 12	0.002	0.002	0.0072	0.002	0.002
Jul 12	0.002	0.002	0.0068	0.002	0.002
Jan 13	0.002	0.002	0.0070	0.002	0.002
Jul 13	0.002	0.002	0.0076	0.002	0.002
Jan 14	0.004	0.004	0.0091	0.004	0.004
Jul 14	0.004	0.004	0.0075	0.004	0.004
Jan 15	0.004	0.004	0.0073	0.004	0.004
Jul 15	0.004	0.004	0.0083	0.004	0.004
Jan 16	0.004	0.004	0.0066	0.004	0.004
Jul 16	0.004	0.004	0.0069	0.004	0.004
Jan 17	0.004	0.004	0.0073	0.004	0.004
Jul 17	0.004	0.004	0.0075	0.004	0.004
Jan 18	0.004	0.004	0.0077	0.001	0.001
Jul 18	0.0015	0.001	0.0077	0.001	0.001
Jan 19	0.001	0.001	0.0102	0.001	0.001
Aug 19	0.001	0.001	0.0056	0.001	0.001
Jan 20	0.003	0.003	0.013	0.013	0.003
Jul 20	0.0033	0.0046	0.0033	0.0033	0.0033
Feb 21	0.002	0.002	0.0082	0.002	0.002

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.01 =	N2	N/A	N/A	N/A	N/A	N/A
T.05 =	T hist	N/A	N/A	N/A	N/A	N/A


Arsenic HPP LANDFILL
Arsenic mg/l
0.6
0.5
0.4
0.3
0.2
0.1
0
M-3
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE

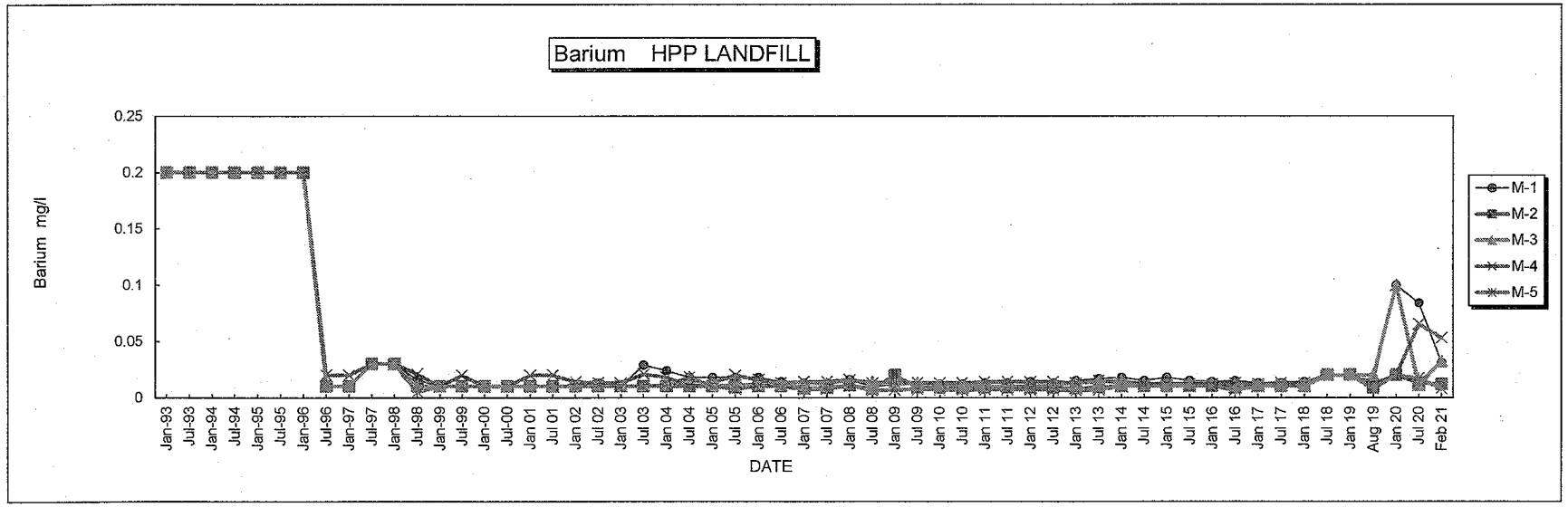
HAWKINS LANDFILL, LLC

Barium mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.2	0.2	0.2	0.2	0.2
Jul-93	0.2	0.2	0.2	0.2	0.2
Jan-94	0.2	0.2	0.2	0.2	0.2
Jul-94	0.2	0.2	0.2	0.2	0.2
Jan-95	0.2	0.2	0.2	0.2	0.2
Jul-95	0.2	0.2	0.2	0.2	0.2
Jan-96	0.2	0.2	0.2	0.2	0.2
Jul-96	0.01	0.01	0.01	0.02	0.01
Jan-97	0.01	0.01	0.01	0.02	0.01
Jul-97	0.03	0.03	0.03	0.03	0.03
Jan-98	0.03	0.03	0.03	0.03	0.03
Jul-98	0.016	0.01	0.01	0.021	0.005
Jan-99	0.01	0.01	0.01	0.01	0.01
Jul-99	0.01	0.01	0.01	0.02	0.01
Jan-00	0.01	0.01	0.01	0.01	0.01
Jul-00	0.01	0.01	0.01	0.01	0.01
Jan 01	0.01	0.01	0.01	0.02	0.01
Jul 01	0.01	0.01	0.01	0.02	0.01
Jan 02	0.012	0.01	0.01	0.014	0.01
Jul 02	0.013	0.01	0.01	0.013	0.01
Jan 03	0.01	0.01	0.01	0.013	0.01
Jul 03	0.029	0.01	0.01	0.021	0.01
Jan 04	0.024	0.01	0.011	0.018	0.01
Jul 04	0.018	0.01	0.018	0.01	0.018
Jan 05	0.018	0.01	0.01	0.013	0.01
Jul 05	0.018	0.0094	0.011	0.02	0.0079
Jan 06	0.018	0.01	0.012	0.016	0.01
Jul 06	0.014	0.01	0.011	0.013	0.01
Jan 07	0.013	0.0082	0.012	0.014	0.0071
Jul 07	0.013	0.0089	0.013	0.014	0.0078
Jan 08	0.016	0.011	0.015	0.016	0.011
Jul 08	0.01	0.0079	0.014	0.013	0.0065
Jan 09	0.012	0.02	0.012	0.014	0.0068
Jul 09	0.012	0.009	0.013	0.013	0.0074
Jan 10	0.012	0.0089	0.011	0.013	0.0069
Jul 10	0.012	0.0083	0.01	0.013	0.0064
Jan 11	0.013	0.0089	0.01	0.014	0.0069
Jul 11	0.013	0.0094	0.0099	0.014	0.0071
Jan 12	0.014	0.0089	0.01	0.014	0.0069
Jul 12	0.013	0.0088	0.011	0.014	0.007
Jan 13	0.015	0.0082	0.0130	0.013	0.0064
Jul 13	0.017	0.009	0.014	0.015	0.0067
Jan 14	0.018	0.01	0.015	0.013	0.01
Jul 14	0.015	0.01	0.012	0.012	0.01
Jan 15	0.018	0.01	0.011	0.012	0.01
Jul 15	0.015	0.01	0.013	0.012	0.01
Jan 16	0.014	0.01	0.013	0.012	0.01
Jul 16	0.0148	0.0087	0.0111	0.0129	0.0064
Jan 17	0.013	0.01	0.012	0.012	0.01
Jul 17	0.013	0.01	0.011	0.013	0.01
Jan 18	0.014	0.01	0.011	0.013	0.01
Jul 18	0.02	0.02	0.02	0.02	0.02
Jan 19	0.02	0.02	0.02	0.02	0.02
Aug 19	0.0139	0.00869	0.02	0.0116	0.008
Jan 20	0.1	0.02	0.1	0.02	0.02
Jul 20	0.084	0.013	0.011	0.065	0.017
Feb 21	0.031	0.012	0.032	0.053	0.008

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	0.0144	0.0106	0.0127	0.0138	N/A
	Std Dev.	0.0025	0.0036	0.0027	0.0008	N/A
T.05 = 2.179	N1	25	25	25	25	N/A
T.01 = 3.055	N2	1	1	1	1	N/A
	T hist	31.93354	1.93521	35.59825	230.9845	N/A


Barium HPP LANDFILL
Barium mg/l
0.25
0.2
0.15
0.1
0.05
0
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

Beryllium mg/l | Shaded Values < Detection Limit | Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.0025	0.0025	0.0025	0.0025	0.0025
Jul 07	0.0025	0.0025	0.0025	0.0025	0.0025
Jan 08	0.0025	0.0025	0.0025	0.0025	0.0025
Jul 08	0.001	0.001	0.001	0.001	0.001
Jan 09	0.001	0.001	0.001	0.001	0.001
Jul 09	0.001	0.001	0.001	0.001	0.001
Jan 10	0.001	0.001	0.001	0.001	0.001
Jul 10	0.001	0.001	0.001	0.001	0.001
Jan 11	0.001	0.001	0.001	0.001	0.001
Jul 11	0.001	0.001	0.001	0.001	0.001
Jan 12	0.001	0.001	0.001	0.001	0.001
Jul 12	0.001	0.001	0.001	0.001	0.001
Jan 13	0.0011	0.001	0.001	0.001	0.001
Jul 13	0.0012	0.001	0.001	0.001	0.001
Jan 14	0.002	0.002	0.002	0.002	0.002
Jul 14	0.002	0.002	0.002	0.002	0.002
Jan 15	0.002	0.002	0.002	0.002	0.002
Jul 15	0.002	0.002	0.002	0.002	0.002
Jan 16	0.002	0.002	0.002	0.002	0.002
Jul 16	0.0013	0.001	0.001	0.0012	0.001
Jan 17	0.002	0.002	0.002	0.002	0.002
Jul 17	0.002	0.002	0.002	0.002	0.002
Jan 18	0.002	0.002	0.002	0.002	0.002
Jul 18	0.02	0.02	0.02	0.02	0.02
Jan 19	0.02	0.02	0.02	0.02	0.02
Aug 19	0.0016	0.0016	0.0025	0.0016	0.0016
Jan 20	0.001	0.0005	0.001	0.001	0.0004
Jul 20	0.0011	0.0011	0.0011	0.0026	0.0011
Feb 21	0.0025	0.002	0.002	0.0024	0.002

Note: Aug 19 M-3 sample obtained October 22, 2019

		Mean	N/A	N/A	N/A	N/A	N/A
		Std Dev.	N/A	N/A	N/A	N/A	N/A
		N1	N/A	N/A	N/A	N/A	N/A
		N2	N/A	N/A	N/A	N/A	N/A
T.05	T.90	T hist	N/A	N/A	N/A	N/A	N/A

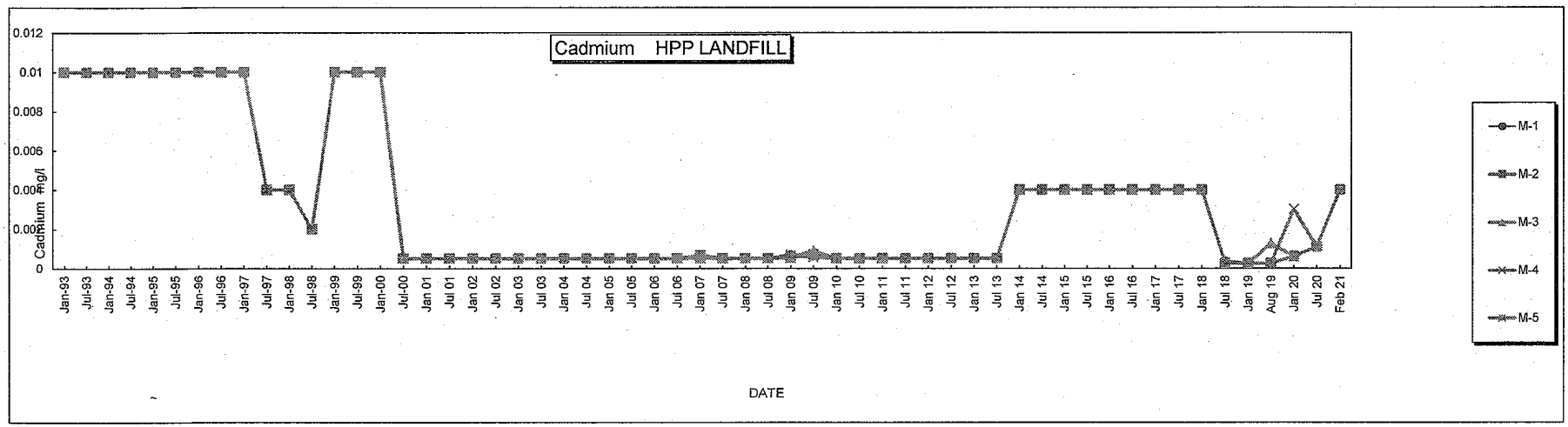
HAWKINS LANDFILL, LLC

Cadmium Cd mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.01	0.01	0.01	0.01	0.01
Jul-93	0.01	0.01	0.01	0.01	0.01
Jan-94	0.01	0.01	0.01	0.01	0.01
Jul-94	0.01	0.01	0.01	0.01	0.01
Jan-95	0.01	0.01	0.01	0.01	0.01
Jul-95	0.01	0.01	0.01	0.01	0.01
Jan-96	0.01	0.01	0.01	0.01	0.01
Jul-96	0.01	0.01	0.01	0.01	0.01
Jan-97	0.01	0.01	0.01	0.01	0.01
Jul-97	0.004	0.004	0.004	0.004	0.004
Jan-98	0.004	0.004	0.004	0.004	0.004
Jul-98	0.002	0.002	0.002	0.002	0.002
Jan-99	0.01	0.01	0.01	0.01	0.01
Jul-99	0.01	0.01	0.01	0.01	0.01
Jan-00	0.01	0.01	0.01	0.01	0.01
Jul-00	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 01	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 01	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 02	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 02	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 03	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 03	0.00052	0.0005	0.0005	0.0005	0.0005
Jan 04	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 04	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 05	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 05	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 06	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 06	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 07	0.00069	0.00065	0.00051	0.00058	0.00059
Jul 07	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 08	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 08	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 09	0.00071	0.00054	0.00057	0.00063	0.00069
Jul 09	0.0007	0.0007	0.00089	0.00057	0.00061
Jan 10	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 10	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 11	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 11	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 12	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 12	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 13	0.0005	0.0005	0.0005	0.0005	0.0005
Jul 13	0.0005	0.0005	0.0005	0.0005	0.0005
Jan 14	0.004	0.004	0.004	0.004	0.004
Jul 14	0.004	0.004	0.004	0.004	0.004
Jan 15	0.004	0.004	0.004	0.004	0.004
Jul 15	0.004	0.004	0.004	0.004	0.004
Jan 16	0.004	0.004	0.004	0.004	0.004
Jul 16	0.004	0.004	0.004	0.004	0.004
Jan 17	0.004	0.004	0.004	0.004	0.004
Jul 17	0.004	0.004	0.004	0.004	0.004
Jan 18	0.004	0.004	0.004	0.004	0.004
Jul 18	0.000379	0.00025	0.00025	0.00025	0.00025
Jan 19	0.000275	0.00025	0.00025	0.00025	0.00025
Aug 19	0.00025	0.00025	0.00125	0.00025	0.00025
Jan 20	0.0006	0.0006	0.0006	0.003	0.0006
Jul 20	0.0011	0.0011	0.0011	0.0011	0.0011
Feb 21	0.004	0.004	0.004	0.004	0.004

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.90	T hist	N/A	N/A	N/A	N/A	N/A


Cadmium HPP LANDFILL
Cadmium mg/l
0.012
0.01
0.008
0.006
0.004
0.002
0
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

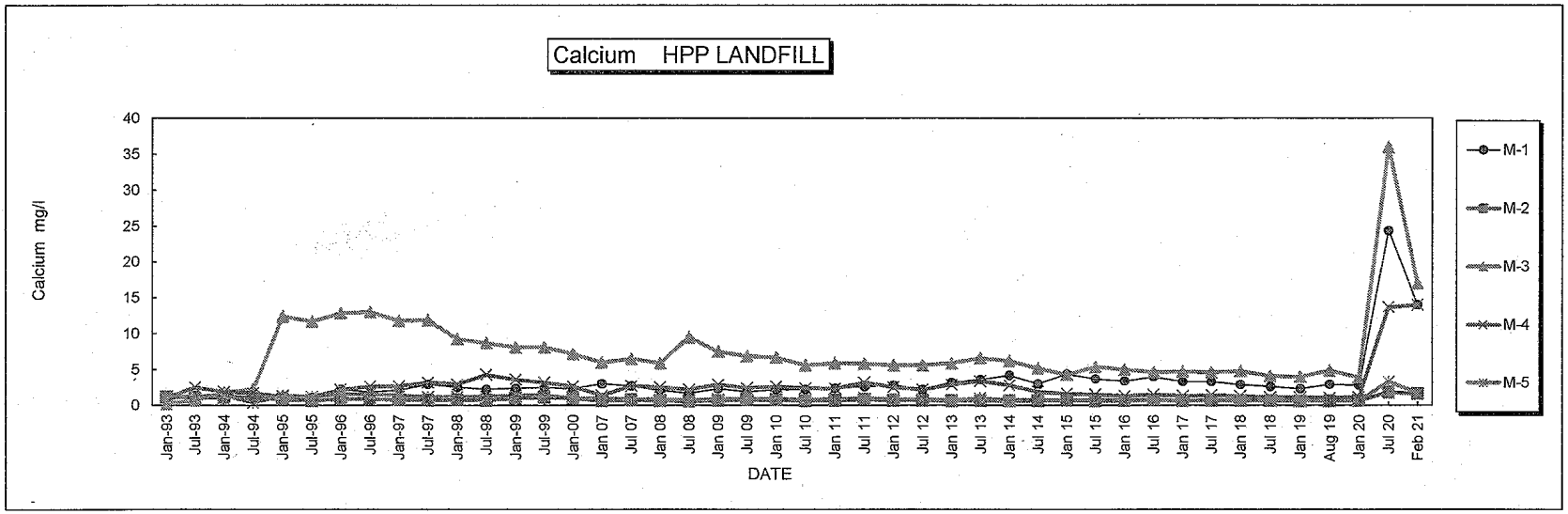
Calcium Ca mg/l

Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	1.37	1.18	0.22	1.06	1.04
Jul-93	1.34	1.09	0.7	2.47	1.19
Jan-94	1.63	1.08	1.79	1.89	1.4
Jul-94	0.83	1.18	2.25	1.66	0.4
Jan-95	1.25	0.82	12.4	1.23	1.39
Jul-95	1.09	0.64	11.7	1.17	1.18
Jan-96	2.24	0.85	12.9	2.16	1.57
Jul-96	1.86	0.86	13	2.62	1.55
Jan-97	2.1	0.76	11.8	2.66	1.35
Jul-97	2.95	0.73	11.9	3.16	1.17
Jan-98	2.54	0.79	9.25	2.95	1.16
Jul-98	2.24	0.738	8.7	4.3	1.22
Jan-99	2.4	1	8.1	3.6	1.4
Jul-99	2.5	1.1	8.1	3.2	1.4
Jan-00	2.3	1	7.2	2.6	1
Jan 07	3	0.63	6	1.4	0.96
Jul 07	2.7	0.73	6.5	2.7	0.87
Jan 08	2.1	0.63	5.9	2.5	0.82
Jul 08	1.7	0.56	9.5	2.2	0.74
Jan 09	2.3	0.68	7.5	2.9	0.86
Jul 09	1.9	0.78	6.9	2.4	0.87
Jan 10	2.2	0.74	6.7	2.6	0.88
Jul 10	2.2	0.64	5.6	2.4	0.77
Jan 11	2.4	0.71	5.9	2.3	0.86
Jul 11	2.6	0.8	5.8	3.2	0.97
Jan 12	2.8	0.71	5.6	2.5	0.87
Jul 12	2.2	0.69	5.6	2.2	0.83
Jan 13	3.2	0.62	5.9	2.9	0.76
Jul 13	3.6	0.63	6.6	3.4	0.96
Jan 14	4.2	0.62	6.2	2.8	0.75
Jul 14	3	0.63	5.2	1.9	0.72
Jan 15	4.4	0.73	4.3	1.6	0.67
Jul 15	3.7	0.62	5.4	1.5	0.73
Jan 16	3.4	0.67	5	1.3	0.74
Jul 16	4.01	0.715	4.63	1.47	0.792
Jan 17	3.3	0.64	4.7	1.3	0.66
Jul 17	3.3	0.67	4.6	1.4	0.74
Jan 18	2.9	0.68	4.8	1.3	0.73
Jul 18	2.6	0.63	4.1	1.1	0.69
Jan 19	2.3	0.62	4.0	1.1	0.64
Aug 19	2.92	0.62	4.9	1.07	0.604
Jan 20	2.8	0.66	3.9	1.1	0.61
Jul 20	24.4	1.8	36.0	13.7	3.3
Feb 21	14	1.6	17.0	14	1.7

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	2.4077	0.6862	6.4154	2.4769	0.8508
	Std Dev.	0.4329	0.0686	1.0938	0.4381	0.0687
T.05 = 2.179	N1	13	13	13	13	13
T.01 = 3.055	N2	1	1	1	1	1
	T hist	92.75432	48.01552	34.89046	94.83672	44.54777


Calcium HPP LANDFILL
Calcium mg/l
40
35
30
25
20
15
10
5
0
Jan-93
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jan 07
Jul 07
Jan 08
Jul 08
Jan 09
Jul 09
Jan 10
Jul 10
Jan 11
Jul 11
Jan 12
Jul 12
Jan 13
Jul 13
Jan 14
Jul 14
Jan 15
Jul 15
Jan 16
Jul 16
Jan 17
Jul 17
Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

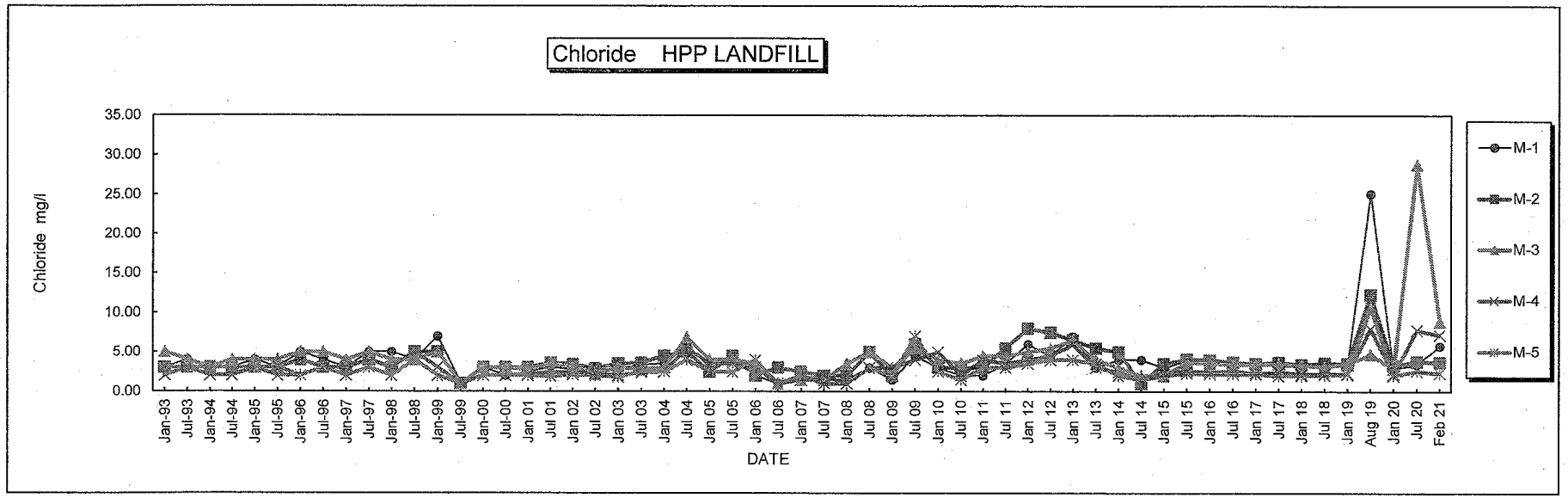
HAWKINS LANDFILL, LLC

Chloride Cl mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	3.00	3.00	5.00	2.00	3.00
Jul-93	4.00	3.00	4.00	3.00	3.00
Jan-94	3.00	3.00	3.00	2.00	3.00
Jul-94	3.00	3.00	4.00	2.00	3.00
Jan-95	4.00	3.00	4.00	3.00	3.00
Jul-95	3.00	3.00	4.00	2.00	3.00
Jan-96	5.00	4.00	5.00	2.00	2.00
Jul-96	4.00	3.00	5.00	3.00	3.00
Jan-97	3.00	3.00	4.00	3.00	2.00
Jul-97	5.00	4.00	5.00	4.00	3.00
Jan-98	5.00	3.00	4.00	3.00	2.00
Jul-98	4.00	5.00	4.00	5.00	4.00
Jan-99	7.00	5.00	5.00	3.00	2.00
Jul-99	1.00	1.00	1.00	1.00	1.00
Jan-00	3.00	3.00	3.00	2.00	2.00
Jul-00	2.00	3.00	3.00	2.00	2.00
Jan 01	2.40	3.00	2.80	2.20	2.00
Jul 01	3.10	3.60	3.50	2.40	1.90
Jan 02	2.70	3.40	3.00	2.40	2.10
Jul 02	2.70	2.90	2.20	2.20	2.00
Jan 03	2.80	3.50	3.00	2.00	1.80
Jul 03	3.40	3.60	2.80	2.40	2.60
Jan 04	3.50	4.50	3.00	2.50	2.50
Jul 04	6.00	5.00	6.90	5.50	4.00
Jan 05	3.00	2.50	4.00	3.50	2.50
Jul 05	4.00	4.50	4.00	3.50	2.50
Jan 06	2.00	2.00	3.50	3.00	4.00
Jul 06	1.00	3.00	1.00	1.00	1.00
Jan 07	2.00	2.50	1.50	1.50	2.00
Jul 07	1.50	2.00	1.50	2.00	1.00
Jan 08	1.50	2.00	3.50	1.00	1.00
Jul 08	3.00	5.00	5.00	3.00	3.00
Jan 09	1.50	2.00	3.00	3.00	2.00
Jul 09	4.50	6.00	5.50	4.00	7.00
Jan 10	3.00	3.00	4.00	5.00	2.50
Jul 10	2.00	3.00	3.50	2.00	1.50
Jan 11	2.00	3.00	4.50	4.00	3.00
Jul 11	3.50	5.50	4.50	3.50	3.00
Jan 12	6.00	8.00	5.00	4.00	3.50
Jul 12	4.50	7.50	5.50	4.50	4.00
Jan 13	7.00	6.50	6.50	6.00	4.00
Jul 13	3.00	5.50	4.00	3.00	3.50
Jan 14	4.00	5.00	3.00	2.50	2.00
Jul 14	4.00	1.00	2.00	1.50	1.50
Jan 15	3.00	3.50	2.00	2.50	2.00
Jul 15	3.90	4.10	3.70	2.60	2.30
Jan 16	3.80	4.00	3.60	2.50	2.20
Jul 16	3.60	3.70	3.40	2.60	2.20
Jan 17	3.50	3.50	3.40	2.30	2.20
Jul 17	3.30	3.70	3.50	2.50	2.00
Jan 18	3.20	3.40	3.30	2.20	2.00
Jul 18	3.10	3.57	3.16	2.28	2.09
Jan 19	3.38	3.55	3.49	2.23	2.15
Aug 19	25.10	12.30	4.73	7.99	10.70
Jan 20	2.90	3.30	2.90	2.20	2.00
Jul 20	3.4	3.8	28.8	7.8	2.6
Feb 21	5.8	3.7	8.9	7.2	2.3

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	2.6722	3.2222	3.1778	2.5056	2.2167
	Std Dev.	1.1585	1.0074	1.3419	1.0350	0.8515
T.05 = 2.179	N1	13	13	13	13	13
T.01 = 3.055	N2	1	1	1	1	1
	T hist	9.352553	1.642981	14.77203	15.7127	0.339032

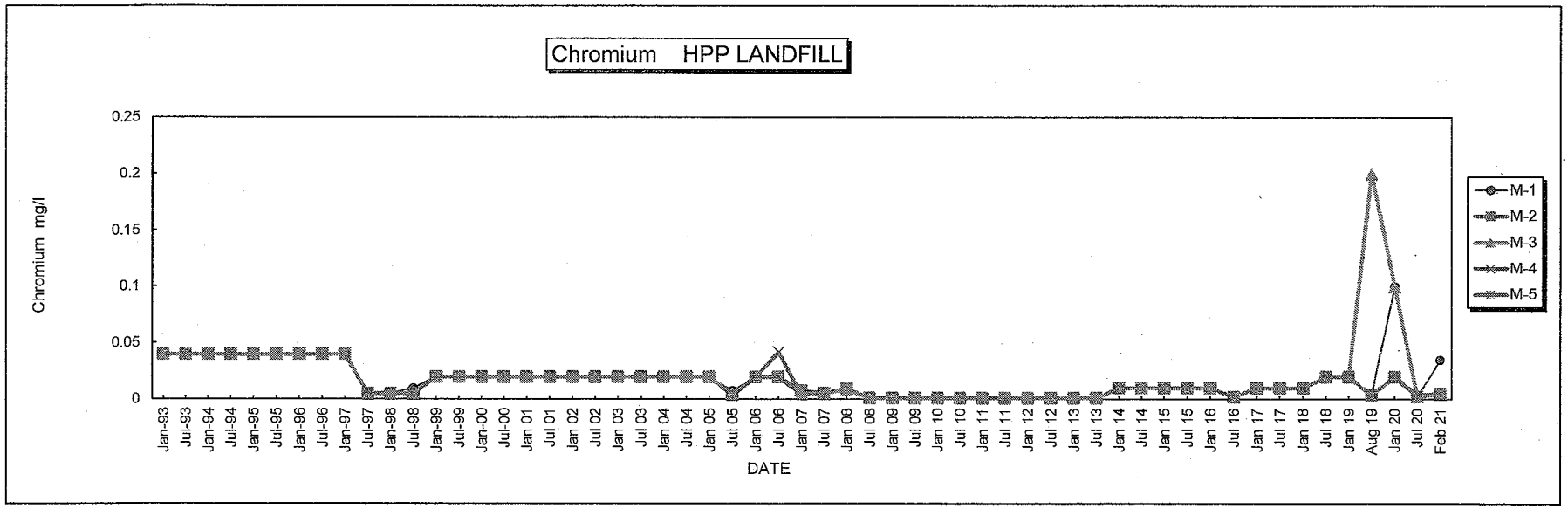

Chloride HPP LANDFILL
Chloride mg/l
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

Chromium mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.04	0.04	0.04	0.04	0.04
Jul-93	0.04	0.04	0.04	0.04	0.04
Jan-94	0.04	0.04	0.04	0.04	0.04
Jul-94	0.04	0.04	0.04	0.04	0.04
Jan-95	0.04	0.04	0.04	0.04	0.04
Jul-95	0.04	0.04	0.04	0.04	0.04
Jan-96	0.04	0.04	0.04	0.04	0.04
Jul-96	0.04	0.04	0.04	0.04	0.04
Jan-97	0.04	0.04	0.04	0.04	0.04
Jul-97	0.005	0.005	0.005	0.005	0.005
Jan-98	0.005	0.005	0.005	0.005	0.005
Jul-98	0.01	0.005	0.005	0.005	0.005
Jan-99	0.02	0.02	0.02	0.02	0.02
Jul-99	0.02	0.02	0.02	0.02	0.02
Jan-00	0.02	0.02	0.02	0.02	0.02
Jul-00	0.02	0.02	0.02	0.02	0.02
Jan 01	0.02	0.02	0.02	0.02	0.02
Jul 01	0.02	0.02	0.02	0.02	0.02
Jan 02	0.02	0.02	0.02	0.02	0.02
Jul 02	0.02	0.02	0.02	0.02	0.02
Jan 03	0.02	0.02	0.02	0.02	0.02
Jul 03	0.02	0.02	0.02	0.02	0.02
Jan 04	0.02	0.02	0.02	0.02	0.02
Jul 04	0.02	0.02	0.02	0.02	0.02
Jan 05	0.02	0.02	0.02	0.02	0.02
Jul 05	0.0076	0.0037	0.0053	0.0048	0.0052
Jan 06	0.02	0.02	0.02	0.02	0.02
Jul 06	0.02	0.02	0.02	0.042	0.02
Jan 07	0.0055	0.0078	0.0056	0.0047	0.0049
Jul 07	0.0054	0.0055	0.0056	0.0057	0.0054
Jan 08	0.0092	0.0094	0.0084	0.0092	0.0086
Jul 08	0.001	0.001	0.001	0.001	0.001
Jan 09	0.001	0.001	0.001	0.001	0.001
Jul 09	0.001	0.001	0.001	0.001	0.001
Jan 10	0.001	0.001	0.001	0.001	0.001
Jul 10	0.001	0.001	0.001	0.001	0.001
Jan 11	0.001	0.001	0.001	0.001	0.001
Jul 11	0.001	0.001	0.001	0.001	0.001
Jan 12	0.001	0.001	0.001	0.001	0.001
Jul 12	0.001	0.001	0.001	0.001	0.001
Jan 13	0.001	0.001	0.001	0.001	0.001
Jul 13	0.001	0.001	0.001	0.001	0.001
Jan 14	0.01	0.01	0.01	0.01	0.01
Jul 14	0.01	0.01	0.01	0.01	0.01
Jan 15	0.01	0.01	0.01	0.01	0.01
Jul 15	0.01	0.01	0.01	0.01	0.01
Jan 16	0.01	0.01	0.01	0.01	0.01
Jul 16	0.002	0.002	0.002	0.002	0.002
Jan 17	0.01	0.01	0.01	0.01	0.01
Jul 17	0.01	0.01	0.01	0.01	0.01
Jan 18	0.01	0.01	0.01	0.01	0.01
Jul 18	0.02	0.02	0.02	0.02	0.02
Jan 19	0.02	0.02	0.02	0.02	0.02
Aug 19	0.004	0.004	0.2	0.004	0.004
Jan 20	0.1	0.02	0.1	0.02	0.02
Jul 20	0.0022	0.0022	0.0022	0.0040	0.0022
Feb 21	0.035	0.005	0.005	0.005	0.005

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.90	T hist	N/A	N/A	N/A	N/A	N/A



NOTE: Aug 19 Datum Point for M-3 (sample obtained October 22, 2019) and Jan 20 data points for M-1 and M-3 reflect elevated laboratory reporting limit (PQL).

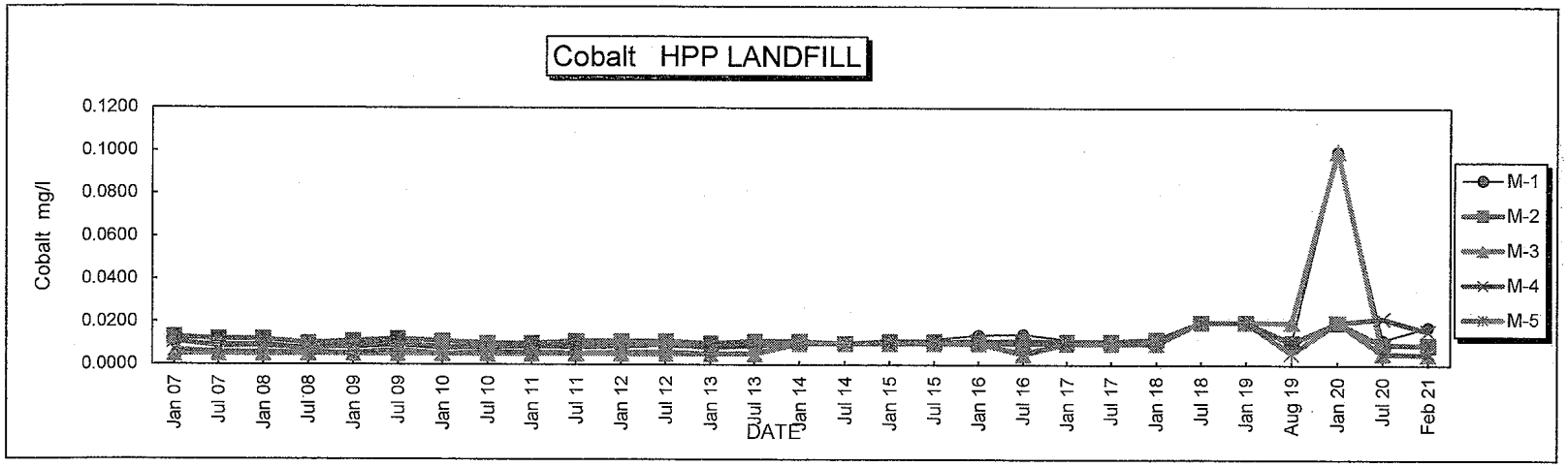
HAWKINS LANDFILL, LLC

Cobalt mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.0110	0.0130	0.0050	0.0110	0.0069
Jul 07	0.0097	0.0120	0.0050	0.0087	0.0059
Jan 08	0.0100	0.0120	0.0050	0.0089	0.0057
Jul 08	0.0081	0.0100	0.0050	0.0075	0.0056
Jan 09	0.0077	0.0110	0.0050	0.0090	0.0054
Jul 09	0.0088	0.0120	0.0050	0.0100	0.0069
Jan 10	0.0072	0.0110	0.0050	0.0083	0.0051
Jul 10	0.0077	0.0100	0.0050	0.0085	0.0060
Jan 11	0.0080	0.0100	0.0050	0.0098	0.0058
Jul 11	0.0076	0.0110	0.0050	0.0091	0.0054
Jan 12	0.0081	0.0110	0.0050	0.0094	0.0058
Jul 12	0.0089	0.0110	0.0050	0.0094	0.0060
Jan 13	0.0088	0.0100	0.0050	0.0082	0.0051
Jul 13	0.0110	0.0110	0.0050	0.0090	0.0054
Jan 14	0.0100	0.0110	0.0100	0.0100	0.0100
Jul 14	0.0100	0.0100	0.0100	0.0100	0.0100
Jan 15	0.0100	0.0110	0.0100	0.0100	0.0100
Jul 15	0.0120	0.0110	0.0100	0.0100	0.0100
Jan 16	0.0140	0.0110	0.0100	0.0100	0.0100
Jul 16	0.0144	0.0112	0.0050	0.0101	0.0056
Jan 17	0.0120	0.0110	0.0100	0.0100	0.0100
Jul 17	0.0110	0.0110	0.0100	0.0100	0.0100
Jan 18	0.0110	0.0120	0.0100	0.0100	0.0100
Jul 18	0.0200	0.0200	0.0200	0.0200	0.0200
Jan 19	0.0200	0.0200	0.0200	0.0200	0.0200
Aug 19	0.0107	0.0106	0.0200	0.0103	0.0057
Jan 20	0.1000	0.0200	0.1000	0.0200	0.0200
Jul 20	0.0120	0.0098	0.0056	0.022	0.0056
Feb 21	0.0180	0.0096	0.0050	0.016	0.0050

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	0.0086	0.0111	N/A	0.0091	N/A
	Std Dev.	0.0011	0.0010	N/A	0.0009	N/A
T.05 = 2.179	N1	13	13	N/A	13	N/A
T.01 = 3.055	N2	1	1	N/A	1	N/A
	T hist	29.63351	-5.36249	N/A	26.80177	N/A



NOTE: Jan 20 data points for M-1 and M-3 reflect elevated laboratory reporting limit (PQL).

HAWKINS LANDFILL, LLC

Chemical Oxygen Demand mg/l
COD

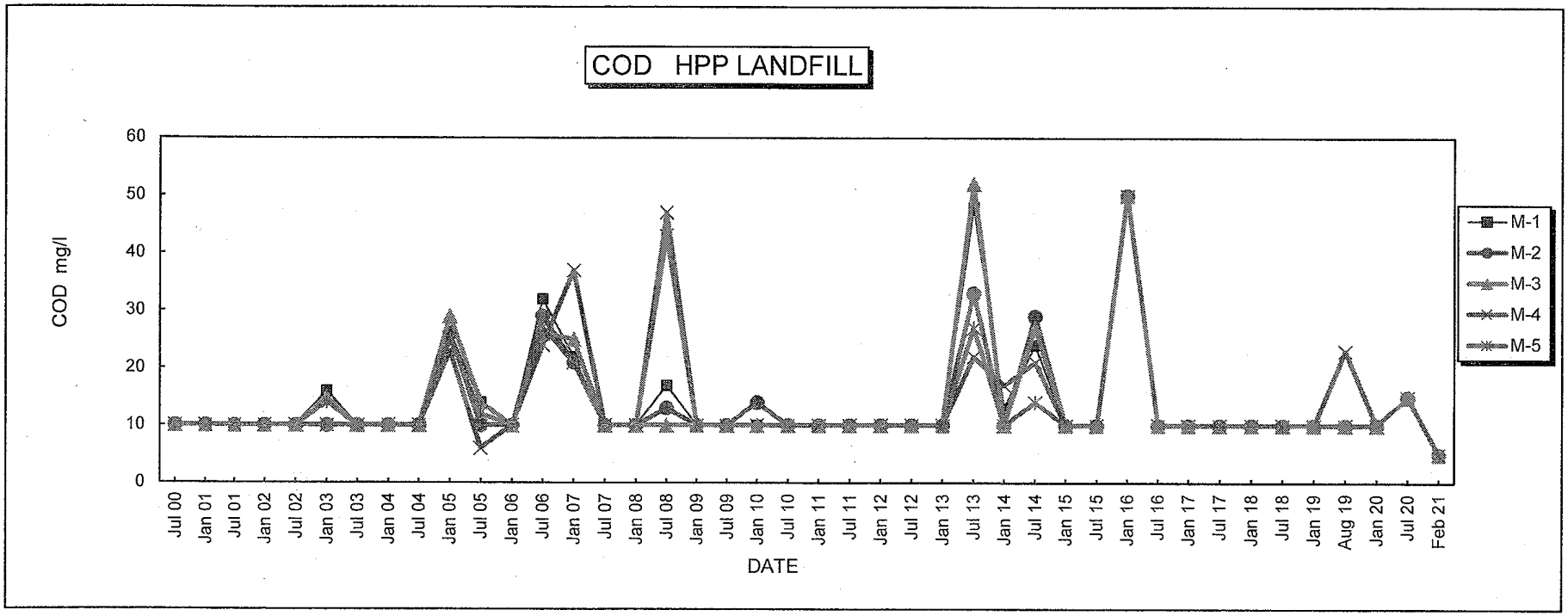
Shaded Values < Detection Limit

Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	10	10	10	10	10
Jan 01	10	10	10	10	10
Jul 01	10	10	10	10	10
Jan 02	10	10	10	10	10
Jul 02	10	10	10	10	10
Jan 03	16	10	15	10	14
Jul 03	10	10	10	10	10
Jan 04	10	10	10	10	10
Jul 04	10	10	10	10	10
Jan 05	26	26	29	23	25
Jul 05	14	10	14	6	12
Jan 06	10	10	10	10	10
Jul 06	32	29	26	24	27
Jan 07	22	21	25	37	21
Jul 07	10	10	10	10	10
Jan 08	10	10	10	10	10
Jul 08	17	13	10	47	43
Jan 09	10	10	10	10	10
Jul 09	10	10	10	10	10
Jan 10	10	14	10	10	10
Jul 10	10	10	10	10	10
Jan 11	10	10	10	10	10
Jul 11	10	10	10	10	10
Jan 12	10	10	10	10	10
Jul 12	10	10	10	10	10
Jan 13	10	10	10	10	10
Jul 13	48	33	52	22	27
Jan 14	13	10	10	17.0	10
Jul 14	24	29	27	21	14
Jan 15	10	10	10	10	10
Jul 15	10	10	10	10	10
Jan 16	50	50	50	50	50
Jul 16	10	10	10	10	10
Jan 17	10	10	10	10	10
Jul 17	10	10	10	10	10
Jan 18	10	10	10	10	10
Jul 18	10	10	10	10	10
Jan 19	10	10	10	10	10
Aug 19	10	10	10	23	10
Jan 20	10	10	10	10	10
Jul 20	15	15	15	15	15
Feb 21	5	5	5	5	5

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	N/A	N/A	N/A	N/A	N/A
Std Dev.	N/A	N/A	N/A	N/A	N/A
N1	N/A	N/A	N/A	N/A	N/A
N2	N/A	N/A	N/A	N/A	N/A
T hist	N/A	N/A	N/A	N/A	N/A


COD HPP LANDFILL
COD mg/l
60
50
40
30
20
10
0
Jul 00
Jan 01
Jul 01
Jan 02
Jul 02
Jan 03
Jul 03
Jan 04
Jul 04
Jan 05
Jul 05
Jan 06
Jul 06
Jan 07
Jul 07
Jan 08
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Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

Copper mg/l Cu

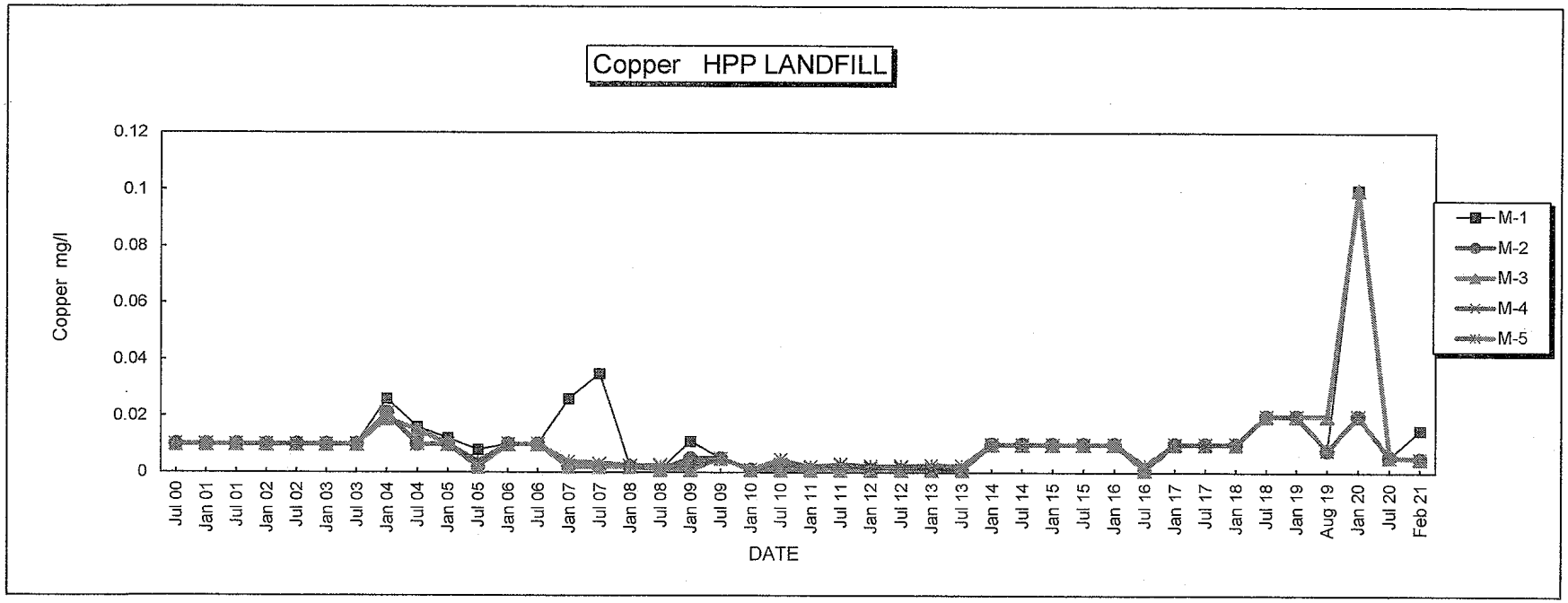
Shaded Values < Detection Limit

Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	0.01	0.01	0.01	0.01	0.01
Jan 01	0.01	0.01	0.01	0.01	0.01
Jul 01	0.01	0.01	0.01	0.01	0.01
Jan 02	0.01	0.01	0.01	0.01	0.01
Jul 02	0.01	0.01	0.01	0.01	0.01
Jan 03	0.01	0.01	0.01	0.01	0.01
Jul 03	0.01	0.01	0.01	0.01	0.01
Jan 04	0.026	0.021	0.019	0.021	0.021
Jul 04	0.016	0.01	0.015	0.01	0.01
Jan 05	0.012	0.01	0.01	0.01	0.01
Jul 05	0.008	0.002	0.002	0.0038	0.0038
Jan 06	0.01	0.01	0.01	0.01	0.01
Jul 06	0.01	0.01	0.01	0.01	0.01
Jan 07	0.026	0.002	0.002	0.0039	0.0038
Jul 07	0.035	0.002	0.002	0.0032	0.0028
Jan 08	0.0021	0.002	0.002	0.0024	0.0025
Jul 08	0.001	0.001	0.001	0.0026	0.0021
Jan 09	0.011	0.005	0.001	0.0027	0.0024
Jul 09	0.005	0.005	0.005	0.005	0.005
Jan 10	0.001	0.001	0.001	0.001	0.001
Jul 10	0.001	0.001	0.001	0.0029	0.0046
Jan 11	0.001	0.001	0.001	0.0021	0.0019
Jul 11	0.001	0.001	0.001	0.0028	0.003
Jan 12	0.001	0.001	0.001	0.0015	0.0023
Jul 12	0.001	0.001	0.001	0.0019	0.0023
Jan 13	0.001	0.001	0.001	0.0014	0.0025
Jul 13	0.001	0.001	0.001	0.0013	0.0024
Jan 14	0.01	0.01	0.01	0.01	0.01
Jul 14	0.01	0.01	0.01	0.01	0.01
Jan 15	0.01	0.01	0.01	0.01	0.01
Jul 15	0.01	0.01	0.01	0.01	0.01
Jan 16	0.01	0.01	0.01	0.01	0.01
Jul 16	0.0014	0.001	0.001	0.0015	0.0025
Jan 17	0.01	0.01	0.01	0.01	0.01
Jul 17	0.01	0.01	0.01	0.01	0.01
Jan 18	0.01	0.01	0.01	0.01	0.01
Jul 18	0.02	0.02	0.02	0.02	0.02
Jan 19	0.02	0.02	0.02	0.02	0.02
Aug 19	0.008	0.008	0.02	0.008	0.008
Jan 20	0.1	0.02	0.1	0.02	0.02
Jul 20	0.0056	0.0056	0.0056	0.0056	0.0056
Feb 21	0.015	0.005	0.005	0.005	0.005

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
T.05 = 2.179	N1	N/A	N/A	N/A	N/A	N/A
T.01 = 3.055	N2	N/A	N/A	N/A	N/A	N/A
	T hist	N/A	N/A	N/A	N/A	N/A



NOTE: Jan 20 data points for M-1 and M-3 reflect elevated laboratory reporting limit (PQL).

HAWKINS LANDFILL, LLC

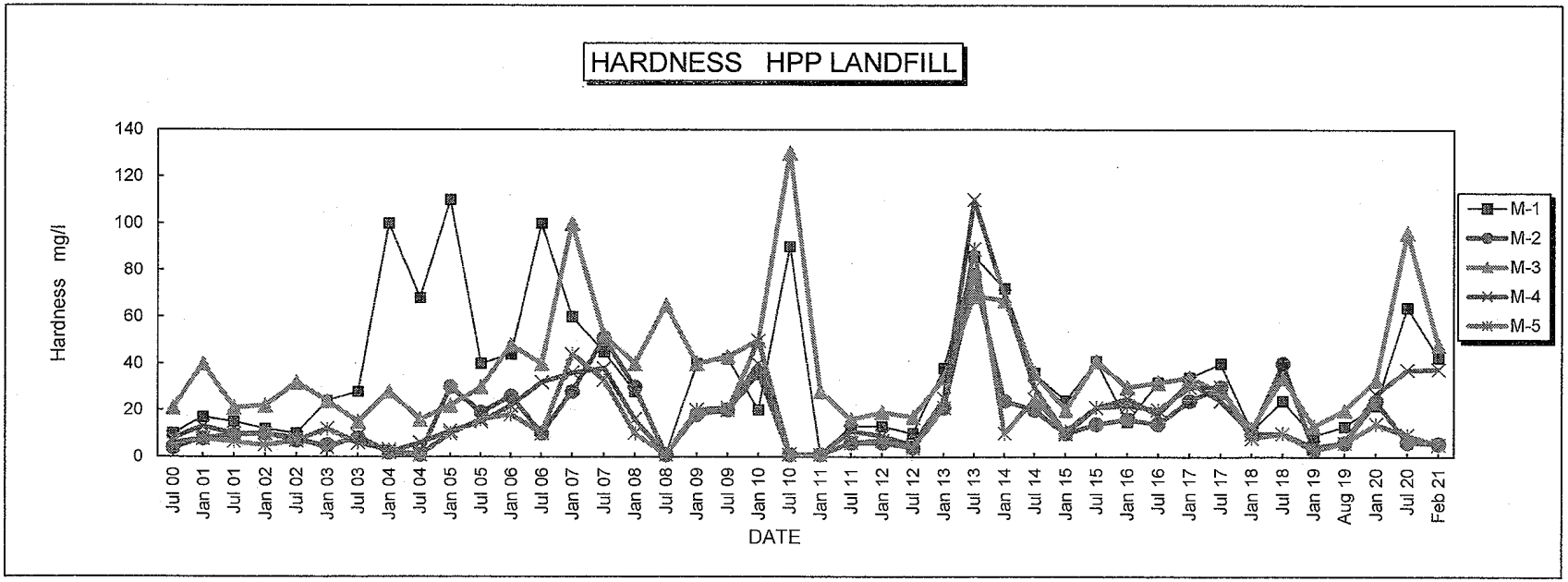
Hardness (as CaCO3) mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	10	4	21	8	6
Jan 01	17	7.9	40	13	7.9
Jul 01	15	9.4	21	9.9	6.4
Jan 02	12	10	22	10	5
Jul 02	10	7	32	8	7
Jan 03	24	5	24	4	12
Jul 03	28	8	15	9	6
Jan 04	100	2	28	2	3
Jul 04	68	1	16	6	1
Jan 05	110	30	22	11	10
Jul 05	40	19	30	15	16
Jan 06	44	26	48	22	18
Jul 06	100	10	40	32	10
Jan 07	60	28	100	36	44
Jul 07	45	51	52	38	33
Jan 08	28	30	40	16	10
Jul 08	1	1	65	1	1
Jan 09	40	18	40	20	20
Jul 09	42	20	43	21	20
Jan 10	20	36	50	40	50
Jul 10	90	1	130	1	1
Jan 11	1	1	28	1	1
Jul 11	13	6	16	11	6
Jan 12	13	6	19	9	7
Jul 12	10	4	17	5	4
Jan 13	38	21	34	25	21
Jul 13	86	78	69	110	89
Jan 14	72	24	67	69	10
Jul 14	36	20	36	30	25
Jan 15	24	10	20	10	11
Jul 15	41	14	41	21	21
Jan 16	15	16	30	25	22
Jul 16	32	14	32	18	20
Jan 17	34	24	34	32	30
Jul 17	40	30	28	24	30
Jan 18	11	10	12	10	8
Jul 18	24	40	34	10	10
Jan 19	8.9	3.3	13	4.2	2.8
Aug 19	13	6.0	20	6.0	6.0
Jan 20	22	24	33	27	14
Jul 20	64	6.2	95.9	37.3	9.4
Feb 21	42.6	5.71	48.0	37.7	5.16

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	41.7778	14.8500	36.4444	14.4944	12.0167
Std Dev.	33.4937	13.4763	20.7796	11.1181	11.1412
N1	18	18	18	18	18
N2	1	1	1	1	1
T hist	0.101216	-2.79641	2.292865	8.605687	-2.53749

T.01 = 2.898
T.05 = 2.110


HARDNESS HPP LANDFILL
Hardness mg/l
140
120
100
80
60
40
20
0
Jul 00
Jan 01
Jul 01
Jan 02
Jul 02
Jan 03
Jul 03
Jan 04
Jul 04
Jan 05
Jul 05
Jan 06
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Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

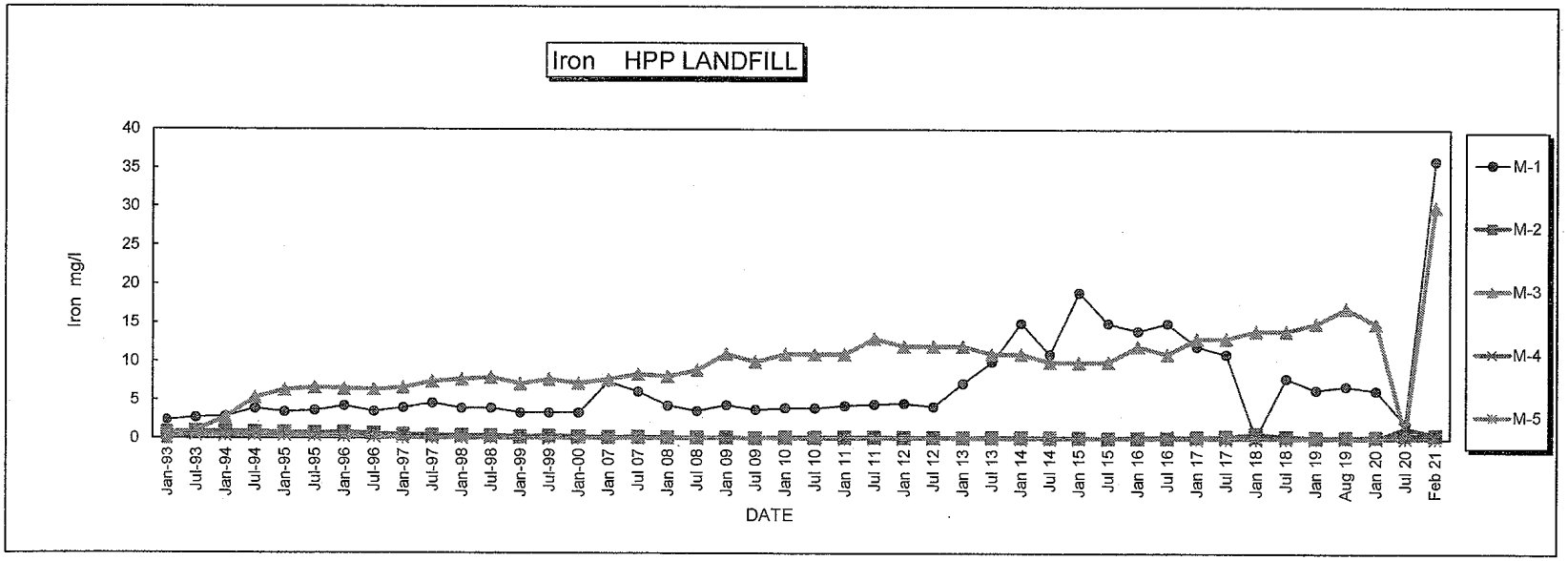
HAWKINS LANDFILL, LLC

Iron Fe mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	2.4	0.82	0.12	0.19	0.53
Jul-93	2.72	0.94	1.03	0.48	0.56
Jan-94	2.87	0.92	2.73	0.4	0.49
Jul-94	3.93	0.85	5.33	0.49	0.6
Jan-95	3.48	0.8	6.33	0.41	0.43
Jul-95	3.65	0.73	6.6	0.39	0.42
Jan-96	4.25	0.83	6.48	0.45	0.35
Jul-96	3.52	0.67	6.36	0.26	0.25
Jan-97	4	0.52	6.6	0.23	0.15
Jul-97	4.64	0.449	7.41	0.172	0.143
Jan-98	3.95	0.415	7.68	0.2	0.152
Jul-98	3.98	0.399	7.95	0.216	0.147
Jan-99	3.4	0.3	7.1	0.2	0.1
Jul-99	3.4	0.4	7.7	0.2	0.1
Jan-00	3.4	0.3	7.2	0.2	0.1
Jan 07	7.4	0.22	7.7	0.1	0.11
Jul 07	6.1	0.26	8.4	0.1	0.1
Jan 08	4.3	0.16	8.1	0.1	0.1
Jul 08	3.6	0.16	8.9	0.09	0.11
Jan 09	4.4	0.16	11	0.087	0.099
Jul 09	3.8	0.15	10	0.077	0.068
Jan 10	4	0.23	11	0.11	0.066
Jul 10	4	0.24	11	0.11	0.061
Jan 11	4.3	0.27	11	0.11	0.067
Jul 11	4.5	0.27	13	0.11	0.069
Jan 12	4.6	0.2	12	0.17	0.069
Jul 12	4.2	0.19	12	0.15	0.067
Jan 13	7.2	0.18	12	0.17	0.064
Jul 13	10	0.2	11	0.16	0.07
Jan 14	15	0.22	11	0.17	0.066
Jul 14	11	0.2	10	0.14	0.067
Jan 15	19	0.18	9.9	0.11	0.065
Jul 15	15	0.14	10	0.11	0.058
Jan 16	14	0.15	12	0.26	0.095
Jul 16	15	0.15	11	0.33	0.05
Jan 17	12	0.31	13	0.25	0.065
Jul 17	11	0.36	13	0.23	0.069
Jan 18	0.2	0.73	14	0.19	0.066
Jul 18	7.9	0.39	14	0.15	0.068
Jan 19	6.4	0.25	15	0.13	0.059
Aug 19	6.9	0.325	17	0.122	0.08
Jan 20	6.3	0.35	15	0.098	0.069
Jul 20	2.1	0.58	0.70	1.5	0.15
Feb 21	36	0.53	30	0.64	0.12

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	4.8000	0.2069	10.4692	0.1095	0.0808
	Std Dev.	1.2610	0.0442	1.7031	0.0261	0.0193
T.05 = 2.179	N1	13	13	13	13	13
T.01 = 3.055	N2	1	1	1	1	1
	T hist	85.71299	25.30268	39.72492	70.3085	7.025383


Iron HPP LANDFILL
Iron mg/l
40
35
30
25
20
15
10
5
0
Jan-93
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jan 07
Jul 07
Jan 08
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Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

Lead Pb mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.1	0.1	0.1	0.1	0.1
Jul-93	0.1	0.1	0.1	0.1	0.1
Jan-94	0.1	0.1	0.1	0.1	0.1
Jul-94	0.1	0.1	0.1	0.1	0.1
Jan-95	0.1	0.1	0.1	0.1	0.1
Jul-95	0.1	0.1	0.1	0.1	0.1
Jan-96	0.1	0.1	0.1	0.1	0.1
Jul-96	0.1	0.1	0.1	0.1	0.1
Jan-97	0.1	0.1	0.1	0.1	0.1
Jul-97	0.06	0.06	0.06	0.06	0.06
Jan-98	0.06	0.06	0.06	0.06	0.06
Jul-98	0.01	0.01	0.01	0.01	0.01
Jan-99	0.1	0.1	0.1	0.1	0.1
Jul-99	0.1	0.1	0.1	0.1	0.1
Jan-00	0.1	0.1	0.1	0.1	0.1
Jul-00	0.005	0.005	0.005	0.005	0.005
Jan 01	0.005	0.005	0.005	0.005	0.005
Jul 01	0.005	0.005	0.005	0.005	0.005
Jan 02	0.005	0.005	0.005	0.005	0.005
Jul 02	0.005	0.005	0.005	0.005	0.005
Jan 03	0.005	0.005	0.005	0.005	0.005
Jul 03	0.005	0.005	0.005	0.005	0.005
Jan 04	0.005	0.005	0.005	0.005	0.005
Jul 04	0.005	0.005	0.005	0.005	0.005
Jan 05	0.005	0.005	0.005	0.005	0.005
Jul 05	0.0079	0.002	0.002	0.002	0.002
Jan 06	0.002	0.002	0.002	0.002	0.002
Jul 06	0.002	0.002	0.002	0.002	0.002
Jan 07	0.002	0.002	0.002	0.002	0.002
Jul 07	0.002	0.002	0.002	0.002	0.002
Jan 08	0.002	0.002	0.002	0.002	0.002
Jul 08	0.002	0.002	0.002	0.002	0.002
Jan 09	0.0031	0.005	0.0024	0.0025	0.0027
Jul 09	0.002	0.002	0.002	0.002	0.002
Jan 10	0.002	0.002	0.002	0.002	0.002
Jul 10	0.002	0.002	0.002	0.002	0.002
Jan 11	0.001	0.001	0.001	0.001	0.001
Jul 11	0.001	0.001	0.001	0.001	0.001
Jan 12	0.001	0.001	0.001	0.001	0.001
Jul 12	0.001	0.001	0.001	0.001	0.001
Jan 13	0.001	0.001	0.001	0.001	0.001
Jul 13	0.001	0.001	0.001	0.001	0.001
Jan 14	0.002	0.002	0.002	0.002	0.002
Jul 14	0.002	0.002	0.002	0.002	0.002
Jan 15	0.002	0.002	0.002	0.002	0.002
Jul 15	0.002	0.002	0.002	0.002	0.002
Jan 16	0.002	0.002	0.002	0.002	0.002
Jul 16	0.002	0.002	0.002	0.002	0.002
Jan 17	0.002	0.002	0.002	0.002	0.002
Jul 17	0.002	0.002	0.002	0.002	0.002
Jan 18	0.002	0.002	0.002	0.002	0.002
Jul 18	0.001	0.001	0.001	0.001	0.001
Jan 19	0.001	0.001	0.001	0.001	0.001
Aug 19	0.001	0.001	0.005	0.001	0.001
Jan 20	0.001	0.001	0.001	0.001	0.001
Jul 20	0.0022	0.0022	0.0022	0.0022	0.0022
Feb 21	0.0021	0.002	0.002	0.002	0.002

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

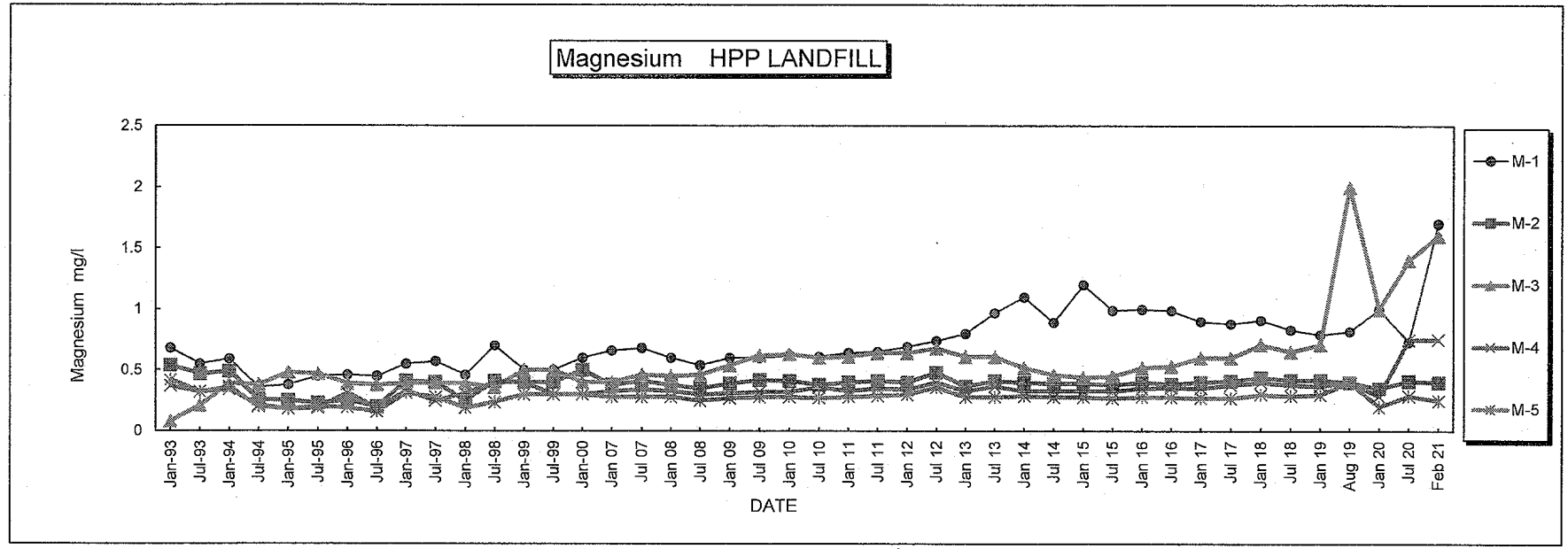
HAWKINS LANDFILL, LLC

Magnesium Mg mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.68	0.54	0.08	0.37	0.42
Jul-93	0.55	0.47	0.21	0.32	0.32
Jan-94	0.59	0.49	0.39	0.34	0.36
Jul-94	0.36	0.26	0.38	0.21	0.2
Jan-95	0.38	0.25	0.48	0.18	0.18
Jul-95	0.45	0.23	0.47	0.19	0.2
Jan-96	0.46	0.25	0.39	0.31	0.19
Jul-96	0.45	0.2	0.38	0.19	0.16
Jan-97	0.55	0.41	0.39	0.33	0.31
Jul-97	0.571	0.4	0.393	0.248	0.279
Jan-98	0.46	0.25	0.39	0.31	0.19
Jul-98	0.701	0.41	0.358	0.401	0.238
Jan-99	0.5	0.4	0.5	0.4	0.3
Jul-99	0.5	0.4	0.5	0.3	0.3
Jan-00	0.6	0.5	0.4	0.3	0.3
Jan 07	0.66	0.38	0.4	0.33	0.28
Jul 07	0.68	0.41	0.46	0.34	0.28
Jan 08	0.6	0.38	0.45	0.33	0.28
Jul 08	0.54	0.35	0.46	0.3	0.25
Jan 09	0.6	0.39	0.54	0.31	0.27
Jul 09	0.6	0.42	0.62	0.32	0.28
Jan 10	0.62	0.41	0.63	0.32	0.28
Jul 10	0.61	0.38	0.6	0.36	0.27
Jan 11	0.64	0.4	0.61	0.33	0.28
Jul 11	0.65	0.41	0.64	0.35	0.29
Jan 12	0.69	0.4	0.64	0.34	0.3
Jul 12	0.74	0.48	0.68	0.4	0.36
Jan 13	0.8	0.37	0.61	0.33	0.28
Jul 13	0.97	0.41	0.61	0.37	0.28
Jan 14	1.1	0.4	0.52	0.33	0.29
Jul 14	0.89	0.39	0.46	0.33	0.28
Jan 15	1.2	0.39	0.44	0.33	0.28
Jul 15	0.99	0.38	0.45	0.33	0.27
Jan 16	1.0	0.40	0.52	0.35	0.28
Jul 16	0.989	0.386	0.531	0.358	0.277
Jan 17	0.90	0.40	0.60	0.35	0.27
Jul 17	0.88	0.41	0.60	0.38	0.27
Jan 18	0.91	0.44	0.71	0.40	0.30
Jul 18	0.83	0.42	0.65	0.38	0.29
Jan 19	0.79	0.42	0.71	0.37	0.30
Aug 19	0.817	0.40	2.00	0.40	0.40
Jan 20	1.00	0.35	1.00	0.29	0.20
Jul 20	0.73	0.41	1.40	0.75	0.29
Feb 21	1.70	0.4	1.60	0.75	0.25

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	0.7952	0.4010	0.5656	0.3455	0.2835
	Std Dev.	0.1805	0.0251	0.0910	0.0263	0.0194
T.01 = 2.797	N1	25	25	25	25	25
T.05 = 2.064	N2	1	1	1	1	1
	T hist	24.56297	-0.20266	55.65646	75.43081	-8.46691



ote: Aug 19 Datum Point for M-3 (sample obtained October 22, 2019) and Jan 20 points reflect abnormally high laboratory reporting limits (PQL's).

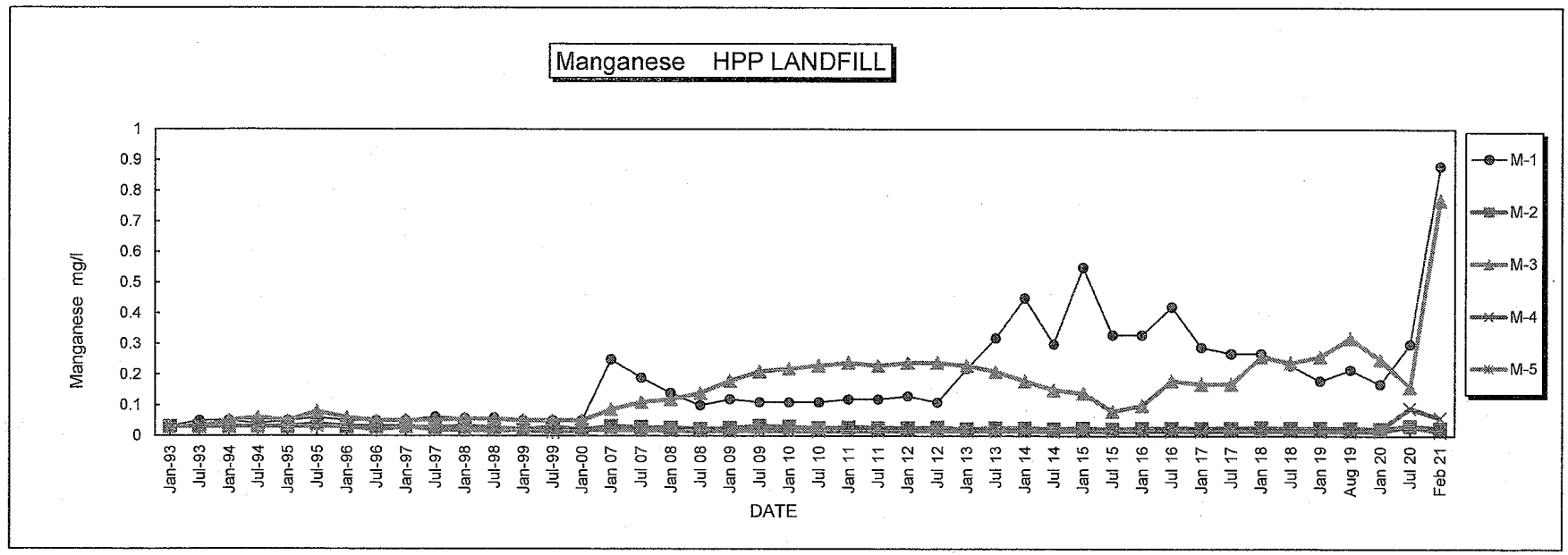
HAWKINS LANDFILL, LLC

Manganese Mn mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.03	0.03	0.03	0.03	0.03
Jul-93	0.05	0.03	0.03	0.03	0.03
Jan-94	0.05	0.03	0.05	0.03	0.03
Jul-94	0.04	0.03	0.06	0.03	0.03
Jan-95	0.05	0.03	0.05	0.03	0.03
Jul-95	0.06	0.04	0.08	0.03	0.03
Jan-96	0.05	0.03	0.06	0.03	0.03
Jul-96	0.05	0.03	0.05	0.02	0.02
Jan-97	0.05	0.03	0.05	0.03	0.03
Jul-97	0.062	0.028	0.052	0.02	0.02
Jan-98	0.057	0.03	0.056	0.022	0.019
Jul-98	0.059	0.027	0.055	0.018	0.016
Jan-99	0.05	0.02	0.05	0.02	0.02
Jul-99	0.05	0.03	0.05	0.02	0.01
Jan-00	0.05	0.02	0.05	0.02	0.02
Jan 07	0.25	0.032	0.086	0.025	0.019
Jul 07	0.19	0.029	0.11	0.023	0.018
Jan 08	0.14	0.027	0.12	0.023	0.017
Jul 08	0.1	0.023	0.14	0.019	0.015
Jan 09	0.12	0.026	0.18	0.023	0.016
Jul 09	0.11	0.033	0.21	0.021	0.016
Jan 10	0.11	0.031	0.22	0.021	0.016
Jul 10	0.11	0.026	0.23	0.023	0.015
Jan 11	0.12	0.027	0.24	0.031	0.016
Jul 11	0.12	0.026	0.23	0.027	0.016
Jan 12	0.13	0.026	0.24	0.025	0.017
Jul 12	0.11	0.028	0.24	0.023	0.016
Jan 13	0.22	0.024	0.23	0.023	0.016
Jul 13	0.32	0.026	0.21	0.024	0.016
Jan 14	0.45	0.025	0.18	0.023	0.016
Jul 14	0.3	0.024	0.15	0.021	0.015
Jan 15	0.55	0.025	0.14	0.02	0.016
Jul 15	0.33	0.024	0.081	0.019	0.015
Jan 16	0.33	0.025	0.1	0.023	0.016
Jul 16	0.422	0.0253	0.181	0.0271	0.016
Jan 17	0.29	0.025	0.17	0.026	0.015
Jul 17	0.27	0.025	0.17	0.027	0.016
Jan 18	0.27	0.028	0.26	0.027	0.017
Jul 18	0.23	0.026	0.24	0.024	0.016
Jan 19	0.18	0.026	0.26	0.024	0.015
Aug 19	0.216	0.025	0.32	0.0245	0.0155
Jan 20	0.17	0.024	0.25	0.022	0.015
Jul 20	0.30	0.033	0.16	0.091	0.031
Feb 21	0.88	0.025	0.77	0.059	0.014

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	0.1342	0.0278	0.1905	0.0237	0.0164
	Std Dev.	0.0434	0.0029	0.0577	0.0031	0.0012
T.05 = 2.179	N1	13	13	13	13	13
T.01 = 3.055	N2	1	1	1	1	1
	T hist	59.57047	-3.36351	34.79462	39.30585	-7.18899


Manganese HPP LANDFILL
Manganese mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-93
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jan 07
Jul 07
Jan 08
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Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

Mercury Hg mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 05	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 05	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 06	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 06	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 07	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 07	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 08	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 08	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 09	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 09	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 10	0.000364	0.0002	0.0002	0.0002	0.0002
Jul 10	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 11	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 11	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 12	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 12	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 13	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 13	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 14	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 14	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 15	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 15	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 16	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 16	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 17	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 17	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 18	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 18	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 19	0.0002	0.0002	0.0002	0.0002	0.0002
Aug 19	0.0002	0.0002	0.0002	0.0002	0.0002
Jan 20	0.0002	0.0002	0.0002	0.0002	0.0002
Jul 20	0.0005	0.0005	0.0005	0.0005	0.0005
Feb 21	0.0002	0.0002	0.0002	0.0002	0.0002

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

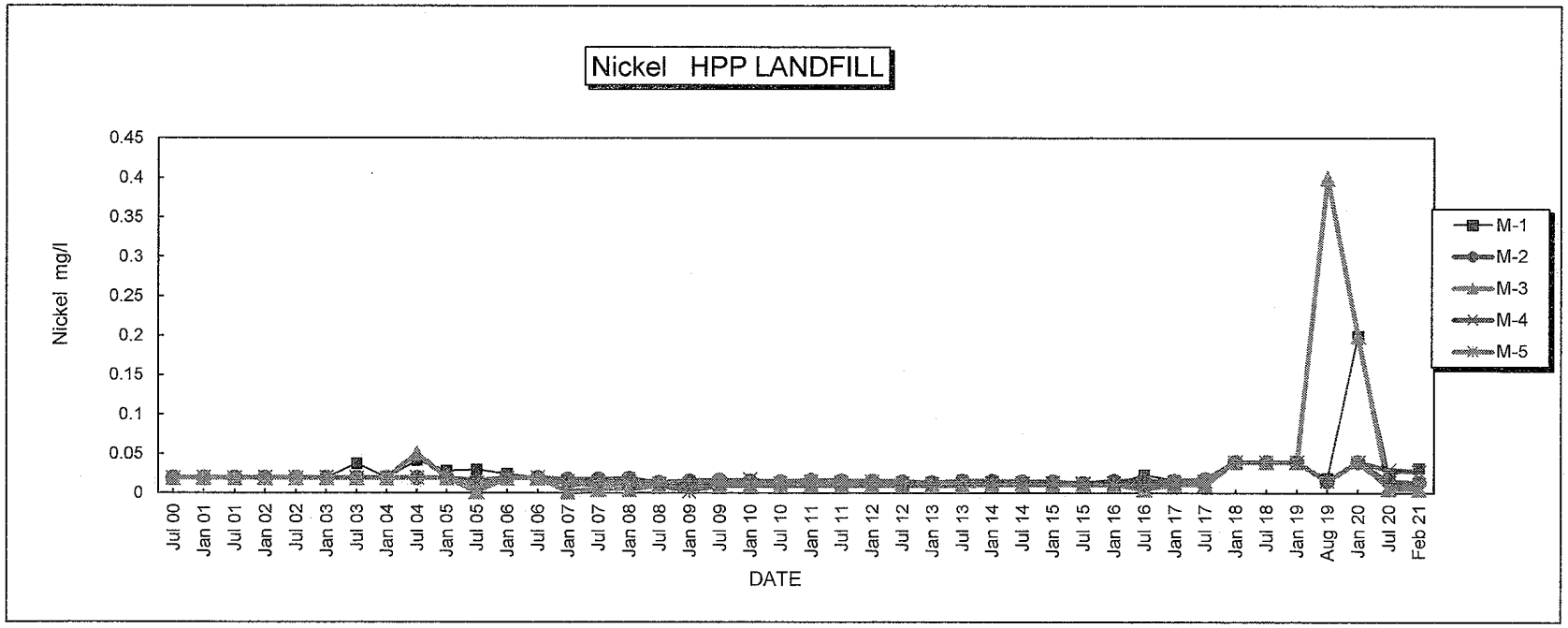
HAWKINS LANDFILL, LLC

Nickel mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	0.02	0.02	0.02	0.02	0.02
Jan 01	0.02	0.02	0.02	0.02	0.02
Jul 01	0.02	0.02	0.02	0.02	0.02
Jan 02	0.02	0.02	0.02	0.02	0.02
Jul 02	0.02	0.02	0.02	0.02	0.02
Jan 03	0.02	0.02	0.02	0.02	0.02
Jul 03	0.038	0.02	0.02	0.02	0.02
Jan 04	0.02	0.02	0.02	0.02	0.02
Jul 04	0.042	0.02	0.051	0.02	0.02
Jan 05	0.029	0.02	0.02	0.02	0.02
Jul 05	0.03	0.016	0.002	0.013	0.0094
Jan 06	0.025	0.02	0.02	0.02	0.02
Jul 06	0.02	0.02	0.02	0.02	0.02
Jan 07	0.016	0.018	0.002	0.016	0.012
Jul 07	0.018	0.018	0.005	0.013	0.011
Jan 08	0.02	0.019	0.005	0.015	0.012
Jul 08	0.014	0.014	0.01	0.012	0.01
Jan 09	0.012	0.016	0.01	0.012	0.0024
Jul 09	0.015	0.017	0.01	0.013	0.01
Jan 10	0.014	0.016	0.01	0.018	0.01
Jul 10	0.013	0.015	0.01	0.013	0.01
Jan 11	0.015	0.017	0.01	0.015	0.01
Jul 11	0.013	0.016	0.01	0.014	0.01
Jan 12	0.013	0.016	0.01	0.015	0.01
Jul 12	0.015	0.015	0.01	0.013	0.01
Jan 13	0.014	0.014	0.01	0.012	0.01
Jul 13	0.017	0.016	0.01	0.013	0.01
Jan 14	0.014	0.016	0.011	0.014	0.011
Jul 14	0.011	0.015	0.011	0.013	0.011
Jan 15	0.011	0.015	0.011	0.014	0.011
Jul 15	0.011	0.013	0.011	0.013	0.011
Jan 16	0.012	0.016	0.011	0.014	0.011
Jul 16	0.024	0.0161	0.005	0.0149	0.0098
Jan 17	0.017	0.016	0.011	0.014	0.011
Jul 17	0.017	0.018	0.011	0.016	0.011
Jan 18	0.040	0.040	0.040	0.040	0.040
Jul 18	0.040	0.040	0.040	0.040	0.040
Jan 19	0.040	0.040	0.040	0.040	0.040
Aug 19	0.0195	0.016	0.400	0.016	0.016
Jan 20	0.200	0.040	0.200	0.040	0.040
Jul 20	0.025	0.015	0.0056	0.030	0.009
Feb 21	0.032	0.014	0.0055	0.028	0.0083

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	0.0178	0.0189	N/A	0.0171	0.0138
Std Dev.	0.0089	0.0081	N/A	0.0088	0.0100
T.01 = 2.797 N1	25	25	N/A	25	25
T.05 = 2.064 N2	1	1	N/A	1	1
T hist	7.831	-2.964	N/A	6.115	-2.668



Note: Aug 19 Datum Point for M-3, (sample obtained October 22, 2019) and points for Jan 20 M-1 and M-2 reflect abnormally high laboratory reporting limits (PQL's).

HAWKINS LANDFILL, LLC

Nitrate as N mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	0.05	0.06	0.07	0.05	0.05
Jan 01	0.068	0.05	0.066	0.05	0.05
Jul 01	0.05	0.05	0.05	0.05	0.05
Jan 02	0.05	0.05	0.05	0.05	0.05
Jul 02	0.13	0.05	0.18	0.05	0.05
Jan 03	0.21	0.05	0.13	0.05	0.05
Jul 03	0.16	0.05	0.05	0.05	0.05
4-Jan	0.05	0.05	0.05	0.05	0.05
Jul 04	0.05	0.05	0.05	0.05	0.05
Jan 05	0.05	0.05	0.05	0.05	0.05
Jul 05	0.05	0.05	0.05	0.03	0.05
Jan 06	1.2	1.2	1.2	1.2	1.2
Jul 06	0.34	0.05	0.26	0.051	0.05
Jan 07	0.05	0.05	0.05	0.05	0.05
Jul 07	0.05	0.05	0.05	0.05	0.05
Jan 08	0.05	0.05	0.057	0.05	0.05
Jul 08	0.055	0.055	0.055	0.055	0.055
Jan 09	0.05	0.05	0.05	0.05	0.05
Jul 09	0.05	0.05	0.05	0.05	0.05
Jan 10	0.05	0.05	0.05	0.05	0.05
Jul 10	0.05	0.05	0.05	0.05	0.05
Jan 11	0.05	0.05	0.05	0.05	0.05
Jul 11	0.05	0.05	0.05	0.05	0.05
Jan 12	0.05	0.05	0.05	0.05	0.05
Jul 12	0.05	0.05	0.05	0.05	0.05
Jan 13	0.05	0.05	0.05	0.05	0.05
Jul 13	0.094	0.05	0.089	0.05	0.05
Jan 14	0.12	0.05	0.051	0.05	0.05
Jul 14	0.05	0.05	0.05	0.05	0.05
Jan 15	0.05	0.05	0.05	0.05	0.05
Jul 15	0.1	0.1	0.1	0.1	0.1
Jan 16	0.1	0.1	0.1	0.1	0.1
Jul 16	0.1	0.1	0.1	0.1	0.1
Jan 17	0.1	0.1	0.1	0.1	0.1
Jul 17	0.1	0.1	0.1	0.1	0.1
Jan 18	0.054	0.05	0.05	0.05	0.05
Jul 18	0.054	0.05	0.05	0.05	0.05
Jan 19	0.1	0.1	0.1	0.1	0.1
Aug 19	0.1	0.1	0.1	0.1	0.1
Jan 20	0.12	0.1	0.13	0.1	0.1
Jul 20	0.24	0.20	0.38	0.20	0.20
Feb 21	0.04	0.02	0.08	0.14	0.04

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
T.05	N1	N/A	N/A	N/A	N/A	N/A
T.01	N2	N/A	N/A	N/A	N/A	N/A
	T hist	N/A	N/A	N/A	N/A	N/A

HAWKINS LANDFILL, LLC

Nitrite (N) mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.0050	0.0050	0.0050	0.0050	0.0050
Jul 07	0.0050	0.0050	0.0050	0.0050	0.0050
Jan 08	0.0050	0.0050	0.0050	0.0050	0.0050
Jul 08	0.0050	0.0050	0.0050	0.0050	0.0050
Jan 09	0.0050	0.0050	0.0050	0.0050	0.0050
Jul 09	0.0050	0.0050	0.0050	0.0050	0.0050
Jan 10	0.0120	0.0120	0.0120	0.0120	0.0120
Jul 10	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 11	0.0120	0.0120	0.0120	0.0120	0.0120
Jul 11	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 12	0.0120	0.0120	0.0120	0.0120	0.0120
Jul 12	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 13	0.0120	0.0180	0.0200	0.0120	0.0120
Jul 13	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 14	0.0120	0.0120	0.0120	0.0120	0.0130
Jul 14	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 15	0.0120	0.0120	0.0120	0.0120	0.0120
Jul 15	0.1000	0.1200	0.1000	0.1000	0.1000
Jan 16	0.1000	0.1000	0.1000	0.1000	0.1000
Jan 17	0.1000	0.1000	0.1000	0.1000	0.1000
Jan 18	0.1000	0.1000	0.1000	0.1000	0.1000
Jul 18	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 19	0.0120	0.0120	0.0120	0.0120	0.0120
Aug 19	0.0120	0.0120	0.0120	0.0120	0.0120
Jan 20	0.0500	0.0500	0.0500	0.0500	0.0500
Jul 20	N/A	N/A	N/A	N/A	N/A
Feb 21	N/A	N/A	N/A	N/A	N/A

Note: 1) Aug 19 M-3 sample obtained October 22, 2019
2) Nitrite tests not required for July 2020 sampling event
3) Nitrite tests not required for February 2021 sampling event

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

HAWKINS LANDFILL, LLC

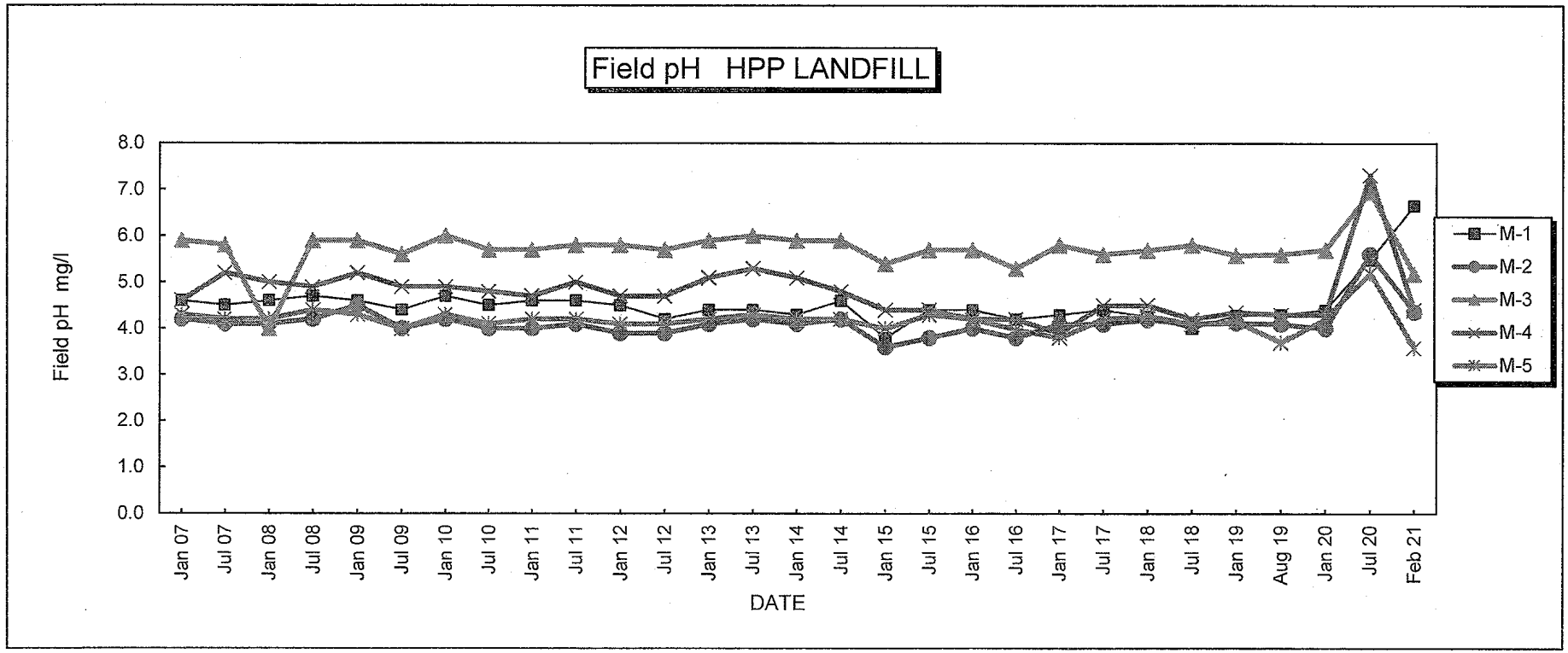
Field pH

	Well No.				
	M-1	M-2	M-3	M-4	M-5
Jan 07	4.6	4.2	5.9	4.6	4.3
Jul 07	4.5	4.1	5.8	5.2	4.2
Jan 08	4.6	4.1	4.0	5.0	4.2
Jul 08	4.7	4.2	5.9	4.9	4.4
Jan 09	4.6	4.5	5.9	5.2	4.3
Jul 09	4.4	4.0	5.6	4.9	4.0
Jan 10	4.7	4.2	6.0	4.9	4.3
Jul 10	4.5	4.0	5.7	4.8	4.1
Jan 11	4.6	4.0	5.7	4.7	4.2
Jul 11	4.6	4.1	5.8	5.0	4.2
Jan 12	4.5	3.9	5.8	4.7	4.1
Jul 12	4.2	3.9	5.7	4.7	4.1
Jan 13	4.4	4.1	5.9	5.1	4.2
Jul 13	4.4	4.2	6.0	5.3	4.3
Jan 14	4.3	4.1	5.9	5.1	4.2
Jul 14	4.6	4.2	5.9	4.8	4.2
Jan 15	3.8	3.6	5.4	4.4	4.0
Jul 15	4.4	3.8	5.7	4.4	4.3
Jan 16	4.4	4.0	5.7	4.2	4.2
Jul 16	4.2	3.8	5.3	4.2	3.98
Jan 17	4.3	4.1	5.8	3.9	3.8
Jul 17	4.4	4.1	5.6	4.5	4.2
Jan 18	4.26	4.19	5.69	4.50	4.28
Jul 18	4.00	4.10	5.80	4.20	4.10
Jan 19	4.29	4.12	5.58	4.35	4.16
Aug 19	4.30	4.10	5.60	4.30	3.70
Jan 20	4.40	4.00	5.70	4.30	4.20
Jul 20	5.49	5.61	6.95	7.31	5.21
Feb 21	6.65	4.36	5.18	4.40	3.58

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	4.5417	4.1000	5.6500	4.8833	4.2000
Std Dev.	0.1379	0.1651	0.5317	0.1946	0.1128
N1	12	12	12	12	12
N2	1	1	1	1	1
T hist	50.70908	5.221622	-2.93164	-8.23654	-18.2272

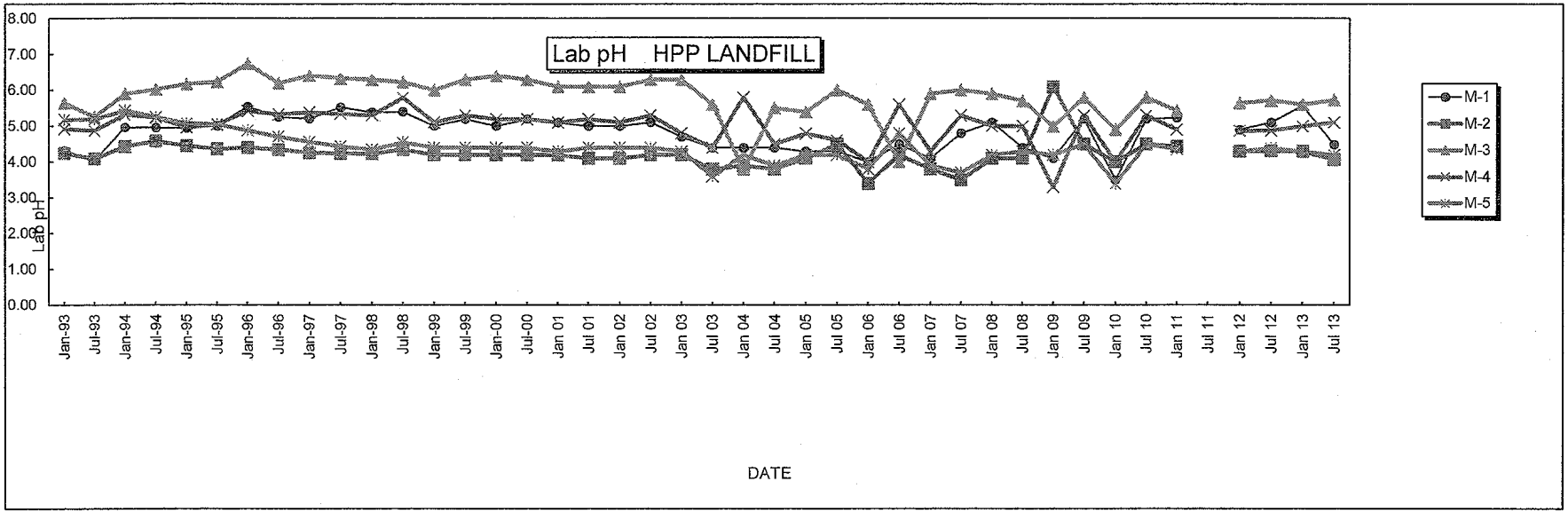
T.01 = 3.106
T.05 = 2.201


Field pH HPP LANDFILL
Field pH mg/l
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jan 07
Jul 07
Jan 08
Jul 08
Jan 09
Jul 09
Jan 10
Jul 10
Jan 11
Jul 11
Jan 12
Jul 12
Jan 13
Jul 13
Jan 14
Jul 14
Jan 15
Jul 15
Jan 16
Jul 16
Jan 17
Jul 17
Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

Lab pH

Well No.

		M-1	M-2	M-3	M-4	M-5
	Jan-93	4.32	4.25	5.65	4.92	5.18
	Jul-93	4.05	4.09	5.26	4.88	5.20
	Jan-94	4.97	4.44	5.90	5.32	5.44
	Jul-94	4.96	4.58	6.02	5.23	5.25
	Jan-95	4.95	4.45	6.17	4.97	5.07
	Jul-95	5.01	4.37	6.23	5.04	5.05
	Jan-96	5.54	4.40	6.74	5.42	4.88
	Jul-96	5.26	4.35	6.20	5.33	4.71
	Jan-97	5.21	4.26	6.41	5.38	4.56
	Jul-97	5.52	4.24	6.33	5.34	4.43
	Jan-98	5.38	4.23	6.30	5.30	4.34
	Jul-98	5.40	4.35	6.22	5.79	4.55
	Jan-99	5.00	4.20	6.00	5.10	4.40
	Jul-99	5.20	4.20	6.30	5.30	4.40
	Jan-00	5.00	4.20	6.40	5.20	4.40
	Jul-00	5.20	4.20	6.30	5.20	4.40
	Jan 01	5.10	4.20	6.10	5.10	4.30
	Jul 01	5.00	4.10	6.10	5.20	4.40
	Jan 02	5.00	4.10	6.10	5.10	4.40
	Jul 02	5.10	4.20	6.30	5.30	4.40
	Jan 03	4.70	4.20	6.30	4.80	4.30
	Jul 03	4.40	3.80	5.60	4.40	3.60
	Jan 04	4.40	3.90	3.80	5.80	4.20
	Jul 04	4.40	3.80	5.50	4.50	3.90
	Jan 05	4.30	4.10	5.40	4.80	4.20
	Jul 05	4.30	4.50	6.00	4.60	4.20
	Jan 06	4.00	3.40	5.60	4.00	3.80
	Jul 06	4.50	4.20	4.00	5.60	4.80
	Jan 07	4.10	3.80	5.90	4.30	3.90
	Jul 07	4.80	3.50	6.00	5.30	3.70
	Jan 08	5.10	4.10	5.90	5.00	4.20
	Jul 08	4.40	4.10	5.70	5.00	4.30
	Jan 09	4.10	6.10	5.00	3.30	4.20
	Jul 09	5.20	4.50	5.80	5.30	4.50
	Jan 10	3.50	4.00	4.90	4.00	3.40
	Jul 10	5.20	4.50	5.80	5.30	4.50
	Jan 11	5.23	4.43	5.43	4.90	4.36
	Jul 11					
	Jan 12	4.90	4.30	5.64	4.87	4.29
	Jul 12	5.10	4.31	5.72	4.88	4.39
	Jan 13	5.57	4.30	5.60	5.00	4.29
	Jul 13	4.49	4.07	5.73	5.10	4.20
	Jan 14	Not Performed for this Sampling Event				
	Jul 14	Not Performed for this Sampling Event				
	Jan 15	Not Performed for this Sampling Event				
	Jul 15	Not Performed for this Sampling Event				
	Jan 16	Not Performed for this Sampling Event				
	Jul 16	Not Performed for this Sampling Event				
	Jan 17	Not Performed for this Sampling Event				
	Jul 17	Not Performed for this Sampling Event				
	Jan 18	Not Performed for this Sampling Event				
	Jul 18	Not Performed for this Sampling Event				
	Jan 19	Not Performed for this Sampling Event				
	Aug 19	Not Performed for this Sampling Event				
	Jan 20	Not Performed for this Sampling Event				
	Jul 20	Not Performed for this Sampling Event				
	Feb 21	Not Performed for this Sampling Event				
	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A


Lab pH HPP LANDFILL
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Lab pH
Jan-93
Jul-93
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Jan-95
Jul-95
Jan-96
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M-3
M-4
M-5

HAWKINS LANDFILL, LLC

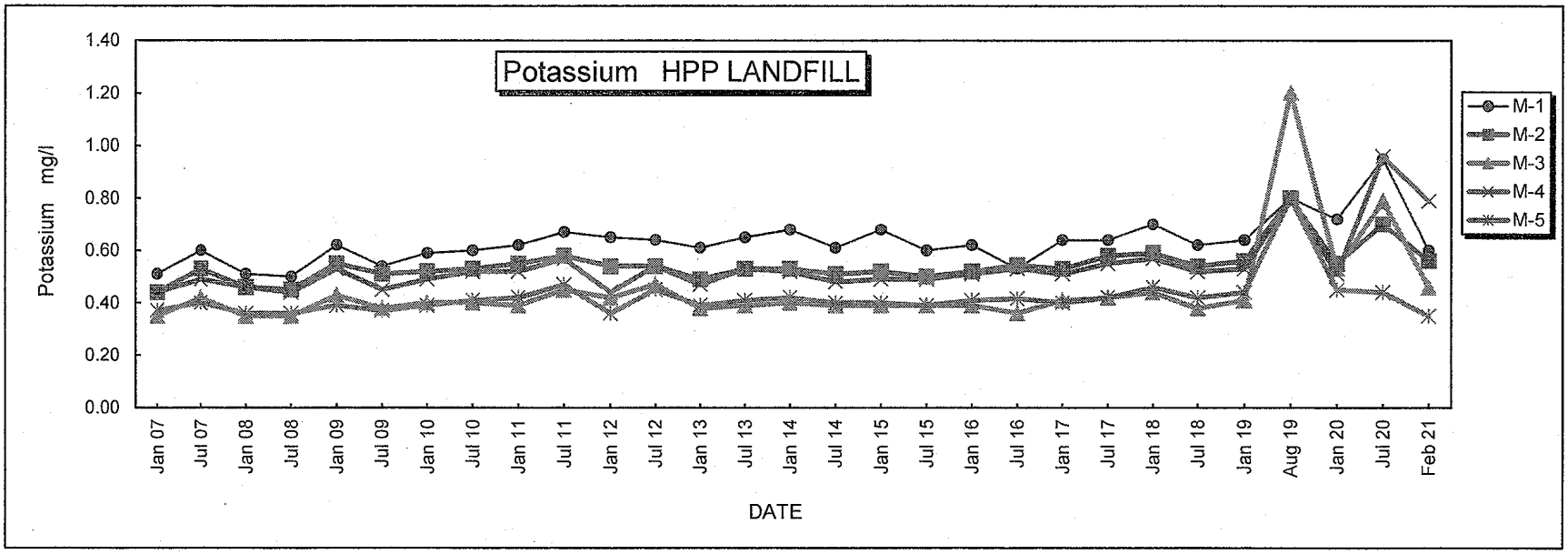
Potassium K mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.51	0.44	0.35	0.44	0.37
Jul 07	0.60	0.53	0.42	0.49	0.40
Jan 08	0.51	0.46	0.35	0.46	0.36
Jul 08	0.50	0.45	0.35	0.44	0.36
Jan 09	0.62	0.55	0.43	0.53	0.39
Jul 09	0.54	0.51	0.38	0.45	0.37
Jan 10	0.59	0.52	0.40	0.49	0.39
Jul 10	0.60	0.53	0.40	0.52	0.41
Jan 11	0.62	0.55	0.39	0.52	0.42
Jul 11	0.67	0.58	0.45	0.57	0.47
Jan 12	0.65	0.54	0.42	0.44	0.36
Jul 12	0.64	0.54	0.47	0.54	0.45
Jan 13	0.61	0.49	0.38	0.47	0.39
Jul 13	0.65	0.53	0.39	0.53	0.41
Jan 14	0.68	0.53	0.40	0.52	0.42
Jul 14	0.61	0.51	0.39	0.48	0.40
Jan 15	0.68	0.52	0.39	0.49	0.40
Jul 15	0.60	0.50	0.39	0.49	0.39
Jan 16	0.62	0.52	0.39	0.51	0.41
Jul 16	0.531	0.544	0.361	0.531	0.416
Jan 17	0.640	0.530	0.410	0.510	0.400
Jul 17	0.640	0.580	0.420	0.550	0.420
Jan 18	0.700	0.590	0.440	0.570	0.460
Jul 18	0.620	0.540	0.380	0.520	0.420
Jan 19	0.640	0.560	0.410	0.530	0.440
Aug 19	0.800	0.800	1.200	0.800	0.800
Jan 20	0.720	0.550	0.530	0.510	0.450
Jul 20	0.95	0.70	0.79	0.96	0.44
Feb 21	0.60	0.56	0.46	0.79	0.35

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	0.6034	0.5178	0.3958	0.4962	0.3993
Std Dev.	0.0556	0.0343	0.0310	0.0367	0.0281
N1	21	21	21	21	21
N2	1	1	1	1	1
T hist	-0.27218	5.495616	9.26141	35.77955	-7.86278

T.01 = 2.845
T.05 = 2.086



All Aug 19 Data Points reflect high laboratory reporting limit (PQL)

HAWKINS LANDFILL, LLC

Selenium Se mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.004	0.004	0.004	0.004	0.004
Jul-93	0.004	0.004	0.004	0.004	0.004
Jan-94	0.004	0.004	0.004	0.004	0.004
Jul-94	0.004	0.004	0.004	0.004	0.004
Jan-95	0.004	0.004	0.004	0.004	0.004
Jul-95	0.004	0.004	0.004	0.004	0.004
Jan-96	0.004	0.004	0.004	0.004	0.004
Jul-96	0.004	0.004	0.004	0.004	0.004
Jan-97	0.002	0.002	0.002	0.002	0.002
Jul-97	0.001	0.001	0.001	0.001	0.001
Jan-98	0.001	0.001	0.001	0.001	0.001
Jul-98	0.001	0.001	0.001	0.001	0.001
Jan-99	0.5	0.5	0.5	0.5	0.5
Jul-99	0.5	0.5	0.5	0.5	0.5
Jan-00	0.5	0.5	0.5	0.5	0.5
Jan 07	0.005	0.005	0.005	0.005	0.005
Jul 07	0.005	0.005	0.005	0.005	0.005
Jan 08	0.005	0.005	0.005	0.005	0.005
Jul 08	0.01	0.01	0.01	0.01	0.01
Jan 09	0.01	0.01	0.01	0.01	0.01
Jul 09	0.018	0.011	0.01	0.01	0.01
Jan 10	0.01	0.01	0.01	0.01	0.01
Jul 10	0.01	0.01	0.01	0.01	0.01
Jan 11	0.01	0.01	0.01	0.01	0.01
Jul 11	0.01	0.01	0.01	0.01	0.01
Jan 12	0.01	0.01	0.01	0.01	0.01
Jul 12	0.01	0.01	0.01	0.01	0.01
Jan 13	0.01	0.01	0.01	0.01	0.01
Jul 13	0.01	0.01	0.01	0.01	0.01
Jan 14	0.012	0.012	0.012	0.012	0.012
Jul 14	0.012	0.012	0.012	0.012	0.012
Jan 15	0.012	0.012	0.012	0.012	0.012
Jul 15	0.012	0.012	0.012	0.012	0.012
Jan 16	0.012	0.012	0.012	0.012	0.012
Jul 16	0.012	0.012	0.012	0.012	0.012
Jan 17	0.012	0.012	0.012	0.012	0.012
Jul 17	0.012	0.012	0.012	0.012	0.012
Jan 18	0.012	0.012	0.012	0.012	0.012
Jul 18	0.005	0.005	0.005	0.005	0.005
Jan 19	0.005	0.005	0.005	0.005	0.005
Aug 19	0.005	0.005	0.025	0.005	0.005
Jan 20	0.001	0.001	0.005	0.005	0.001
Jul 20	0.0056	0.0056	0.0056	0.0056	0.0056
Feb 21	0.005	0.005	0.025	0.005	0.005

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

HAWKINS LANDFILL, LLC

Silver Ag mg/l — Shaded Values < Detection Limit — Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	0.02	0.02	0.02	0.02	0.02
Jul-93	0.02	0.02	0.02	0.02	0.02
Jan-94	0.02	0.02	0.02	0.02	0.02
Jul-94	0.02	0.02	0.02	0.02	0.02
Jan-95	0.02	0.02	0.02	0.02	0.02
Jul-95	0.02	0.02	0.02	0.02	0.02
Jan-96	0.02	0.02	0.02	0.02	0.02
Jul-96	0.01	0.01	0.01	0.01	0.01
Jan-97	0.01	0.01	0.01	0.01	0.01
Jul-97	0.01	0.01	0.01	0.01	0.01
Jan-98	0.01	0.01	0.01	0.01	0.01
Jul-98	0.005	0.005	0.005	0.005	0.005
Jan-99	0.02	0.02	0.02	0.02	0.02
Jul-99	0.02	0.02	0.02	0.02	0.02
Jan-00	0.02	0.02	0.02	0.02	0.02
Jan 07	0.0031	0.0028	0.0018	0.0026	0.0021
Jul 07	0.001	0.001	0.001	0.001	0.001
Jan 08	0.02	0.02	0.02	0.02	0.02
Jul 08	0.001	0.001	0.001	0.001	0.001
Jan 09	0.005	0.005	0.005	0.005	0.005
Jul 09	0.0011	0.001	0.001	0.001	0.001
Jan 10	0.001	0.001	0.001	0.001	0.001
Jul 10	0.001	0.001	0.001	0.001	0.001
Jan 11	0.004	0.004	0.004	0.004	0.004
Jul 11	0.004	0.004	0.0051	0.004	0.004
Jan 12	0.004	0.004	0.004	0.004	0.004
Jul 12	0.004	0.004	0.004	0.004	0.004
Jan 13	0.004	0.004	0.004	0.004	0.004
Jul 13	0.004	0.004	0.004	0.004	0.004
Jan 14	0.01	0.01	0.01	0.01	0.01
Jul 14	0.01	0.01	0.01	0.01	0.01
Jan 15	0.01	0.01	0.01	0.01	0.01
Jul 15	0.01	0.01	0.01	0.01	0.01
Jan 16	0.01	0.01	0.01	0.01	0.01
Jul 16	0.001	0.001	0.001	0.001	0.001
Jan 17	0.01	0.01	0.01	0.01	0.01
Jul 17	0.01	0.01	0.01	0.01	0.01
Jan 18	0.01	0.01	0.01	0.01	0.01
Jul 18	0.004	0.004	0.004	0.004	0.004
Jan 19	0.004	0.004	0.004	0.004	0.004
Aug 19	0.008	0.008	0.008	0.008	0.008
Jan 20	0.02	0.004	0.02	0.004	0.004
Jul 20	0.0022	0.0022	0.0022	0.0022	0.0022
Feb 21	0.005	0.005	0.005	0.005	0.005

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

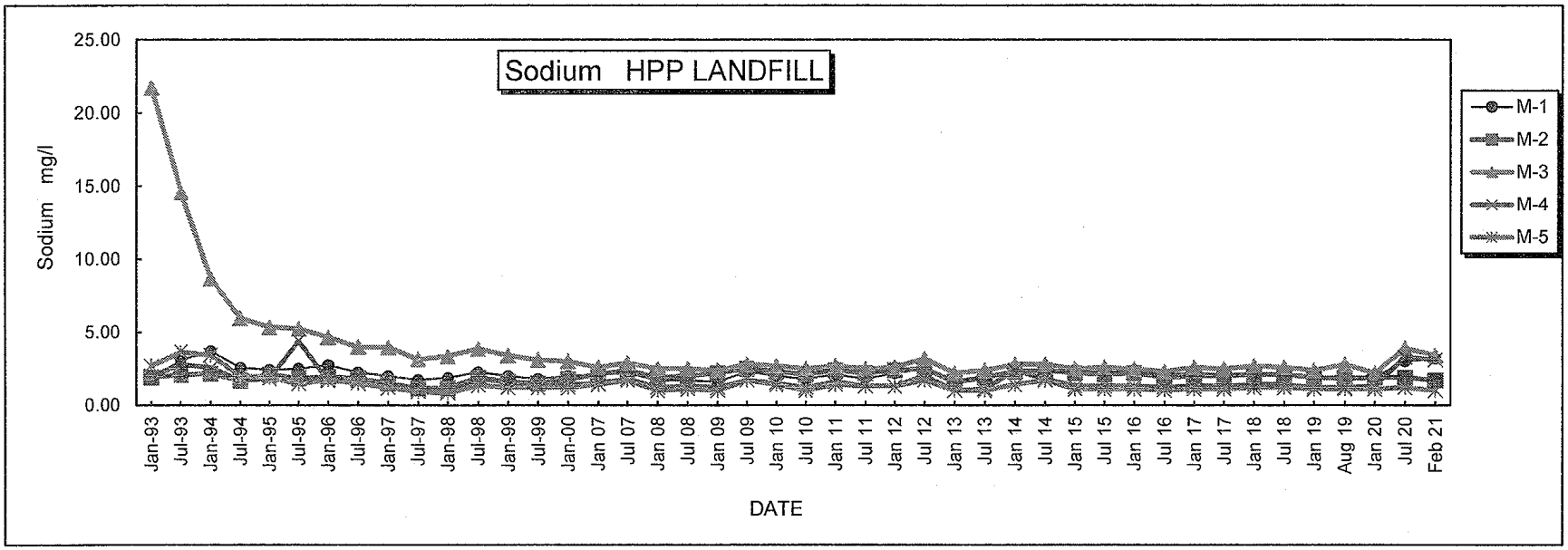
HAWKINS LANDFILL, LLC

Sodium Na mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	1.90	1.90	21.70	2.00	2.70
Jul-93	3.06	2.09	14.60	2.79	3.65
Jan-94	3.71	2.14	8.70	2.57	3.42
Jul-94	2.57	1.69	5.97	1.68	2.00
Jan-95	2.43	2.10	5.35	1.82	1.90
Jul-95	2.50	1.85	5.25	4.40	1.45
Jan-96	2.75	1.95	4.65	1.65	1.75
Jul-96	2.25	1.85	4.00	1.65	1.50
Jan-97	2.00	1.50	3.95	1.45	1.20
Jul-97	1.75	1.15	3.13	1.05	0.93
Jan-98	1.88	1.17	3.36	0.99	0.835
Jul-98	2.26	1.90	3.86	1.82	1.36
Jan-99	2.00	1.60	3.40	1.60	1.20
Jul-99	1.80	1.50	3.10	1.40	1.20
Jan-00	2.00	1.80	3.00	1.40	1.20
Jan 07	2.10	2.10	2.60	1.50	1.40
Jul 07	2.20	2.40	2.90	1.80	1.70
Jan 08	1.70	1.90	2.50	1.20	1.00
Jul 08	1.70	2.00	2.50	1.30	1.10
Jan 09	1.60	2.20	2.40	1.20	1.00
Jul 09	2.30	2.50	2.80	1.70	1.70
Jan 10	2.00	2.30	2.70	1.50	1.40
Jul 10	1.80	2.10	2.50	1.20	1.00
Jan 11	2.10	2.40	2.70	1.60	1.40
Jul 11	1.80	2.20	2.50	1.30	1.30
Jan 12	2.20	2.40	2.60	1.30	1.30
Jul 12	2.50	2.50	3.20	2.00	1.70
Jan 13	1.50	1.60	2.20	1.00	1.00
Jul 13	1.80	1.90	2.40	1.10	1.00
Jan 14	2.40	2.30	2.80	2.40	1.40
Jul 14	2.40	2.40	2.80	1.80	1.70
Jan 15	2.40	2.20	2.5	1.3	1.1
Jul 15	2.20	2.10	2.6	1.3	1.1
Jan 16	2.40	2.20	2.5	1.3	1.1
Jul 16	2.10	1.90	2.32	1.24	1.03
Jan 17	2.20	2.00	2.6	1.3	1.1
Jul 17	2.10	2.00	2.5	1.3	1.1
Jan 18	2.20	2.10	2.7	1.4	1.2
Jul 18	2.10	2.10	2.6	1.4	1.2
Jan 19	1.90	1.90	2.4	1.2	1.1
Aug 19	2.00	1.85	2.8	1.21	1.11
Jan 20	1.90	1.90	2.2	1.3	1.1
Jul 20	3.00	1.90	3.9	3.3	1.2
Feb 21	3.2	1.7	3.4	3.1	1.0

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	2.0750	2.1583	2.6008	1.4350	1.2875
	Std Dev.	0.2801	0.2205	0.2073	0.3146	0.3044
	N1	24	24	24	24	24
T.01 = 2.807	N2	1	1	1	1	1
T.05 = 2.069	T hist	19.25936	-9.96836	18.48853	25.38264	-4.5291


Sodium HPP LANDFILL
Sodium mg/l
25.00
20.00
15.00
10.00
5.00
0.00
Jan-93
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Jan-94
Jul-94
Jan-95
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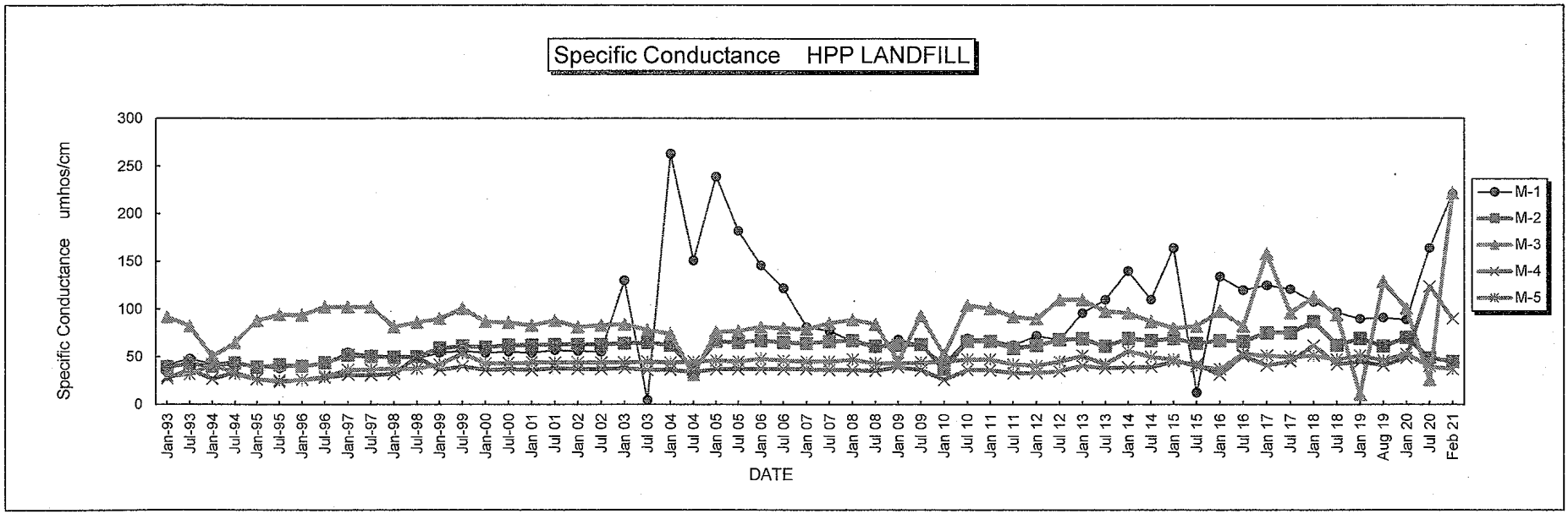
HAWKINS LANDFILL, LLC

Specific Conductance umhos/cm Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	41.6	39.3	91.8	27.5	29.6
Jul-93	47.9	43	81.9	36.7	31.6
Jan-94	42.4	39.9	50.2	26.7	42.3
Jul-94	45.4	43.4	64.6	33.5	32.2
Jan-95	39.8	39	87.9	26.4	26.1
Jul-95	37.8	41.6	94.3	23.8	24.8
Jan-96	41.7	40	93.7	25.8	25.6
Jul-96	42.7	43.6	102.7	28	29.2
Jan-97	54.7	51.6	102.5	31.1	36.1
Jul-97	51.3	50.2	102.4	30.3	36.5
Jan-98	49.4	49.7	81.2	31.8	37.5
Jul-98	48.6	50.1	86.2	49.9	37.1
Jan-99	54	59	90	36	42
Jul-99	56	61	101	40	53
Jan-00	54	60	87	36	43
Jul-00	55	62	86	37	43
Jan 01	54	62	83	36	44
Jul 01	57	63	88	38	44
Jan 02	56	63	81	37	44
Jul 02	55	63	83	37	44
Jan 03	130	64	84	38	44
Jul 03	4.4	65	78	36	45
Jan 04	263	62	74	36	44
Jul 04	151	37	31	34	45
Jan 05	239	66	76	37	46
Jul 05	182	65	77	37	45
Jan 06	146	67	81	37	48
Jul 06	122	65	80	37	46
Jan 07	81	64	79	37	45
Jul 07	77	66	85	36	45
Jan 08	66	67	89	36	47
Jul 08	59	61	84	35	43
Jan 09	68	62	45	39	43
Jul 09	62	63	93	36	44
Jan 10	42	37	52	26	45
Jul 10	69	66	104	36	47
Jan 11	68	66	101	36	47
Jul 11	62	59	92	33	42
Jan 12	72	62	90	33	41
Jul 12	68	68	110	35	45
Jan 13	96	69	110	41	51
Jul 13	110	61	98	38	42
Jan 14	140	69	96	39	56
Jul 14	110	67	87	39	50
Jan 15	164	69	80	45	47
Jul 15	12.5	64	82	42	40
Jan 16	134	67	98	31	37
Jul 16	120	66	82	51	53
Jan 17	125	75	158	41	51
Jul 17	121	75	96	45	50
Jan 18	108	87	113	62	51
Jul 18	97	62	94	42	47
Jan 19	90	69	10.3	45	51
Aug 19	91	61	129	41	46
Jan 20	89	70	101	49	53
Jul 20	164	49	26	124	40
Feb 21	221	45	222	90	37

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	98.5378	64.2162	87.0270	38.1351	45.7027
Std Dev.	54.9711	8.2467	20.2230	5.8031	3.7183
N1	37	37	37	37	37
T.01 = 2.715 N2	1	1	1	1	1
T.05 = 2.028 T hist	1.4589	-10.1722	11.8811	55.4446	-22.6603


Specific Conductance HPP LANDFILL
Specific Conductance umhos/cm
300
250
200
150
100
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Jan-93
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HAWKINS LANDFILL, LLC

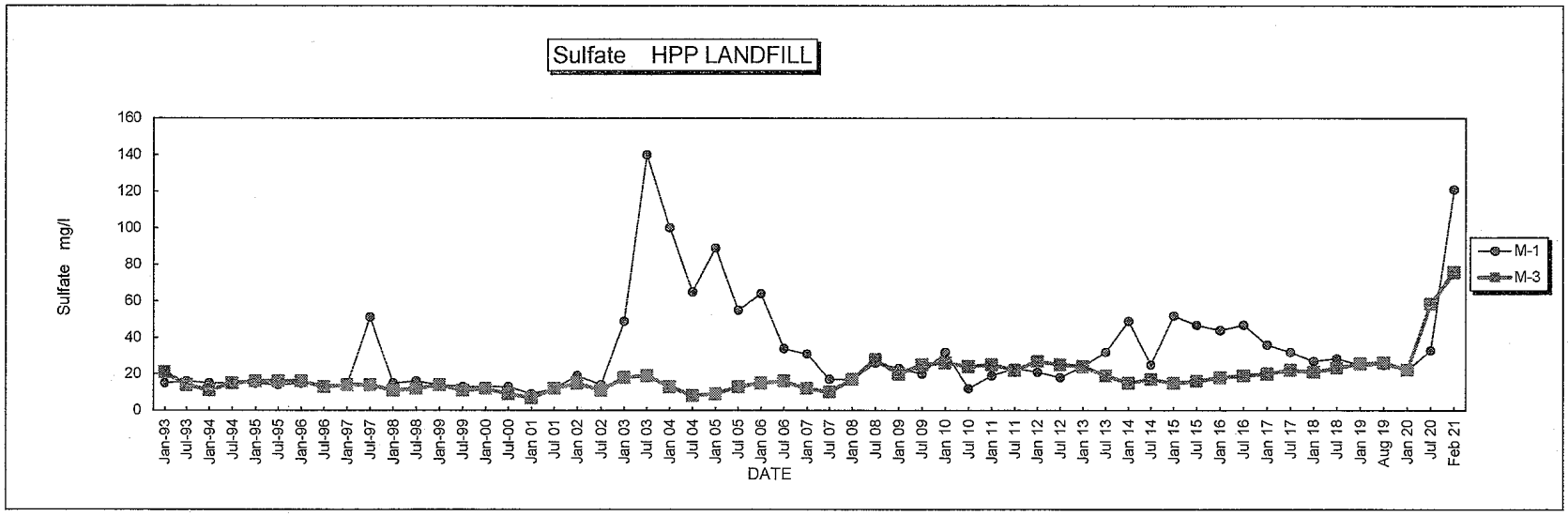
Sulfate SO4 mg/l

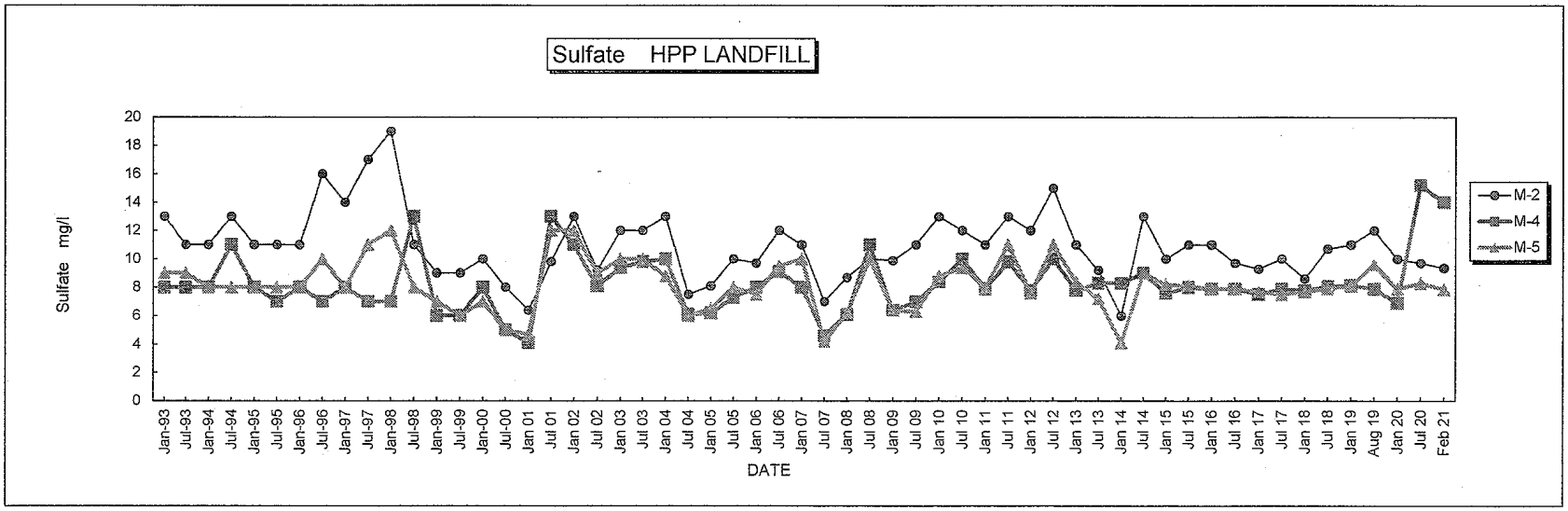
Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	15	13	21	8	9
Jul-93	16	11	14	8	9
Jan-94	15	11	11	8	8
Jul-94	15	13	15	11	8
Jan-95	15	11	16	8	8
Jul-95	14	11	16	7	8
Jan-96	15	11	16	8	8
Jul-96	13	16	13	7	10
Jan-97	14	14	14	8	8
Jul-97	51.3	17	14	7	11
Jan-98	15	19	11	7	12
Jul-98	16	11	12	13	8
Jan-99	14	9	14	6	7
Jul-99	13	9	11	6	6
Jan-00	13	10	12	8	7
Jul-00	13	8	9	5	5
Jan 01	9.1	6.4	6.9	4.1	4.7
Jul 01	12	9.8	12	13	12
Jan 02	19	13	15	11	12
Jul 02	14	9.2	11	8.1	9
Jan 03	49	12	18	9.4	10
Jul 03	140	12	19	9.8	10
Jan 04	100	13	13	10	8.8
Jul 04	65	7.5	8.1	6.1	6
Jan 05	89	8.1	9.1	6.2	6.5
Jul 05	55	10	13	7.3	8
Jan 06	64	9.7	15	8	7.5
Jul 06	34	12	16	9.1	9.5
Jan 07	31	11	12	8	10
Jul 07	17	7	10	4.6	4.2
Jan 08	17	8.7	17	6.1	6.2
Jul 08	26	10	28	11	10
Jan 09	23	9.9	20	6.4	6.4
Jul 09	20	11	25	7	6.3
Jan 10	32	13	26	8.4	8.8
Jul 10	12	12	24	10	9.4
Jan 11	19	11	25	7.9	8
Jul 11	23	13	22	9.8	11
Jan 12	21	12	27	7.8	7.6
Jul 12	18	15	25	10	11
Jan 13	24	11	24	7.8	8.4
Jul 13	32	9.2	19	8.3	7.2
Jan 14	49	6	15	8.3	4.1
Jul 14	25	13	17	9	9
Jan 15	52	10	15	7.6	8.2
Jul 15	47	11	16	8	8.1
Jan 16	44	11	18	7.9	7.9
Jul 16	47	9.7	19	7.9	7.9
Jan 17	36	9.3	20	7.5	7.7
Jul 17	32	10	22	7.9	7.5
Jan 18	27	8.6	21	7.8	7.7
Jul 18	28.5	10.7	23.3	8.08	7.91
Jan 19	24.90	11.00	25.50	8.15	8.09
Aug 19	25.00	12.00	26.00	7.90	9.60
Jan 20	22.10	10.00	22.30	6.90	7.90
Jul 20	33.00	9.70	58.40	15.20	8.30
Feb 21	121.00	9.37	75.80	14.00	7.87

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	36.9081	10.3730	17.7135	8.1130	8.0949
	Std Dev.	27.1249	2.0331	5.7819	1.7980	1.9675
T.01 = 2.724	N1	37	37	37	37	37
T.05 = 2.03	N2	1	1	1	1	1
	T hist	18.60105	-2.95986	60.27783	19.64498	-0.68574


Sulfate HPP LANDFILL
Sulfate mg/l
160
140
120
100
80
60
40
20
0
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE
M-1
M-3


Sulfate HPP LANDFILL
Sulfate mg/l
20
18
16
14
12
10
8
6
4
2
0
Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96 Jul-96 Jan-97 Jul-97 Jan-98 Jul-98 Jan-99 Jul-99 Jan-00 Jul-00 Jan 01 Jul 01 Jan 02 Jul 02 Jan 03 Jul 03 Jan 04 Jul 04 Jan 05 Jul 05 Jan 06 Jul 06 Jan 07 Jul 07 Jan 08 Jul 08 Jan 09 Jul 09 Jan 10 Jul 10 Jan 11 Jul 11 Jan 12 Jul 12 Jan 13 Jul 13 Jan 14 Jul 14 Jan 15 Jul 15 Jan 16 Jul 16 Jan 17 Jul 17 Jan 18 Jul 18 Jan 19 Aug 19 Jan 20 Jul 20 Feb 21
DATE
M-2
M-4
M-5

HAWKINS LANDFILL, LLC

Thallium mg/l Shaded Values < Detection Limit Well No.

		M-1	M-2	M-3	M-4	M-5
	Jan 07	0.002	0.002	0.002	0.002	0.002
	Jul 07	0.002	0.002	0.002	0.002	0.002
	Jan 08	0.002	0.002	0.002	0.002	0.002
	Jul 08	0.02	0.02	0.02	0.02	0.02
	Jan 09	0.02	0.02	0.02	0.02	0.02
	Jul 09	0.02	0.02	0.02	0.02	0.02
	Jan 10	0.002	0.002	0.002	0.002	0.002
	Jul 10	0.002	0.002	0.002	0.002	0.002
	Jan 11	0.001	0.001	0.001	0.001	0.001
	Jul 11	0.001	0.001	0.001	0.001	0.001
	Jan 12	0.001	0.001	0.001	0.001	0.001
	Jul 12	0.001	0.001	0.001	0.001	0.001
	Jan 13	0.001	0.001	0.001	0.001	0.001
	Jul 13	0.001	0.001	0.001	0.001	0.001
	Jan 14	0.002	0.002	0.002	0.002	0.002
	Jul 14	0.002	0.002	0.002	0.002	0.002
	Jan 15	0.002	0.002	0.002	0.002	0.002
	Jul 15	0.002	0.002	0.002	0.002	0.002
	Jan 16	0.002	0.002	0.002	0.002	0.002
	Jul 16	0.002	0.002	0.002	0.002	0.002
	Jan 17	0.002	0.002	0.002	0.002	0.002
	Jul 17	0.002	0.002	0.002	0.002	0.002
	Jan 18	0.002	0.002	0.002	0.002	0.002
	Jul 18	0.001	0.001	0.001	0.001	0.001
	Jan 19	0.001	0.001	0.001	0.001	0.001
	Aug 19	0.001	0.001	0.005	0.001	0.001
	Jan 20	0.0002	0.0002	0.0002	0.001	0.0002
	Jul 20	0.0011	0.0011	0.0011	0.0011	0.0011
	Feb 21	0.002	0.002	0.002	0.002	0.002

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
	N1	N/A	N/A	N/A	N/A	N/A
T.05	N2	N/A	N/A	N/A	N/A	N/A
T.01	T hist	N/A	N/A	N/A	N/A	N/A

HAWKINS LANDFILL, LLC

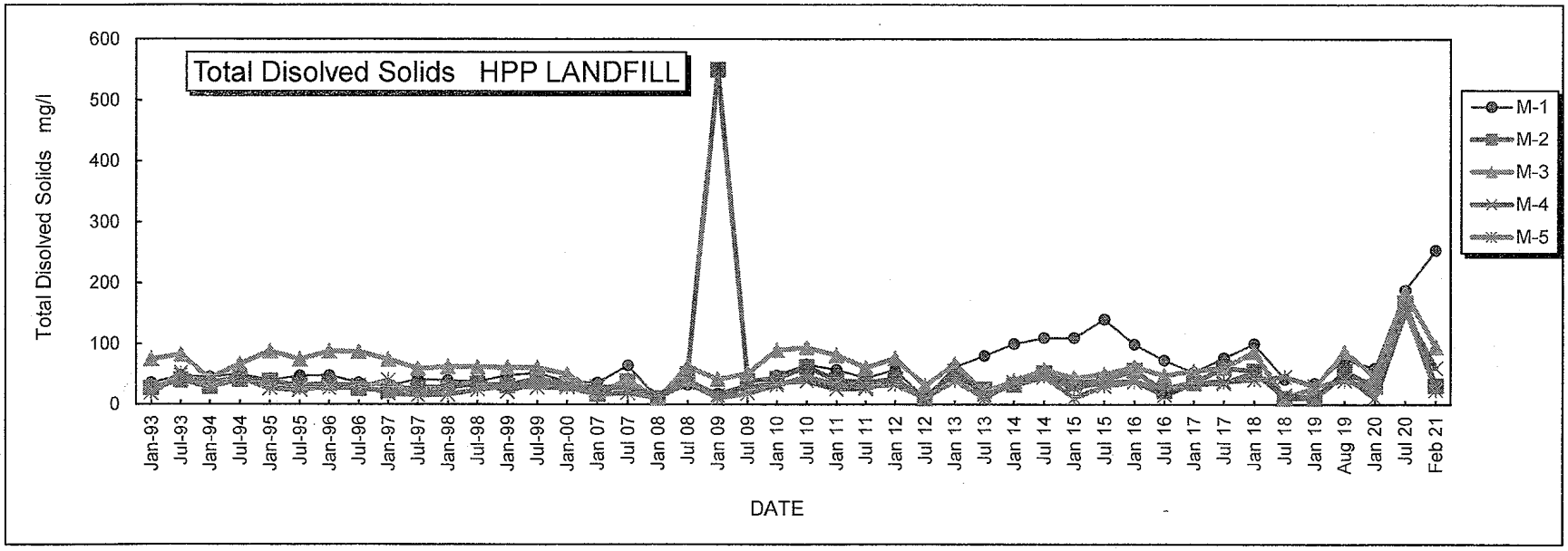
Total Disolved Solids TDS mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan-93	36	27	75	19	18
Jul-93	47	40	82	48	52
Jan-94	45	29	43	36	31
Jul-94	50	41	67	45	44
Jan-95	39.8	39.0	87.9	26.4	26.1
Jul-95	47	31	74	23	26
Jan-96	48	35	88	33	27
Jul-96	36	26	87	31	27
Jan-97	30	22	74	18	40
Jul-97	42	28	59	15	15
Jan-98	40	28	62	28	16
Jul-98	38	34	62	40	24
Jan-99	48	31	61	21	30
Jul-99	52	44	61	38	28
Jan-00	38	34	50	31	28
Jan 07	36	17	20	29	16
Jul 07	64	38	40	27	19
Jan 08	10.0	10.0	10	15	10.0
Jul 08	32	50	63	40	36
Jan 09	18	550	42	15	10.0
Jul 09	34	39	51	28	18
Jan 10	48	43	90	36	32
Jul 10	66	62	94	39	46
Jan 11	57	40	81	25	33
Jul 11	44	37	61	26	30
Jan 12	57	42	76	40	33
Jul 12	10.0	10.0	31	10.0	10.0
Jan 13	62	46	67	55	40
Jul 13	80	25	21	16	10
Jan 14	100	33	39	32	37
Jul 14	110	52	57	45	47
Jan 15	110	36	44	28	11
Jul 15	140	41	50	37	30
Jan 16	99	56	62	39	38
Jul 16	73	22	48	15	26
Jan 17	53	36	55	34	37
Jul 17	77	61	61	35	38
Jan 18	100	55	87	54	41
Jul 18	42	10	10	15	46
Jan 19	35	10	28	11	30
Aug 19	74	55	87	49	40
Jan 20	60	30	47	10	28
Jul 20	188	168	184	152	160
Feb 21	254	31	95	60	23

Note: Aug 19 M-3 sample obtained October 22, 2019
July 20 TDS samples obtained September 25, 2020

Mean	63.4167	58.7917	52.5000	30.6250	28.9167
Std Dev.	33.8448	105.7474	23.7175	12.2716	12.7105
N1	24	24	24	24	24
N2	1	1	1	1	1
T hist	27.00578	-1.2604	8.593759	11.47996	-2.23242

T.01 = 2.807
T.05 = 2.069


Total Disolved Solids HPP LANDFILL
Total Disolved Solids mg/l
600
500
400
300
200
100
0
Jan-93
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jan 07
Jul 07
Jan 08
Jul 08
Jan 09
Jul 09
Jan 10
Jul 10
Jan 11
Jul 11
Jan 12
Jul 12
Jan 13
Jul 13
Jan 14
Jul 14
Jan 15
Jul 15
Jan 16
Jul 16
Jan 17
Jul 17
Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

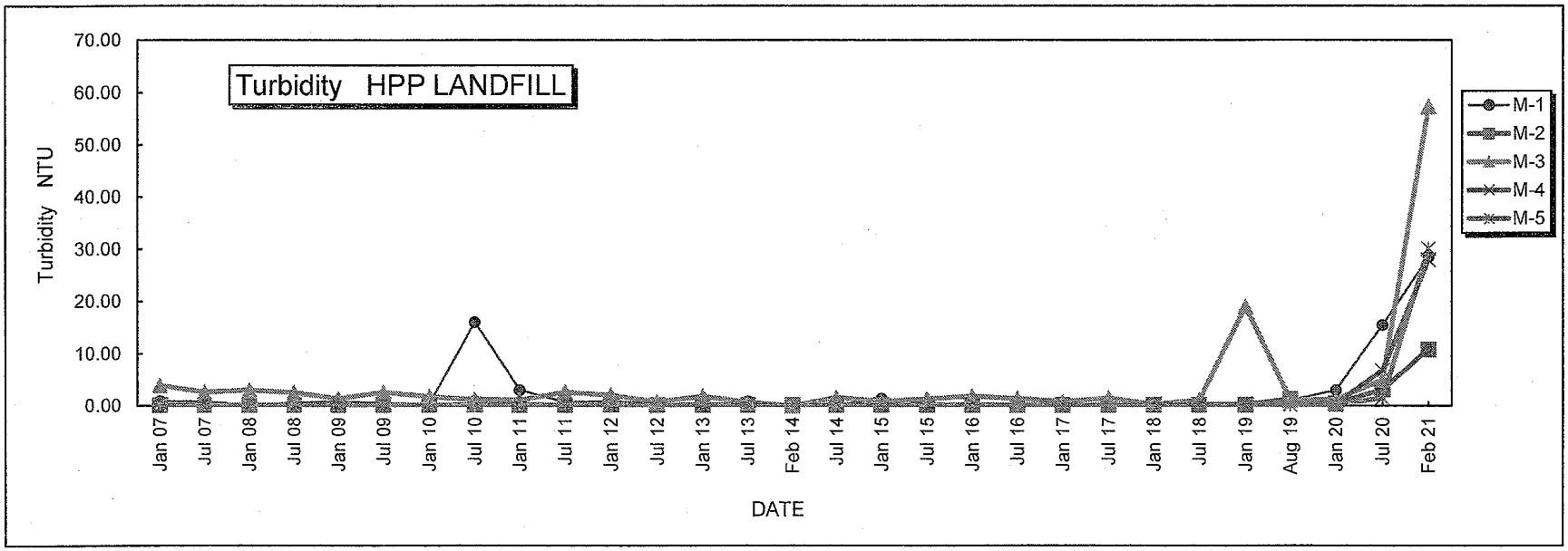
Turbidity NTU — Shaded Values < Detection Limit — Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.91	0.10	3.90	0.10	0.10
Jul 07	0.83	0.10	2.60	0.10	0.10
Jan 08	0.18	0.10	3.00	0.10	0.10
Jul 08	0.57	0.10	2.50	0.10	0.10
Jan 09	0.79	0.10	1.40	0.10	0.10
Jul 09	0.52	0.10	2.60	0.10	0.10
Jan 10	0.36	0.10	1.70	0.10	0.10
Jul 10	16.00	0.25	1.20	0.17	0.10
Jan 11	3.00	0.13	1.10	0.20	0.13
Jul 11	0.68	0.10	2.60	0.10	0.10
Jan 12	0.85	0.24	2.00	0.14	0.26
Jul 12	0.44	0.10	0.73	0.16	0.10
Jan 13	0.19	0.21	1.80	0.10	0.10
Jul 13	0.80	0.15	0.62	0.10	0.10
Feb 14	0.25	0.10	1,50	0.10	0.10
Jul 14	0.13	0.10	1.58	0.10	0.10
Jan 15	1.40	0.10	0.88	0.10	0.10
Jul 15	0.53	0.10	1.30	0.17	0.10
Jan 16	0.28	0.10	1.80	0.10	0.20
Jul 16	0.29	0.10	1.40	0.11	0.10
Jan 17	0.10	0.10	0.75	0.10	0.10
Jul 17	0.26	0.10	1.50	0.10	0.10
Jan 18	0.20	0.20	0.30	0.20	0.20
Jul 18	0.27	0.20	1.10	0.21	0.20
Jan 19	0.37	0.20	19.00	0.30	0.20
Aug 19	1.00	1.30	1.10	0.29	0.21
Jan 20	3.00	0.43	1.20	0.38	0.20
Jul 20	15.50	3.10	5.00	6.80	1.50
Feb 21	28.5	10.8	57.3	28.0	30.1

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	1.2429	N/A	1.6678	N/A	N/A
Std Dev.	3.2002	N/A	0.8711	N/A	N/A
N1	24	N/A	23	N/A	N/A
N2	1	N/A	1	N/A	N/A
T hist	40.84751	N/A	306.2928	N/A	N/A

T.01 = 2.807
T.05 = 2.069


Turbidity HPP LANDFILL
Turbidity NTU
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Jan 07
Jul 07
Jan 08
Jul 08
Jan 09
Jul 09
Jan 10
Jul 10
Jan 11
Jul 11
Jan 12
Jul 12
Jan 13
Jul 13
Feb 14
Jul 14
Jan 15
Jul 15
Jan 16
Jul 16
Jan 17
Jul 17
Jan 18
Jul 18
Jan 19
Aug 19
Jan 20
Jul 20
Feb 21
DATE
M-1
M-2
M-3
M-4
M-5

HAWKINS LANDFILL, LLC

Vanadium mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jan 07	0.0077	0.005	0.005	0.005	0.005
Jul 07	0.002	0.005	0.005	0.005	0.005
Jan 08	0.0270	0.0260	0.017	0.029	0.026
Jul 08	0.0038	0.005	0.005	0.005	0.005
Jan 09	0.0044	0.0016	0.005	0.00048	0.02
Jul 09	0.0039	0.0012	0.00062	0.005	0.02
Jan 10	0.0037	0.00058	0.002	0.005	0.002
Jul 10	0.0034	0.00088	0.002	0.005	0.002
Jan 11	0.005	0.005	0.001	0.005	0.001
Jul 11	0.005	0.005	0.001	0.005	0.001
Jan 12	0.005	0.005	0.001	0.005	0.001
Jul 12	0.005	0.005	0.001	0.005	0.001
Jan 13	0.005	0.005	0.001	0.005	0.001
Jul 13	0.007	0.005	0.001	0.005	0.001
Jan 14	0.010	0.010	0.010	0.010	0.010
Jul 14	0.010	0.010	0.010	0.010	0.010
Jan 15	0.010	0.010	0.010	0.010	0.010
Jul 15	0.010	0.010	0.010	0.010	0.010
Jan 16	0.011	0.010	0.010	0.010	0.010
Jul 16	0.0112	0.005	0.005	0.005	0.005
Jan 17	0.0100	0.010	0.010	0.010	0.010
Jul 17	0.010	0.010	0.010	0.010	0.010
Jan 18	0.020	0.020	0.020	0.020	0.020
Jul 18	0.020	0.020	0.020	0.020	0.020
Jan 19	0.020	0.020	0.020	0.020	0.020
Aug 19	0.008	0.020	0.200	0.020	0.020
Jan 20	0.100	0.020	0.100	0.020	0.020
Jul 20	0.0022	0.0031	0.0022	0.0029	0.0022
Feb 21	0.190	0.005	0.020	0.005	0.005

Note: Aug 19 M-3 sample obtained October 22, 2019

	Mean	N/A	N/A	N/A	N/A	N/A
	Std Dev.	N/A	N/A	N/A	N/A	N/A
T.05	N1	N/A	N/A	N/A	N/A	N/A
T.01	N2	N/A	N/A	N/A	N/A	N/A
	T hist	N/A	N/A	N/A	N/A	N/A

HAWKINS LANDFILL, LLC

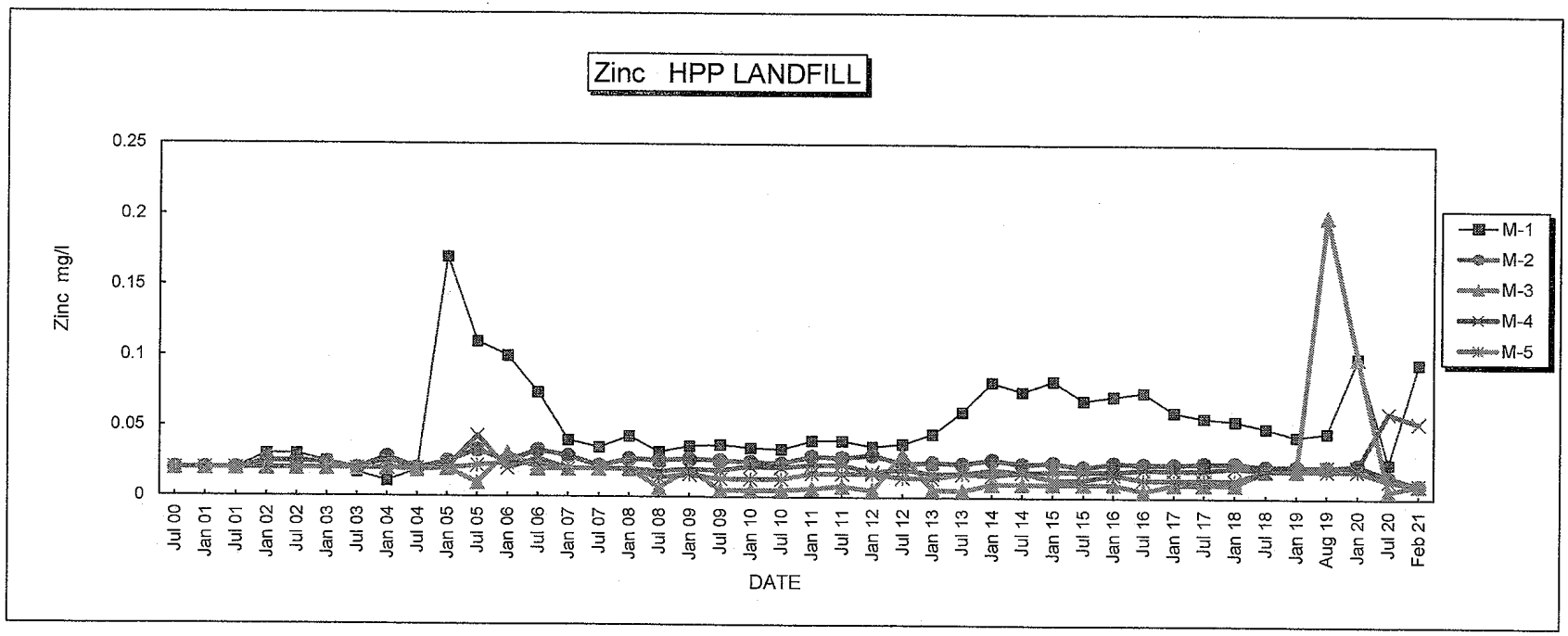
Zinc Zn mg/l Shaded Values < Detection Limit Well No.

	M-1	M-2	M-3	M-4	M-5
Jul 00	0.02	0.02	0.02	0.02	0.02
Jan 01	0.02	0.02	0.02	0.02	0.02
Jul 01	0.02	0.02	0.02	0.02	0.02
Jan 02	0.03	0.025	0.02	0.02	0.02
Jul 02	0.03	0.025	0.02	0.02	0.02
Jan 03	0.025	0.024	0.02	0.02	0.02
Jul 03	0.017	0.02	0.02	0.02	0.02
Jan 04	0.011	0.028	0.02	0.026	0.02
Jul 04	0.019	0.02	0.019	0.02	0.02
Jan 05	0.17	0.025	0.02	0.02	0.02
Jul 05	0.11	0.033	0.01	0.043	0.022
Jan 06	0.1	0.025	0.031	0.02	0.024
Jul 06	0.074	0.033	0.02	0.027	0.023
Jan 07	0.04	0.029	0.02	0.02	0.02
Jul 07	0.035	0.022	0.02	0.02	0.02
Jan 08	0.043	0.027	0.02	0.02	0.02
Jul 08	0.032	0.026	0.0067	0.018	0.014
Jan 09	0.036	0.027	0.02	0.02	0.016
Jul 09	0.037	0.026	0.005	0.019	0.013
Jan 10	0.035	0.025	0.005	0.022	0.013
Jul 10	0.034	0.024	0.005	0.021	0.013
Jan 11	0.04	0.029	0.0062	0.023	0.017
Jul 11	0.04	0.028	0.0079	0.023	0.017
Jan 12	0.036	0.03	0.005	0.018	0.017
Jul 12	0.038	0.024	0.031	0.02	0.014
Jan 13	0.045	0.025	0.0055	0.017	0.014
Jul 13	0.061	0.024	0.005	0.017	0.017
Jan 14	0.082	0.027	0.01	0.02	0.016
Jul 14	0.0753	0.024	0.01	0.018	0.018
Jan 15	0.083	0.025	0.01	0.019	0.013
Jul 15	0.069	0.022	0.01	0.019	0.013
Jan 16	0.072	0.025	0.01	0.019	0.017
Jul 16	0.0749	0.0240	0.005	0.0201	0.0129
Jan 17	0.061	0.0240	0.01	0.02	0.013
Jul 17	0.057	0.0250	0.01	0.02	0.013
Jan 18	0.055	0.0250	0.01	0.022	0.013
Jul 18	0.050	0.0230	0.02	0.02	0.02
Jan 19	0.044	0.0230	0.02	0.02	0.02
Aug 19	0.047	0.0227	0.2	0.0227	0.02
Jan 20	0.1	0.0240	0.1	0.023	0.02
Jul 20	0.025	0.016	0.0056	0.061	0.013
Feb 21	0.096	0.01	0.01	0.054	0.01

Note: Aug 19 M-3 sample obtained October 22, 2019

Mean	0.0507	0.0251	N/A	0.0208	0.0174
Std Dev.	0.0314	0.0032	N/A	0.0042	0.0034
N1	37	37	N/A	37	37
N2	1	1	N/A	1	1
T hist	8.6615	N/A	N/A	46.8631	N/A

T.01 = 2.71
T.05 = 2.028



NOTE: Aug 19 Datum Point for M-3 (sample obtained October 22, 2019) and Jan 20 M-1 and M-3 points reflect elevated laboratory reporting limits (PQL's).

CALIBER ANALYTICAL SERVICES

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 10:25
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-01 **Matrix: Water** **Lab ID: 21021701-01**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Alkalinity						Batch: 24764	
Alkalinity as CaCO3	**2.2**	mg/L	1	SM2320B	02/19/21	02/19/21 9:16	SS
Ammonia Nitrogen						Batch: 24764	
Ammonia	ND	mg/L	0.1	EPA 350.1	02/23/21	02/23/21 16:04	SS
Chemical Oxygen Demand						Batch: 24764	
COD	ND	mg/L	5	SM5220D	02/19/21	02/19/21 9:00	SS
Chloride by IC						Batch: 24764	
Chloride	**5.8**	mg/L	0.5	EPA 300.0	02/17/21	02/18/21 19:26	SS
Dissolved Metals						Batch: 24754	
Vanadium	ND	ug/L	0.005	EPA 6020A	02/23/21	02/23/21 14:59	MBC
Hardness by Calculation						Batch: 24747	
Hardness (as CaCO3)	**42.6**	mg/L	0.5	SM2340 B	02/19/21	02/19/21 15:49	MBC
Nitrate/Nitrite-N by ALS						Batch: 24781	
Nitrate/Nitrite	j **0.04**	mg/L	0.02	EPA 353.2	02/25/21	02/25/21 12:58	ALS
Sulfate by IC						Batch: 24764	
Sulfate	**121**	mg/L	2	EPA 300.0	02/18/21	02/18/21 16:25	SS
Total Dissolved Solids						Batch: 24753	
TDS	**254**	mg/L	10	SM2540C	02/23/21	02/24/21 11:30	ACS
Total Metals						Batch: 24747	
Antimony	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Arsenic	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Barium	**0.031**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Beryllium	**0.0025**	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Cadmium	ND	mg/L	0.004	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Calcium	**14**	mg/L	0.08	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Chromium	**0.035**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Cobalt	**0.018**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Copper	**0.015**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Iron	**36**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Lead	**0.0021**	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Magnesium	**1.7**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Manganese	**0.88**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Mercury	ND	mg/L	0.0002	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Nickel	**0.032**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Potassium	**0.60**	mg/L	0.1	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Selenium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Silver	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Sodium	**3.2**	mg/L	0.2	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Thallium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:49	MBC

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Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 10:25
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-01 **Matrix: Water** **Lab ID: 21021701-01**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Total Metals						Batch: 24747	
Vanadium	**0.19**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Zinc	**0.096**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:49	MBC
Volatile Organic Compounds						Batch: 24762	
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Methylene chloride	b **0.0043**	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH

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Towson, MD 21286

Date Sampled: 02/17/21 10:25
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-01 **Matrix: Water** **Lab ID: 21021701-01**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:10	GFH
Dibromofluoromethane (SURR)	**97**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
Toluene-d8 (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
4-Bromofluorobenzene (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:10	GFH

Notes/Qualifiers:

LLQ- Lowest Level of Quantitation

ND - Not Detected at a concentration greater than or equal to the LLQ.

b - Analyte often detected in method blank. Suspected laboratory artifact.

j - estimated value less than PQL but greater than MDL.

Nitrate/Nitrite-N analysis performed by Analytical Laboratory Services, Inc. See attached ALSI Report.

Approved by: Matt Ocker

QC Chemist

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Certificate of Analysis

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Date Sampled: 02/17/21 12:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-02 **Matrix: Water** **Lab ID: 21021701-02**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Alkalinity						Batch:	24764
Alkalinity as CaCO3	ND	mg/L	1	SM2320B	02/19/21	02/19/21 9:16	SS
Ammonia Nitrogen						Batch:	24764
Ammonia	**0.3**	mg/L	0.1	EPA 350.1	02/23/21	02/23/21 16:17	SS
Chemical Oxygen Demand						Batch:	24764
COD	ND	mg/L	5	SM5220D	02/19/21	02/19/21 9:00	SS
Chloride by IC						Batch:	24764
Chloride	**3.7**	mg/L	0.5	EPA 300.0	02/18/21	02/18/21 19:46	SS
Hardness by Calculation						Batch:	24747
Hardness (as CaCO3)	**5.71**	mg/L	0.5	SM2340 B	02/19/21	02/19/21 15:54	MBC
Nitrate/Nitrite-N by ALS						Batch:	24781
Nitrate/Nitrite	j **0.02**	mg/L	0.02	EPA 353.2	02/25/21	02/25/21 13:01	ALS
Sulfate by IC						Batch:	24764
Sulfate	**9.37**	mg/L	1	EPA 300.0	02/18/21	02/18/21 19:46	SS
Total Dissolved Solids						Batch:	24753
TDS	**31**	mg/L	10	SM2540C	02/23/21	02/24/21 11:30	ACS
Total Metals						Batch:	24747
Antimony	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Arsenic	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Barium	**0.012**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Beryllium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Cadmium	ND	mg/L	0.004	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Calcium	**1.6**	mg/L	0.08	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Chromium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Cobalt	**0.0096**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Copper	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Iron	**0.53**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Lead	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Magnesium	**0.40**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Manganese	**0.025**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Mercury	ND	mg/L	0.0002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Nickel	**0.014**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Potassium	**0.56**	mg/L	0.1	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Selenium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Silver	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Sodium	**1.7**	mg/L	0.2	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Thallium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Vanadium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:54	MBC
Zinc	ND	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:54	MBC

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 12:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-02 **Matrix: Water** **Lab ID: 21021701-02**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Methylene chloride	b 0.0045	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH

Certificate of Analysis

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Date Sampled: 02/17/21 12:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-02 **Matrix: Water** **Lab ID: 21021701-02**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 11:40	GFH
Dibromofluoromethane (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
Toluene-d8 (SURR)	**101**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
4-Bromofluorobenzene (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 11:40	GFH

Notes/Qualifiers:

LLQ- Lowest Level of Quantitation

ND - Not Detected at a concentration greater than or equal to the LLQ.

b - Analyte often detected in method blank. Suspected laboratory artifact.

j - estimated value less than PQL but greater than MDL.

Nitrate/Nitrite-N analysis performed by Analytical Laboratory Services, Inc. See attached ALSI Report.

Approved by: Matt Ochs

QC Chemist

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Date Sampled: 02/17/21 12:00
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Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-03 **Matrix: Water** **Lab ID: 21021701-03**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Alkalinity						Batch: 24764	
Alkalinity as CaCO3	ND	mg/L	1	SM2320B	02/19/21	02/19/21 9:16	SS
Ammonia Nitrogen						Batch: 24764	
Ammonia	**0.12**	mg/L	0.1	EPA 350.1	02/23/21	02/23/21 16:19	SS
Chemical Oxygen Demand						Batch: 24764	
COD	ND	mg/L	5	SM5220D	02/19/21	02/19/21 9:00	SS
Chloride by IC						Batch: 24764	
Chloride	**8.9**	mg/L	0.5	EPA 300.0	02/18/21	02/18/21 20:06	SS
Dissolved Metals						Batch: 24754	
Vanadium	ND	ug/L	0.005	EPA 6020A	02/23/21	02/23/21 15:02	MBC
Hardness by Calculation						Batch: 24747	
Hardness (as CaCO3)	**48.0**	mg/L	0.5	SM2340 B	02/19/21	02/19/21 15:59	MBC
Nitrate/Nitrite-N by ALS						Batch: 24781	
Nitrate/Nitrite	j **0.08**	mg/L	0.02	EPA 353.2	02/25/21	02/25/21 13:02	ALS
Sulfate by IC						Batch: 24764	
Sulfate	**75.8**	mg/L	1	EPA 300.0	02/18/21	02/18/21 20:06	SS
Total Dissolved Solids						Batch: 24753	
TDS	**95**	mg/L	10	SM2540C	02/23/21	02/24/21 11:30	ACS
Total Metals						Batch: 24747	
Antimony	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Arsenic	**0.0082**	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Barium	**0.032**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Beryllium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Cadmium	ND	mg/L	0.004	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Calcium	**17**	mg/L	0.08	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Chromium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Cobalt	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Copper	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Iron	**30**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Lead	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Magnesium	**1.6**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Manganese	**0.77**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Mercury	ND	mg/L	0.0002	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Nickel	**0.0055**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Potassium	**0.46**	mg/L	0.1	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Selenium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Silver	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Sodium	**3.4**	mg/L	0.2	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Thallium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 15:59	MBC

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 12:00
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-03 **Matrix: Water** **Lab ID: 21021701-03**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Total Metals						Batch: 24747	
Vanadium	**0.020**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Zinc	ND	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 15:59	MBC
Volatile Organic Compounds						Batch: 24762	
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Methylene chloride	b **0.0048**	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH

Certificate of Analysis

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8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 12:00
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-03 **Matrix: Water** **Lab ID: 21021701-03**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 12:41	GFH
Dibromofluoromethane (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
Toluene-d8 (SURR)	**101**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
4-Bromofluorobenzene (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 12:41	GFH

Notes/Qualifiers:

LLQ- Lowest Level of Quantitation

ND - Not Detected at a concentration greater than or equal to the LLQ.

b - Analyte often detected in method blank. Suspected laboratory artifact.

j - estimated value less than PQL but greater than MDL.

Nitrate/Nitrite-N analysis performed by Analytical Laboratory Services, Inc. See attached ALSI Report.

Approved by: Matt Ocker

QC Chemist

8851 Orchard Tree Lane | Towson, Maryland 21286 | tel: 410.825.1151 | fax: 410.825.2126 | www.caslabs.net

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 11:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-04 **Matrix: Water** **Lab ID: 21021701-04**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Alkalinity						Batch:	24764
Alkalinity as CaCO3	**17.9**	mg/L	1	SM2320B	02/19/21	02/19/21 9:16	SS
Ammonia Nitrogen						Batch:	24764
Ammonia	ND	mg/L	0.1	EPA 350.1	02/23/21	02/23/21 16:21	SS
Chemical Oxygen Demand						Batch:	24764
COD	ND	mg/L	5	SM5220D	02/19/21	02/19/21 9:00	SS
Chloride by IC						Batch:	24764
Chloride	**7.2**	mg/L	0.5	EPA 300.0	02/18/21	02/18/21 20:26	SS
Hardness by Calculation						Batch:	24747
Hardness (as CaCO3)	**37.7**	mg/L	0.5	SM2340 B	02/19/21	02/19/21 16:04	MBC
Nitrate/Nitrite-N by ALS						Batch:	24781
Nitrate/Nitrite	**0.14**	mg/L	0.02	EPA 353.2	02/25/21	02/25/21 13:03	ALS
Sulfate by IC						Batch:	24764
Sulfate	**14.0**	mg/L	1	EPA 300.0	02/18/21	02/18/21 20:26	SS
Total Dissolved Solids						Batch:	24753
TDS	**60**	mg/L	10	SM2540C	02/23/21	02/24/21 11:30	ACS
Total Metals						Batch:	24747
Antimony	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Arsenic	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Barium	**0.053**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Beryllium	**0.0024**	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Cadmium	ND	mg/L	0.004	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Calcium	**14**	mg/L	0.08	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Chromium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Cobalt	**0.016**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Copper	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Iron	**0.64**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Lead	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Magnesium	**0.75**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Manganese	**0.059**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Mercury	ND	mg/L	0.0002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Nickel	**0.028**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Potassium	**0.79**	mg/L	0.1	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Selenium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Silver	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Sodium	**3.1**	mg/L	0.2	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Thallium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Vanadium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:04	MBC
Zinc	**0.054**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 16:04	MBC

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 11:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-04 **Matrix: Water** **Lab ID: 21021701-04**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Methylene chloride	b 0.0045	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH

Certificate of Analysis

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Date Sampled: 02/17/21 11:30
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-04 **Matrix: Water** **Lab ID: 21021701-04**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:11	GFH
Dibromofluoromethane (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
Toluene-d8 (SURR)	**101**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
4-Bromofluorobenzene (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:11	GFH

Notes/Qualifiers:
LLQ- Lowest Level of Quantitation
ND - Not Detected at a concentration greater than or equal to the LLQ.
b - Analyte often detected in method blank. Suspected laboratory artifact.
Nitrate/Nitrite-N analysis performed by Analytical Laboratory Services, Inc. See attached ALSI Report.

Approved by: Matt Ochs
QC Chemist

8851 Orchard Tree Lane | Towson, Maryland 21286 | tel: 410.825.1151 | fax: 410.825.2126 | www.caslabs.net

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 11:00
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-05 **Matrix: Water** **Lab ID: 21021701-05**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Alkalinity						Batch: 24764	
Alkalinity as CaCO3	ND	mg/L	1	SM2320B	02/19/21	02/19/21 9:16	SS
Ammonia Nitrogen						Batch: 24764	
Ammonia	ND	mg/L	0.1	EPA 350.1	02/23/21	02/23/21 16:24	SS
Chemical Oxygen Demand						Batch: 24764	
COD	ND	mg/L	5	SM5220D	02/19/21	02/19/21 9:00	SS
Chloride by IC						Batch: 24764	
Chloride	**2.3**	mg/L	0.5	EPA 300.0	02/18/21	02/18/21 20:47	SS
Hardness by Calculation						Batch: 24747	
Hardness (as CaCO3)	**5.16**	mg/L	0.5	SM2340 B	02/19/21	02/19/21 16:09	MBC
Nitrate/Nitrite-N by ALS						Batch: 24781	
Nitrate/Nitrite	j **0.04**	mg/L	0.02	EPA 353.2	02/25/21	02/25/21 13:04	ALS
Sulfate by IC						Batch: 24764	
Sulfate	**7.87**	mg/L	1	EPA 300.0	02/18/21	02/18/21 20:47	SS
Total Dissolved Solids						Batch: 24753	
TDS	**23**	mg/L	10	SM2540C	02/23/21	02/24/21 11:30	ACS
Total Metals						Batch: 24747	
Antimony	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Arsenic	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Barium	**0.0080**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Beryllium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Cadmium	ND	mg/L	0.004	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Calcium	**1.7**	mg/L	0.08	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Chromium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Cobalt	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Copper	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Iron	**0.12**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Lead	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Magnesium	**0.25**	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Manganese	**0.014**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Mercury	ND	mg/L	0.0002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Nickel	**0.0083**	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Potassium	**0.35**	mg/L	0.1	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Selenium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Silver	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Sodium	**1.0**	mg/L	0.2	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Thallium	ND	mg/L	0.002	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Vanadium	ND	mg/L	0.005	EPA 200.8	02/19/21	02/19/21 16:09	MBC
Zinc	ND	mg/L	0.01	EPA 200.8	02/19/21	02/19/21 16:09	MBC

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 11:00
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-05 **Matrix: Water** **Lab ID: 21021701-05**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Methylene chloride	b 0.0047	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 11:00
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: 2021-025-05 **Matrix: Water** **Lab ID: 21021701-05**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 13:42	GFH
Dibromofluoromethane (SURR)	**98**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
Toluene-d8 (SURR)	**101**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
4-Bromofluorobenzene (SURR)	**98**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 13:42	GFH

Notes/Qualifiers:
LLQ- Lowest Level of Quantitation
ND - Not Detected at a concentration greater than or equal to the LLQ.
b - Analyte often detected in method blank. Suspected laboratory artifact.
j - estimated value less than PQL but greater than MDL.
Nitrate/Nitrite-N analysis performed by Analytical Laboratory Services, Inc. See attached ALSI Report.

Approved by: Matt Ochs
QC Chemist

8851 Orchard Tree Lane | Towson, Maryland 21286 | tel: 410.825.1151 | fax: 410.825.2126 | www.caslabs.net

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Trip Blank **Matrix: Water** **Lab ID: 21021701-06**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Methylene chloride	b 0.0069	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH

Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Trip Blank **Matrix: Water** **Lab ID: 21021701-06**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:13	GFH
Dibromofluoromethane (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
Toluene-d8 (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
4-Bromofluorobenzene (SURR)	**97**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:13	GFH

Notes/Qualifiers:
LLQ- Lowest Level of Quantitation
ND - Not Detected at a concentration greater than or equal to the LLQ.
b - Analyte often detected in method blank. Suspected laboratory artifact.

Approved by: Matt Osher
QC Chemist

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Certificate of Analysis

Jenkins Environmental, Inc.
8600 LaSalle Road
York Building, Suite 509
Towson, MD 21286

Date Sampled: 02/17/21 10:50
Date Received: 02/17/21 13:00
Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Field Blank 1 **Matrix: Water** **Lab ID: 21021701-07**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Methylene chloride	b 0.0067	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH

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Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Field Blank 1 **Matrix: Water** **Lab ID: 21021701-07**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 14:43	GFH
Dibromofluoromethane (SURR)	**98**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
Toluene-d8 (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
4-Bromofluorobenzene (SURR)	**98**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 14:43	GFH

Notes/Qualifiers:
LLQ- Lowest Level of Quantitation
ND - Not Detected at a concentration greater than or equal to the LLQ.
b - Analyte often detected in method blank. Suspected laboratory artifact.

Approved by: Matt Osher
QC Chemist

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Date Issued: 03/03/21

Project: Hawkins Well Sampling
Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Field Blank 2 **Matrix: Water** **Lab ID: 21021701-08**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
Chloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Vinyl chloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Bromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Chloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Trichlorofluoromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,1-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Acetone	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Carbon disulfide	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Methylene chloride	b 0.0066	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
trans-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Methyl t-butyl ether (MTBE)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,1-Dichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
cis-1,2-Dichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
2-Butanone (MEK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Bromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Chloroform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,1,1-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Carbon tetrachloride	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Benzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2-Dichloroethane (EDC)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Trichloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2-Dichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Dibromomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Bromodichloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
cis-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
4-Methyl-2-pentanone (MIBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Toluene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
trans-1,3-Dichloropropene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,1,2-Trichloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Tetrachloroethene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
2-Hexanone (MBK)	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Dibromochloromethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2-Dibromoethane (EDB)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Chlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,1,1,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Ethylbenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
m&p-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
o-Xylene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Styrene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Bromoform	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH

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Site Location: 3901 Ft. Armistead Rd
Project Number: 2021-025

SDG Number: 21021701

Field Sample ID: Field Blank 2 **Matrix: Water** **Lab ID: 21021701-08**

	Result	Unit	LLQ	Method	Prepared	Analyzed	Init.
Volatile Organic Compounds						Batch:	24762
1,1,2,2-Tetrachloroethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2,3-Trichloropropane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,4-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2-Dichlorobenzene	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,2-Dibromo-3-chloropropane (DBCP)	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Acrylonitrile	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
trans-1,4-dichloro-2-butene	ND	mg/L	0.005	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Iodomethane	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Vinyl Acetate	ND	mg/L	0.001	EPA 8260B	02/24/21	02/27/21 15:14	GFH
Dibromofluoromethane (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
Toluene-d8 (SURR)	**99**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
4-Bromofluorobenzene (SURR)	**100**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
Pentafluorobenzene (IS-1)	**100**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,4-Difluorobenzene (IS-2)	**100**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
Chlorobenzene-d5 (IS-3)	**100**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH
1,4-Dichlorobenzene-d4 (IS-4)	**100**	%		EPA 8260B	02/24/21	02/27/21 15:14	GFH

Notes/Qualifiers:
LLQ- Lowest Level of Quantitation
ND - Not Detected at a concentration greater than or equal to the LLQ.
b - Analyte often detected in method blank. Suspected laboratory artifact.

Approved by: Matt Osher
QC Chemist

CALIBER ANALYTICAL SERVICES

8851 Orchard Tree Lane Towson, MD 21286
Phone: 410.825.1151
Fax: 410.825.2126
www.caslabs.net

Chain of Custody Record

Customer:	Jenkins Environmental
Contact/Report to:	Michael Cirri
Phone:	410-828-9888
Fax:	410-828-9899

E-mail address:	mcirri@jeinc.org
Project Name:	HAWKINS WELL SAMPLING
Project Location:	3901 Ft. Armistead Rd
Project Number:	2021-025

SDG Number:	2102170l
Sampled by:	M. Cirri/G. Pelc

Analysis Requested

Lab Number	Field Sample ID	Date Sampled	Time Sampled	Preservative: No. of Bottles	Field / Lab	Matrix *	Hawkins Point Sampling Protocol	Date/Time: / Sampling Remarks/ Comments
	021-025-01	02/17/21	1025	8		GW		
	021-025-02	02/17/21	1230	↓		GW	↓	
	021-025-03	02/17/21	1200	↓		GW	↓	
	021-025-04	02/17/21	1130	↓		GW	↓	
	021-025-05	02/17/21	1100	↓		GW	↓	
	Trip Blank	02/17/21	730	2		DI-W	↓	
	Field Blank	02/17/21	1050	↓		DI-W	↓	
	Field Blank Dup	02/17/21	1055	↓		DI-W	↓	

Relinquished by:	Gregory Pelc	Date/Time:	2/17/21 13:05	Deliverables:	Receipt Temp (°C): 2.5 / Turnaround Time:
Received by:		Date/Time:	2/17/21 1305	I II III CLP EDD	On Ice N/A (Same Day) / (STD) Next Day 2-Day Other
Relinquished by:		Date/Time:	/	Custody Seals:	Comments/Special Instructions:
Received by:		Date/Time:	/	Sample Cooler	
Relinquished by:		Date/Time:	/	Delivered by client	
Received by:		Date/Time:	/	CAS Courier	

* DW = Drinking Water | GW = Groundwater | SW = Surface Water | W = Water | WW = Wastewater | S = Soil | SED = Sediment | SL = Sludge | SD = Solid/Bulk | O = Oil / Fuel

TRONOX HPP LANDFILL GROUNDWATER MONITORING PLAN

TABLE 2. SAMPLE HANDLING AND TESTING REQUIREMENTS

PARAMETER	RECOMMENDED CONTAINER (a)	RECOMMENDED PRESERVATIVE (b)	MAX. HOLDING TIME/TEMP.	ANALYTICAL METHOD	REPORTING LIMIT/PQL
Alkalinity[1]	P,G	None	14 days, <6°C	SM2320 B-11	1.00 mg/l
Ammonia (Nitrogen)	P,G	H2SO4 to pH<2	28 days, <4°C	SM4500-NH3 B+G-11	1.00 mg/l
Chloride	P,G	None	28 days, <6°C	EPA-300.1	0.39 mg/l
COD	P,G	H2SO4 to pH<2	28 days, <4°C	EPA-410.4	10 mg/l
Hardness	P,G	HNO_3 to pH<2	6 mos.	SM2340 B-11	0.5 mg/l
Metals[1] EPA 200.2, 200.7					
Barium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Beryllium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0020 mg/l
Calcium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0800 mg/l
Chromium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Cobalt	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Copper	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Iron	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0. 0050 mg/l
Magnesium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0040 mg/l
Manganese	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Nickel	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0110 mg/l
Potassium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.39 mg/l
Silver	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Sodium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.200 mg/l
Vanadium, T&D	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Zinc	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.7	0.0100 mg/l
Metals[1] EPA 200.2, 200.8					
Antimony	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0020 mg/l
Arsenic	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0020 mg/l
Cadmium	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0040 mg/l
Lead	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0020 mg/l
Selenium, T&D	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0350 mg/l
Thallium, T&D	P,G	HNO_3 to pH<2	6 mo., <6°C	EPA 200.8	0.0020 mg/l
Mercury	P,G	HNO_3 to pH<2	28 days, <6°C	EPA 245.1	0.0002 mg/l
Nitrogen-Nitrate-Nitrite	P,G	H2SO4	28 days, <4°C	EPA 353.2	0.060 mg/l
Sulfate	P,G		28 days, <4°C	EPA 300.1	0.38 mg/l
Total Dissolved Solids	P,G		7 days, <6°C	SM 2540 C-11	10 mg/l
VOC's (48 Compounds)[3]	G, T lined septum	HCl or Na2S2O3	14 days, <4°C	EPA 8260B	.0010 mg/l[2]
Field Parameters					
pH	N/A	N/A	Field Determined	SM 4500 H B-11	0.10 SU
Specific Conductance	N/A	N/A	Field Determined	SM 2510 B-11	1 umos
Temperature	N/A	N/A	Field Determined		0.1°C
Turbidity	N/A	N/A	Field Determined	EPA SESDPROC 103 R3	0.11 NTU

NOTES:

[1]Total

[2]VOC practical quantitation limit (PQL) generally 0.001 mg/l except Acetone, Acrylonitrile, 2-Butanone, Trans-1,4-dichloro-2-butene, 2-Hexanone and 4-Methyl-2-pentnone at 0.005 mg/l and Methyl Tertiary Butyl Ether at .002 mg/l.

[3]Refer to following Permit Table I for list of 48 compounds.

(a) Container Types: P = Plastic, G = Glass, T = Teflon

(b) All samples are to be kept near target temperature of 4.0°C.

Table Revised by TM Engineering, Inc. 11/19/19

Documents/
this PC/TRONOX DMSAP TABL 2.1119
Excel Work Book (*.xlsx)

ALS Environmental

301 Fulling Mill Road - Middletown, PA 17057 - Phone: 717-944-5541 - Fax: 717-944-1430 - www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: PJLA 74618
State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

March 2, 2021

Mr. Matt Cohee
Caliber Analytical Services
8851 Orchard Tree Lane
Towson, MD 21286

Certificate of Analysis

Revised Report - 3/2/2021 2:43:24 PM - See workorder comment section for explanation

Project Name:	**2021-NITRATE NITROGEN EPA 353.2**	Workorder:	**3159120**
Purchase Order:		Workorder ID:	**2021-NITRATE NITROGEN EPA 353.**

Dear Mr. Cohee:

Enclosed are the analytical results for samples received by the laboratory on Monday, February 22, 2021.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Ms. Sarah S Leung (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Ms. Lindsey Jones , Accounts Payable

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Ms. Sarah S Leung
Project Coordinator

ALS Environmental

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SAMPLE SUMMARY

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
3159120001	21021701-01	Water	2/17/2021 10:25	2/22/2021 17:45	Mr. Matt Cohee
3159120002	21021701-02	Water	2/17/2021 12:30	2/22/2021 17:45	Mr. Matt Cohee
3159120003	21021701-03	Water	2/17/2021 12:00	2/22/2021 17:45	Mr. Matt Cohee
3159120004	21021701-04	Water	2/17/2021 11:30	2/22/2021 17:45	Mr. Matt Cohee
3159120005	21021701-05	Water	2/17/2021 11:00	2/22/2021 17:45	Mr. Matt Cohee

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SAMPLE SUMMARY

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Notes

-- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
-- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
-- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
-- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
-- The Chain of Custody document is included as part of this report.
-- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
-- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
-- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
-- For microbiological analyses, the "Prepared" value is the date/time into the incubator and the "Analyzed" value is the date/time out the incubator.
-- An Analysis-Prep Method Cross Reference Table is included after Analytical Results & Qualifiers section in this report.

Standard Acronyms/Flags

C	Please reference the Project Summary section of this Certificate of Analysis for case narrative comments.
J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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PROJECT SUMMARY

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Workorder Comments

Temperature of sample taken at time of sample receipt in the laboratory. See chain of custody for actual temperature.

This certificate of analysis was modified to report to the MDL. SSL 3/2/21

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ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID: **3159120001** Date Collected: 2/17/2021 10:25 Matrix: Water

Sample ID: **21021701-01** Date Received: 2/22/2021 17:45

Parameters	Results	Flag	Units	RDL	MDL	Method	Prepared By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Nitrate/Nitrite-N	0.04J	C,J, 2	mg/L	0.10	0.02	EPA 353.2		2/25/21 12:58	KXH	A

Ms. Sarah S Leung
Project Coordinator

ALS Environmental

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State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID: **3159120002** Date Collected: 2/17/2021 12:30 Matrix: Water

Sample ID: **21021701-02** Date Received: 2/22/2021 17:45

Parameters	Results	Flag	Units	RDL	MDL	Method	Prepared By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Nitrate/Nitrite-N	0.02J	C,J	mg/L	0.10	0.02	EPA 353.2		2/25/21 13:01	KXH	A

Ms. Sarah S Leung
Project Coordinator

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State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID: **3159120003** Date Collected: 2/17/2021 12:00 Matrix: Water

Sample ID: **21021701-03** Date Received: 2/22/2021 17:45

Parameters	Results	Flag	Units	RDL	MDL	Method	Prepared By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Nitrate/Nitrite-N	0.08J	C,J	mg/L	0.10	0.02	EPA 353.2		2/25/21 13:02	KXH	A

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State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID: **3159120004** Date Collected: 2/17/2021 11:30 Matrix: Water

Sample ID: **21021701-04** Date Received: 2/22/2021 17:45

Parameters	Results	Flag	Units	RDL	MDL	Method	Prepared By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Nitrate/Nitrite-N	0.14	C	mg/L	0.10	0.02	EPA 353.2		2/25/21 13:03	KXH	A

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Project Coordinator

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State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID: **3159120005** Date Collected: 2/17/2021 11:00 Matrix: Water

Sample ID: **21021701-05** Date Received: 2/22/2021 17:45

Parameters	Results	Flag	Units	RDL	MDL	Method	Prepared By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Nitrate/Nitrite-N	0.04J	C,J	mg/L	0.10	0.02	EPA 353.2		2/25/21 13:04	KXH	A

Ms. Sarah S Leung
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
3159120001	2	21021701-01	EPA 353.2	Nitrate/Nitrite-N

The QC sample type MS for method EPA 353.2 was outside the control limits for the analyte Nitrate/Nitrite-N. The % Recovery was reported as 113.1 and the control limits were 90 to 110.

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State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343

ANALYSIS - PREP METHOD CROSS REFERENCE TABLE

Workorder: 3159120 2021-NITRATE NITROGEN EPA 353.

Lab ID	Sample ID	Analysis Method	Prep Method	Leachate Method
3159120001	21021701-01	EPA 353.2		
3159120002	21021701-02	EPA 353.2		
3159120003	21021701-03	EPA 353.2		
3159120004	21021701-04	EPA 353.2		
3159120005	21021701-05	EPA 353.2		

30
401

CALIBER ANALYTICAL SERVICES
vson, MD 21286
: 410.825.1151
c: 410.825.2126
ww.caslabs.net

3159120

Chain of Custody Record

Customer:	Caliber Analytical Services
Contact/Report to:	Matt Cohee
Phone:	410.825.1151
Fax:	

E-mail address:	mbc@caslabs.net
Project Name:	JEI - HPLF
Project Location:	Baltimore, MD
Project Number:	21021701

SDG Number:	
Sampled by:	JEI/AEC
PO Number:	Quote 812477

Page _1_ of _1_

Analysis Requested

Lab Number	Field Sample ID	Date Sampled	Time Sampled	No. of Bottles	Matrix *	Preservative: Field	Preservative: Lab	EPA 353.2 NO2-NO3-N	H2SO4										Date: 2/17/21 Sampling Remarks/ Comments
	21021701-01	02/17/21	10:25	1	GW			√											
	21021701-02	02/17/21	12:30	1	GW			√											
	21021701-03	02/17/21	12:00	1	GW			√											
	21021701-04	02/17/21	11:30	1	GW			√											
	21021701-05	02/17/21	11:00	1	GW			√											

Relinquished by:	M. Cohee / M. Cohee/CAS	**Date/Time:**	2/22/21 / 1035	**Deliverables:**	**Receipt Temp (°C):**_____	**Turnaround Time:**
Received by:		**Date/Time:**	2/22/21 / 1745	I II III CLP EDD	On Ice N/A Same Day	(STD) Next Day 2-Day Other_____
Relinquished by:		**Date/Time:**	/	**Custody Seals:**	**Comments/Special Instructions:**	
Received by:		**Date/Time:**	/	Sample Cooler		
Relinquished by:		**Date/Time:**	/	Delivered by client		
Received by:		**Date/Time:**	/	CAS Courier		

* **DW** = Drinking Water | **GW** = Groundwater | **SW** = Surface Water | **W** = Water | **WW** = Wastewater | **S** = Soil | **SED** = Sediment | **SL** = Sludge | **O** = Oil / Fuel

301 Fulling Mill Road
Middletown, PA 17057
P: (717) 944-554
F: (717) 944-143(

3159120

Caliber Analytical Services

ndition of Sample Receipt Form

Client: **Initials:** BBD **Date:** 2/23/21

1. Were airbills / tracking numbers present and recorded?	NONE	YES	(NO)
Tracking number: _____			
2. Are Custody Seals on shipping containers intact?	NONE	YES	(NO)
3. Are Custody Seals on sample containers intact?	NONE	YES	(NO)
4. Is there a COC (Chain-of-Custody) present?		(YES)	NO
5. Are the COC and bottle labels complete, legible and in agreement?		YES	NO
5a. Does the COC contain sample locations?		(YES)	NO
5b. Does the COC contain date and time of sample collection for all samples?		(YES)	NO
5c. Does the COC contain sample collectors name?		(YES)	NO
5d. Does the COC note the type(s) of preservation for all bottles?		(YES)	NO
5e. Does the COC note the number of bottles submitted for each sample?		(YES)	NO
5f. Does the COC note the type of sample, composite or grab?		YES	(NO)
5g. Does the COC note the matrix of the sample(s)?		(YES)	NO
6. Are all aqueous samples requiring preservation preserved correctly?[1]	N/A	(YES)	NO
7. Were all samples placed in the proper containers for the requested analyses, with sufficient volume?		(YES)	NO
8. Are all samples within holding times for the requested analyses?		(YES)	NO
9. Were all sample containers received intact and headspace free when required? (not broken, leaking, frozen, etc.)		(YES)	NO
10. Did we receive trip blanks (applies only for methods EPA 504, EPA 524.2 and 1631E (LL Hg)?	N/A	YES	(NO)
11. Were the samples received on ice?		(YES)	NO
12. Were sample temperatures measured at 0.0-6.0°C		(YES)	NO
13. Are the samples DW matrix ? If YES, fill out Reportable Drinking Water questions below		YES	(NO)
13a. Are the samples required for SDWA compliance reporting?	(N/A)	YES	NO
13b. Did the client provide a SDWA PWS ID#?	N/A	YES	NO
13c. Are all aqueous unpreserved SDWA samples pH 5-9?	N/A	YES	NO
13d. Did the client provide the SDWA sample location ID/Description?	N/A	YES	NO
13e. Did the client provide the SDWA sample type (D, E, R, C, P, S)?	N/A	YES	NO

Cooler #:								
Temperature (°C):	3-C							
Thermometer ID:	403							
Radiological (µCi):								

COMMENTS (Required for all NO responses above and any sample non-conformance):

[1]Final determination of correct preservation for analysis such as volatiles, microbiology, and oil and grease is made in the analytical department at the time of or following the analysis

Rev 1/20/2020

Hawkins Point Materials
3901 Fort Armistead Road
Baltimore, MD 21226
Semiannual Groundwater Sampling Field Notes 02 17 21

Parameter & MW ID	MW-1	MW-2	MW-3	MW-4	MW-5
Total Depth [A]	137.64	189.65	171.93	136.15	162.13
DTP	ND	ND	ND	ND	ND
DTGW [B]	42.19	59.08	56.38	40.19	43.50
Linear Feet of Water in Well [C]	95.45	130.57	115.55	95.96	118.63
Diameter of Well (in)	4	4	4	4	4
Volume of Water in Well [E]	62.04	84.87	75.11	62.37	77.11
Temperature (F*)	52.7	56.3	56.1	54.7	55.1
Conductivity (mS/m)	0.221	0.045	0.222	0.090	0.037
Dissolved Oxygen (mg/L)	5.61	5.33	3.85	3.80	7.18
pH	6.65	4.36	5.18	4.40	3.58
ORP (mV)	77	113	86	294	270
NTU	28.5	10.8	57.3	28.0	30.1
Time Sampled	10:25	12:30	12:00	11:30	11:00

C = A - B
E = C x D

	2''	4''	6''
D =	0.16	0.65	1.47

Hawkins Point Materials
3901 Fort Armistead Road
Baltimore, MD 21226
Monthly Groundwater Gauging Field Notes 03 05 2021

Parameter & WELL ID	M-1	M-2	M-3	M-4	M-5
Total Depth [A]	137.64	189.65	171.93	136.15	162.13
DTP	ND	ND	ND	ND	ND
DTGW [B]	42.67	59.34	56.45	40.62	43.93
Linear Feet of Water in Well [C]	94.97	130.31	115.48	95.53	118.2
Diameter of Well (in)	4	4	4	4	4
Volume of Water in Well [E]	61.73	84.70	75.06	62.09	76.83

C = A - B
E = C x D

	2''	4''	6''
D =	0.16	0.65	1.47

Hawkins Point Materials
3901 Fort Armistead Road
Baltimore, MD 21226
Monthly Groundwater Gauging Field Notes 04 02 2021

Parameter & MW ID	M-1	M-2	M-3	M-4	M-5
Total Depth [A]	137.64	189.65	171.93	136.15	162.13
DTP	ND	ND	ND	ND	ND
DTGW [B]	42.46	59.09	55.42	39.41	43.73
Linear Feet of Water in Well [C]	95.18	130.56	116.51	96.74	118.4
Diameter of Well (in)	4	4	4	4	4
Volume of Water in Well [E]	61.87	84.86	75.73	62.88	76.96

C = A - B
E = C x D

	2''	4''	6''
D =	0.16	0.65	1.47

Hawkins Point Materials
3901 Fort Armistead Road
Baltimore, MD 21226
Monthly Groundwater Gauging Field Notes 05 12 2021

Parameter & MW ID	M-1	M-2	M-3	M-4	M-5
Total Depth [A]	137.64	189.65	171.93	136.15	162.13
DTP	ND	ND	ND	ND	ND
DTGW [B]	42.22	58.81	56.14	40.13	43.53
Linear Feet of Water in Well [C]	95.42	130.84	115.79	96.02	118.6
Diameter of Well (in)	4	4	4	4	4
Volume of Water in Well [E]	62.02	85.05	75.26	62.41	77.09

C = A - B
E = C x D

	2''	4''	6''
D =	0.16	0.65	1.47

APPENDIX D
Groundwater Monitoring Plan

GROUNDWATER MONITORING PLAN

FOR THE

TRONOX

HPP LANDFILL

BALTIMORE, MARYLAND

April 27, 1992

REVISED June 2011

REVISED AUGUST 2019

Prepared For:

TRONOX PIGMENTS, USA

3901 FORT ARMISTEAD ROAD

BALTIMORE, MARYLAND 21226

Revised August 2019 By:

TM ENGINEERING, INC.

2501 WESTMINSTER DRIVE
OLNEY, MARYLAND 20832

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Appendix C MDE Well Specifications
Appendix D Standard Procedures
Appendix E Field Data and Chain of Custody Sheet
Appendix F Drinking Water Maximum Concentration Limits

1.0 INTRODUCTION

This Groundwater Monitoring Plan has been prepared for TRONOX Hawkins Point Plant Landfill (HPP Landfill) operating under a Refuse Disposal Permit 92-24- 03-1 JA issued by the Maryland Department of the Environment (MDE) June 22, 1992 and re-issued, with the most recent permit, as Permit 2015-WlF-0527A on December 4, 2015. The Tronox HPP Landfill is a 30-acre parcel receiving non-hazardous industrial waste from titanium dioxide manufacturing operations. Although the manufacturing operations have ceased, the landfill still receives non-hazardous solid wastes generated during maintenance of environmental controls and plant property. These wastes consist of excavated soil, clean-up of residual titanium ore, titanium dioxide or other soil-like materials remaining from the manufacturing operations of the site. This plan sets forth the methods of sampling and analytical testing of groundwater samples from the monitoring well network at the landfill facility in accordance with the regulatory requirements of COMAR 24.07.08(17) and Permit 2005-WIF-0527A, Part III. Section F.

1.1 Facility Location

The HPP Landfill is located in an area known as Hawkins Point in the southern part of Baltimore City, Maryland at the southern border with Anne Arundel County. The city-county boundary marks the southern property line of the landfill tract. The landfill site is contiguous with the HPP Plant parcel and is bound on the north by Fort Armistead Road, on the west by the Cabot Industrial Park, on the south by Anne Arundel County and on the east by the Hawkins Point Plant. The location of the facility is shown in Figure 1.

ne

BALTIMORE CITY ANNE ARUNDEL COUNTY

1.2 General Facility Information

The HPP Landfill consists of one monitorable unit situated on a 30-acre site. Monitoring-wells M-1 through M-5 were installed under the ownership of the original permittee in October 1992 at which time routine sampling and monitoring began.

1.3 Waste Stream Characteristics

The waste stream as allowed by Permit 2005-WIF-0527 A and subsequent amendments and renewals consists of the following constituents:

a. Primary gypsum
h. Secondary gypsum
c. Dewatered dredged solids from the chloride process settling basins
d. Refractory Brick and brick solids from the calciner kilns, batch attack vessels
e. Settled solids from the settling basins on the landfill
f. Batch Attack Mud
g. Batch Attack Vessel Refractory Brick and Brick Solids
h. Chlorinator Refractory Brick and Brick Solids
i. Excavated soil, clay and rubble
j. Residual magnesium hydroxide and unreacted ore residues from the batch attack process

Analytical tests are periodically performed on these wastes and submitted to MDE for review.

2.0 GROUNDWATER MONITORING WELL NETWORK

2.1 Introduction

The groundwater monitoring well network at the HPP Landfill consists of five (5) monitoring wells installed in the uppermost significant saturated zone within unconsolidated natural soil deposits beneath the landfill. Geologically, the sediments are part of the Patapsco Formation in the Patuxent Group within the Atlantic Coastal Plain. The initial hydrogeologic investigation for the landfill was submitted as Phase II of the Permit Application, and two supplements were subsequently provided on December 12, 1991 and February 7, 1992. Documentation of the monitoring well installations with well logs is contained in a report by Haley and Aldrich, Inc., December 9, 1992. A copy of the report is contained in Appendix A.

2.2 Monitoring Wells

In accordance with the Code of Maryland Regulations (COMAR) 26.04.07.08(17), COMAR 26.04.04, and provisions 1.1.2 and 1.1.6 of the Refuse Disposal Permit issued June 22, 1992, a groundwater detection monitoring system was installed to collect samples which meet the following:

- Represent groundwater quality of the geologic media being monitored;
- Capable of determining effect of operations on groundwater quality;
- Determine whether potentially contaminated groundwater is migrating off the property; and
- Represent groundwater quality directly downgradient of the limits of waste placement.

The groundwater monitoring wells consist of 5 wells, M-1 through M-5. The well locations along with the groundwater contour maps are shown in Appendix B, Monitoring Well Location and Groundwater Contour Map. The wells were constructed in general accordance with the Specifications for the Design and Construction of Groundwater Monitoring Wells at Solid Waste Disposal Facilities recommended by the Maryland Department of the Environment, Hazardous and Solid Waste Management Administration, updated December

9, 1991. A copy of the specifications recommended by MDE is contained in Appendix C. The wells range in depth from 137 to 192 feet below the existing ground surface and the screened portion of each well casing column is adjacent to the uppermost significant saturated zone encountered during drilling which was at least ten feet in thickness and capable of producing enough groundwater for sampling. A summary of the pertinent well details is presented in Table 1.

2.3 On-Site Decontamination Procedures

After each monitoring well installation, the drill rig, associated tools and down-hole equipment were decontaminated with a wash of de-ionized distilled water to minimize the potential for spreading potential contamination from one borehole to another. All decontamination procedures followed Standard Procedure 1 in Appendix D.

2.4 Protection and Maintenance of Monitoring Well System

The groundwater monitoring well network is situated away from anticipated operational traffic to avoid possible damage from equipment and vehicles. The integrity of each well will be maintained throughout the life of the monitoring program. All of the monitoring wells will be visually inspected each time the well is accessed for sampling or for water level measurements and the condition of the wells will be recorded. Maintenance or repairs will be made if damage or inability to obtain a reliable sample is reported. All repairs completed on monitoring wells will be documented in the reports of groundwater quality required to be submitted to MDE or in the annual operational report.

2.5 Monitoring Well Development

All monitoring wells were developed to remove excessive amounts of fine soil particles from the filter pack and geologic formation immediately adjacent to the well using a bailer, compressed air and/or submersible pump. Development procedures consisted of evacuating water in the well with

repeated intermittent pumping to create an agitating surge action to dislodge, suspend and evacuate fines. The development was continued until reasonably clear water was obtained from each well. Water removed from the wells was discharged away from the well head.

2.6 Field Surveys

Upon completion, all well locations were horizontally located in the field and elevations were measured by a registered land surveyor. The elevation of the ground surface at each well and the top of PVC casing (with cap removed) were determined to within 0.01 foot from project bench marks of known elevation. The elevations are presented in Table I.

2.7 Decommissioning (Abandonment) of Monitoring Wells

Wells which may become damaged beyond repair or wells which have attained the end of the monitoring period will be abandoned in accordance with COMAR 26.04.04. A copy of this regulation is contained in Appendix D as Standard Procedure 2.

3.0 GROUNDWATER SAMPLING PROGRAM

3.1 Introduction

In compliance with the requirements of Permit 2015-WIF-0527A, groundwater samples are collected from each of the 5 monitoring wells on a semi-annual basis. The samples are tested by an analytical laboratory approved by MDE for a parameter list specified in the permit. The parameters are compared to previous values to determine any changes and for exceedance of maximum concentration levels (MCLs). Water levels in each well are measured and recorded monthly.

3.2 Parameter List

The parameters which require analytical testing by Permit 2015-WIF-0527A are shown in the Permit as Table I, Volatile Organic Compounds and Table II, Elements and Indicator Parameters. The tables include the required practical quantitation limits (PQL's) for each parameter. Copies of these tables are included at the end of this narrative as Permit Table I and Permit Table II. Permit Table II corresponds to the majority of primary and secondary drinking water parameters.

Table 2 (as distinguished from Permit Table II) lists the required preservatives, sample containers, and holding times for the tested parameters. All information included in Table 2 is consistent with criteria established in 40CFR136. Specific methods and laboratory reporting limits are also listed in Table 2. The analytical methods to be used for laboratory analysis of the groundwater samples are consistent with Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Standard Methods (18th edition), Standard Methods for Chemical Analysis of Water and Wastes and/or other industry acceptable methods. All lab analyses reports shall detail the actual test parameters which shall conform to EPA procedures.

3.3 Sample Collection Frequency

In accordance with Permit 2015-WIF-0527A, Part III, F, groundwater samples are collected semi-annually in the first quarter, typically during the month of January, and in the third quarter, typically during July.

3.4 Groundwater Levels/Topographic Map/Groundwater Flow Direction

Groundwater levels are determined in each well on a monthly basis and during each sampling event prior to purging the well as a minimum. The groundwater elevation data are collected in accordance with Standard Procedure 3, the sampling contractor's Standard Operating Procedure for Groundwater Well Sampling. Annually, aerial photogrammetry is obtained for the active landfill and surface mining portion of the site and a topographic map prepared from the data. The monitoring well locations and groundwater level data are utilized to construct a piezometric surface map, indicating groundwater flow direction and rate of seepage.

4.0 SAMPLE COLLECTION PROTOCOL

To ensure that representative samples are obtained from the monitoring wells, the following sample collection protocol is followed:

4.1 Personnel Training

Each member in the sampling team is trained in the use of necessary sampling equipment, proper decontamination procedures, procedures for data recording, and chain of custody protocol. A copy of this Groundwater Monitoring Plan accompanies the sampling team. on each sampling event and is maintained at the facility. All members of the sampling team. have read and comprehended the contents of this Plan before application in the field.

4.2 Health and Safety

A health and safety program for groundwater sampling has been prepared and implemented to ensure the safety of all personnel. Each member of the sampling team is familiar with all health and safety procedures contained in the plan.

4.3 Field Equipment and Calibration

A variety of field equipment is used to collect representative samples from monitoring wells. A summary of equipment currently utilized at the landfill during groundwater sampling is provided below, but it should be recognized that substitute equipment of equal performance or greater performance as technological advances become available, will be implemented from time to time.

Water Level Indicator

An electrical water level indicator is currently used to measure groundwater levels in the monitoring wells. This device detects water levels by lowering a sensing tip attached to an electrical cable graduated with markers at every tenth of a foot. The sensing tip consists of two insulated electrodes creating an open circuit in air. When the tip comes in contact with the water surface, the circuit is closed and a light and audible alarm are turned on.

The depth to water is read on the graduated cable at the reference point (top of PVC well casing) and recorded. Standard Procedure 3, Section 7.1.5, in Appendix D is followed to obtain water levels. The maintenance frequency and calibration procedures follow the manufacturer's recommendations.

pH Meter

To determine the hydrogen ion activity of the groundwater sample, a combined pH and temperature meter is used when measurement of pH is conducted in the field. The proper use and calibration of this piece of equipment is documented in Standard Procedure 4 in Appendix D. This procedure is the sampling contractor's blanket Standard Operating Procedure for Field Determination of Residual Chlorine, pH, Temperature, Dissolved Oxygen, Carbon Dioxide, Specific Conductance and Oxidation-Reduction Potential. It should be noted that only pH, temperature and specific conductance apply to the facility.

Turbidity Meter

A turbidity meter is used to measure the turbidity (suspended solids) contained in the sample in the field. Standard Procedure 4 in appendix D outlines the procedure for use and calibration of this instrument

Electrical Conductivity Meter

An electrical conductivity meter is used to determine the specific conductivity of the sample in the field. Standard Procedure 4 in appendix D outlines the procedure for use and calibration of this instrument.

Purge Pumps

Grundfos or Wilden M-2 pumps are used to evacuate the wells prior to sampling and to extract the groundwater sample. The guidelines for operation and maintenance of the pumps are contained in Standard Procedure 3, Section 7.1, of Appendix D. If one pump is used it is decontaminated before sampling any wells, after each individual well sampling and at the end of the well sampling event before leaving the site. If the purge pump is ineffective, a bailer dedicated to each specific well is used to purge the well and obtain

the sample.

Bailers

Bailers consisting of disposable fluorocarbon (Teflon) tubes with check valves at the base are used to purge and sample low yield wells in accordance with Standard Procedure 3, Section 7.1 in Appendix D.

4.4 Decontamination of Equipment

To assure the integrity of groundwater samples, dedicated or disposable purging and sampling equipment are employed. In the event that non-dedicated purging and sampling equipment are used, proper decontamination procedures are followed. These procedures include decontamination of all measuring, purging, sampling and field test equipment required in Standard Procedure 1 in Appendix D. This activity is to take place at the maintenance building adjacent to the administration trailer.

4.5 Monitoring Well Purging

Prior to sample collection, all monitoring wells are purged to remove any stagnant water in the casing to ensure that a sample representative of groundwater in the porous media is obtained. Standard Procedure 3, Section 7.1, in Appendix D outlines the proper purging procedures and documentation required at the facility. All discharge generated during purging and sampling is directed away from the well head into the surface water collection system where it is discharged from the site through a permitted surface water outfall.

4.6 Sampling Devices

Sampling devices consist of a dedicated in-well pump, but a hollow stainless steel or fluorocarbon (Teflon) tubes with an opening and check valve at the base may be used. The bailer is tethered to a nylon rope used to raise and lower the bailer into and out of the well. The diameter of the bailer is slightly smaller than the inside diameter of the PVC well casing. Sampling equipment is not allowed to come into contact with the ground.

Every well has a dedicated pump. Should a non-dedicated electrically operated pump or non-dedicated bailer ever be used, the bailer and pump will be decontaminated in accordance with the procedures of Section 4.4. before purging the well. After purging, a groundwater sample is collected from each well with the dedicated pump or a disposable Teflon bailer, one for each well. If a single bailer is used for all wells, the decontamination procedures of Section 4.4 are implemented after each well is sampled.

4.7 Sample Collection and Transportation

Containers used for sample collection are preserved by the laboratory using the appropriate preservative as listed in Table 2. The samples are transferred from the pump discharge lines to the containers in such a manner as to avoid agitation and aeration. After collection, the samples are delivered to the laboratory in coolers insulated to maintain four degrees centigrade (4° C). The procedures which are followed for sample collection are contained in Standard Procedure 3 in Appendix D. In general, the order in which the wells are sampled is based on well yield and the relative degree of contamination. Wells with low yield, poor recovery and low contamination levels are purged first, but due slow to very slow recovery, the sample may not be obtained until the latter part of the sampling event. If well yields are similar, the upgradient monitoring well(s) are sampled first, followed by the downgradient wells.

Typically, the order in which sample containers are filled with groundwater is based on the order of volatilization, with the samples for testing of the most volatile constituents containerized first. The general order of sampling occurs as follows:

1. Volatile Organic Compounds (VOC's)
2. COD
3. dissolved metals
4. total alkalinity
5. hardness
6. sulfate and chloride
7. nitrates
8. fluoride

Each time a groundwater sample is obtained from a monitoring well, temperature and specific conductance are measured in the field following their respective protocol defined in the Standard Procedure 4 contained in Appendix D. A trip blank is run for each sampling session. QA/QC samples are run in the lab every 10 samples to validate the tests and the equipment. Any random sample is analyzed in the laboratory using the same methods and procedures as the rest of the samples from the same sampling event.

4.8 Chain of Custody

To track samples from the time of collection through laboratory analysis, a chain of custody protocol has been established. Elements of the protocol include sample labels with specific information, field data sheets, chain of custody records and a laboratory logbook as defined in Standard Procedure 5, Appendix D. The elements are discussed in the following:

Sample Labels

The labels for sample bottles are provided by the analytical laboratory. The labels are waterproof and firmly affixed to the container to prevent loss of sample identification

The label is filled out with the following information:

1. facility where sample was obtained (Hawkins Point Plant (HPP) Industrial Waste Landfill)
2. location within facility where sample was obtained (landfill site)
3. monitoring Well No. from which sample was collected
4. date ofcollection
5. name ofcollector
6. preservatives used
7. parameter testrequested
8. sample identification number

Field Data Sheet

A field data sheet is completed for each monitoring well sampled. The field data sheet currently used is part of the Chain of Custody form. An example of the field data sheet is shown in Appendix E. This sheet includes:

1. project number
2. well number
3. well depth
4. facility name and location
5. name of personnel present
6. static water level
7. top of casing elevation (referenced to mean sea level, datum of 1929, see Table 1)
8. groundwater elevation
9. type of casing material and diameter (2-inch PVC, etc.)
10. volume of static water in well
11. screened interval within well
12. date of purging, purging method, purge volume and pumping rate
13. date, time and method of sampling
14. notation of any evidence of unauthorized tampering with www woo damage to lock or cap
15. field observations and notes

Chain of Custody Record Form:

A Chain of Custody Record form accompanies each sample to document possession of the sample from the time the sample is collected to the time the sample is received at the laboratory. The Chain of Custody Record from also serves as the Request for Analysis form. An example of the Chain of Custody record form appears in Appendix E. The Chain of Custody Record form contains the following information:

1. laboratory sample identification and number
2. sample matrix
3. number of samples
4. sampling date and time
5. names of samplers
6. client name, facility, project name and project number
7. name and signature of person relinquishing and of person receiving samples
8. temperature of sample cooler upon receipt at laboratory
9. time and date samples were relinquished and received
10. notes

5.0 QUALITY ASSURANCE/ QUALITY CONTROL

To ensure the validity of the sample collected and the data reported by the laboratory, a quality assurance and quality control (QA/QC) program is implemented for field and laboratory.

5.1 Field QA/QC

Laboratory analyses of a field blank (to check extraneous sample contamination from equipment or atmosphere) and a duplicate are performed for all sampling events at the facility. One field/equipment blank is collected on each day of the sampling event or ten percent of the total number of samples, whichever is greater. The field blank is collected in the same manner as the groundwater samples by passing distilled/de-ionized water through the equipment used in the field (including filters if samples are to be field filtered). This procedure ensures that equipment or ambient conditions at the time of sampling have not impacted the integrity of the groundwater samples. A custody seal is placed on each shipping container to discourage and detect sample tampering.

5.2 Laboratory QA/QC

The laboratory uses standards, duplicates, spikes and laboratory blanks to calibrate and identify any potential interference. The results of the laboratory quality control samples are used as an indicator of performance or to identify a source of cross contamination, but never to adjust the analytical data. All laboratory QA/QC is managed and maintained by the analytical laboratory. The laboratory is approved by MDE and copies of their QA/QC information should be available in MDE files. The laboratory analytical results provided in reports and required to be submitted to MDE will include the laboratory analytical method for each test along with the detection limit (PQL). The laboratory method detection limit, at a minimum, meets the corresponding established maximum contaminant level.

6.0 METHOD OF EVALUATING AND REPORTING DATA

6.1 General

Based upon the current Permit 2015-WIF-0527 A, Part III, Sections E and F, groundwater level measurements, analyses of groundwater quality, and a semiannual water quality report containing summary and interpretive discussion of all analyses of the chemical quality of groundwater from all of the monitoring wells specified in this landfill's approved groundwater monitoring plan (G&SWM) plan shall be submitted to MDE within 90 days of the close of the first and third calendar quarters.

A qualified groundwater scientist or professional shall evaluate the results of the analyses and advise the permittee of any changes in water quality or any exceedance of applicable State and Federal guidelines.

Parameters must be measured in their Practical Quantitation Limits (PQL) and all "J" values (“J” values are analytical results which are below the PQL but can be quantified by estimation) must be reported. A complete copy of the laboratory data and the interpretive findings shall be included in each semiannual water quality report. The analytical data for each well is to be presented in a spreadsheet in a time series format where quality data for each parameter can be observed simultaneously, to facilitate intra-well comparison.

6.2 Analysis

In order to assess whether a change in groundwater quality has occurred, the facility utilizes the Student "'t" test to determine whether a statistically significant change has occurred in the parameters. After each sampling event, the test result for each parameter is compared to the mean of a selected set of background data to determine if a significant difference has occurred in the groundwater constituents on an intra-well basis. The background data is periodically

updated when a sufficient number (four or more) data points becomes available. The “maximum contaminant levels” (MCL's) for Primary and Secondary Drinking Water

Regulations from the U.S. Environmental Protection Agency are utilized by the facility to determine exceedance. A copy of these values, current as of March 2011, is contained in Appendix H. The MCL's are the same as those contained in COMAR 26.04.01.06.

Upon detection of the exceedance of an MCL, Action Level or other health standard for the first time, the MDE must be notified within 24 hours of the receipt of the analytical data and the monitoring point(s) in which the standard was exceeded must be immediately resampled to verify the initial detection. This resampling must occur as soon as possible, and no later than 30 days (or longer time, but as soon as possible, which allows for a statistically independent sample) following notification of the permittee of the exceedance of the standard by the groundwater professional after initially reviewing and assessing the analytical data.

6.3 Submittals and Time-lines

The following is an outline for time-lines for submittals as required in Permit 20~~0~~15-WIF-0527 A for the on-going monitoring program.

1. Groundwater levels from each well are measured and recorded monthly and included in the semi-annual water quality report.

2. All wells are sampled semi-annually during the first and third calendar quarter. The results of the analytical testing and the analysis of data by the groundwater professional are submitted to MDE within 90 days after the close of the first and third calendar quarter (before end of June and end of December).

3. If analytical results from samples collected from any sources associated with the shall advise the Department of the first-time exceedance and any significant increase thereafter above MCL levels within 24 hours of receipt of the analytical data verifying this occurrence.

4. The semi-annual report shall include a topographic map and piezometric contour map showing the locations of the monitoring wells and piezometers.

7.0 REFERENCES

1. Refuse Disposal Permit 92-24-03-l 3A, issued by the State of Maryland, Department of the Environment, Solid Waste Division, June 22, 1992, expiration date June 22,1997.

2. Refuse Disposal Permit 1997-WIF-0527 issued by the State of Maryland, Department of the Environment, Solid Waste Division, April 2, 1999, expiration date April 11, 2004.

3. Refuse Disposal Permit 2004-WIF-0527 issued by the State of Maryland, Department of the Environment, Solid Waste Division, April 12, 2004, expiration date April 11, 2009.

4. Refuse Disposal Permit 2004-WIF-0527A issued by the State of Maryland, Department of the Environment, Solid Waste Division, January 5, 2011, expiration date January 4, 2016.

5. Letter from State of Maryland, Department of the Environment, November 12, 1999 signed by A. Hussain Alhija, chief Design and Certification Division with modifications to Permit - 1997-WIF-0527.

6. Standard Methods for the Examination of Water and Wastewater, 18th edition, 1992. American Public Association, Washington, D.C.

7. Code of Maryland Regulations, COMAR, Title 26, Subtitle 04, Regulation of Water Supply, Sewage Disposal, and Solid Waste, Chapter 07, Solid Waste Management.

8. Refuse Disposal Permit 2015-WIF-0527A issued by the State of Maryland, Department of the Environment, Solid Waste Division, December 4, 2015, expiration date December 3, 2020.

TRONOX HPP LANDFILLL GROUNDWATER MONITORING PLAN

TABLE 1 MONITORING WELL DIMENSIONAL DATA

Well No.		Depth	Top of Casing(1)	Ground Surface	Well Screen Interval	Filter Sand	Saturated Zone	Clay Seal	Casing Diam.
Current	Prev.	el., ft. msl	el., ft. msl	el., ft. msl	el., ft. msl	el., ft. msl	el., ft. msl	el., ft. msl	m.
HPP-1	M-1	-92.0	46.8	45.0	-81 to -91	-74 to -92	-77 to -92	-71 to -74	4
HPP-2	M-2	-131.5	61.8	60.9	-119.6 to -129.6	-115 to -131.5	-118 to -131.5	-113 to -115	4
HPP-3	M-3	-119.0	57.8	56.0	-104 to -114	-96 to -119	-101 to -119	-94 to -96	4
HPP-4	M-4	-123.2	41.6	40.0	-110 to -120	-104.5 to -123.2	-102 to -123.2	-101 to -104.5	4
HPP-5	M-5	-120.0	47.1	45.0	-105 to -115	-100 to -120	-102 to -120	-97 to -100	4

(1) Top of PVC well casing inside of outer steel protective pipe = Reference point for groundwater measurements.

TABLE 2
SAMPLE HANDLING AND TESTING REQUIREMENTS

VOLATILE ORGANIC COMPOUNDS	Container Material/ Preservative	Hold Time and Temperature	Anaytical Method	PQL (µg/L)
Acetone	3 X 40 mL Glass / HCl tp pH < 2	14 Days at < 6° C No Headspace	SW-846 8260 B/C and SW-846 8011	5.0
Acrylonitrile				5.0
Benzene				1.0
Bromochloromethane				1.0
Bromodichloromethane				1.0
Bromoform				1.0
Bromomethane				1.0
2-Butanone				5.0
Carbon disulfide				1.0
Carbon tetrachloride				1.0
Chlorobenzene				1.0
Chloroethane				1.0
Chloroform				1.0
Chloromethane				1.0
Dibromochloromethane				1.0
1,2-Dibromo-3-chloropropane [1]				0.04
1,2 - Dibromoethane (EDB) [1]				0.04
Dibromomethane				1.0
1,2 - Dichlorobenzene				1.0
1,4 - Dichlorobenzene				1.0
Trans-1,4-dichloro-2-butene				5.0
1,1-Dichloroethane				1.0
1,2-Dichloroethane				1.0
1,1-Dichloroethene				1.0
Cis-1,2-Dichloroethene				1.0
Trans-1,2-Dichloroethene				1.0
Methylene chloride				1.0
1,2-Dichloropropane				1.0
Trans-1,3-Dichloropropene				1.0
Cis-1,3-Dichloropropene				1.0
Ethvlbenzene				1.0
2-Hexanone				5.0
Iodomethane				1.0
4-Methyl-2-pentanone				5.0
Methyl Tertiary Butyl Ether				2.0
Styrene				1.0
1,1,1,2-Tetrachloroethane				1.0
l ,1,2,2-Tetrachloroethane				1.0
Tetrachloroethene				1.0
Toluene				1.0
1,1,I-Trichloroethane				1.0
1,1,2-Trichloroethane				1.0
Trichloroethene				1.0
Trichlorofluoromethane				1.0
1,2,3-Trichlorooropane				1.0
Vinyl acetate				1.0
Vinyl chloride				1.0
Xylene				1.0

TRONOX HPP LANDFILL GROUNDWATER MONITORING PLAN

TABLE 2
SAMPLE HANDLING AND TESTING REQUIREMENTS

ELEMENTS AND INDICATOR PARAMETERS	Container Material/ Preservative	Hold Time and Temperature	Anaytical Method	PQL (mg/L)
Total Antimony	500 mL Plastic / HNO_3 to pH < 2	6 Months at < 6° C	EPA Method 200.8 and EPA Method 2007	0.0020
Total Arsenic				0.0020
Total Barium				0.0100
Total Beryllium				0.0020
Total Cadmium				0.0040
Total Chromium				0.0100
Total Calcium				0.08
Total Cobalt				0.0100
Total Copper				0.0100
Total Iron				0.005
Total Lead				0.0020
Total Nickel				0.0110
Total Magnesium				0.004
Total Manganese				0.0100
Total Potassium				0.39
Total Selenium				0.035
Total Silver				0.0100
Total Sodium				0.2
Total Thallium				0.0020
Total Vanadium				0.0100
Total Zinc				0.0100
Total Mercury		28 Days at < 6° C	EPA Method 245.1	0.0002
Alkalinity	250 mL Plastic / None	14 Days at < 6° C	SM 2320B-11	I
Hardness	250 mL Plastic / HNO_3 pH < 2	6 Months at < 6° C	SM 2340B-1997	0.5
Chloride	2 X 40 mL Plastic / None	28 Days at < 6° C	EPA Method 300.0	0.39
Nitrate	120 mL Plastic / H_2SO_4 pH < 2	48 Hours at < 6° C	EPA Method 353.2	0.06
Chemical oxygen demand	100 mL Plastic / H_2SO_4 pH < 2	28 Days at < 6° C	EPA Method 410.4	10
Ammonia	500 mL Plastic / H_2SO_4 pH < 2	28 Days at < 6° C	SM 4500- NH3 B/C-2011	1
Sulfate	2 X 40 mL Plastic / None	28 Days at < 6° C	EPA Method 300.0	0.38
Total dissolved solids	500 mL Plastic / None	7 Days at < 6° C	SM 2540 C - 1997	10
PH	250 mL Plastic / None	Immediate at < 6° C	SW-846 9040B/C and Field Measured	0.1 (SU)
Specific conductance	250 mL Plastic / None	28 Days at < 6° C	SW-846 9050A and Field Measured	1
Turbidity	250 mL Plastic / None	48 hours at < 6° C	EPA Method 180.1 and Field Measured	0.11 (NTU)

Notes:

[1] - 1,2-dibromoethane and 1,2-dibromo-3-chloropropane will be analyzed SW-846 8011.
mL - milliLiters
ug/L - micrograms per liter
mg/L - millgrams per Liter
SU - Standard Units
NTU - Nephelometric Turbidity Units

Table 1
Monitoring Parameters

Volatile Organic Compounds (VOCs)	PQL (ppb)
Acetone	5.0
Acrylonitrile	5.0
Benzene	1.0
Bromochloromethane	1.0
Bromodichloromethane	1.0
Bromoform	1.0
Bromomethane	1.0
2-Butanone (MEK)	5.0
Carbon Disulfide	1.0
Carbon tetrachloride	1.0
Chlorobenzene	1.0
Chloroethane (Ethyl Chloride)	1.0
Chloroform	1.0
Chloromethame	1.0
Dibromochloromethane	1.0
1,2-Dibromo-3-chloropropane	0.04
1,2-Dibromoethane	0.04
Dibromomethane	1.0
1,2-Dichlorobenzene	1.0
1,4-Dichlorobenzene	1.0
Trans-1,4-dichloro-2-butene	5.0
1,1-Dichloroethane	1.0
1,2-Dichloroethane	1.0
1,1-Dichloroethene	1.0
Cis-1,2-Dichloroethene	1.0
Trans-1,2-Dichloroethene	1.0
Methylene chloride	1.0
1,2-Dichloropropane	1.0
Trans-1,3-Dichloropropene	1.0
Cis-1,3-Dichloropropene	1.0
Ethylbenzene	1.0
2-Hexanone	5.0
Iodomethane	1.0
4-Methyl-2-pentanone	5.0
Methyl-t-Butyl Ether	2.0
Styrene	1.0
1,1,1,2-Tetrachloroethane	1.0
1,1,2,2-Tetrachloroethane	1.0
Tetrachloroethene	1.0
Toluene	1.0
1,1,1-Trichloroethane	1.0
1,1,2-Trichloroethane	1.0
Trichloroethene	1.0
Trichlorofluoromethane	1.0
1,2,3-Trichloropropane	1.0
Vinyl Acetate	1.0
Vinyl Chloride	1.0
Xylene	1.0

PERMIT TABLE II. MONITORING PARAMETERS

ELEMENTS AND INDICATOR PARAMETERS	PQL (ppm)	ELEMENTS AND INDICATOR PARAMETERS	PQL (ppm)
Total Antimony	0.0020	Total Silver	0.0100
Total Arsenic	0.0020	Total Sodium	0.2
Total Barium	0.0100	Total Thallium	0.0020
Total Beryllium	0.0020	Total Vanadium	0.0100
Total Cadmium	0.0040	Total Zinc	0.0100
Total Chromium	0.0100	pH	0.1 (SU)
Total Calcium	0.08	Alkalinity	1
Total Cobalt	0.0100	Hardness	0.5
Total Copper	0.0100	Chloride	0.39
Total Iron	0.005	Specific Conductance	1
Total Lead	0.0020	Nitrate	0.06
Total Nickel	0.0110	Chemical Oxygen Demand (COD)	10
Total Magnesium	0.004	Turbidity	0.11 (NTU)
Total Manganese	0.0100	Ammonia	1
Total Mercury	0.0002	Sulfate	0.38
Total Potassium	0.39	Total dissolved solids	10
Total Selenium	0.035		

APPENDIX A

Monitoring Well Construction Documents

APPENDIX B

Monitoring Well Location Map

Groundwater Piezometric Contour Map

APPENDIX C

MDE Well Specifications

APPENDIX D

Standard Procedures

1. Decontamination
2. Abandonment of Wells
3. Groundwater Sampling Procedures
4. Field Test Procedures

Standard Procedure 1

DECONTAMINATION

APPENDIX E

Field Data and Chain of Custody Sheets

APPENDIX F

Drinking Water Maximum Concentration Limits

APPENDIX E
Historical Laboratory Results

TABLE 2

SUMMARY OF INDEX AND HYDRAULIC CONDUCTIVITY TEST RESULTS [Oosterbaan, 1991]

Sample (Depth (ft))	Elevation* (ft-msl)	k (cm/s)	LL (%)	PI (%)	w_n (%)
G-3D (40)	22	2.15×10^{-6}			
G-7D (26)	21	1.7×10^{-6}			
G-12D (36)	40	8×10^{-6}			
G-16D (20)	21	6.6×10^{-6}			
G-19 (11)	19	6.2×10^{-6}			
G-19 (16)	14	1.6×10^{-5}			
G-22 (30.5)		1.7×10^{-5}	60	37	23
G-8D (50)			25	9	14
G-13D (4)					13
G-13D(66)					19
G-18D(148)					22
G-19(128)					17

* Elevation at which the hydraulic conductivity tests were performed.

TABLE 3

SUMMARY OF INDEX, COMPACTION AND HYDRAULIC CONDUCTIVITY TEST RESULTS

[Geotechnology Associates, Inc., 1999]

Parameter	Maximum	Minimum	Average	Number of Tests
Natural Moisture Content, w_n(%)	16	13	14	
Specific Gravity, G_s	2.83	2.7	2.76	
Liquid Limit, LL (%)	43	39	41	
Plasticity Index PI (%)	24	21	22	
Liquidity Index LI (%)	1.35	-0.34	-0.91	
Maximum Dry Density, γ_{dmax} (pcf)	119.4	113.7	115	8
Optimum Moisture Content, OMC (%)	16.3	13.6	14	8
Hydraulic Conductivity, k (cm/sec)	5.22×10^{-8}	4.37×10^{-8}	4.78×10^{-8}	9

TABLE 7
SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS

Phase II Report
Hawkins Point Plant Landfill
Baltimore, Maryland

Well	Date	1,1,1-Trichloroethane (µg/l)	1,1,2,2-Tetrachloroethane (µg/l)	1,1,2-Trichloroethane (µg/l)	1,1-Dichloroethane (µg/l)	1,1-Dichloroethene (µg/l)	1,2-Dichloroethane (µg/l)	1,2-Dichloropropane (µg/l)	2-Hexanone (µg/l)	4-Methyl-2-Pentanone (µg/l)	Acetone (µg/l)
NPDWR Standard:		**200**	**NA**	**5**	**NA**	**7**	**5**	**5**	**NA**	**NA**	**NA**
MDE GWS:		**200**	**0.053**	**5**	**90**	**7**	**5**	**5**	**NA**	**NA**	**550**
HPP-1	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (50)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
HPP-2	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (50)
	1/8/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
HPP-3	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (50)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)

Notes:

J - The constituent was detected and the associated numerical value is estimated.

µg/L - micrograms per liter

ND - non-detected

NA - not available

NDPWR - National Primary Drinking Water Regulations

MDE GWS - Maryland Department of the Environment Groundwater Standard

Bold - Detected concentration greater than MDL

TABLE 7
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Hawkins Point Plant Landfill
Baltimore, Maryland

Well	Date	1,1,1-Trichloroethane (µg/l)	1,1,2,2-Tetrachloroethane (µg/l)	1,1,2-Trichloroethane (µg/l)	1,1-Dichloroethane (µg/l)	1,1-Dichloroethene (µg/l)	1,2-Dichloroethane (µg/l)	1,2-Dichloropropane (µg/l)	2-Hexanone (µg/l)	4-Methyl-2-Pentanone (µg/l)	Acetone (µg/l)
NPDWR Standard:		**200**	**NA**	**5**	**NA**	**7**	**5**	**5**	**NA**	**NA**	**NA**
MDE GWS:		**200**	**0.053**	**5**	**90**	**7**	**5**	**5**	**NA**	**NA**	**550**
HPP-4	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (50)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/30/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/16/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
HPP-5	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (50)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/29/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (5.0)

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TABLE 7
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Baltimore, Maryland

Well	Date	Benzene (µg/l)	Bromodichloromethane (µg/l)	Bromoform (µg/l)	Bromomethane (µg/l)	Carbon Disulfide (µg/l)	Carbon Tetrachloride (µg/l)	Chlorobenzene (µg/l)	Chloroethane (µg/l)	Chloroform (µg/l)	Chloromethane (µg/l)
NPDWR Standard:		**5**	**NA**	**NA**	**NA**	**NA**	**5**	**100**	**NA**	**NA**	**NA**
MDE GWS:		**5**	**80**	**80**	**0.85**	**100**	**5**	**100**	**3.6**	**80**	**19**
HPP-1	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (10)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
HPP-2	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (10)
	1/8/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
HPP-3	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (10)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)

Notes:

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Hawkins Point Plant Landfill
Baltimore, Maryland

Well	Date	Benzene (µg/l)	Bromodichloromethane (µg/l)	Bromoform (µg/l)	Bromomethane (µg/l)	Carbon Disulfide (µg/l)	Carbon Tetrachloride (µg/l)	Chlorobenzene (µg/l)	Chloroethane (µg/l)	Chloroform (µg/l)	Chloromethane (µg/l)
NPDWR Standard:		**5**	**NA**	**NA**	**NA**	**NA**	**5**	**100**	**NA**	**NA**	**NA**
MDE GWS:		**5**	**80**	**80**	**0.85**	**100**	**5**	**100**	**3.6**	**80**	**19**
HPP-4	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (10)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/30/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/16/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
HPP-5	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (10)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (10)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/29/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (2.0)

Notes:

J - The constituent was detected and the associated numerical value is estimated.

µg/L - micrograms per liter

ND - non-detected

NA - not available

NDPWR - National Primary Drinking Water Regulations

MDE GWS - Maryland Department of the Environment Groundwater Standard

Bold - Detected concentration greater than MDL

TABLE 7
SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS

Phase II Report
Hawkins Point Plant Landfill
Baltimore, Maryland

Well	Date	cis-1,2-Dichloroethene (µg/l)	cis-1,3-Dichloropropene (µg/l)	Dibromochloromethane (µg/l)	Ethylbenzene (µg/l)	m,p-Xylene (µg/l)	Methylene Chloride (µg/l)	o-Xylene (µg/l)	Styrene (µg/l)	Toluene (µg/l)	Total Xylenes (µg/l)
NPDWR Standard:		**70**	**NA**	**NA**	**700**	**NA**	**NA**	**NA**	**NA**	**1,000**	**10,000**
MDE GWS:		**70**	**0.44**	**80**	**700**	**NA**	**NA**	**NA**	**100**	**1,000**	**10,000**
HPP-1	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
HPP-2	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/8/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
HPP-3	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)

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NPDWR Standard:		**70**	**NA**	**NA**	**700**	**NA**	**NA**	**NA**	**NA**	**1,000**	**10,000**
MDE GWS:		**70**	**0.44**	**80**	**700**	**NA**	**NA**	**NA**	**100**	**1,000**	**10,000**
HPP-4	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/30/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/16/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
HPP-5	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (10)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/29/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	**0.38 J**	**1.6 J**	ND (2.0)	**0.52 J**	ND (1.0)	**0.60 J**	**2.2 J**
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)

Notes:

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Bold - Detected concentration greater than MDL

TABLE 7
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Baltimore, Maryland

Well	Date	trans-1,2-Dichloroethene (µg/l)	trans-1,3-Dichloropropene (µg/l)	Trichloroethene (µg/l)	Vinyl Chloride (µg/l)
NPDWR Standard:		**100**	**NA**	**5**	**2**
	MDE GWS:	**100**	**0.44**	**5**	**2**
HPP-1	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/7/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (2.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
HPP-2	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/6/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (2.0)
	1/8/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
HPP-3	7/8/2014	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	ND (5.0)	ND (2.0)
	1/7/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)

Well	Date	trans-1,2-Dichloroethene (µg/l)	trans-1,3-Dichloropropene (µg/l)	trans-1,4-Dichloro-2-Butene (µg/l)	Trichloroethene (µg/l)	Vinyl acetate (µg/l)	Vinyl Chloride (µg/l)
NPDWR Standard:		**100**	**NA**		**5**		**2**
	MDE GWS:	**100**	**0.44**		**5**		**2**
HPP-4	7/8/2014	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	1/8/2015	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	-	ND (5.0)	-	ND (2.0)
	1/7/2016	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/28/2016	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	1/30/2017	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (1.0)
	1/16/2019	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
HPP-5	7/8/2014	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	1/7/2015	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/7/2015	ND (5.0)	ND (5.0)	-	ND (5.0)	-	ND (2.0)
	1/7/2016	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/29/2016	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	2/6/2017	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/18/2017	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	1/15/2018	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)
	7/18/2018	ND (1.0)	ND (1.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (1.0)
	1/15/2019	ND (1.0)	ND (1.0)	-	ND (1.0)	-	ND (2.0)

Notes:
J - The constituent was detected and the associated numerical value is estimated.
µg/L - micrograms per liter
ND - non-detected
NA - not available
NDPWR - National Primary Drinking Water Regulations
MDE GWS - Maryland Department of the Environment Groundwater Standard
Bold - Detected concentration greater than MDL

TABLE 8
SUMMARY OF METALS, GENERAL CHEMISTRY,
AND FIELD PARAMETERS

Phase II Report
Hawkins Point Plant Landfill
Baltimore, Maryland

Analyte	Units	Location	HPP-1	HPP-1	HPP-1	HPP-1	HPP-2
		Date	8/18/2017	1/15/2018	7/18/2018	1/15/2019	8/18/2017
		GWQC					
General Chemistry/Field Parameters							
Turbidity (Lab)	NTU		**0.26**	<0.20	**0.27**	**0.37**	<0.10
Nitrate as N	mg/L	10	<0.10	<0.10	**0.054**	<0.10	<0.10
Nitrite as N	mg/L	10	<0.10	<0.10	<0.012	<0.012	<0.10
Chemical Oxygen Demand	mg/L		<10	<10	<10	<10	<10
Alkalinity (total)	mg $CaCO_3$ /L		<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids	mg/L		**77**	**100**	**42**	**35**	**61**
Ammonia as N	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
Hardness (as $CaCO_3$)	mg/L		**40**	**11**	**24**	**8.9**	**30**
Specific Conductance (Field)	µmhos/cm		121	108	97	90	75
pH (Field)	pH units		4.40	4.26	4.00	4.29	4.10
Chloride	mg/L		**3.30**	**3.20**	**3.10**	**3.38**	**3.70**
Sulfate	mg/L		**32**	**27**	**28.5**	**24.9**	**10**
Metals (Total)							
Antimony	mg/L	0.006	<0.0020	<0.0020	<0.0010	<0.0010	<0.0020
Arsenic	mg/L	0.01	<0.0040	<0.0040	**0.0015**	<0.0010	<0.0040
Barium	mg/L	2	**0.013**	**0.014**	<0.020	<0.020	<0.010
Beryllium	mg/L	0.004	<0.0020	<0.0020	<0.0020	<0.020	<0.0020
Cadmium	mg/L	0.004	<0.00400	<0.00400	0.000379	0.000275	<0.00400
Calcium	mg/L		**3.30**	**2.90**	**2.60**	**2.30**	**0.67**
Chromium (III+VI)	mg/L	0.1	<0.010	<0.010	<0.020	<0.020	<0.010
Cobalt	mg/L	0.006	**0.011**	**0.011**	<0.020	<0.020	**0.011**
Copper	mg/L	1.3	<0.010	<0.010	<0.020	<0.020	<0.010
Iron	mg/L	1.4	**11**	**9.2**	**7.9**	**6.4**	**0.36**
Lead	mg/L	0.015	<0.0020	<0.0020	<0.0010	<0.0010	<0.0020
Magnesium	mg/L		**0.88**	**0.91**	**0.83**	**0.79**	**0.41**
Manganese	mg/L	0.043	**0.27**	**0.27**	**0.23**	**0.18**	**0.025**
Molybdenum	mg/L	0.01	<0.0160	<0.0160	**0.0057**	<0.0050	<0.0160
Mercury	mg/L	0.002	<0.00020	<0.00020	<0.00020	<0.00020	**0.000023 J**
Nickel	mg/L	0.073	**0.017**	**0.019**	<0.040	**<0.040**	**0.018**
Potassium	mg/L		**0.64**	**0.70**	**0.62**	**0.64**	**0.58**
Selenium	mg/L	0.05	<0.0120	<0.0120	<0.0050	<0.0050	<0.0120
Silver	mg/L	0.0094	<0.010	<0.010	<0.0040	<0.0040	<0.010
Sodium	mg/L		**2.10**	**2.20**	**2.10**	**1.90**	**2.0**
Thallium	mg/L	0.002	<0.0020	<0.0020	<0.0010	<0.0010	<0.0020
Vanadium	mg/L	8.6	<0.010	**0.012**	<0.020	<0.020	<0.010
Zinc	mg/L	5	**0.057**	**0.055**	**0.050**	**0.044**	**0.025**

Notes:
J - The constituent was detected and the associated numerical value is estimated.
U - The constituent was analyzed for, but was not detected at a level greater than or equal to the method detection limit (MDL).
mg/L - milligrams per liter
µS/cm - micro Siemens per centimeter
SU - standard units
mV - millivolts
NTU - Nephelometric Turbidity Units
Analytes not detected shown as < Reporting Limit
GWQC - Groundwater Quality Criteria is USEPA Maximum Contaminant Level, MDE Cleanup Standard, or USEPA Region III Tapwater RSL
Bold - Detected concentration greater than MDL
Bold and Shaded - Sample concentration detected greater than GWQC

TABLE 8
SUMMARY OF METALS, GENERAL CHEMISTRY,
AND FIELD PARAMETERS

Phase II Report
Hawkins Point Plant Landfill
Baltimore, Maryland

Analyte	Units	Location	HPP-2	HPP-2	HPP-2	HPP-3	HPP-3
		Date	1/15/2018	7/18/2018	1/15/2019	8/18/2017	1/15/2018
		GWQC					
General Chemistry/Field Parameters							
Turbidity (Lab)	NTU		<0.20	<0.20	<0.20	**1.5**	0.30
Nitrate as N	mg/L	10	<0.10	<0.050	<0.10	<0.10	<0.10
Nitrite as N	mg/L	10	<0.10	<0.012	<0.012	<0.10	<0.10
Chemical Oxygen Demand	mg/L		<10	<10	<10	<10	<10
Alkalinity (total)	mg $CaCO_3$ /L		<1.0	<1.0	<1.0A	**10**	<1.0
Total Dissolved Solids	mg/L		**55**	<10	**10**	**61**	**87**
Ammonia as N	mg/L		<0.10	<0.10	<0.10	**0.20**	<0.10
Hardness (as $CaCO_3$)	mg/L		**10**	**40**	**3.3**	**28**	**12**
Specific Conductance (Field)	µmhos/cm		87	62	69	96	113
pH (Field)	pH units		4.19	4.1	4.12	5.6	5.69
Chloride	mg/L		**3.40**	**3.57**	**3.55**	**3.50**	**3.30**
Sulfate	mg/L		**8.6**	**10.7**	**11**	**22**	**21**
Metals (Total)							
Antimony	mg/L	0.006	<0.0020	<0.0010	<0.0010	<0.0020	<0.0020
Arsenic	mg/L	0.01	<0.0040	<0.0010	<0.0010	**0.0075**	**0.0077**
Barium	mg/L	2	<0.010	<0.020	<0.020	**0.011**	**0.011**
Beryllium	mg/L	0.004	<0.0020	<0.020	<0.020	<0.0020	<0.0020
Cadmium	mg/L	0.004	<0.00400	<0.000250	<0.000250	<0.00400	<0.00400
Calcium	mg/L		**0.68**	**0.63**	**0.62**	**4.6**	**4.8**
Chromium (III+VI)	mg/L	0.1	<0.010	<0.020	<0.020	<0.010	<0.010
Cobalt	mg/L	0.006	**0.012**	<0.020	<0.020	<0.010	<0.010
Copper	mg/L	1.3	<0.010	<0.020	<0.020	<0.010	<0.010
Iron	mg/L	1.4	**0.73**	**0.39**	**0.25**	**13**	**14**
Lead	mg/L	0.015	<0.0020	<0.0010	<0.0010	<0.0020	<0.0020
Magnesium	mg/L		**0.44**	**0.42**	**0.42**	**0.60**	**0.71**
Manganese	mg/L	0.043	**0.028**	**0.026**	**0.026**	**0.17**	**0.26**
Molybdenum	mg/L	0.01	<0.0160	<0.0050	<0.0050	<0.0160	<0.0160
Mercury	mg/L	0.002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel	mg/L	0.073	**0.018**	<0.040	<0.040	<0.011	<0.011
Potassium	mg/L		**0.59**	**0.54**	**0.56**	**0.42**	**0.44**
Selenium	mg/L	0.05	<0.0120	<0.0050	<0.0050	<0.0120	<0.0120
Silver	mg/L	0.0094	<0.010	<0.0040	<0.0040	<0.010	<0.010
Sodium	mg/L		**2.1**	**2.1**	**1.9**	**2.5**	**2.7**
Thallium	mg/L	0.002	<0.0020	<0.0010	<0.0010	<0.0020	<0.0020
Vanadium	mg/L	8.6	<0.010	<0.020	<0.020	<0.010	<0.010
Zinc	mg/L	5	**0.025**	**0.023**	**0.023**	<0.010	<0.010

Notes:
J - The constituent was detected and the associated numerical value is estimated.
U - The constituent was analyzed for, but was not detected at a level greater than or equal to the method detection limit (MDL).
mg/L - milligrams per liter
µS/cm - micro Siemens per centimeter
SU - standard units
mV - millivolts
NTU - Nephelometric Turbidity Units
Analytes not detected shown as < Reporting Limit
GWQC - Groundwater Quality Criteria is USEPA Maximum Contaminant Level, MDE Cleanup Standard, or USEPA Region III Tapwater RSL
Bold - Detected concentration greater than MDL
Bold and Shaded - Sample concentration detected greater than GWQC

TABLE 8
SUMMARY OF METALS, GENERAL CHEMISTRY,
AND FIELD PARAMETERS

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Hawkins Point Plant Landfill
Baltimore, Maryland

Analyte	Units	Location	HPP-3	HPP-3	HPP-4	HPP-4	HPP-4
		Date	7/18/2018	1/15/2019	8/18/2017	1/15/2018	7/18/2018
		GWQC					
General Chemistry/Field Parameters							
Turbidity (Lab)	NTU		**1.1**	**19**	<0.10	<0.20	**0.21**
Nitrate as N	mg/L	10	**0.050**	<0.10	<0.10	<0.10	<0.050
Nitrite as N	mg/L	10	<0.012	<0.012	<0.10	<0.10	<0.012
Chemical Oxygen Demand	mg/L		<10	<10	<10	<10	<10
Alkalinity (total)	mg $CaCO_3$ /L		<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids	mg/L		<10	**28**	**35**	**54**	**15**
Ammonia as N	mg/L		0.25	0.19	**0.10**	<0.10	<0.10
Hardness (as $CaCO_3$)	mg/L		**34**	**13**	**24**	**10**	**10**
Specific Conductance (Field)	µmhos/cm		94	10.3	45	62	42
pH (Field)	pH units		5.80	5.58	4.50	4.5	4.20
Chloride	mg/L		**3.16**	**3.49**	**2.50**	**2.20**	**2.28**
Sulfate	mg/L		**23.3**	**25.5**	**7.9**	**7.8**	**8.08**
Metals (Total)							
Antimony	mg/L	0.006	<0.0010	<0.0010	<0.0020	<0.0020	<0.0010
Arsenic	mg/L	0.01	**0.0077**	**0.0102**	<0.0040	<0.0040	<0.0010
Barium	mg/L	2	<0.020	<0.020	**0.013**	**0.013**	<0.020
Beryllium	mg/L	0.004	<0.020	<0.020	<0.0020	<0.0020	<0.020
Cadmium	mg/L	0.004	<0.000250	<0.000250	<0.00400	<0.00400	<0.000250
Calcium	mg/L		**4.1**	**4.0**	**1.4**	**1.3**	**1.1**
Chromium (III+VI)	mg/L	0.1	<0.020	<0.020	<0.010	<0.010	<0.020
Cobalt	mg/L	0.006	<0.020	<0.020	**0.010**	<0.010	<0.020
Copper	mg/L	1.3	<0.020	<0.020	<0.010	<0.010	<0.020
Iron	mg/L	1.4	**14**	**15**	**0.23**	**0.19**	**0.15**
Lead	mg/L	0.015	<0.0010	<0.0010	<0.0020	<0.0020	<0.0010
Magnesium	mg/L		**0.65**	**0.71**	**0.38**	**0.40**	**0.38**
Manganese	mg/L	0.043	**0.24**	**0.26**	**0.027**	**0.027**	**0.024**
Molybdenum	mg/L	0.01	<0.0050	<0.0050	<0.0160	<0.0160	<0.0050
Mercury	mg/L	0.002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel	mg/L	0.073	<0.040	<0.040	**0.016**	**0.016**	<0.040
Potassium	mg/L		0.38	**0.41**	**0.55**	**0.57**	**0.52**
Selenium	mg/L	0.05	<0.0050	<0.0050	<0.0120	<0.0120	<0.0050
Silver	mg/L	0.0094	<0.0040	<0.0040	<0.010	<0.010	<0.0040
Sodium	mg/L		**2.6**	**2.4**	**1.3**	**1.4**	**1.4**
Thallium	mg/L	0.002	<0.0010	<0.0010	<0.0020	<0.0020	<0.0010
Vanadium	mg/L	8.6	<0.020	<0.020	<0.010	<0.010	<0.020
Zinc	mg/L	5	<0.020	<0.020	**0.020**	**0.022**	**0.020**

Notes:
J - The constituent was detected and the associated numerical value is estimated.
U - The constituent was analyzed for, but was not detected at a level greater than or equal to the method detection limit (MDL).
mg/L - milligrams per liter
µS/cm - micro Siemens per centimeter
SU - standard units
mV - millivolts
NTU - Nephelometric Turbidity Units
Analytes not detected shown as < Reporting Limit
GWQC - Groundwater Quality Criteria is USEPA Maximum Contaminant Level, MDE Cleanup Standard, or USEPA Region III Tapwater RSL
Bold - Detected concentration greater than MDL
Bold and Shaded - Sample concentration detected greater than GWQC

TABLE 8
SUMMARY OF METALS, GENERAL CHEMISTRY,
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Phase II Report
Hawkins Point Plant Landfill
Baltimore, Maryland

Analyte	Units	Location	HPP-4	HPP-5	HPP-5	HPP-5	HPP-5
		Date	1/16/2019	8/18/2017	1/15/2018	7/18/2018	1/15/2019
		GWQC					
General Chemistry/Field Parameters							
Turbidity (Lab)	NTU		**0.30**	<0.10	<0.20	<0.20	<0.20
Nitrate as N	mg/L	10	<0.10	<0.10	<0.10	<0.050	<0.10
Nitrite as N	mg/L	10	<0.012	<0.10	<0.10	<0.012	<0.012
Chemical Oxyge	mg/L		<10	<10	<10	<10	<10
Alkalinity (total)	mg $CaCO_3$ /L		<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved	mg/L		**11**	**38**	**41**	**46**	**30**
Ammonia as N	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
Hardness (as Ca	mg/L		**4.2**	**30**	**8.0**	**10**	**2.8**
Specific Conduc	µmhos/cm		45	50	51	47	51
pH (Field)	pH units		4.35	4.2	4.28	4.1	4.16
Chloride	mg/L		**2.23**	**2.0**	**2.0**	**2.09**	**2.15**
Sulfate	mg/L		**8.15**	**7.5**	**7.7**	**7.91**	**8.09**
Metals (Total)							
Antimony	mg/L	0.006	<0.0010	<0.0020	<0.0020	<0.0010	<0.0010
Arsenic	mg/L	0.01	<0.0010	<0.0040	<0.0040	<0.0010	<0.0010
Barium	mg/L	2	<0.020	<0.010	<0.010	<0.020	<0.020
Beryllium	mg/L	0.004	<0.020	<0.0020	<0.0020	<0.020	<0.020
Cadmium	mg/L	0.004	<0.000250	<0.00400	<0.00400	<0.000250	<0.000250
Calcium	mg/L		**1.1**	**0.74**	**0.73**	**0.69**	**0.64**
Chromium (III+	mg/L	0.1	<0.020	<0.010	<0.010	<0.020	<0.020
Cobalt	mg/L	0.006	<0.020	<0.010	<0.010	<0.020	<0.020
Copper	mg/L	1.3	<0.020	<0.010	<0.010	<0.020	<0.020
Iron	mg/L	1.4	**0.13**	**0.069**	**0.066**	**0.068**	**0.059**
Lead	mg/L	0.015	<0.0010	<0.0020	<0.0020	<0.0010	<0.0010
Magnesium	mg/L		**0.37**	**0.27**	**0.30**	**0.29**	**0.30**
Manganese	mg/L	0.043	**0.024**	**0.016**	**0.017**	**0.016**	**0.015**
Molybdenum	mg/L	0.01	<0.0050	<0.0160	<0.0160	<0.0050	<0.0050
Mercury	mg/L	0.002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel	mg/L	0.073	<0.040	**0.011**	<0.011	<0.040	<0.040
Potassium	mg/L		**0.53**	**0.42**	**0.46**	**0.42**	**0.44**
Selenium	mg/L	0.05	<0.0050	<0.0120	<0.0120	<0.0050	<0.0050
Silver	mg/L	0.0094	<0.0040	<0.010	<0.010	<0.0040	<0.0040
Sodium	mg/L		**1.2**	**1.1**	**1.2**	**1.2**	**1.1**
Thallium	mg/L	0.002	<0.0010	<0.0020	<0.0020	<0.0010	<0.0010
Vanadium	mg/L	8.6	<0.020	<0.010	<0.010	<0.020	<0.020
Zinc	mg/L	5	**0.020**	**0.013**	**0.013**	<0.020	<0.020

Notes:
J - The constituent was detected and the associated numerical value is estimated.
U - The constituent was analyzed for, but was not detected at a level greater than or equal to the method detection limit (MDL).
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