HUMPHREY IMPOUNDMENT
CORRECTIVE MEASURES STUDY REPORT

AREA B: PARCEL B14
TRADEPOINT ATLANTIC
SPARROWS POINT, MARYLAND

Prepared For:

TRADEPOINT ATLANTIC
1600 Sparrows Point Boulevard
Sparrows Point, Maryland 21219

Prepared By:

ARM GROUP LLC
9175 Guilford Road
Suite 310
Columbia, Maryland 20146

ARM Project No. 20010214

Respectfully Submitted:

Joshua M. Barna, G.I.T.
Staff Geologist

QA Reviewed By:

T. Neil Peters, P.E.
Senior Vice President

Revision 0 – April 27, 2021

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONT.)

FIGURES

TABLES

APPENDICES

ELECTRONIC ATTACHMENTS

1.0 INTRODUCTION

ARM Group LLC (ARM), on behalf of Tradepoint Atlantic, has prepared this Corrective Measures Study (CMS) Report for a portion of the Tradepoint Atlantic property (formerly Sparrows Point Terminal, LLC) that has been designated as Area B: Parcel B14 (the Site). Parcel B14 is comprised of 60.3 acres of the approximately 3,100-acre former steel making facility (**Figure 1**). The majority of Parcel B14 is occupied by the Humphrey Impoundment, which is approximately 43 acres in size. The Site is bounded to the west by the Humphreys Creek Waste Water Treatment Plant (HCWWTP) and Emergency Detention Basin (within Parcel B24), to the north by the Billet Building (within Parcel B8) and the New Cold Mill Complex (NCMC; within Parcel A4), and to the east and south by the Tin Mill Canal (TMC; within Parcel B16). This document describes the findings of field activities that were proposed and implemented under the Pre-Design Investigation Work Plan (Revision 1 dated December 10, 2019) and Comment Response Letter (dated August 28, 2020). The proposed remedial activities presented in this CMS are based on these findings in addition to the findings and recommendations of the Phase II Investigation Report for Area B: Parcel B14 (Revision 0 dated March 27, 2018).

1.1. SITE DESCRIPTION AND HISTORY

From the late 1800s until 2012, the production and manufacturing of steel was conducted at Sparrows Point. Iron and steel production operations and processes at Sparrows Point included raw material handling, coke production, sinter production, iron production, steel production, and semi-finished and finished product preparation. In 1970, Sparrows Point was the largest steel facility in the United States, producing hot and cold rolled sheets, coated materials, pipes, plates, and rod and wire. The steel making operations at Sparrows Point ceased in fall 2012.

The majority of Parcel B14, as shown on **Figure 2**, is occupied by the Humphrey Impoundment, which is approximately 43 acres in size. As stated in the Description of Current Conditions (DCC) Report prepared by Rust Environment and Infrastructure, dated January 1998, the USEPA identified the Humphrey Impoundment as a potential concern due to the wastes which were historically managed within the impoundment, and potential environmental releases which could have occurred due to its construction (slag base and sides).

Between 1950 and 1970, Humphrey Creek existed as open water (the impoundment did not yet exist) and received wastewater from various steel processing areas including the Hot Strip Mill, Cold Sheet Mill, Tin Mill, and Rod & Wire Mill. Following construction of the TMC (ca. 1969), from 1970 to 1985 the Humphrey Impoundment was used as a dewatering area for on-site sludges and slurry materials generated from the Basic Oxygen Furnace (BOF) and various on-site water treatment plants. Materials that were dewatered within the impoundment included: BOF slurry; Blast Furnace G, H, J, K, and L thickener sludges; HCWWTP sludge; Sinter Plant slurry; Open Hearth (No.4) slurry; waste oil pit sludge and non-recoverable waste oil residue; and pre-limer

clarifier sludge. Since 1985, the impoundment was used for sludge/slurry dewatering in emergency scenarios only (i.e., when upsets had occurred in the on-site water treatment systems). The MDE was notified prior to these emergency uses. According to the DCC Report, all of the wastes that were placed inside the impoundment were determined to be non-hazardous.

The majority of the surface elevations within the Humphrey Impoundment range between approximately 4 and 10 feet above mean sea level (amsl). The Humphrey Impoundment has a sharply sloping berm that surrounds its perimeter, such that elevations at the Site range from 4 feet amsl within the impoundment up to approximately 32 feet amsl at the highest point of the berm. In most sections, the top of the berm surrounding the impoundment ranges between 12 and 14 feet amsl. Stormwater that falls in the impoundment is collected and accumulates in low-lying areas where it infiltrates into the ground. The portions of the Site with lower average elevations are primarily located in the eastern half of the parcel, and perched surface water currently covers a large portion of the eastern half of the impoundment. The impoundment is covered primarily with scrub vegetation and *Phragmites* reeds.

1.2. Regulatory Setting

This CMS has been prepared based on the results and recommendations of the Phase II Investigation Report, and in accordance with the following documents:

- Administrative Consent Order (ACO) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the MDE effective September 12, 2014; and
- Settlement Agreement and Covenant Not to Sue (SA) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the USEPA effective November 25, 2014.

An application to enter the full Tradepoint Atlantic property (3,100 acres) into the Maryland Department of the Environment Voluntary Cleanup Program (MDE-VCP) was submitted to the MDE and delivered on June 27, 2014. The property's current and anticipated future use is Tier 3 (Industrial), and plans for the property include demolition and redevelopment over the next several years. Parcel B14 is also part of the acreage that remains subject to the requirements of the Multimedia Consent Decree between Bethlehem Steel Corporation, the USEPA, and the MDE (effective October 8, 1997) as documented in correspondence received from the USEPA on September 12, 2014. The Humphrey Impoundment is included as a Special Study Area (SSA) under the Consent Order.

1.3. Corrective Measures Study Objectives

Based on the findings and recommendations of the Phase II Investigation Report (detailed in Section 2), and supplemented with the results of the Pre-Design Investigation Work Plan (detailed in Section 3), described herein, the objectives of the CMS are to:

- control human exposure to the constituents of potential concern (COPCs) remaining in residual sludges, sediments, soils, and groundwater,
- control further releases of COPCs to the groundwater to the extent practicable,
- remove NAPL to the extent practicable, and

ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors nor adjacent surface water.

To the extent practical and appropriate, the corrective measures will also be designed and implemented in a manner to facilitate potential future use of portions of the Site.

2.0 PHASE II SITE CHARACTERIZATION SUMMARY

A Phase II Investigation was conducted to characterize the nature and extent of contamination at the Site. During the Phase II Investigation, a total of eight groundwater samples and 69 soil samples were collected and analyzed to define the nature and extent of contamination in Parcel B14. The sampling and analysis plan for the parcel was developed to target specific features that were considered to represent a potential release of regulated substances and/or petroleum products to the environment. The results and recommendations from this investigation were presented in the Phase II Investigation Report for Area B: Parcel B14 (Revision 0, dated March 27, 2018), and the major findings and recommendations from that report are presented in the following subsections to provide some additional background and basis for the proposed closure.

2.1. SOIL

There were no soil Project Action Limit (PAL) exceedances for volatile organic compounds (VOCs), indicating that VOCs are not significant contaminants in soil at the Site. Exceedances of the PALs in soil within Parcel B14 were limited to four inorganics (arsenic, hexavalent chromium, lead, and manganese), one semi-volatile organic compound (SVOC) (benzo[a]pyrene), three PCB categories (Aroclor 1254, Aroclor 1260, and total PCBs), diesel range organics (DRO), and Oil & Grease. Arsenic exceeded its PAL in the largest proportion of the samples analyzed site-wide. Arsenic was detected in 97% of the soil samples analyzed for this constituent, with a maximum detection of 136 mg/kg. In comparison, lead, manganese, and hexavalent chromium exceeded their PALs in 18 samples (detected in 100% of samples), three samples (detected in 100% of samples), and one sample (detected in 7% of samples), respectively. The average lead concentrations in the surface, subsurface, and pooled (surface and subsurface) soils are below the USEPA's Regional Screening Level (RSL) of 800 mg/kg, indicating that no further action is needed with respect to lead. In addition, there were no locations where detections of lead exceeded 10,000 mg/kg, the designated threshold at which delineation would be required. Benzo[a]pyrene was the only SVOC detected above its PAL, with five PAL exceedances distributed between four boring locations. The maximum detection of benzo[a]pyrene in soil was 7.9 mg/kg. Five surface soil samples had PAL exceedances of PCBs with maximum detections of 3.4 mg/kg. There were no concentrations of total PCBs identified in Parcel B14 above the mandatory delineation criterion of 50 mg/kg, indicating that no further action is needed. Petroleum impacts, including a discussion of the analytical exceedance of the total petroleum hydrocarbons (TPH)/Oil & Grease PAL as well as borings with physical evidence of non-aqueous phase liquid (NAPL) in the soil cores, are further discussed in Section 2.3 below.

2.2. GROUNDWATER

Exceedances of the PALs in shallow groundwater at Parcel B14 consisted of six total/dissolved metals (chromium, hexavalent chromium, iron, lead, manganese, and vanadium), one VOC

(benzene), five SVOCs (1,1-biphenyl, 1,4-dioxane, benz[a]anthracene, naphthalene, and pentachlorophenol), DRO, gasoline range organics (GRO), and Oil & Grease. The aqueous metal exceedances were relatively limited at the Site, with only six constituents (chromium, hexavalent chromium, iron, lead, manganese, and vanadium) documented at four groundwater sample locations. Manganese was the only inorganic parameter with exceedances noted at multiple sample locations. Benzene was the only VOC detected above its applicable aqueous PAL, with a maximum detection of 653 ug/L reported in a sample collected from well TM04-PZM006, located at the south-central side of the impoundment. Among the five SVOCs that were detected above their PALs, two of these analytes had exceedances observed in more than one aqueous sample (benz[a]anthracene and naphthalene). The maximum observed concentration of naphthalene (405 ug/L) was detected at the same location with the maximum detection of benzene identified above.

DRO was detected above its PAL in six groundwater samples (all of the locations for which it was analyzed). Oil & Grease and GRO were each responsible for two PAL exceedances. The maximum detections of DRO, GRO, and Oil & Grease (2,770 ug/L, 1,450 ug/L, and 1,200 ug/L, respectively) were all identified at the same location (the south-central side of the impoundment) as the maximum benzene and naphthalene concentrations. This location was observed to have the most significant impacts among all of the aqueous sample locations, and conditions in the vicinity of this well may present a potential risk for future vapor intrusion. Each groundwater sample location was checked for the potential presence of NAPL using an oil-water interface probe prior to sampling. During these checks, NAPL was not detected in any of the perimeter groundwater monitoring wells surrounding Parcel B14. However, measurable NAPL has been documented in several of the temporary screening piezometers which were installed inside the impoundment throughout the parcel.

2.3. NAPL

A comprehensive NAPL investigation was completed for Parcel B14 within the berm surrounding the Humphrey Impoundment. A series of 23 temporary piezometers were installed in an extensive network across the Site for ongoing NAPL monitoring events. As depicted in the Phase II Investigation Report, NAPL has been observed to accumulate at several of the piezometer locations, and it is currently assumed that NAPL may be present across a significant portion of the impoundment.

A total of 23 historical monitoring wells are located along the berm which surrounds the Humphrey Impoundment, and NAPL was not detected at any of these locations. Based on the documented presence of NAPL in numerous piezometers located inside of the berm area and the absence of NAPL in groundwater monitoring wells located outside of the berm area, as well as the results of the Pre-Design Investigation, discussed below, NAPL is contained within the waste materials disposed of inside the impoundment area and is considered immobile, with potential migration laterally restricted by the presence of the constructed berm.

2.4. HUMAN HEALTH SCREENING LEVEL RISK ASSESSMENT

A human health screening level risk assessment (SLRA) was completed as part of the Phase II Investigation Report, and the results are summarized as follows:

- Groundwater is not used on the Tradepoint Atlantic property (and is not proposed to be utilized), therefore there is no potential for direct human exposure for Composite Worker to groundwater. Construction Worker risks will be evaluated in site-specific Response and Development Work Plans.

- NAPL was encountered in several soil borings and piezometers constructed within the impoundment materials. NAPL presence is not a quantifiable risk, however, future development will prevent Construction Worker exposure to potential NAPL impacts. Two parameters detected in groundwater (benzene at 653 ug/L and naphthalene at 405 ug/L) at one location exceeded the USEPA individual vapor intrusion (VI) screening levels for carcinogens. This sample location (TM04-PZM006, located along the southcentral edge of the impoundment) was also observed to have elevated TPH/Oil & Grease detections above the aqueous PALs. There were no exceedances of the individual VI criteria for non-carcinogens, or any other exceedances of the acceptable no further action levels. In particular, this location had a computed cumulative cancer risk of 1E-4. Further assessment or mitigation may be warranted to address the potential VI risk identified at this location if development in the immediate area of this location is proposed. The selection of appropriate response measures, based on the specific development plan for the parcel, should be addressed in a project-specific Response and Development Work Plan.

- The current Composite Worker could potentially be exposed through contact to surface soils at the Site, and future development of the Site could potentially lead to Composite Worker exposures to subsurface soils. The risk ratios indicated that the cumulative cancer risks for the Composite Worker scenario were equal to 1E-5 for both surface and subsurface soils (equal to the target benchmark), and that the non-cancer cumulative hazard index for Composite Worker exposures to surface or subsurface soils did not exceed the target benchmark of 1. Since the target cancer and non-cancer values were not exceeded, no additional action is required to address potential risks to a Composite Worker. The Site is suitable for occupancy and use by a Composite Worker without special land-use considerations or corrective measures.

2.5. REMEDIATION RECOMMENDATIONS

Based on the results of the site investigation activities and SLRA, the Site is suitable for use by Composite Workers in its current condition, and remedial action is not required to support occupancy and use of the parcel. NAPL was encountered in a number of soil borings and piezometers constructed within the impoundment materials. NAPL is not a quantifiable risk,

however, future development will prevent Construction Worker exposure to potential NAPL impacts. The following measures were recommended to address the identified site conditions and potential future land uses:

- Although the SLRA indicated acceptable conditions for Composite Workers for an industrial use scenario, the future use of the parcel should be restricted as follows, unless additional assessment of risk to other potential receptors is conducted as part of a Response and Development Work Plan:
    - Deed restriction for industrial Site use only; no portion of the Site should be used for commercial/recreational or residential purposes. A supplemental SLRA in a project-specific Response and Development Work Plan would be required prior to non-industrial use of any portion of the Site.
    - Deed restriction on groundwater use; no subsurface water or groundwater should be extracted from aquifers for any purpose.
- Although the SLRA did not indicate any unacceptable risks for future Composite Workers, institutional controls may need to be implemented for the protection of Construction Workers to ensure proper oversight and management of any future construction activity that includes disturbances of the existing soil and to ensure that specified Construction Worker limits are followed. These institutional controls will need to include a written notice to the MDE of any future soil disturbance activities, proper management and characterization of any material disturbed at the Site, and may require enhanced health and safety requirements for any excavations of substantial time periods. Construction Worker risks will be evaluated in site-specific Response and Development Work Plans.
- If an enclosed structure is proposed for construction in the vicinity of the south-central edge of the impoundment, further assessment or mitigation of the potential for human exposures via the vapor intrusion to indoor air pathway should be addressed in a Response and Development Work Plan.
- Based on the presence of NAPL within the soil cores and piezometers across the impoundment, the presence of the NAPL should be factored into any future planning for foundations, utilities, or other subsurface structures. In particular, appropriate protocols for the mitigation of potential product (NAPL) mobility and vapor migration should be addressed in a Response and Development Work Plan.
- Based on the results of the NAPL investigation, continued monitoring and/or appropriate response actions should be conducted as part of any remediation or redevelopment activities. The absence of NAPL in the perimeter groundwater monitoring wells

surrounding the impoundment suggests that the NAPL is contained within the berm structure.

- During the field investigation, an area of oil-stained ground was observed within the impoundment. Capping of the Site will remediate this visual evidence of contamination.

- Based on the historical use of the Humphrey Impoundment as a disposal area for non-hazardous sludges and slurries from the various on-site water treatment plants, the impoundment is recommended to be addressed as a single comprehensive unit. Although the SLRA did not indicate any unacceptable risks for future Composite Workers, the documented presence of NAPL below a significant portion of the Site is representative of its past use as a waste placement area, and redevelopment of the Site should include the construction of a cap or cover system, along with properly addressing the NAPL. As shown on **Figure 3**, the westernmost portion of the Site is anticipated to abut to the eastern berm of a Best Management Practice stormwater pond. The remainder of the Site is likely to be developed as a vehicle parking lot or material lay-down area in the future under a separate Response and Development Work Plan. The entirety of Parcel B14 will be capped.

3.0 PRE-DESIGN INVESTIGATION SUMMARY

A Pre-Design Investigation (PDI) was conducted to further characterize the nature and extent of NAPL contamination at the Site. During the investigation, shallow piezometers were installed and gauged, permeability tests were completed, NAPL transmissivity tests were performed, and NAPL was sampled and analyzed for density and viscosity, as described in the Pre-Design Investigation Work Plan (Revision 1 dated December 10, 2019) and subsequent Comment Response Letter (dated August 28, 2020). In addition, methane concentrations in the wells were measured.

3.1. SOIL, GROUNDWATER, AND GEOTECHNICAL INVESTIGATION

As proposed in the Pre-Design Investigation Work Plan (Revision 1 dated December 10, 2019), geotechnical soil borings were completed at 11 locations, as shown on **Figure 2**. The results of this analysis are included as **Appendix A**. Overall, the geotechnical soil boring results show high particle size distribution variability between different boring locations, with grain size generally decreasing towards the center of the impoundment. B14-003-PDI and B14-006-PDI are among locations with the highest percentage of fine-grained particles, and the sample at B14-004-PDI has more fine-grained particles than the sample at B14-005-PDI. These results will be used in the geotechnical embankment assessment, which will evaluate the integrity and structural stability of the perimeter embankment and which is further discussed in Section 7.2. **Figure 2** also shows the location of the previous geotechnical borings completed by Hillis-Carnes, for which the results can be found in Appendix D of the Work Plan, which is included as an electronic attachment. In addition, PDI soil borings and piezometers, shown on **Figure 2**, were completed to further characterize contamination within the impoundment and provide locations for permeability and transmissivity testing. Soil boring and piezometer construction logs are included as **Appendix B**. Subsurface cross sections incorporating the additional borings are provided as **Figure 4** to **Figure 9**.

3.2. PERMEABILITY TESTING

Permeability testing was completed at three locations in order to determine local hydraulic conductivity values within the Humphrey Impoundment. The Pre-Design Investigation Work Plan Comment Response Letter (dated August 28, 2020) specified testing at locations B14-002-PDI, B14-003-PDI, and B14-006-PDI; however, due to the presence of NAPL at B14-006-PDI, permeability testing was conducted at B14-013-PZ instead.

An In-Situ sonde with vented cable was used to record water displacement in the wells. A 5-foot sealed PVC tube "slug" was submerged in the well, water level was allowed to equilibrate, and then the slug was removed. Water depth measurements were recorded at 1-second intervals during both the "slug-in" and "slug-out" response. Based on the measured displacement from static-water level, the software program AquiferWin32 was used to calculate hydraulic conductivity values

using the Bouwer & Rice method. Early stage and late stage displacement values were excluded from the calculation. Two slug tests were completed at B14-013-PZ due to the rapid response, however both slug-in tests were not evaluated due to early stage noise. The permeability test results are summarized in **Table 1** and AquiferWin32 calculations are included as electronic attachments. Overall, the permeability test results show that hydraulic conductivity values at B14-013-PZ are nearly two orders of magnitude greater than at B14-002-PDI, B14-003-PDI. This suggests significantly variable permeability within the impoundment, with at least one area exhibiting relatively high local permeability values comparable to clean unconsolidated medium-sized sand. Given the relatively high hydraulic conductivity values measured at B14-013-PZ, no NAPL has been observed at the location despite its proximity to B14-006-PDI, located only 40 feet away. This suggests that hydraulic conductivity is not sufficiently high enough to overcome NAPL viscosity in this area. These hydraulic conditions will allow for effective dewatering to facilitate fill placement and compaction in dry conditions with conventional earthwork equipment.

3.3. NAPL MONITORING

The Pre-Design Investigation Work Plan Comment Response Letter (dated August 28, 2020) specified NAPL bail-down transmissivity testing at locations B14-008-PZ, B14-011-PZ, and B14-013-PZ. Following installation and development of 2-inch diameter wells, B14-006-PDI, B14-008R-PZ, B14-011R-PZ, B14-013R-PZ, and B14-038R-PZ and were gauged to determine the rate of NAPL flow into each of the wells. A summary of these NAPL gauging results is provided in **Table 2**. Subsurface NAPL observations are also shown on the cross sections provided as **Figure 4** to **Figure 9**.

No measurable NAPL thickness was detected at B14-008R-PZ, trace NAPL was reported at B14-011R-PZ, and significantly less NAPL thickness was measured at B14-013R-PZ and B14-038R-PZ than in the co-located 1-inch piezometers used to identify these reinstallation points in the Pre-Design Investigation Work Plan (Revision 1, dated December 10, 2019). The maximum accumulated product thicknesses at these locations can be found in Appendix C of the referenced Work Plan, which is included as an electronic attachment. Due to the insufficient amount of NAPL accumulating in each of the proposed wells, gauging for the NAPL transmissivity calculation was conducted at B14-038R-PZ instead, and is described in the following section.

On November 11, 2020, a down-hole camera was used to determine the location of the air-NAPL interface in relation to the screened intervals of wells B14-011R-PZ, B14-013R-PZ, and B14-006-PDI. This visual inspection found that the well screen was above the air-NAPL interface at B14-006-PDI but below the air-NAPL interface at B14-011R-PZ and B14-013R-PZ. The submerged screens at these two locations suggest that potential NAPL in these areas may exist in the subsurface but may have limited mobility to flow into the wells. Additionally, both B14-011R-PZ and B14-013R-PZ were redeveloped on November 11, 2020 in an attempt to increase well connectivity. The results of these redevelopment activities are recorded on **Table 2**.

Because the screened intervals of B14-011R-PZ and B14-013R-PZ were below the air-NAPL interface or air-water interface, additional temporary 2-inch piezometers were installed at these locations from 0.5-foot bgs to 5.5-foot bgs. The gauging of these piezometers is also included in **Table 2**, which shows that no NAPL has been detected at this interval at either location. This suggests that there is no mobile NAPL at the air-water interface that would not have been identified by the piezometers that were screened at 5-20 feet bgs. Subsurface heterogeneity potentially explains the variability observed at these locations with respect to NAPL detection.

3.4. NAPL TRANSMISSIVITY

NAPL transmissivity (Tn) was calculated based on the measurement of NAPL flow into well B14-038R-PZ following development. As noted above, the amount of NAPL that accumulated in the other proposed wells was insufficient for NAPL transmissivity calculations due to the slow NAPL recovery rate. Transmissivity was estimated using the manual skimming method developed by the Applied NAPL Science Review (ANSR). NAPL transmissivity at B14-038R-PZ was calculated to be 0.0015 ft^2/day. The full calculation is included as **Appendix C**.

The results of the transmissivity testing were compared to guidance from Interstate Technology & Regulatory Council (ITRC) from December 2009 titled Evaluating LNAPL Remedial Technologies for Achieving Project Goals (ITRC, 2009). As stated in the guidance, "Beckett and Lundegard (1997) proposed that appreciable quantities of NAPL cannot be recovered and that there is little migration risk associated with a well with an NAPL transmissivity of 0.015 ft^2/day." The guidance further indicates that "hydraulic or pneumatic recovery systems can practically reduce Tn to values between 0.1 and 0.8 ft^2/day" and that "lower Tn values can potentially be achieved, but technologies other than hydraulic and pneumatic recovery technologies typically need to be employed to recover additional NAPL. Further lowering of Tn is difficult and can be inefficient; that is, it can take very long to marginally reduce Tn without much benefit in terms of reduction of NAPL mass, migration potential, risk, or longevity". The guidance indicates that sites exhibiting NAPL transmissivity values in the range of 0.1 to 0.8 ft^2/day have been closed or granted no further remedial action based upon the impracticality of NAPL recoverability (irrespective of in-well NAPL thickness) remaining.

The results of the transmissivity testing at B14-038R-PZ, and the insufficient accumulation of NAPL in the other proposed test wells, indicate that NAPL transmissivity is two orders of magnitude below the values considered recoverable and mobile. Therefore, significant removal of NAPL from the Humphrey Impoundment has been determined to be technically impracticable.

3.5. METHANE INVESTIGATION

Based on the observation of NAPL bubbling shown on the down-hole camera, a GEM 2000 with adapter was used to identify the presence of methane in several of the wells on November 12, 2020, January 13, 2021, January 14, 2021, and January 18, 2021. **Table 3** provides a summary of

the observed methane concentrations, which are also shown on **Figure 10**. Methane concentrations at four locations (B14-006-PZ, B14-008-PZ, B14-013-PZ, and B14-038-PZ) exceeded the lower explosive limit (LEL) of 5%. Therefore, the final remedy should address methane generation and migration to prevent accumulation of potentially flammable concentrations and volumes.

3.6. NAPL SAMPLING

There was not enough NAPL thickness to attempt sampling at any of the new wells except B14-038R-PZ. On November 11, 2020, a peristaltic pump and bailer were used in order to remove the 8 ounces of NAPL required for analyzing viscosity, specific gravity, and density. However, only approximately 2 ounces were able to be recovered. These samples were refrigerated and more NAPL was subsequently collected via bailer on November 18, November 24, and December 3 until enough volume for analysis was collected. The results of this NAPL sampling are included as **Appendix D**. Overall, the NAPL density is 9% less than water, which suggests that the NAPL does not separate easily from water and that a NAPL-groundwater suspension may form during colder winter months. NAPL viscosity is 87.36 centipoises (cP), and is comparable to SAE-10 oil or olive oil at room temperature. Overall, this relatively high NAPL viscosity, coupled with low measured transmissivity, suggests observed NAPL is generally immobile.

4.0 IDENTIFICATION OF CORRECTIVE MEASURE ALTERNATIVES

4.1. GENERAL

Based on the results and conclusions of the site investigation activities and human health risk screening, this section presents a summary of the identification and evaluation of remedial alternatives for Parcel B14 in general accordance with USEPA guidance and based on communications with the USEPA and the MDE. In particular, this section presents the establishment of media cleanup objectives, the identification and initial screening of remedial alternatives for meeting the cleanup objectives, a detailed evaluation of the final remedial alternatives based on established evaluation criteria, and a recommendation of the most appropriate remedial alternative based on the evaluation criteria.

4.2. ESTABLISHMENT OF MEDIA CLEANUP OBJECTIVES

This section summarizes the cleanup objectives for the Humphrey Impoundment based on the results of the preceding investigations, applicable environmental cleanup regulations, and an evaluation of potential risks to human health and the environment. In general, the objectives for the impoundment are to mitigate potential risks to future Composite and Construction Workers associated with the identified of NAPL contamination, and to reduce the migration of contaminants. These objectives are further discussed as follows:

- Potential future direct contact risks to impacted materials should be mitigated through appropriate containment, treatment, and/or removal actions.
- Potential future inhalation and methane generation risks should be mitigated through appropriate containment, treatment, and/or removal actions.
- The selected remedy should prevent migration of subsurface NAPL.

4.3. IDENTIFICATION OF CORRECTIVE MEASURES ALTERNATIVES

This section presents the identification of corrective measure alternatives evaluated in this CMS Report. The corrective measure alternatives were developed based on the description of the current status, the media clean-up objectives, communications with the USEPA and the MDE, and professional experience with the identification of corrective measure alternatives, and consist of the following:

1. No Action Alternative (Alternative 1): This alternative does not include the implementation of any corrective measures, and essentially represents leaving the impoundment in its existing condition. This alternative does not address the media cleanup objectives, but is presented as a baseline condition for comparison purposes.

2. Filling and Capping (Alternative 2): This alternative has been developed to meet the media cleanup objectives, and generally involves the following major activities: filling of the impoundment with MDE approved material; capping of fill with an impermeable asphaltic cap to prevent direct contact exposure risks and limit precipitation infiltration that could affect NAPL mobility; and institutional controls to restrict future disturbance of the cap.

3. Alternative 3 – In-Situ Treatment: This alternative represents one of a number of potential in-situ treatment alternatives for the identified contamination. In particular, this alternative would involve the in-situ treatment of the contamination through the injection of specialized chemical reagents using direct push technology or injection wells for the stimulation of biological activity to degrade or destroy contaminants of concern. The goal of the treatment would be to reduce contaminant concentrations to the point that no additional engineering controls or long-term monitoring would be required. Treatability studies would be required to confirm the effectiveness of the treatment and to refine the application rates and methods.

4. Alternative 4 – Removal and Disposal: This alternative has been developed for comparative purposes, and would involve the excavation and off-site disposal of all contaminated soils and NAPLs, above and below the water table. Excavated materials would have to be dewatered, loaded and transported to an approved off-site disposal facility. Any regulated materials would be properly treated and disposed of at an approved waste facility. The excavated area would be backfilled with clean fill to facilitate the planned redevelopment.

5. Contingent Corrective Measures – NAPL Recovery: This contingent alternative can be utilized with all of the previously mentioned alternatives. If recoverable NAPL is identified in perimeter wells, then NAPL recovery may be initiated via existing monitoring wells or NAPL recovery trenches. However, as discussed in Sections 3.4 and 3.6, testing has indicated that NAPL transmissivity is low (significantly below the values considered recoverable and mobile) and NAPL viscosity is high. Overall, this suggests observed NAPL is generally immobile.

4.4. Initial Screening of Remedial Alternatives

This section presents an initial screening of the identified remedial alternatives against the threshold criteria (i.e., protection of human health and the environment; attainment of media cleanup objectives; and controlling the sources). The screening is summarized as follows:

- Protection of Human Health and the Environment: Based on the SLRA conducted as part of the B14 Phase II Investigation, Alternative 1 (No Action) would be protective of human health. However, Alternatives 2 through 4 (In-Place Containment, In-Situ Treatment, and

Removal and Disposal) would provide further protection of human health and the environment, although Alternative 3 (In-Situ Treatment) and particularly Alternative 4 (Removal and Disposal) have the potential to increase short-term exposure risks through increased mobilization and waste treatment/handling. Subsurface NAPL within the Site poses an unquantifiable risk to the potential future Construction Worker. Since potential exposure to NAPL cannot be quantified, it was not included in the risk assessment. Therefore, all ground intrusive Construction Workers will be OSHA HAZWOPER certified to be protective against NAPL-related risks.

- Attainment of Media Cleanup Objectives: Alternative 1 (No Action) would not meet all of the established media cleanup objectives, while Alternatives 2 through 4 (In-Place Containment, In-Situ Treatment, and Removal and Disposal) would address all of the established media cleanup objectives.

- Controlling the Sources: Historic sources of contamination to the area have previously been eliminated through the decommissioning and removal of the previous steel production operations at the Site. Alternative 1 (No Action) would not provide any additional control of the existing contaminants, although Alternatives 2 through 4 (In-Place Containment, In-Situ Treatment, and Removal and Disposal) would provide varying levels of additional control with respect to the risks posed by the current site conditions.

Based on this initial screening, Alternative 1 (No Action) does not meet the threshold screening criteria, but Alternatives 2 through 4 (In-Place Containment, In-Situ Treatment, and Removal and Disposal) would meet the threshold criteria and will be retained for detailed evaluation in the following section of this report. Even though the No Action Alternative does not meet the threshold criteria, it has also been retained for detailed evaluation in the following section of this report to provide a baseline condition for comparison purposes.

4.5. DETAILED EVALUATION OF ALTERNATIVES

This section presents a detailed evaluation of the remedial alternatives that were identified and screened in the previous section. This detailed evaluation has been conducted with respect to the following evaluation/balancing criteria: long-term effectiveness; toxicity, mobility and volume reduction; short-term effectiveness; implementability; community acceptance; state acceptance; and cost. A summary of the detailed evaluation of alternatives is presented on **Table 4**.

4.5.1. Long-Term Effectiveness

This criterion refers to the expected effectiveness, reliability and risk of failure of the alternatives, including the effectiveness under analogous site conditions, the potential impact resulting from a failure of the alternative, and the projected useful life of the alternative.

- Alternative 1 – No Action: This alternative may not be effective in the long-term because of the continued potential for migration of and direct contact with contaminants. This alternative does not eliminate stormwater infiltration and possible NAPL mobilization caused by infiltration.

- Alternative 2 – Filling and Capping: This alternative provides long-term effectiveness through the containment of contaminated sediments, the placement of an erosion-resistant and stable cap, the removal of methane to the extent practicable, the implementation of perimeter groundwater monitoring, and long-term inspection and maintenance requirements (institutional controls). This alternative eliminates stormwater infiltration and possible NAPL mobilization caused by infiltration.

- Alternative 3 – In-Situ Treatment: The long-term effectiveness of this alternative is currently unknown and would have to be estimated from treatability studies and possibly additional sampling if this alternative is chosen. The treatment measures have the potential to increase contaminant mobility in the long-term because of the required disturbance and chemical changes.

- Alternative 4 – Removal and Disposal: This alternative provides long-term effectiveness through the removal and secure disposal of contaminated materials.

4.5.2. Reduction in Toxicity, Mobility, or Volume of Wastes

This criterion generally refers to how much the remedial alternatives will reduce the waste toxicity, mobility and/or volume, primarily through treatment.

- Alternative 1 – No Action: This alternative does not provide any reduction in the toxicity, mobility or volume of the contaminated materials.

- Alternative 2 – Filling and Capping: This alternative does not provide any reduction in toxicity or volume. The low permeability cap will help reduce long-term potential contaminant mobility by reducing infiltration through the unsaturated zone, preventing migration along utility corridors, and preventing the generation of dust. During filling, increased loading has the potential to increase NAPL mobility, however, as described above, observed low NAPL transmissivity suggests limited risk to mobilization. Additionally, perimeter monitoring will be conducted to ensure NAPL is not migrating off-site.

- Alternative 3 – In-Situ Treatment: This alternative has the potential to provide significant reduction in contaminant toxicity, mobility, and volume through treatment, but, if chosen, would need to be confirmed through treatability studies, and in-situ treatment has the potential to increase contaminant mobility.

- Alternative 4 – Removal and Disposal: This alternative may involve some reduction in toxicity, mobility, and volume if materials are determined to require pre-treatment prior to disposal at an approved off-site facility. Otherwise, there is no reduction in toxicity, mobility, or volume; a large volume of waste is just relocated. The significant site disturbance associated with this alternative could increase contaminant mobility in the short term.

4.5.3. Short-Term Effectiveness

This criterion generally refers to potential short-term risks to on-site workers and the community in association with implementation of the remedial alternatives, such as might be associated with the excavation, handling, treatment, containment, and transportation of contaminated materials.

- Alternative 1 – No Action: Because this alternative does not involve any actions, it does not present any increased short-term exposure risks, or any short-term benefits.
- Alternative 2 – Filling and Capping: This alternative presents a slightly increased risk of short-term direct contact exposures to the contaminated sediments in association with filling the impoundment, but these risks can be controlled through the implementation of conventional best management practices for waste handling, dust control, and worker health and safety. The benefits of this alternative will be realized immediately following alternative implementation.
- Alternative 3 – In-Situ Treatment: This alternative would be expected to increase short-term exposure risks through the intrusive disturbance of contaminated materials and the handling of reactive chemicals.
- Alternative 4 – Removal and Disposal: This alternative is expected to significantly increase short-term risks to on-site workers and the community because of the exposure, handling and transportation of a large volume of waste.

4.5.4. Implementability

This criterion refers to the relative ease of alternative implementation (construction), including duration, administrative and technical feasibility, and availability of the required services and materials.

- Alternative 1 – No Action: Implementation of this alternative is feasible.
- Alternative 2 – Filling and Capping: This alternative is readily implementable because it can be completed within a reasonable timeframe, the alternative can be conducted in a manner consistent with applicable permit requirements and regulations, the required technologies are feasible and well proven, and the required services and materials are readily available.

- Alternative 3 – In-Situ Treatment: This alternative presents implementation concerns because it requires specialized equipment and materials, and treatability studies would be required to confirm the technical feasibility. The large volume and the heterogeneity of the material make the effective distribution of reagents difficult to achieve and potentially impracticable.
- Alternative 4 – Removal and Disposal: This alternative presents significant implementation concerns because of potential short-term exposure risks, required air-emission and odor controls, the removal of materials from below the groundwater table, and the handling and transportation of a relatively large volume of waste materials.

4.5.5. Community Acceptance

This criterion refers to the known or anticipated community acceptance associated with the remedial alternatives.

- Alternative 1 – No Action: It is anticipated that this alternative will not be favorable to the community because it does not provide an increased level of long-term protection of human health and the environment.
- Alternative 2 – Filling and Capping: This alternative is expected to receive a higher level of community acceptance because it reduces risks and increases short- and long-term protection of human health and the environment.
- Alternative 3 – In-Situ Treatment: This alternative is potentially acceptable depending on the results of treatability studies and other supplemental studies which would be required if this alternative is chosen.
- Alternative 4 – Removal and Disposal: This alternative is potentially acceptable, but the transportation of large volumes of waste through any community is generally not favorable, and fugitive emissions and odors are expected to be a potential concern.

4.5.6. State Acceptance

This criterion refers to how the remedial alternatives will comply with applicable environmental regulations (e.g., permit requirements).

- Alternative 1 – No Action: This alternative does not require any new permits. However, this alternative is not expected to be acceptable because it does not meet the remedial action objectives.
- Alternative 2 – Filling and Capping: This alternative can be implemented in a manner consistent with applicable State permitting requirements, and is expected to be acceptable to the State because it addresses applicable requirements of the MDE-VCP.

- Alternative 3 – In-Situ Treatment: This alternative is potentially acceptable depending in the results of treatability and other supplemental studies.
- Alternative 4 – Removal and Disposal: This alternative is potentially acceptable, but the relocation of large volumes of wastes is generally not favorable.

4.5.7. Cost

This criterion addresses the anticipated short- and long-term costs associated with implementation of the remedial alternatives.

- Alternative 1 – No Action: This alternative does not have any cost.
- Alternative 2 – Filling and Capping: Based on the existing ground surface elevations across the impoundment, and as necessary to establish a cap that can freely drain surface water, the cover system construction is expected to require the placement and compaction of fill materials to thickness ranging between 2 feet (minimum) to approximately 10 feet, and a total volume of approximately 475,000 cubic yards. The cap design will also incorporate a vapor collection layer (approximately 4-inches of gravel) and appropriate vents (2-inch PVC) to allow for venting of generated methane. Implementation of this alternative is expected to cost approximately $6.7 million dollars for installation of an impermeable cap with a vapor collection layer, although long-term inspection and maintenance costs are expected to be relatively low as the cap can generally function on its own without any active management.
- Alternative 3 – In-Situ Treatment: The costs for this alternative would depend on the results of treatability studies and subsequent designs, but preliminary estimates based on an assumption that 30% of the site will require treatment (based on observed NAPL extents), vendor-supplied data and previous experience indicate an anticipated cost of at least $20 million. This does not include future regrading or site improvement activities.
- Alternative 4 – Removal and Disposal: The costs for this alternative would depend on the final volume of materials to be removed, the need for air-emission and other controls during excavation and handling, the amount of excavated material, and costs for off-site transportation, treatment and disposal. Assuming removal across the entire 43-acre impoundment area over an average depth interval of 30 ft (approximately 15 ft amsl to -15 ft amsl), with 70% of soils being unsuitable and requiring offsite disposal, 30% of materials being suitable for reuse, and backfill to the surrounding ground surface elevation (approximately 10 ft amsl), anticipated costs are likely to be over $100 million.

5.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURES ALTERNATIVE

Based on the detailed evaluation of corrective measure alternatives as presented in the following section, **Alternative 2 – Filling and Capping, is recommended for Parcel B14.** This alternative clearly satisfies the evaluation criteria better than the other potential alternatives, and is an appropriate and favorable corrective measure alternative for the Humphrey Impoundment. Supporting rational for selection of Alternative 2 – Filling and Capping is summarized below:

- it satisfies the threshold screening criteria;
- it best satisfies the detailed alternative evaluation criteria;
- it meets the media cleanup goals;
- it can be readily and quickly implemented with proven and reliable technologies;
- it improves the site conditions and drainage;
- it is consistent and compatible with the proposed site development plans;
- it is durable and provides for long-term protection of human health and the environment; and
- it can be conducted in accordance with applicable regulations.

5.1. DETAILED DESCRIPTION OF RECOMMENDED ALTERNATIVE

To provide a basis for the subsequent evaluation and comparison of alternatives, this section presents a detailed description of the Filling and Capping Alternative (i.e., Alternative 2). The major components of this alternative are as follows:

- Prior to beginning earthwork, existing vegetation (e.g., *Phragmites* and trees) within the limits of disturbance will be removed and segregated from the sediments to be excavated. Any existing abandoned utilities and fencing will be removed during the course of the work as necessary to provide for equipment operation and support the placement of fill within the impoundment. MDE approved reclamation material will be used where possible and when available.

- Following filling activities, an impermeable asphaltic cap will be installed to prevent future direct contact exposures, and to minimize surface water infiltration. The cap design will incorporate a vapor collection layer and appropriate vents to allow for venting of generated methane. A typical cross section of the impoundment with the methane venting system and asphaltic cap is shown on **Figure 11**. The venting system and cap specifications will be provided in detail in a forthcoming Response and Development Work Plan (RADWP).

- Institutional controls will be established as necessary to provide for the long-term protection of future site workers. These controls will be recorded with the deed(s) for this

portion of the property, and will include provisions for periodic inspections and maintenance of the engineered cap, as well as proper oversight and management of any future intrusive construction activities that would disturb sediments below the cap. These institutional controls will include a requirement for written notice to the MDE of any future intrusive activities, along with appropriate measures for worker health and safety, material management, and cap restoration.

- A monitoring well network will be installed as shown on **Figure 3**. A monitoring program that will consist of BTEX, naphthalene, and TPH/Oil & Grease sampling will be conducted quarterly during the construction phase and annually following completion. Long-term monitoring will ultimately be incorporated into the sitewide groundwater monitoring program.

5.2. CONTINGENT CORRECTIVE MEASURE – NAPL RECOVERY

This contingent alternative can be utilized with all of the previously mentioned alternatives. If recoverable NAPL is identified in perimeter wells, then NAPL recovery may be initiated via existing monitoring wells or NAPL recovery trenches. However, testing has indicated that observed NAPL is generally immobile and unrecoverable.

6.0 REFERENCES

ARM Group, Inc. (2018). *Phase II Investigation Report for Area B: Parcel B14.* Revision 0. March 27, 2018.

ARM Group, Inc. (2016). *Quality Assurance Project Plan: Sparrows Point Terminal Site*. Revision 3. April 5, 2016.

FIGURES

Tradepoint Atlantic
Area A and Area B Parcels

April 21, 2021

Figure
1

ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
Area A: Project 200101
Area B: Project 200102
Parcel B14: 20010214

Piezometer (NAPL)
Piezometer (Trace NAPL)
Piezometer (No NAPL)
Environmental Soil Boring (No NAPL)
Existing Well (No NAPL)
Geotechnical Soil Boring - SPT
Historical Geotechnical Soil Boring - CPT
Cross Section
Observed Surficial Oil Area (Approximate)
Parcel Boundary

Parcel A1
Parcel A4
Parcel B6
Parcel B8
Parcel B14
Parcel B24
Parcel B16
Parcel B15

B8-013-PZ
B8-016-PZ
B8-017-PZ
B8-018-PZ
B8-019-PZ
B8-020-PZ
18A
18B
18C
18D
20A
20B
20C
20D
20E
20F
20G
20H
20I
HI02-PZM006
HI04-PZM006
HI07-PZM005
B14-002-PDI
B14-002-PZ
B14-003-PDI
B14-003-SB
B14-004-PDI
B14-005-PDI
B14-006-PDI
B14-006-PZ
B14-007-PDI
B14-007-PZ
B14-008-PDI
B14-008-PZ
B14-009-PDI
B14-009-SB
B14-010-PDI
B14-010-PZ
B14-011-PDI
B14-011-PZ
B14-012-PZ
B14-013-PZ
B14-014-SB
B14-015-PZ
B14-016-SB
B14-017-PZ
B14-018-SB
B14-019-SB
B14-020-SB
B14-021-PZ
B14-022-PZ
B14-023-SB
B14-024-SB
B14-025-SB
B14-026-SB
B14-027-SB
B14-028-PZ
B14-029-SB
B14-030-SB
B14-031-SB
B14-032-SB
B14-033-SB
B14-034-PZ
B14-035-PZ
B14-036-PZ
B14-037-PZ
B14-038-PZ
B14-039-PZ
B14-040-PZ
B14-041-PZ
B14-042-PZ
B14-043-PZ
Boring 214
Boring 215
Boring 216
Boring 217
TM02-PZM009
TM04-PZM006
TM06-PZM008
TM08-PZM007
Well 2

A
A'
B
B'
C
C'
D
D'
E
E'
F
F'

Parcel B14 CMS Investigation Locations & Cross Sections

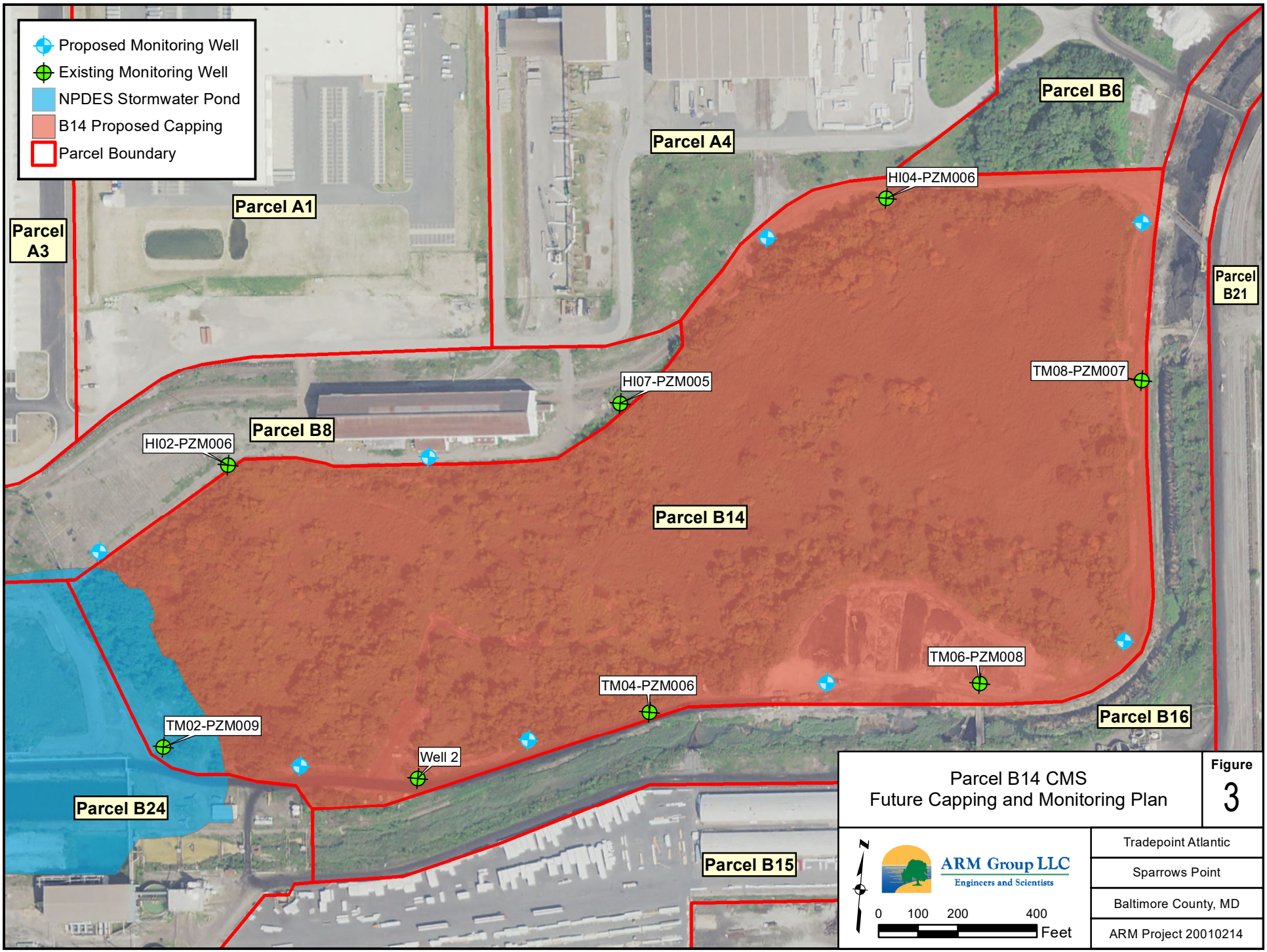
Figure 2

ARM Group LLC
Engineers and Scientists

0 100 200 400
Feet

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 20010214

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B14PDI (11x17).mxd


Proposed Monitoring Well
Existing Monitoring Well
NPDES Stormwater Pond
B14 Proposed Capping
Parcel Boundary
Parcel A1
Parcel A3
Parcel A4
Parcel B6
Parcel B21
Parcel B8
Parcel B14
Parcel B16
Parcel B15
Parcel B24
HI04-PZM006
HI07-PZM005
TM08-PZM007
HI02-PZM006
TM06-PZM008
TM04-PZM006
TM02-PZM009
Well 2
P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B14 PDI.mxd
Parcel B14 CMS
Future Capping and Monitoring Plan
Figure
3
ARM Group LLC
Engineers and Scientists
0 100 200 400
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 20010214

A (southwest)

A' (northeast)

B14-037-PZ

B14-011-PZ

B14-036-PZ

B14-022-PZ

HI07-PZM

B14-002-PZ

Original Creek Bottom Elevation

Elevation (feet)

20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40

0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

Figure 4

Geologic Cross section

Section A-A'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL In Well
- NAPL Sheen
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation

12-02-2020 \\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\180589M EAG B14 Humphrey Impoundment\Documents\Cross Sections\A-A' (short).cro

B (west)

B' (east)

TM02-PZM

B14-041-PZ

B14-038-PZ

TM04-PZM

TM06-PZM

B14-017-PZ

Tin Mill Canal

Original Creek Bottom Elevation

Elevation (feet)

20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40

0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

ARM Group LLC
Engineers and Scientists

Figure 5

Geologic Cross section

Section B-B'

LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL In Well
- NAPL Observed
- NAPL Sheen
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation
- Observed Surficial Oil Area

C (north)

C' (south)

B14-035-PZ

B14-006-PZ

TM08-PZM

B14-010-PZ

B14-017-PZ

Original Creek Bottom Elevation

Elevation (feet)

20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

ARM Group LLC
Engineers and Scientists

Figure 6

Geologic Cross section

Section C-C'

LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL In Well
- NAPL Sheen
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation

12-02-2020 \\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\180589M EAG B14 Humphrey Impoundment\Documents\Cross Sections\C-C' (short).cro

D (north)

D' (south)

HI07-PZM

B14-007-PZ

TM04-PZM

Original Creek
Bottom Elevation

Elevation (feet)

20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40

0
100
200
300
400
500
600
700
800
900
1000
1100

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

Figure 7

Geologic Cross section

Section D-D'

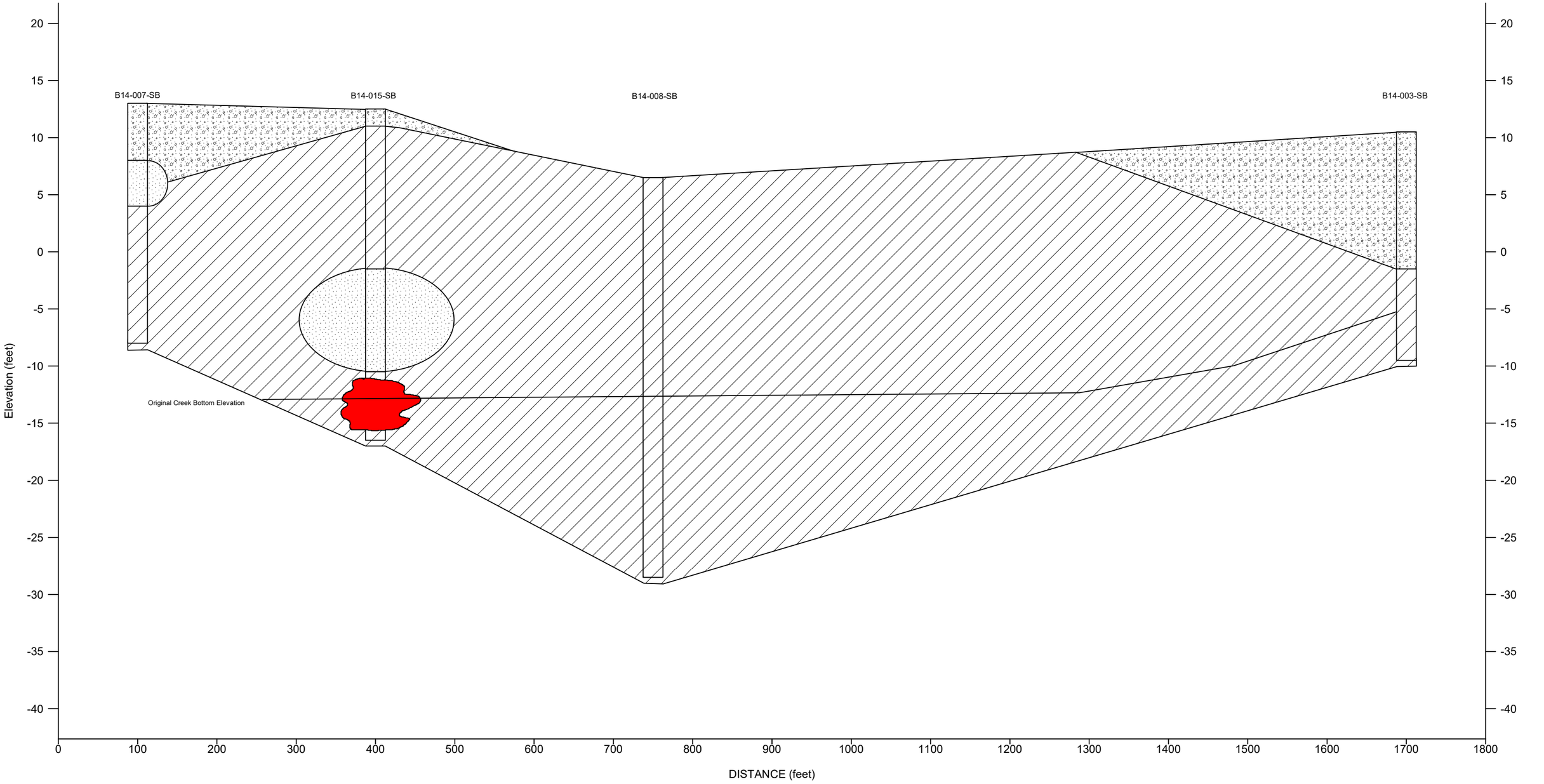
ARM Group LLC
Engineers and Scientists

LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL In Well
- Shallow Well Groundwater Elevation
- Inermediate Well Groundwater Elevation

E (southwest)

E' (northeast)



Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

ARM Group LLC
Engineers and Scientists

Figure 8

Geologic Cross section

Section E-E'

LEGEND

Slag

Sand

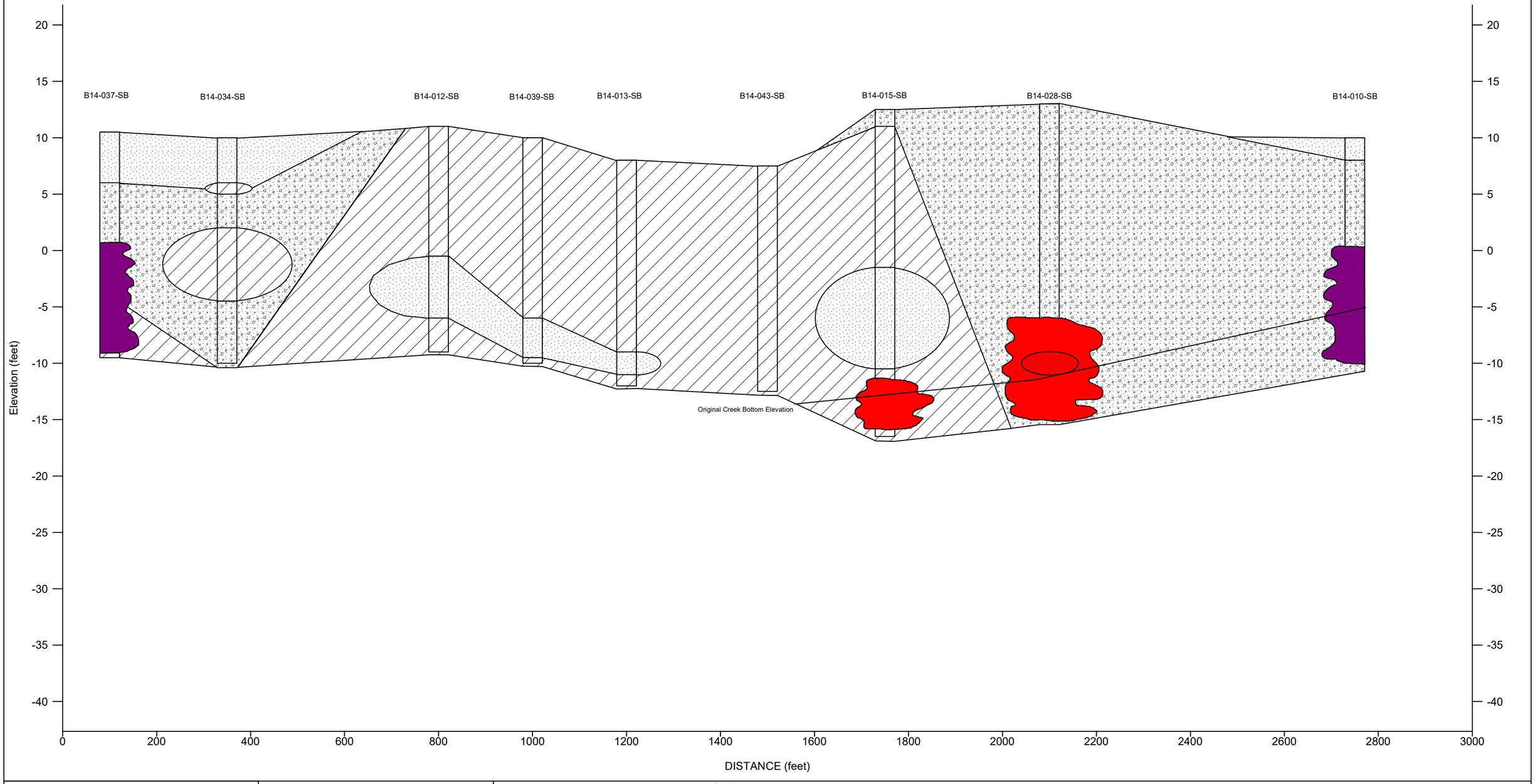
Silt/Clay

NAPL Observed

12-04-2020 \\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\180589M EAG B14 Humphrey Impoundment\Documents\Cross Sections\E-E'.cro

F (west)

F' (east)



Tradepoint Atlantic
Sparrows Point, MD
ARM Project 20010214

ARM Group LLC
Engineers and Scientists

Figure 9

Geologic Cross section

Section F-F'

LEGEND

Slag

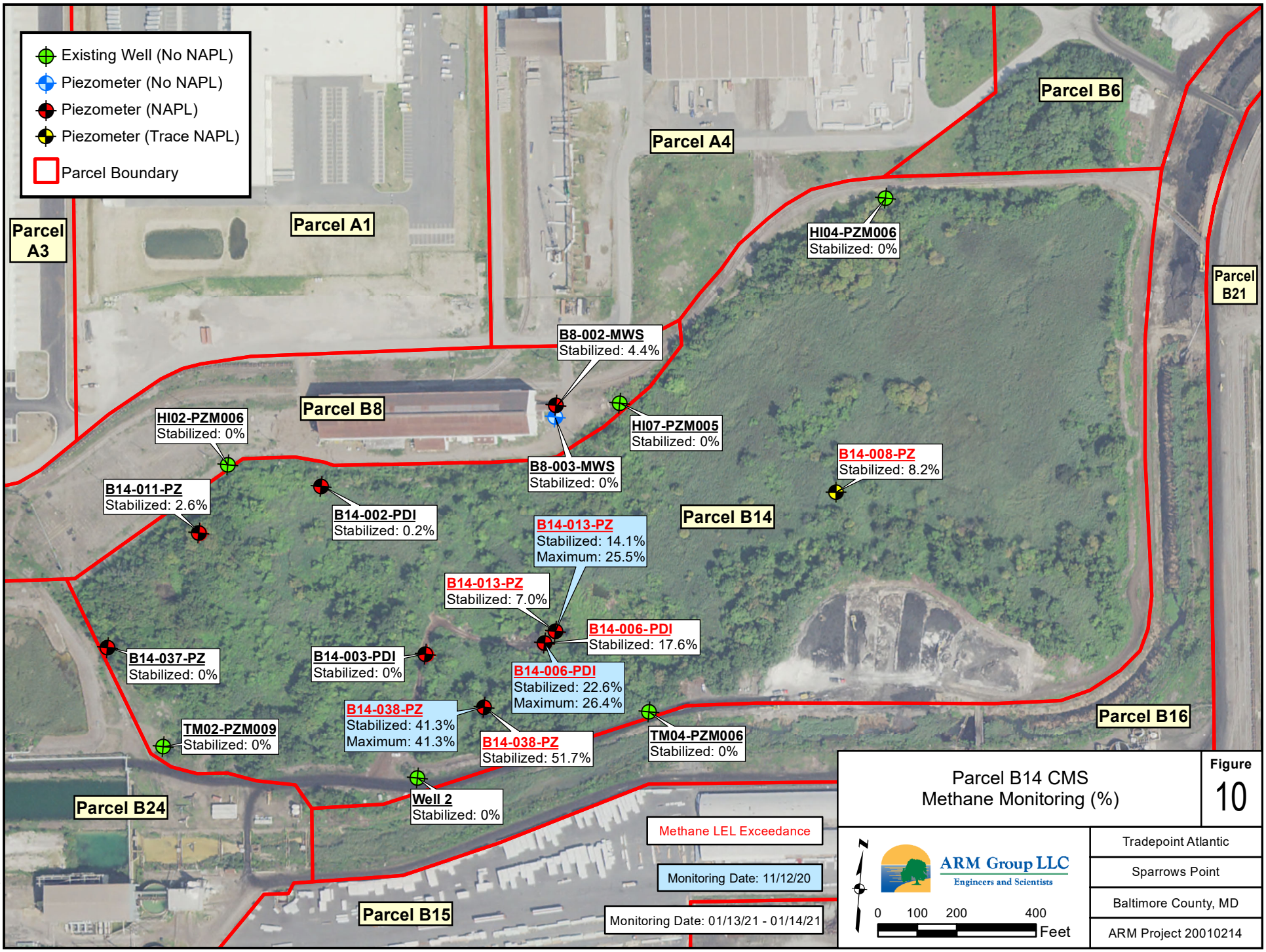
Sand

Silt/Clay

NAPL Observed

NAPL Sheen

12-04-2020 \\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\180589M EAG B14 Humphrey Impoundment\Documents\Cross Sections\F-F'.cro



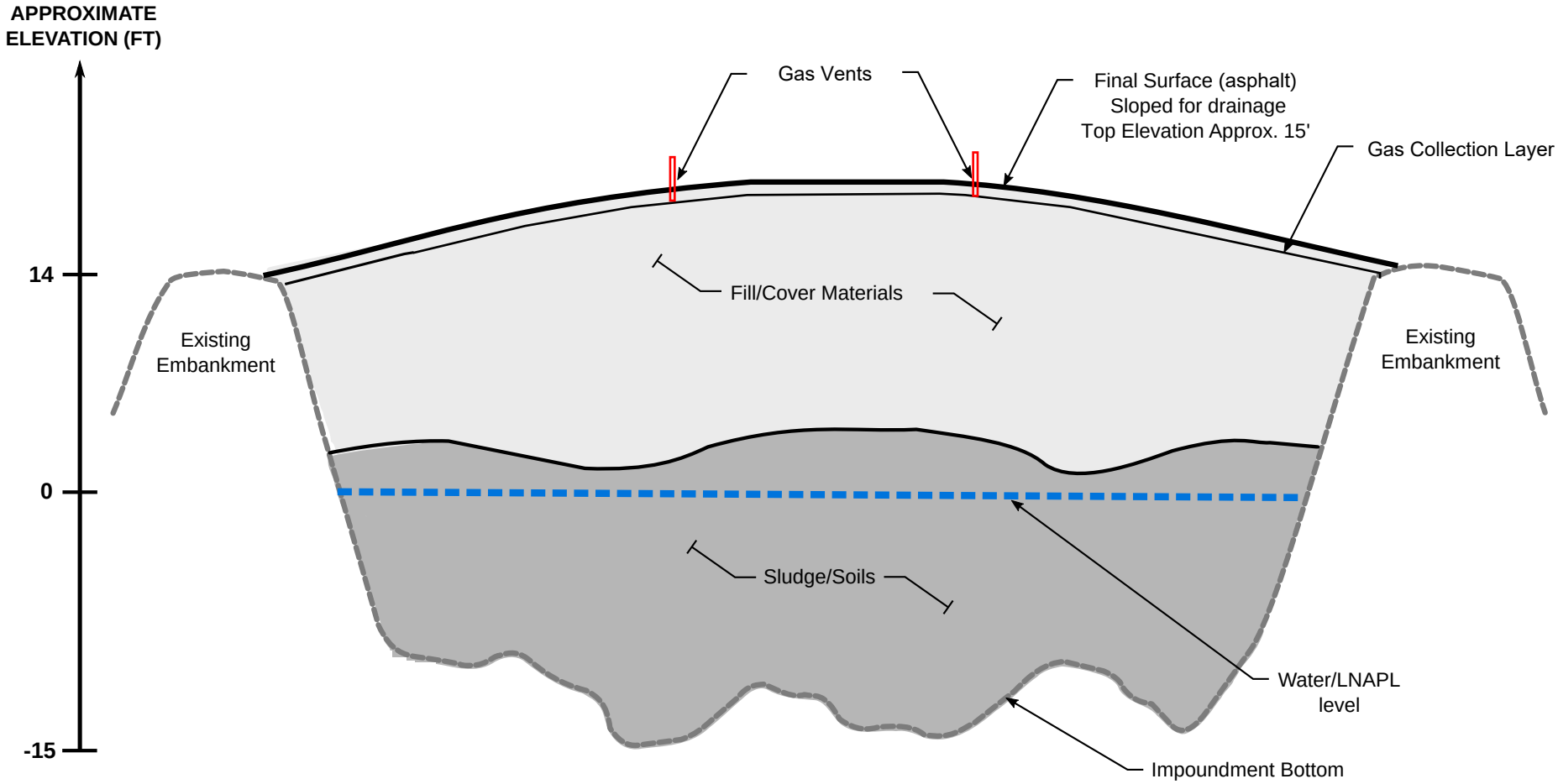
P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B14 PDI.mxd

Parcel B14 CMS
Methane Monitoring (%)

Figure
10

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 20010214



TYPICAL CROSS-SECTION THROUGH CLOSED IMPOUNDMENT

NOT TO SCALE

Parcel B14 - CMS Typical Cross-Section January 21, 2021	**Figure** 11
Tradepoint Atlantic	
Sparrows Point	
Baltimore County, MD	
ARM Project 20010214	

ARM Group LLC
Engineers and Scientists

TABLES

Table 1 - Permeability Test Data
Parcel B14 CMS

Location Name	Slug In/ Slug Out	K (ft/s)	K (ft/day)	K (cm/s)
B14-002-PDI	Slug In	2.9E-06	0.25	9.0E-05
	Slug Out	3.7E-06	0.32	1.1E-04
	Average	3.3E-06	0.28	1.0E-04
B14-003-PDI	Slug In	2.8E-06	0.24	8.5E-05
	Slug Out	3.0E-06	0.26	9.1E-05
	Average	2.9E-06	0.25	8.8E-05
B14-013-PZ	Slug Out 1	1.7E-04	15	5.3E-03
	Slug Out 2	2.9E-04	25	8.9E-03
	Average	2.3E-04	20	7.1E-03

K = Hydraulic Conductivity

Table 2 - NAPL Gauging Activities
Parcel B14 CMS

	B14-006-PDI			B14-008R-PZ			B14-011R-PZ			B14-013R-PZ			B14-038R-PZ			B14-011-PZ-5-ft			B14-013-PZ-5-ft		
	Installation Date: 9/17/2020			Installation Date: 9/17/2020			Installation Date: 9/14/2020			Installation Date: 9/15/2020			Installation Date: 9/14/2020			Installation Date: 11/2/2020			Installation Date: 11/2/2020		
	Total Well Depth (feet bgs) = 15			Total Well Depth (feet bgs) = 20			Total Well Depth (feet bgs) = 20			Total Well Depth (feet bgs) = 20			Total Well Depth (feet bgs) = 20			Total Well Depth (feet bgs) = 5.5			Total Well Depth (feet bgs) = 5.5		
	Screen Interval (feet bgs) = 3-15			Screen Interval (feet bgs) = 5-20			Screen Interval (feet bgs) = 5-20			Screen Interval (feet bgs) = 5-20			Screen Interval (feet bgs) = 5-20			Screen Interval (feet bgs) = 0.5-5.5			Screen Interval (feet bgs) = 0.5-5.5		
	Riser Stick-Up (feet) = 2.91			Riser Stick-Up (feet) = 2.61			Riser Stick-Up (feet) = 3.18			Riser Stick-Up (feet) = 2.76			Riser Stick-Up (feet) = 2.86			Riser Stick-Up (feet) = 2.97			Riser Stick-Up (feet) = 2.99		
Date	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)	Depth to NAPL (feet TOC)	Depth to Water (feet TOC)	NAPL Thickness (feet)
9/23/2020				NM	NM	NM	NM	NM	NM	-	7.49/7.54*	-	-	13.84/17.86*	-	NA	NA	NA	NA	NA	NA
9/24/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	7.52	-	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/25/2020	NM	NM	NM	-	3.88/3.90*	-	-	8.14/8.60*	-	-	7.59	-	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/28/2020	-	10.56	-	-	3.66	-	-	8.11	-	-	7.4	-	**12.75**	**12.76**	**0.01**	NA	NA	NA	NA	NA	NA
9/29/2020	**10.55**	**10.56**	**0.01**	-	3.69	-	-	8.14	-	-	7.41	-	**12.8**	**12.82**	**0.02**	NA	NA	NA	NA	NA	NA
10/1/2020	**trace**	**9.92**	**trace**	-	3.19	-	-	7.61	-	**trace**	**6.77**	**trace**	**12.96**	**13.15**	**0.19**	NA	NA	NA	NA	NA	NA
10/2/2020	**trace**	**9.96**	**trace**	-	3.21	-	-	7.59	-	**trace**	**6.82**	**trace**	**13.02**	**13.55**	**0.53**	NA	NA	NA	NA	NA	NA
10/5/2020	**10.24**	**10.41**	**0.17**	-	3.44	-	-	7.72	-	**trace**	**6.95**	**trace**	**13.05**	**13.68**	**0.63**	NA	NA	NA	NA	NA	NA
10/6/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**12.88**	**13.35**	**0.47**	NA	NA	NA	NA	NA	NA
10/7/2020	**trace**	**10.12**	**trace**	-	3.38	-	-	7.78	-	**7.02**	**7.05**	**0.03**	**12.68**	**13.2**	**0.52**	NA	NA	NA	NA	NA	NA
10/8/2020	**10.25**	**10.38**	**0.13**	-	3.45	-	-	7.83	-	**7.06**	**7.18**	**0.12**	**12.94**	**13.62**	**0.68**	NA	NA	NA	NA	NA	NA
10/20/2020	**10.05**	**10.48**	**0.43**	-	3.33	-	-	7.73	-	**7.03**	**7.18**	**0.15**	**12.8**	**13.45**	**0.65**	NA	NA	NA	NA	NA	NA
10/28/2020	NM	NM	NM	NM	NM	NM	**trace**	**7.84**	**trace**	**trace**	**7.55**	**trace**	NM	NM	NM	NA	NA	NA	NA	NA	NA
11/6/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	7.58	-	-	7.33	-
11/11/2020	NM	NM	NM	NM	NM	NM	-	7.31/16.65*	-	**6.52/-***	**6.65/6.71***	**0.13/-***	**12.15/NA^**	**12.50/12.57^**	**0.35/trace^**	NM	NM	NM	NM	NM	NM
11/16/2020	NM	NM	NM	-	2.67	-	-	6.31	-	**trace**	**6.09**	**trace**	**11.7**	**11.91**	**0.21**	-	6.46	-	-	6.46	-
11/18/2020	NM	NM	NM	-	2.72	-	-	6.48	-	**6.29**	**6.40**	**0.11**	**12.09**	**12.31**	**0.22**	-	6.63	-	-	7.02	-
11/24/2020	**9.83**	**9.84**	**0.01**	-	2.82	-	-	6.77	-	**NM/6.44^**	**NM/6.48^**	**NM/0.04^**	**12.00/Trace^**	**12.54/12.00^**	**0.54/Trace^**	-	6.88	-	-	7.12	-

NA = Not Applicable
NM = Not Measured
SHADED = NAPL Detection
bgs = below ground surface

*Pre-Development/Post-Development
^Pre-NAPL Removal/Post-NAPL Removal

Table 3 - Methane Monitoring
Parcel B14 CMS

Date: 11/12/2020
Time: 11:00-14:00
Personnel: LEP
Instrument: GEM 2000

Weather: Rain 50s-70s
Calibration: Manufacturer Calibration:
Field Calibration: Air

	Stabilized Readings					Maximum Readings			
Well Name	Methane (%)	CO_2 (%)	Oxygen (%)	Balance (%)	Elapsed Time (mins)	Methane (%)	CO_2 (%)	Oxygen (%)	Balance (%)
B14-013R-PZ	14.1	1.0	18.0	66.9	15	25.5	1.9	15.0	57.6
B14-006-PDI	22.6	3.6	13.6	60.0	15	26.4	4.8	11.8	57.0
B14-038R-PZ	41.3	12.5	0.9	45.3	10	*same as stabilized*			

NOTES:

ARM Group LLC

Table 3 - Methane Monitoring
Parcel B14 CMS

Date: 1/13/2021-1/14/21
1/18/2021
Personnel: Ryan Clancy
Instrument: GEM 2000

Weather: Sunny 40s-50s
Calibration: Manufacturer Calibration:
Field Calibration: Air

	Stabilized Readings					
Well Name	Methane (%)	CO_2 (%)	Oxygen (%)	Balance (%)	Elapsed Time (mins)	Notes
B14-002-PDI	0.2	0.3	21.5	78.0	15	Trace NAPL
B14-003-PDI	0.0	0.1	21.5	78.4	15	
B14-006-PDI	17.6	4.4	14.2	63.8	15	Trace NAPL
B14-008-PZ	8.2	0.3	19.9	71.6	5	Water at surface surrounding well pad. Bubbles visible in well water surface. Initial methane concentration of 47%.
B14-011-PZ	2.6	0.8	20.6	76.0	15	Initial methane concentration of 7.2%. Bubbling visible on endoscope.
B14-013-PZ	7.0	0.8	21.5	70.7	15	Trace NAPL
B14-037-PZ	0.0	0.3	20.9	78.8	5	Trace NAPL. Outside of impoundment. Light bubbling visible on endoscope.
B14-038-PZ	51.7	15.4	1.2	31.7	15	NAPL. Bubbling visible on endoscope.
B8-002-MWS	4.4	1.4	2.4	91.8	15	NAPL recovery well
B8-003-MWS	0.0	0.2	17.9	81.9	15	NAPL monitoring well, no NAPL
HI02-PZM006	0.0	0.2	20.4	79.4	10	
HI04-PZM006	0.0	2.0	18.2	79.8	15	Trace NAPL. Endoscope video shows screen fouling, possible bubbling.
HI07-PZM005	0.0	0.2	22.7	77.1	15	
TM02-PZM009	0.0	0.2	21.5	78.3	15	
TM04-PZM006	0.0	0.2	21.1	78.7	15	
Well 2	0.0	0.2	21.1	78.7	15	

ARM Group

Table 4 - Summary of Remedial Alternatives Evaluation
Parcel B14 CMS

	POTENTIAL REMEDIAL ALTERNATIVES			
CRITERIA	**Alternative 1** **No Action**	**Alternative 2** **Filling and Capping**	**Alternative 3** **In-Situ Remediation**	**Alternative 4** **Removal and Disposal**
Description	- No remedial actions taken.	- In-place containment of materials below an impermeable asphaltic cap. - Cap design will incorporate a vapor collection layer and appropriate vents to allow for venting of generated methane. - Property use restrictions and long-term monitoring and maintenance to ensure that controls remain effective.	- Injection of chemical reagent using direct push technology or injection wells -Two step process consisting of permeability reduction followed by chemical weathering and NAPL encapsulation.	- Excavate contaminated materials and transport to approved off-site disposal facility. - RCRA-hazardous materials would require treatment and/or disposal at an approved hazardous waste facility.
Long-Term Effectiveness	- Does not address all of the media cleanup objectives.	- Capping will provide for long-term control of direct contact exposures. - Sub-slab vapor barrier and venting system and utility backfill controls will prevent unacceptable inhalation risks. - Long-term monitoring will be conducted to ensure long-term effectiveness.	- Long-term effectiveness is unknown and would have to be estimated from treatability studies. - May increase contaminant mobility.	- Has the potential to be effective in the long-term.
Reduction of Toxicity, Mobility and Volume (TMV) by Treatment	- No reduction in TMV.	- No reduction in toxicity or volume, but may reduce mobility by reducing infiltration.	- Treatability studies required to confirm potential reduction in TMV. - In-situ chemical treatment has the potential to increase contaminant mobility.	- May involve some reduction of TMV through treatment, but primarly just relocates a relativey large volume of waste.
Short-Term Effectiveness	- No change to short term risks.	- Can be quickly implemented with minimal short-term exposure risks.	- May increase short-term exposure risks because of material exposure, handling, and treatment.	- Expected to significantly increase short-term exposure risks because of the exposure, handling, and transportation of a relatively large volume of waste.
Implementability	- Does not present any technical implementation concerns, but not expected to be administratively implementable because it does not address remedial objectives.	- Can be readily implemented with available and proven technologies.	- Requires specialized equipment and materials. - Treatability studies required to confirm technical implementability.	- Potential short-term exposure risks, air emission controls, excavation of materials from below the groundwater table, materials handling and transportation, and other factors present significant implementation concerns.
Community Acceptance	- Not anticipated to be favorable because it does not address remedial objectives.	- Expected to be acceptable because it meets remedial objectives without increasing exposure risks to the community.	- Potentially acceptable depending on results of treatability studies and supplemental studies.	- Transportation of large volumes of waste through any community is generally not favorable. - Fugutive chemical emissions and odors are a potential concern.
State Acceptance	- Not anticipated to be favorable because it does not address remedial objectives.	- Expected to be acceptable because it meets remedial objectives and evaluation criteria.	- Potentially acceptable depending on results of treatability studies and supplemental studies.	- Potentially acceptable, but the relocation of large volumes of waste is generally not favorable.
Estimated Cost	$0	$6.7 million	$20 million	$100 million
Conclusion	Does not meet cleanup objectives. **NOT RECOMMENDED**.	Cost-effectively meets cleanup objectives and evaluation criteria. **RECOMMENDED**.	Questionable effectiveness, implementation concerns, increased short-term exposure risks, and high cost. **NOT RECOMMENDED**.	Implementation concerns, increased short-term exposure risks, and extremely high cost. **NOT RECOMMENDED**.

Notes:
- Estimated costs are prelminary order-of-magnitde costs developed for comparison purposes and may not account for all required items and components.

APPENDIX A

JLT Laboratories, Inc.
Geotechnical, Geosynthetic and Materials Testing and Research

938 South Central Avenue
Canonsburg, Pennsylvania, 15317
Tel: 724-746-4441 Fax: 724-745-4261
e-mail: jboschuk@jltlabs.com
www.jltlabs.com

January 18, 2019
19LS3748.01

EnviroAnalytics Group
1600 Sparrows Point Blvd.
Suite B2
Sparrows Point, MD 21219

Attn: James Calenda

RE: GEOTECHNICAL TEST RESULTS
B14 PDI GEOTECH
ENVIROANALYTICS PO NO: EAG-SPT-8126

Dear Mr. Calenda:

Submitted herein are the results of Sieve & Atterberg Limits performed on eight (8) samples identified as 001 through 008 for the above referenced project. All testing was performed per ASTM Standards while subject to JLT's internal QA / QC data validation procedures.

We appreciate the opportunity of being of service to you and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JLT LABORATORIES, INC.

John Boschuk, Jr., P.E., C.F.E.
President

cc: Laura Sargent – AP
Stewart K – Results Only

Enclosures
JB\mlb
\MSWord\letter\1914
Inv# 7179

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

Split Spoon, Jar, and Other Samples

PAGE 1 of 1

CLIENT: EnviroAnalytics Group
JLT JOB No.: 1925 3748
DATE RECEIVED: 1-15-18

PROJECT ID: B14 PDI Geotech
DATE ASSIGNED: 1-15-18
DATE COMPLETED:

BORING AND SAMPLE I.D.	DEPTH (feet)	PHYSICAL PROPERTIES										PERMEABILITY (1)		ENGINEERING PROPERTIES (1)									
		M/C ☐ D2216	SIEVE ☐ D422	HYDRO ☐ D422	LIQUID LIMIT ☐ D4318	PLASTIC LIMIT ☐ D4318	SPEC GRAVTY ☐ D854 ☐ C127	ORG CONT ☐ D2974 ☐ D5268	pH ☐ 4972	CLASS. ☐ D2487 ☐ D2488 ☐ C127			PERM ☐ D5084	PERM ☐ D2434	CONSOL TEST ☐ D2435	DIRECT SHEAR ☐ D3080	UNCONF TEST ☐ D2166	UU TEST ☐ D2850	CIU TEST ☐ D4767	CIU w/pp TEST ☐ D4767					
B14-001-PDI	0-8		X			X																	
B14-002-PDI	5-8		X			X																	
B14-003-PDI	3-4		X			X																	
B14-004-PDI	6-8		X			X																	
B14-005-PDI	0-6		X			X																	
B14-006-PDI	3-4		X			X																	
B14-007-PDI	4-11		X			X																	
B14-008-PDI	2-12		X			X																	

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT. ALSO FAX COPY AS PRE-NOTIFICATION

SHIPPER: ARM Group Inc.
ADDRESS: 9175 Guilford Rd Suite 310
Columbia, MD 21046

CONTACT: Stewart Kabis
TEL: 410-290-7775 x2006 EMAIL: [redacted] skabis@armgroup.net

SHIP TO: JLT Laboratories Inc.
938 South Central Avenue
Canonsburg, PA 15317
Tel: (724) 746-4441
Fax: (724) 745-4261
e-mail: jboschuk@jltlabs.com or
e-mail: mboschuk@jltlabs.com

NOTES / INSTRUCTIONS Bill to: James Calenda
Enviroanalytics Group
1600 Sparrows Point Blvd
Sparrows Point, MD 21219

Relinquished By: St Kab Date: 1-14-18

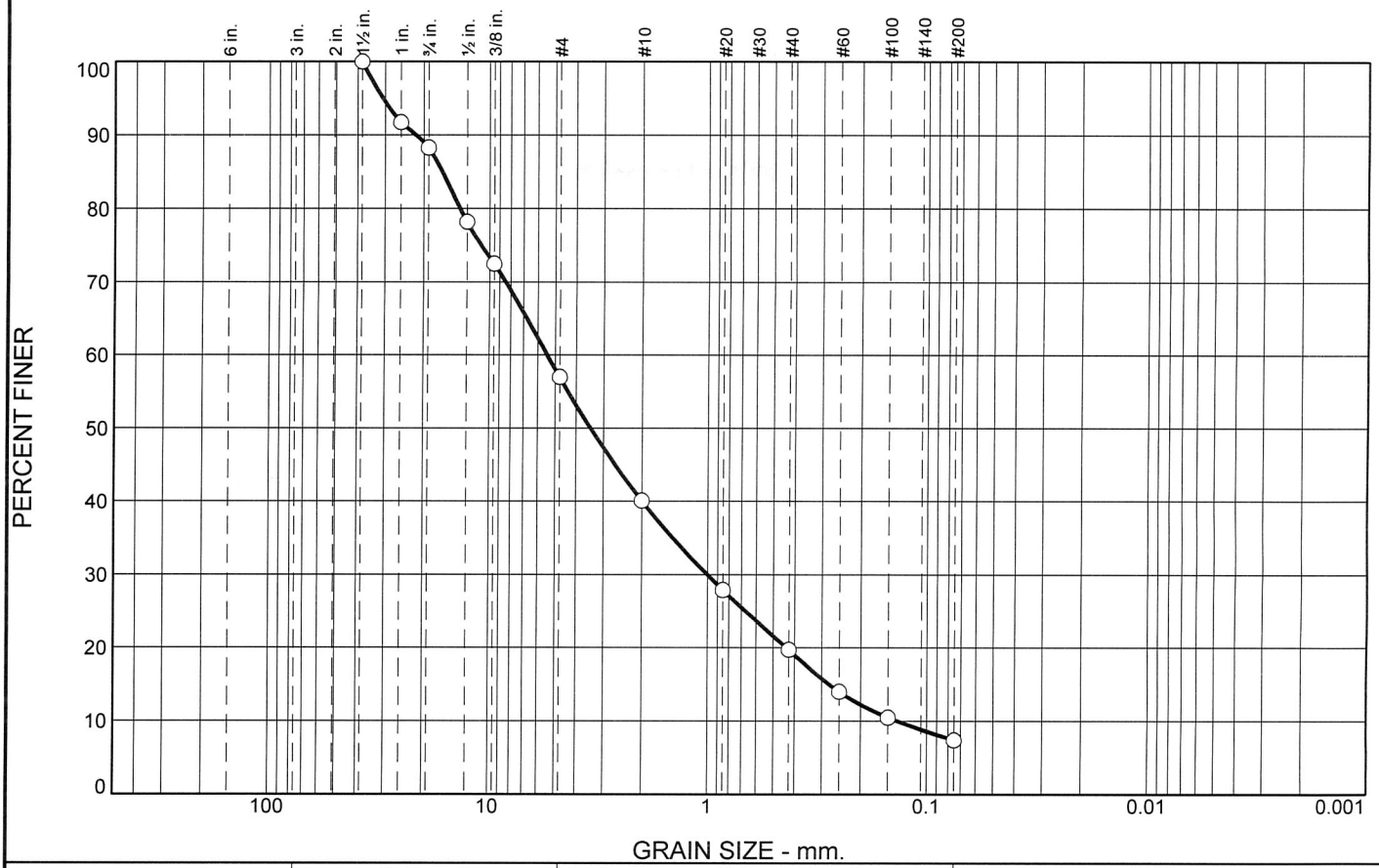
Received By: _____ Date: _____

☐ ASSIGNED TEST

(1) Test parameters to be provided by the Engineer.

JLT GEOTECHNICAL LABORATORY
soilcocjar.wpd

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.7	31.3	16.9	20.4	12.3	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	91.7		
0.75	88.3		
0.50	78.2		
0.375	72.5		
#4	57.0		
#10	40.1		
#20	27.9		
#40	19.7		
#60	14.0		
#100	10.5		
#200	7.4		

* (no specification provided)

Material Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 21.6964 D_{85}= 16.4132 D_{60}= 5.4158
D_{50}= 3.4297 D_{30}= 1.0020 D_{15}= 0.2776
D_{10}= 0.1362 C_u= 39.76 C_c= 1.36

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-001-PDI **Depth:** 0-8 **Date:** 01/18/2019

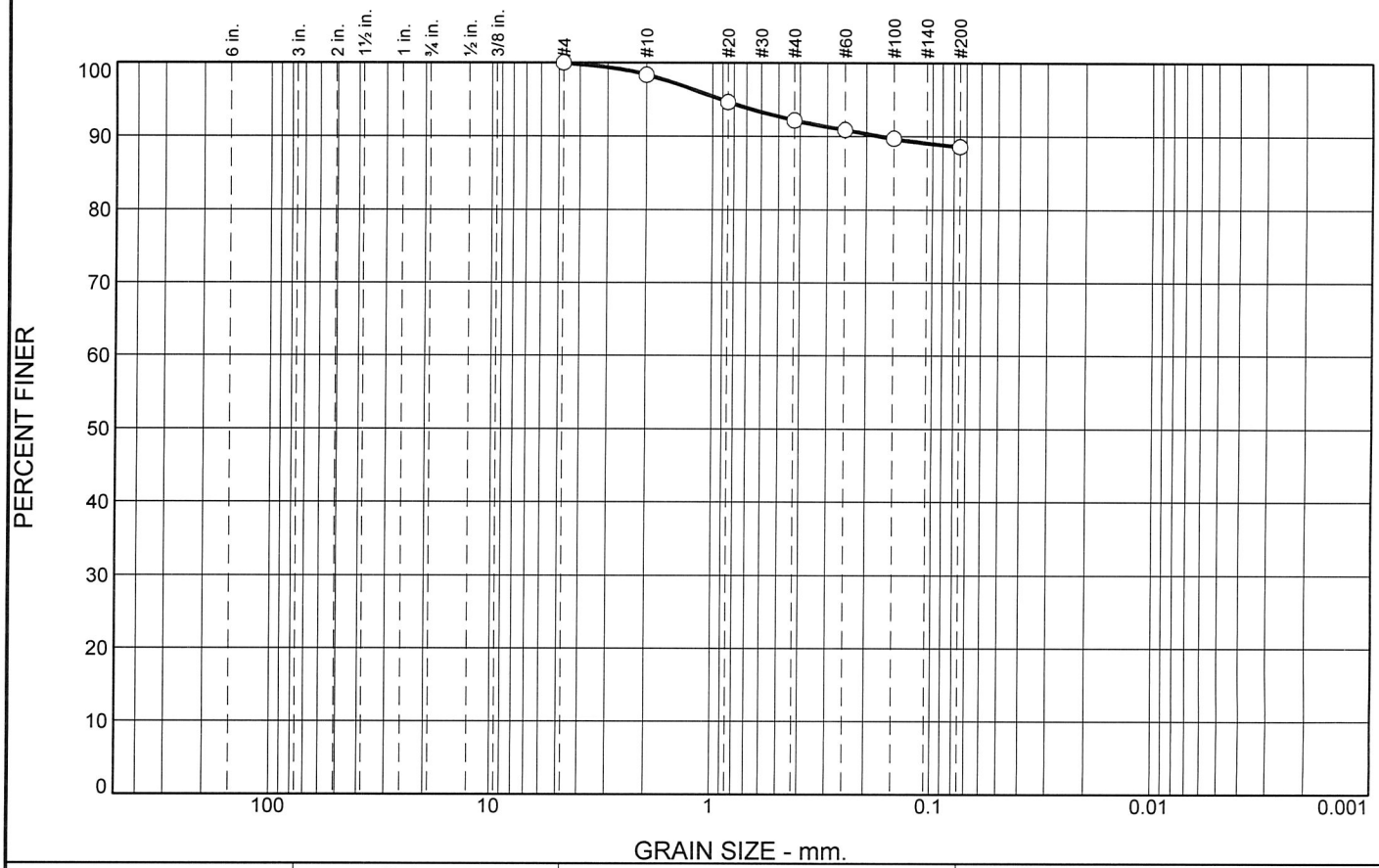
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.6	6.2	3.6	88.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.4		
#20	94.7		
#40	92.2		
#60	90.9		
#100	89.7		
#200	88.6		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1710 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Atterbergs Hydrophobic

Location: B14 PDI
Sample Number: B14-002-PDI **Depth:** 5-8 **Date:** 01/18/2019

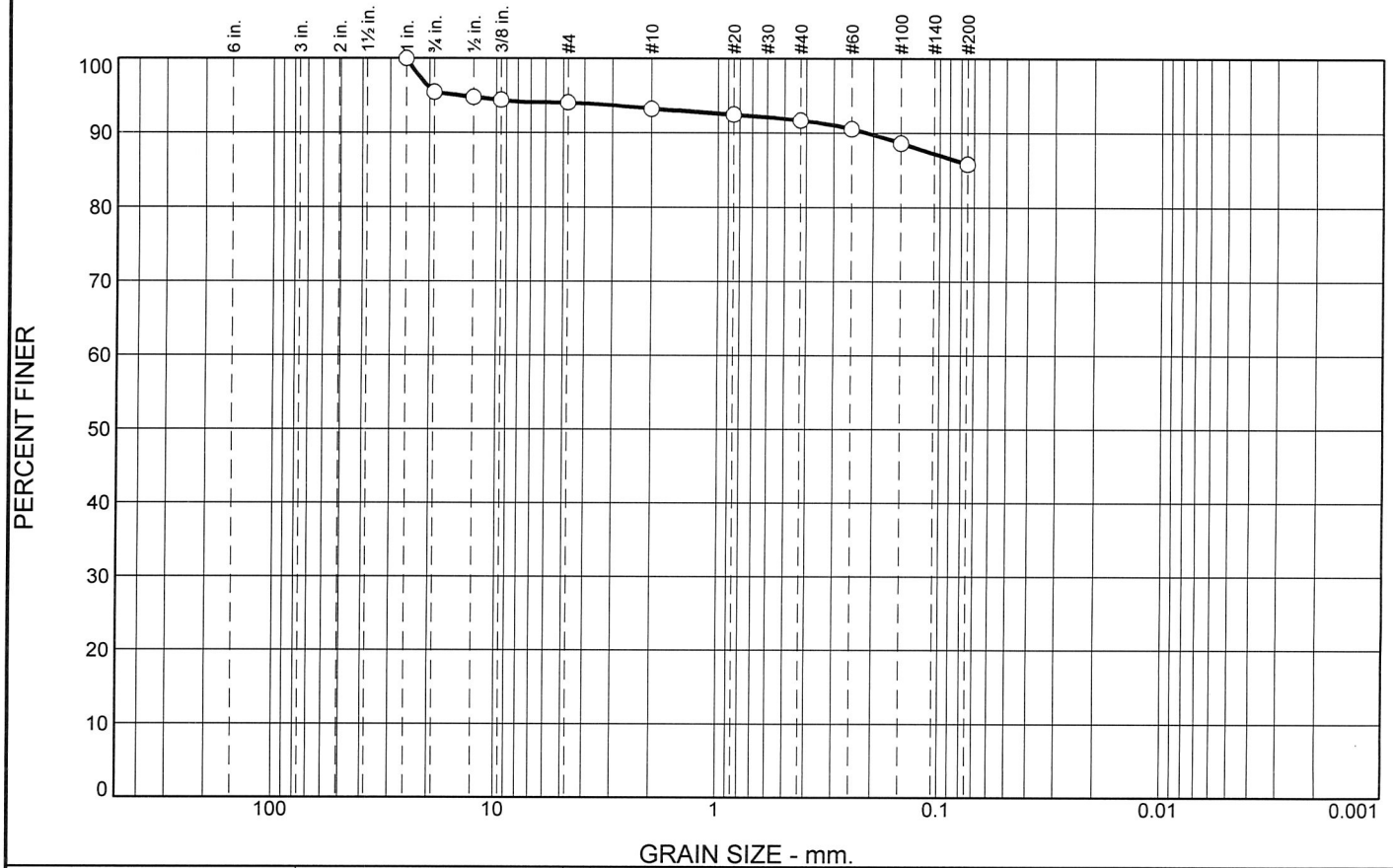
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.5	1.5	0.8	1.5	5.9	85.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.00	100.0		
0.75	95.5		
0.50	94.8		
0.375	94.4		
#4	94.0		
#10	93.2		
#20	92.5		
#40	91.7		
#60	90.5		
#100	88.6		
#200	85.8		

* (no specification provided)

Material Description

Atterberg Limits

PL= 14 LL= 19 PI= 5

Coefficients

D_{90}= 0.2134 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-003-PDI **Depth:** 3-4 **Date:** 01/18/2019

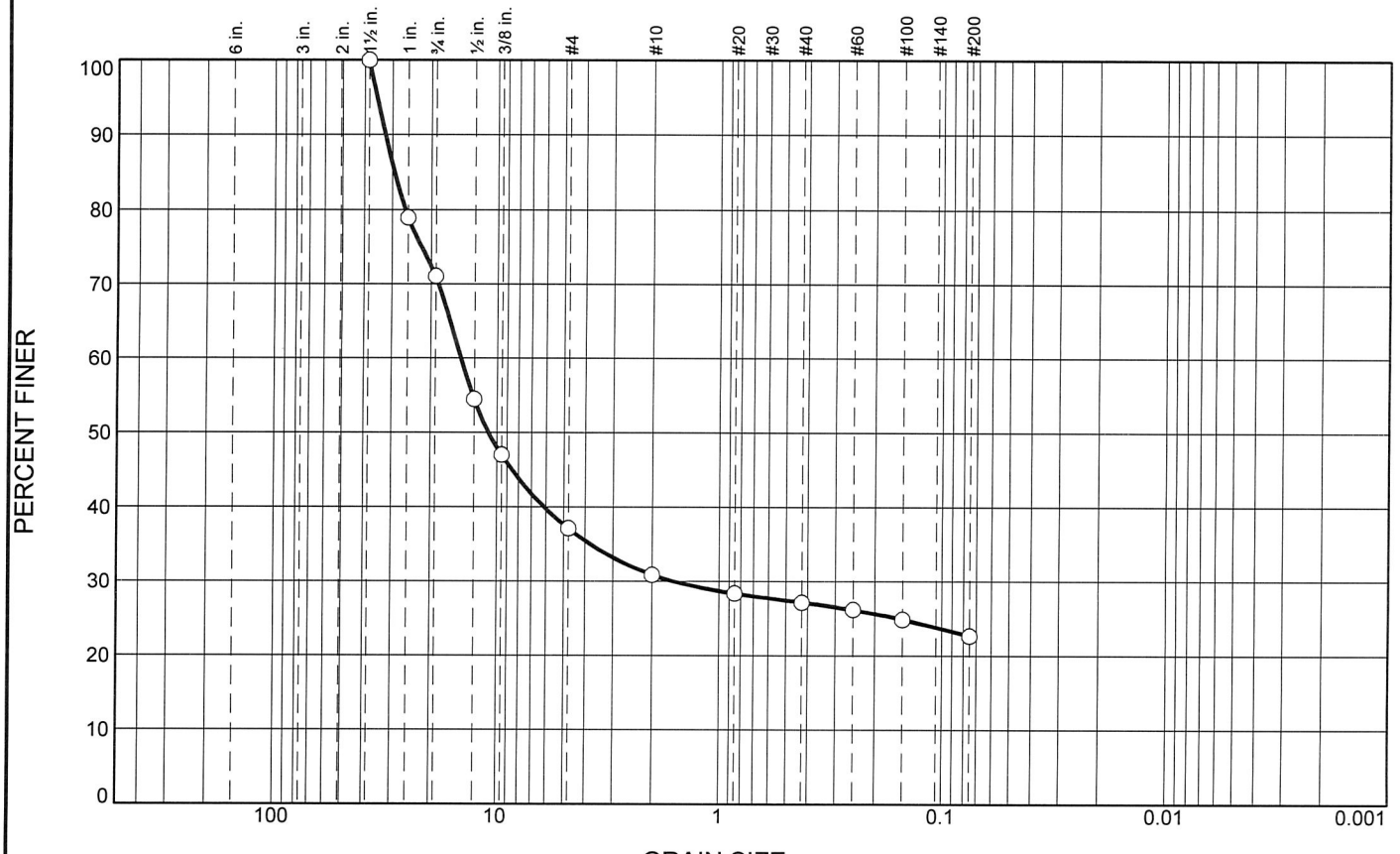
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.9	34.0	6.2	3.7	4.5	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	79.0		
0.75	71.1		
0.50	54.5		
0.375	47.0		
#4	37.1		
#10	30.9		
#20	28.4		
#40	27.2		
#60	26.1		
#100	24.9		
#200	22.7		

* (no specification provided)

Material Description

Atterberg Limits

PL= 14 LL= 18 PI= 4

Coefficients

D_{90}= 32.1635 D_{85}= 29.2662 D_{60}= 14.5475
D_{50}= 10.9342 D_{30}= 1.6128 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-004-PDI **Depth:** 6-8 **Date:** 01/18/2019

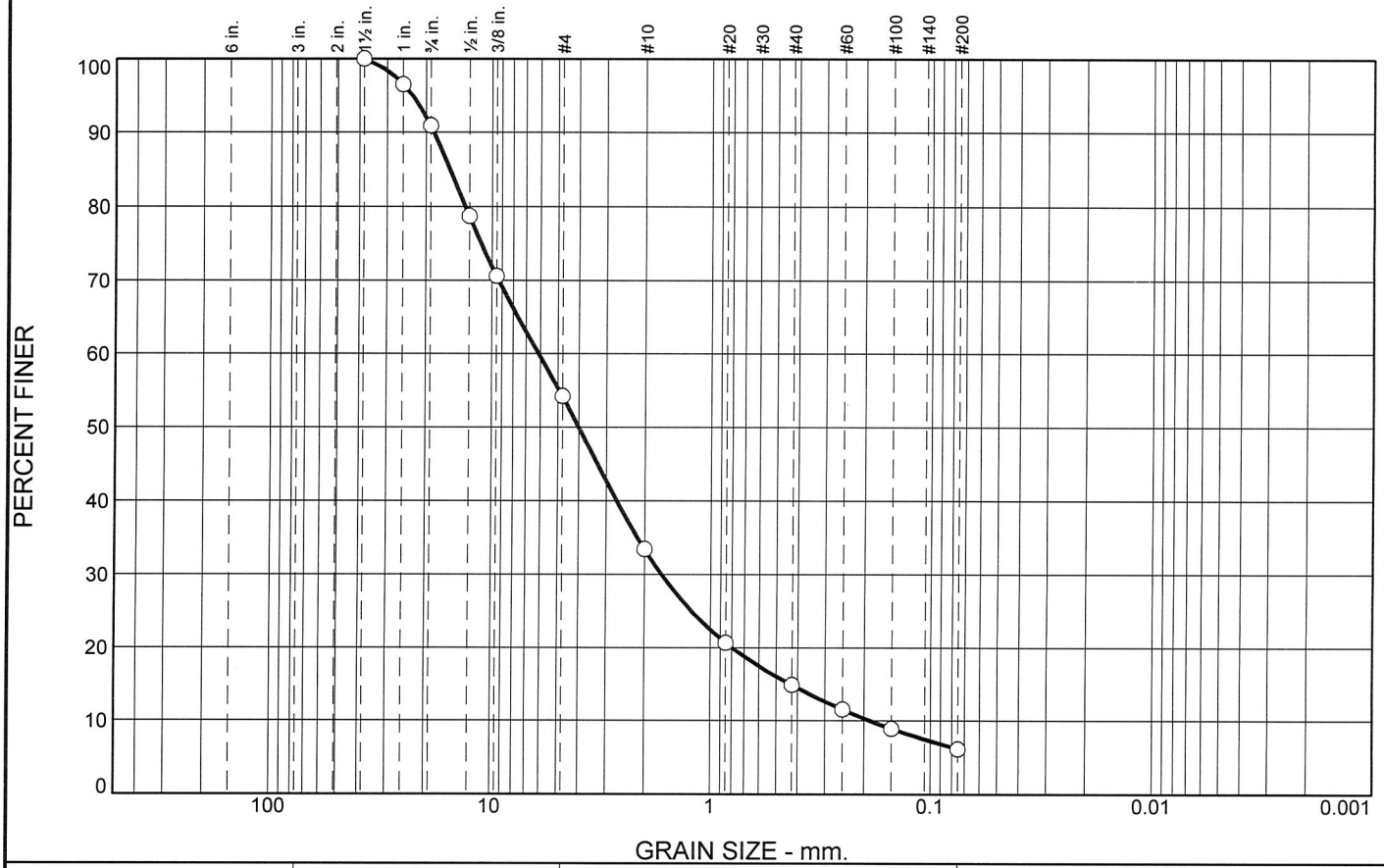
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.1	36.7	20.7	18.6	8.7	6.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	96.6		
0.75	90.9		
0.50	78.8		
0.375	70.6		
#4	54.2		
#10	33.5		
#20	20.7		
#40	14.9		
#60	11.6		
#100	8.9		
#200	6.2		

* (no specification provided)

Material Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 18.3727 D_{85}= 15.4995 D_{60}= 6.1010
D_{50}= 4.0017 D_{30}= 1.6689 D_{15}= 0.4315
D_{10}= 0.1874 C_u= 32.55 C_c= 2.44

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-005-PDI **Depth:** 0-6 **Date:** 01/18/2019

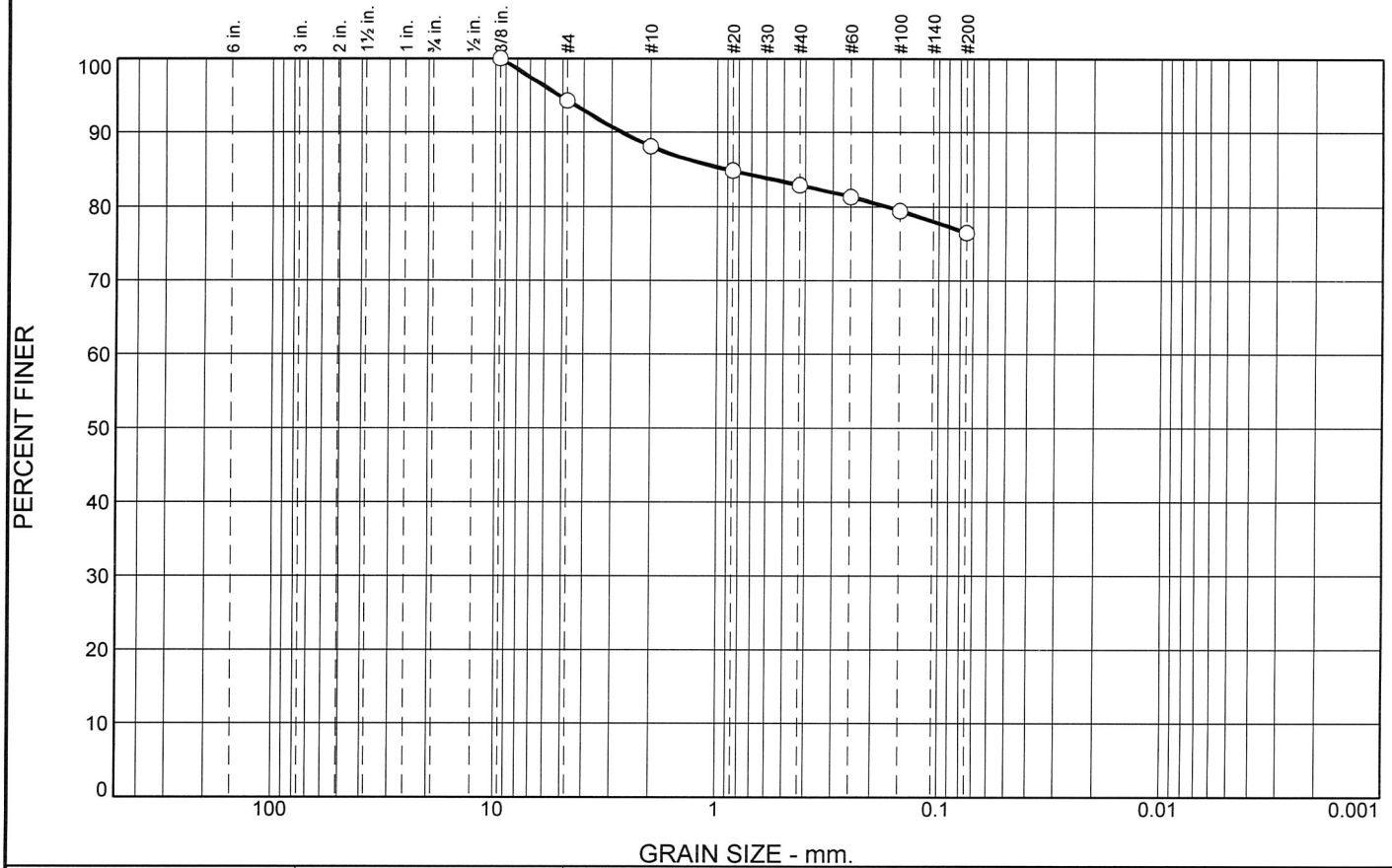
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.7	6.2	5.2	6.4	76.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	94.3		
#10	88.1		
#20	84.8		
#40	82.9		
#60	81.3		
#100	79.5		
#200	76.5		

* (no specification provided)

Material Description

Atterberg Limits

PL= 12 LL= 18 PI= 6

Coefficients

D_{90}= 2.7011 D_{85}= 0.9066 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-006-PDI **Depth:** 3-4 **Date:** 01/18/2019

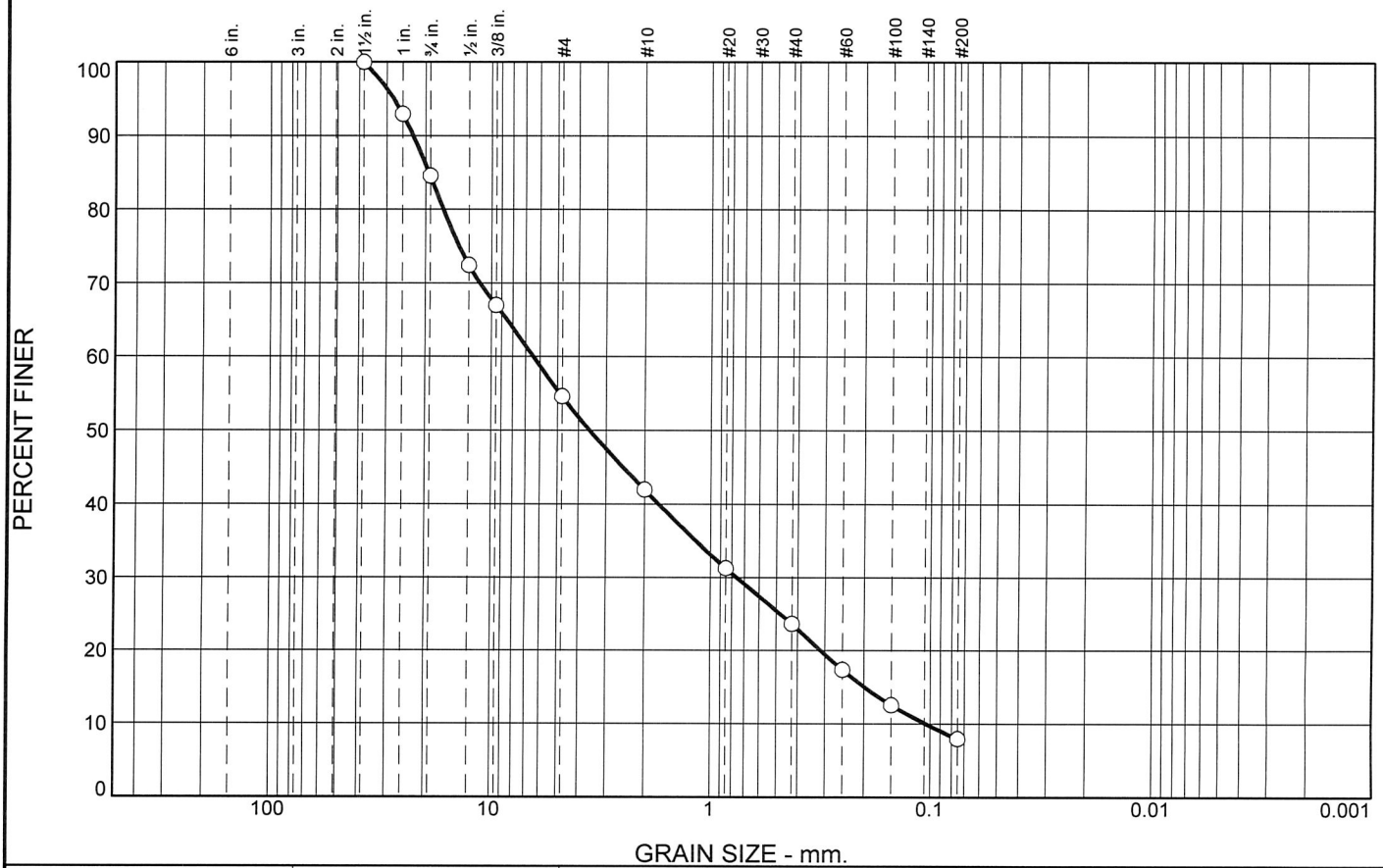
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.4	30.0	12.6	18.4	15.6	8.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	93.0		
0.75	84.6		
0.50	72.5		
0.375	67.1		
#4	54.6		
#10	42.0		
#20	31.3		
#40	23.6		
#60	17.4		
#100	12.5		
#200	8.0		

* (no specification provided)

Material Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 22.6922 D_{85}= 19.2823 D_{60}= 6.4311
D_{50}= 3.5552 D_{30}= 0.7586 D_{15}= 0.1986
D_{10}= 0.1047 C_u= 61.40 C_c= 0.85

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-007-PDI **Depth:** 4-11 **Date:** 01/18/2019

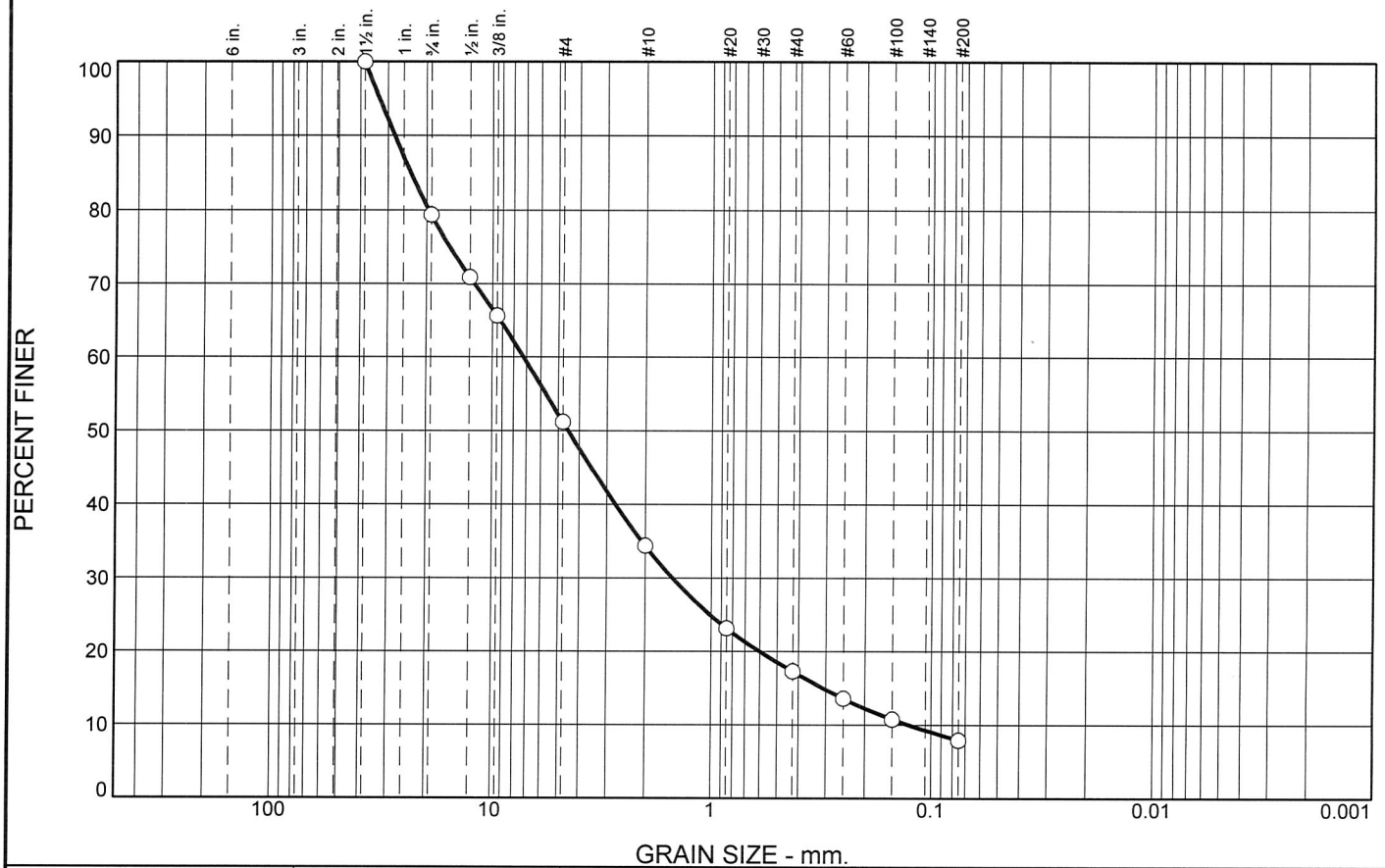
JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.6	28.2	16.8	17.1	9.4	7.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
0.75	79.4		
0.50	70.9		
0.375	65.6		
#4	51.2		
#10	34.4		
#20	23.2		
#40	17.3		
#60	13.6		
#100	10.8		
#200	7.9		

* (no specification provided)

Material Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 27.8318 D_{85}= 23.5217 D_{60}= 7.1793
D_{50}= 4.4844 D_{30}= 1.4982 D_{15}= 0.3083
D_{10}= 0.1260 C_u= 56.96 C_c= 2.48

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-008-PDI **Depth:** 2-12 **Date:** 01/18/2019

JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech
EnviroAnalytics PO: EAG-SPT-8126
Project No: 19LS3748.01 **Figure**

Tested By: AE **Checked By:** JB

JLT Laboratories, Inc.
Geotechnical, Geosynthetic and Materials Testing and Research

938 South Central Avenue
Canonsburg, Pennsylvania, 15317
Tel: 724-746-4441 Fax: 724-745-4261
e-mail: jboschuk@jltlabs.com
www.jltlabs.com

October 16, 2019
19LS3811.01

EnviroAnalytics Group
1600 Sparrows Point Blvd.
Suite B2
Sparrows Point, MD 21219

Attn: James Calenda

RE: GEOTECHNICAL TEST RESULTS
B14 PDI GEOTECH 9-11

Dear Mr. Calenda:

Submitted herein are the results of Sieve & Atterberg Limits performed on four (4) samples according to the attached COC for the above referenced project. All testing was performed per ASTM Standards while subject to JLT's internal QA / QC data validation procedures.

We appreciate the opportunity of being of service to you and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JLT LABORATORIES, INC.

John Boschuk, Jr., P.E., C.F.E.
President

cc: Laura Sargent – AP

Enclosures
JB\mlb
MSWord\letter\19229
Inv# 7395

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

Split Spoon, Jar, and Other Samples

CLIENT: Enviroanalytics Group
PROJECT ID: B14 PDI Geotech 9-11
JLT JOB No.: 19LS3811
DATE ASSIGNED: 10-14-19
DATE RECEIVED: 10-14
DATE COMPLETED: 10-16-19

BORING AND SAMPLE I.D.	DEPTH (feet)	PHYSICAL PROPERTIES											PERMEABILITY (1)		ENGINEERING PROPERTIES (1)										
		M/C ☐ D2216	SIEVE ☐ D422	HYDRO ☐ D422	LIQUID LIMIT ☐ D4318	PLASTIC LIMIT ☐ D4318	SPEC GRAVITY ☐ D854 ☐ C127	ORG CONT ☐ D2974 ☐ D5268	pH ☐ 4972	CLASS. ☐ D2487 ☐ D2488 ☐ C127			PERM ☐ D5084	PERM ☐ D2434	CONSOL TEST ☐ D2435	DIRECT SHEAR ☐ D3080	UNCONF TEST ☐ D2166	UU TEST ☐ D2850	CIU TEST ☐ D4767	CIU w/pp TEST ☐ D4767					
B14-009-PDI	0-12		X			X																			
B14-010-PDI	0-4		X			X																			
B14-011-PDI	0-12	.75	X			[redacted]		—	Received	10-14															
B14-010-PDI	5.5-10		X			X																			

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT. ALSO FAX COPY AS PRE-NOTIFICATION

SHIPPER: ARM Group Inc.
ADDRESS: 9175 Guilford Road, Suite 310
Columbia, MD 21046

CONTACT:
TEL: EMAIL: skabis@armgroup.net

SHIP TO: JLT Laboratories Inc.
938 South Central Avenue
Canonsburg, PA 15317
Tel: (724) 746-4441
Fax: (724) 745-4261
e-mail: jboschuk@jltlabs.com or
e-mail: mboschuk@jltlabs.com

NOTES / INSTRUCTIONS Bill to: James Calenda
Enviroanalytics Group
1600 Sparrows Point Blvd
Sparrows Point, MD 21219

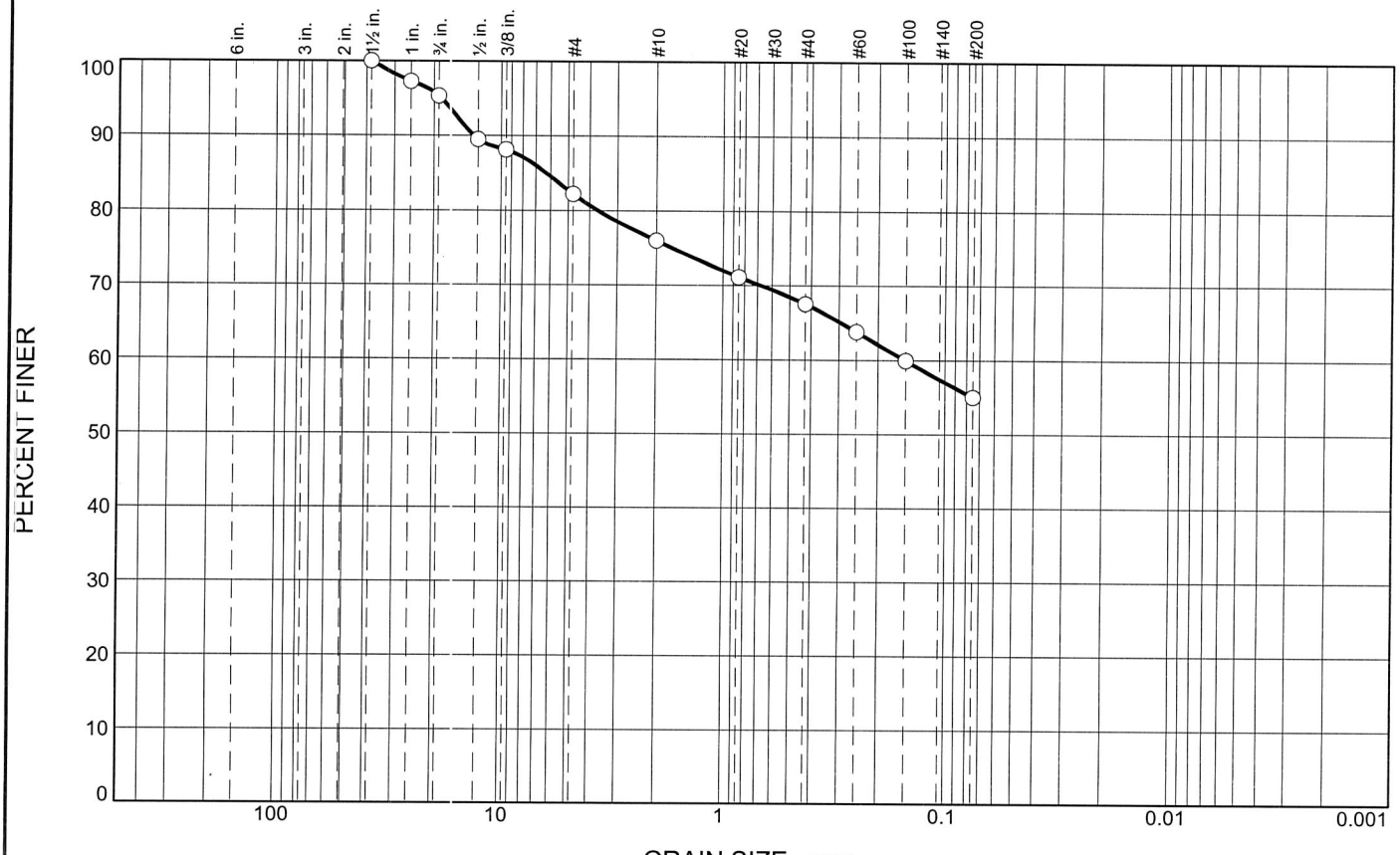
Relinquished By: [signature] Date: 10-9-2019
Received By: [signature] Date: 10-14-19

☐ ASSIGNED TEST

(1) Test parameters to be provided by the Engineer.

JLT GEOTECHNICAL LABORATORY
soilcocjar.wpd

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	13.1	6.2	8.5	12.5	55.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	97.3		
0.75	95.3		
0.50	89.4		
0.375	88.1		
#4	82.2		
#10	76.0		
#20	71.1		
#40	67.5		
#60	63.8		
#100	59.9		
#200	55.0		

* (no specification provided)

Material Description

Atterberg Limits

PL= 21 LL= 30 PI= 9

Coefficients

D_{90}= 13.3471 D_{85}= 6.2886 D_{60}= 0.1515
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-009-PDI **Depth:** 0-12 **Date:** 10/16/2019

JLT Laboratories, Inc.

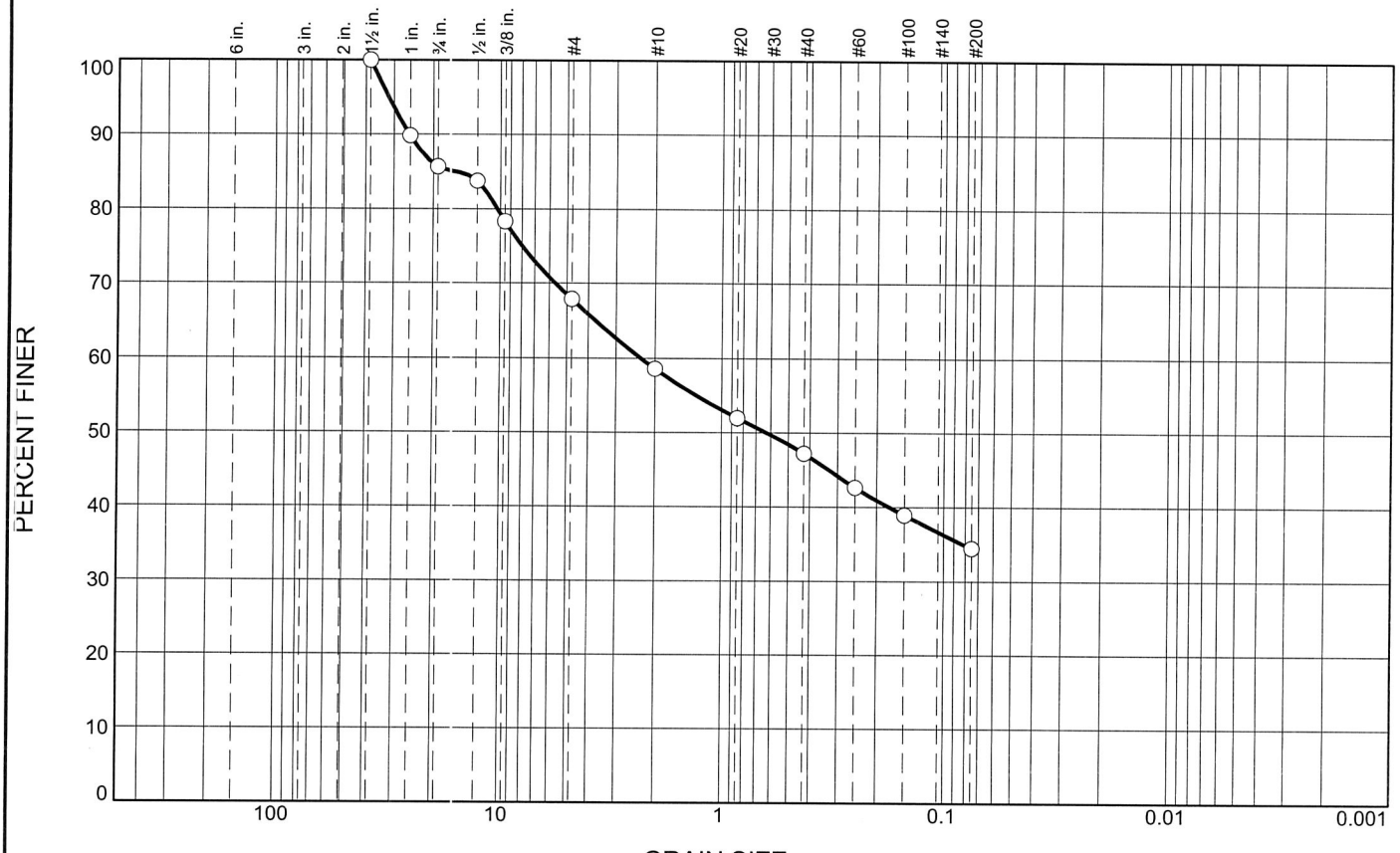
Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech 9-11

Project No: 19LS3811.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.4	17.7	9.3	11.4	12.7	34.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	89.8		
0.75	85.6		
0.50	83.7		
0.375	78.3		
#4	67.9		
#10	58.6		
#20	51.9		
#40	47.2		
#60	42.6		
#100	38.9		
#200	34.5		

* (no specification provided)

Material Description

Atterberg Limits

PL= 21 LL= 31 PI= 10

Coefficients

D_{90}= 25.6186 D_{85}= 16.0706 D_{60}= 2.3222
D_{50}= 0.6299 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Some Glass Present

Location: B14 PDI
Sample Number: B14-010-PDI **Depth:** 0-4 **Date:** 10/16/2019

JLT Laboratories, Inc.

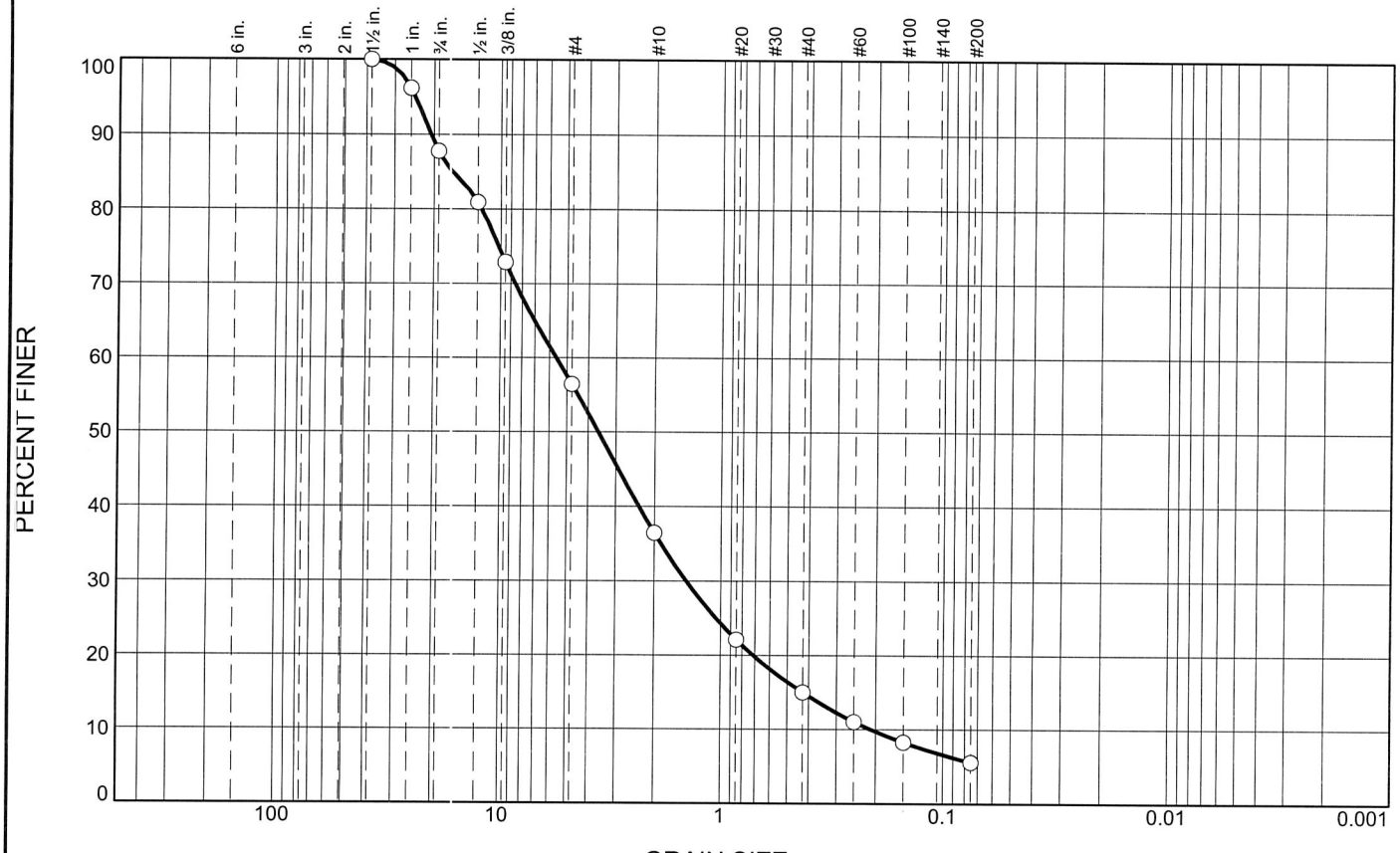
Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech 9-11

Project No: 19LS3811.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.3	31.3	19.9	21.5	9.5	5.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	96.2		
0.75	87.7		
0.50	80.9		
0.375	72.9		
#4	56.4		
#10	36.5		
#20	22.1		
#40	15.0		
#60	11.0		
#100	8.3		
#200	5.5		

* (no specification provided)

Material Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 20.6558 D_{85}= 16.5188 D_{60}= 5.5928
D_{50}= 3.5963 D_{30}= 1.4330 D_{15}= 0.4256
D_{10}= 0.2111 C_u= 26.49 C_c= 1.74

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-011-PDI **Depth:** 0-12.75 **Date:** 10/16/2019

JLT Laboratories, Inc.

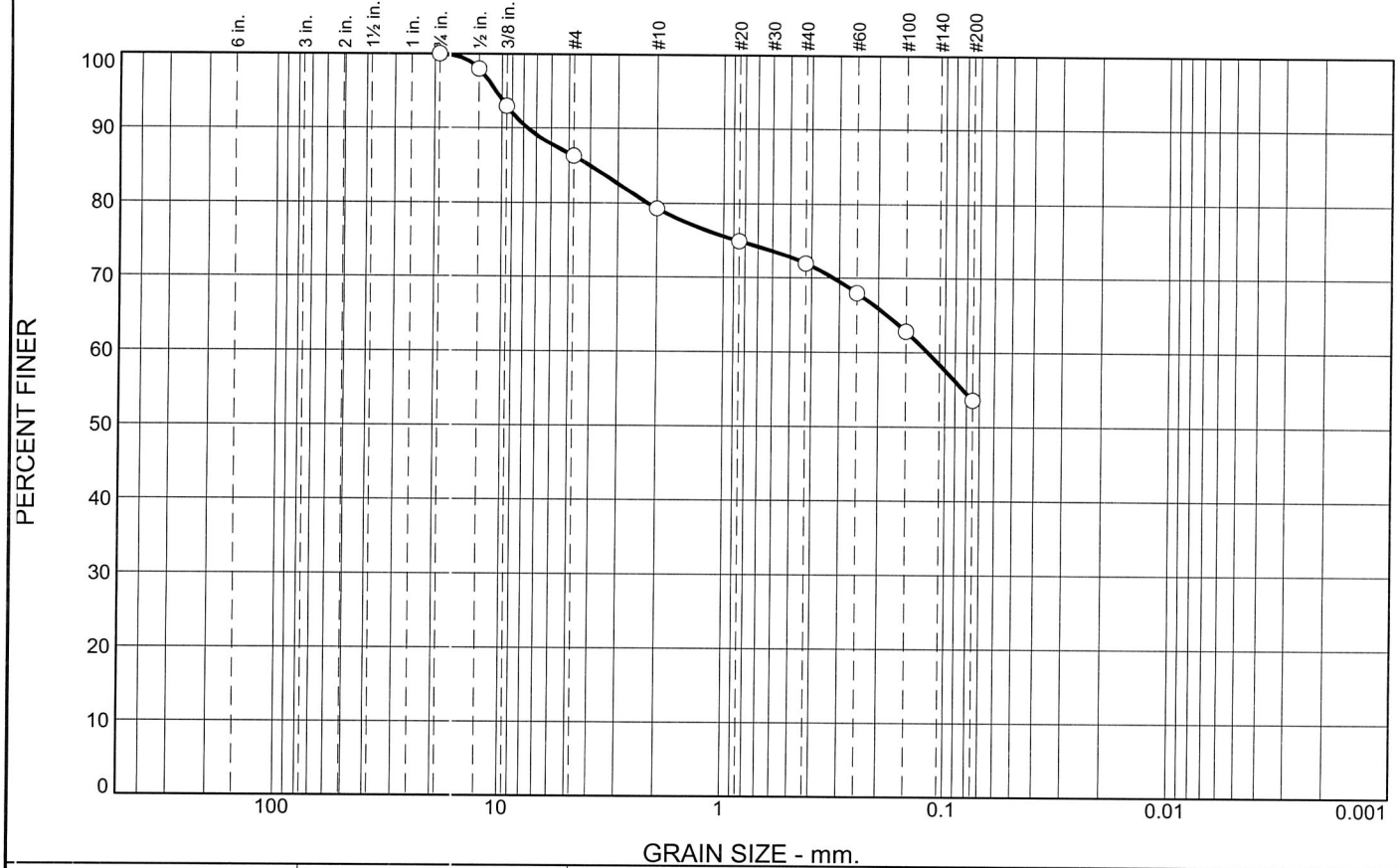
Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech 9-11

Project No: 19LS3811.01 **Figure**

Tested By: AE **Checked By:** JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.8	6.9	7.4	18.3	53.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.50	98.0		
0.375	93.0		
#4	86.2		
#10	79.3		
#20	74.9		
#40	71.9		
#60	68.0		
#100	62.8		
#200	53.6		

* (no specification provided)

Material Description

Atterberg Limits

PL= 17 LL= 24 PI= 7

Coefficients

D_{90}= 7.6768 D_{85}= 4.0283 D_{60}= 0.1197
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B14 PDI
Sample Number: B14-010-PDI **Depth:** 5.5-10 **Date:** 10/16/2019

JLT Laboratories, Inc.

Canonsburg, PA

Client: EnviroAnalytics
Project: B14 PDI Geotech 9-11

Project No: 19LS3811.01 **Figure**

Tested By: AE **Checked By:** JB

APPENDIX B

ARM Group LLC
Engineers and Scientists

Boring ID: B14-001-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method	: 4.25" ESA

Date Started	: 6/25/18
Date Completed	: 6/25/18
Northing	: 569371.43
Easting	: 1457379.31

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0	S-1	27 49 39 35	88	100	GW/SW	(0-6') SLAG GRAVEL and SAND with SILT from 4.8-6' bgs, dense, black and gray, dry, no plasticity, no cohesion	Wet at 20' bgs
2	S-2	33 40 50/1	>50	58			
4	S-3	10 18 11 14	29	83			
6	S-4	35 51 55 46	106	100	GW/SW	(6-12.6') SLAG SAND and GRAVEL, dry, dense	
8		23 36 38 28	74	100			
10		26 42 26 38	68	66			
12		25 25 46 35	71	100	CL	(12.6-13.1') SILTY CLAY, firm, dark grayish green, dry, low plasticity, cohesive	
14		34 36 43 46	79	100	GW/SW	(13.1-26') SLAG SAND and GRAVEL, dry to moist at 15' bgs then wet at 20' bgs, dense, no plasticity, no cohesion	
16							
18							
20		17 10 15 18	25	33			
22							
24							
26		48 50/3	>50	50		End of Boring	

Boring terminated 26' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-002-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method	: 4.25" ESA

Date Started	: 6/25/18
Date Completed	: 6/25/18
Weather	:
Northing	: 569933.39
Easting	: 1457697.79

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0		WOH WOH WOH WOH	1	16	SW	(0-2') TOPSOIL with SAND, soft, brown, dry, no plasticity, no cohesion	
2	S-1	2 2 WOH	3	83		(2-16') CLAY, soft, gray, dry, high plasticity, cohesive	
4	S-2	WOH WOH WOH WOH	0	66			Wet at 20' bgs
6	S-3	2 2	3	92			
8		WOH WOH WOH WOH	0	33	CH		
10		WOH WOH WOH WOH	0	100			
12		WOH WOH WOH WOH	0	100			
14		WOH WOH WOH WOH	0	100			
16						End of Boring	

Boring terminated 16' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-003-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method:	: 4.25" ESA

Date Started	: 6/22/18
Date Completed	: 6/22/18
Weather	:
Northing	: 569530.08
Easting	: 1457984.30

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0		28 5 2 2	7	33	-	(0-1.6') No Recovery	
2	S-1	3 2 1 1	3	42	SW	(1.6-3.1') TOPSOIL with SAND, soft, brown, dry, no plasticity, no cohesion	
4		WOH WOH WOH 2	0	0	CH	(3.1-16') CLAY, soft, gray, dry, high plasticity, high cohesion	
6		WOH WOH WOH 1	0	0			
8		WOH WOH WOH WOH	0	17			
10		WOH WOH WOH WOH	0	100			
12		WOH WOH 1 2	0	100			
14		2 3 3 5	6	75			
16		1 1 WoH 1	<1	100			
18						End of Boring	

Boring terminated 18' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-004-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method:	: 4.25" ESA

Date Started	: 6/22/18
Date Completed	: 6/22/18
Northing	: 569330.43
Easting	: 1458099.84

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0		1 WOH WOH WOH		33	CL	(0-2.5') CLAYEY SILT, hard, brown, dry, low plasticity, cohesive	
2		WOH WOH WOH WOH WOH	0	42	ML	(2.5-4.5') SILT, dense, brown, dry, medium plasticity, medium cohesion	
4		WOH 1 WOH WOH	1	0	CH	(4.5-8') CLAY, soft, brown, high plasticity, cohesive	
6	S-1	WOH WOH WOH 5	0	0			
8		4 16 47 42	63	17	ML	(8-9') SANDY SILT, dense, pale brown to gray, dry, no plasticity, no cohesion	
					NA	(9-10') Fractured SLAG	
10		8 19 10 6	29	100	ML	(10-12') SILT with GRAVEL, dense, no plasticity, cohesive	
12	S-2	2 3 2 3	5	100	CH	(12-16') CLAY, gray, soft, high plasticity, cohesive	Slight petroleum-like odor from 12-16' bgs
14	S-3	WOH 1 1 1	2	75			
16						End of Boring	

Boring terminated 18' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-005-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method	: 4.25" ESA

Date Started	: 6/25/18
Date Completed	: 6/25/18
Northing	: 569280.96
Easting	: 1458104.41

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0	S-1	10 6 7 7	13	66	GW	(0-8') SLAG GRAVEL with SAND, coarse, dense, black, dry, no plasticity, no cohesion	Wet at 10' bgs
2	S-2	5 5 7 13	12	50			
4	S-3	6 6 5 5	11	50			
6		5 4 4 5	8	58			
8	S-4	1 1 1 WOH	2	66	CL	(8-11') CLAY, soft, reddish brown, wet, no plasticity, no cohesion	
10	S-5	1 3 16 23	19	75	GW	(11-16') SLAG GRAVEL, dense, dry, gray, no plasticity, no cohesion	
12		6 11 10 7	21	50			
14		4 49 50/1		33			
16					-	(16-20') NO RECOVERY - ADVANCED AUGERS TO 20'	
18							
20		5 6 3 2	9	33	GW/SW	(20-22') SLAG GRAVEL and SAND, loose, wet, no plasticity, no cohesion	
22					-	(22-25') NO RECOVERY - ADVANCED AUGERS TO 20'	
24							
26		3 WOH WOH 1	0	100	CH	(25-27') CLAY, soft to firm, gray, dry, high plasticity, cohesive	
28						End of Boring	

Boring terminated 27' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

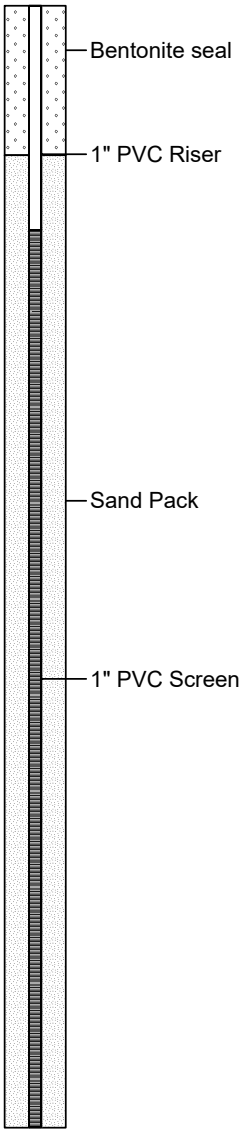
Boring ID: B14-006-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 150300M-1-2
Project Description	: Sparrows Point - Parcel B14
Site Location	: Sparrows Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Method	: 4.25" ESA

Soil Boring Installation Date	: 6/22/18
Piezometer Installation Date	: 6/22/18
Casing/Riser/Screen Type	: PVC
Borehole Diameter	: 4"
Riser/Screen Diameter	: 2"
Northing (US ft)	: 569588.51
Easting (US ft)	: 1458290.01
0-Hr DTW	:
48-Hr DTW	:
No LNAPL or DNAPL at 0 or 48 hours	

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0	S-1	4, 8, 2	10	100%	SW/GW	(0-1.5') SAND and GRAVEL, dry, loose, no plasticity, no cohesion	
		1, 3, 2	5		ML	(2-3.5') CLAYEY SILT, firm, dry, low plasiticity, cohesion	
		1, 1, 1	2		-	(3.5-14') No recovery	
5		WOH, 1	1				
		WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH, WOH	WOH				
15					CL	(14-15') SANDY CLAY, soft, moist, low plasticity, cohesive	
						End of Boring	



Wet at 7.2'

Oily sheen

Boring terminated at 15' bgs due to water and piezometer installation
TOC: Top of PVC casing
DTW: Depth to water
bgs: Below ground surface
AMSL: Above mean sea level

Riser: 0 - 3' bgs
Screen: 3 - 15' bgs [Slot Size: 0.010"]
Sand Pack: 2 - 15' bgs [Grain Size: WG #2]
Bentonite Seal: 0.5 - 2' bgs [Grain Size: 3/8" chips]

ARM Group LLC
Engineers and Scientists

Boring ID: B14-007-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method:	: 4.25" ESA

Date Started	: 6/25/18
Date Completed	: 6/25/18
Northing	: 569462.73
Easting	: 1458596.31

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0		2 22 29 11	51	75	GW	(1-11') SLAG GRAVEL, loose, black to brown, no plasticity, no cohesion	
2	S-1	14 13 12 15	25	58			
4		4 14 9 10	23	67			
6		11 9 10 10	19	67			
8		9 9 16 8	25	75			
10		10 23 24 26	47	67			
12		8 14 14 19	28	33	SW	(11.5-14.5') SAND with ROCK fragments from 12-14' bgs, loose, moist to wet at 12' bgs, no plasticity, cohesive	
14			-	0	SW	(14.5-15') SAND, coarse, loose, gray, wet, no plasticity, cohesive	
16		5 14 8 12	22	58	GW	(15.5-17') SLAG GRAVEL, wet, no plasticity, no cohesion	
18			-	0	-	(17-20') NO RECOVERY - ADVANCED AUGERS to 20' bgs	
20		5 7 11 16	18	58	SW	(20-21.2') SAND, loose, gray, wet, low plasticity, cohesive	
22			-	0	-	(21.2-22') Fractured SLAG and ROCK, black (22-25') NO RECOVERY - ADVANCED AUGERS to 25' bgs	
24							
26		8 18 23 29	41	92	SW	(25-26') SAND, loose, gray, wet, low plasticity, cohesive	
					GW	(26-27') Fractured SLAG, black	
28						End of Boring	

Boring terminated 18' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-008-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: S. Kabis
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Drilling Method	: 4.25" ESA

Date Started	: 6/25/18
Date Completed	: 6/25/18
Northing	: 569684.74
Easting	: 1459704.63

Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0		10 6 3 3	9	50	SW	(0-1.3') SLAG SAND and GRAVEL, loose to dense, dry, no plasticity, no cohesion	
					ML	CLAYEY SAND, (1.3-1.8') SANDY SILT, loose, dry, brown, no plasticity, cohesive	
2	S-1	9 11 13 14	23	100	SW/GW	(1.8-17') SLAG SAND and GRAVEL, dense, dark gray, dry to wet at 12', no plasticity, no cohesion	
4		1 WOH 3 5	3	0			
6	S-2	3 4 5 5	9	33			
8	S-3	10 11 14 16	25	67			
10	S-4	5 7 4 3	11	33			
12		3 4 8 8	12	33			
14		11 12 8 7	20	67			
16						End of Boring	
18							

Boring terminated 17' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-009-PDI

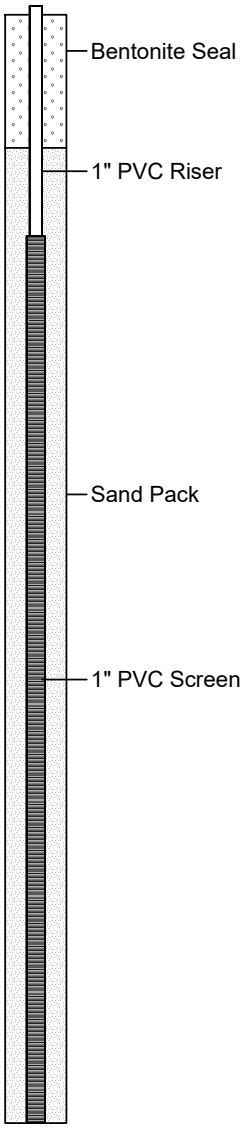
(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: M. Kedenburg, G.I.T.
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Driller	: Tim Moyer

Date Started	: 10/16/18 11:15
Date Completed	: 10/16/18
Northing	:
Easting	:
Total Depth	: 24.76' TOC
Depth to Water - 0hr	: 8.68' TOC
Depth to Water - 48hr	: 8.65' TOC

No DNAPL or LNAPL detected at 0 or 48 hrs

Depth (ft.)	PID	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0	0.0	WOH 1	40	35	SM	(0-4') SILTY SAND with few GRAVEL, loose to medium dense, brown, dry, no plasticity, no cohesion	
2	0.0	WOH 1 1 1 2 3	22	20			
4	0.0	4 3 2 2 5	15	10	GW	(4-7.3') BRICK and SLAG GRAVEL with some SAND, loose, red and very light brown, dry, no plasticity, no cohesion	
6	0.0	4 2 2 4 3	22	0.4			
8	0.0	4 3 4 2 10	29	45	ML	(7.3-12') SANDY SILT with few BRICK/SLAG GRAVEL, firm to soft, reddish brown and brown, dry then moist at 8.1' bgs	Wet at 9.7' bgs
10	0.0	12 4 6 8 10	24	30			
12	1.8	2 4 6 10	21	100	GC	(12-13') CLAYEY GRAVEL, loose, black and gray, wet, no plasticity, no cohesion	
14	1.0		19	100	CL	(13-15') CLAY with few GRAVEL, soft, greenish gray and black, very moist to wet, low plasticity, cohesive	
16					CL	(15-16') SANDY CLAY, hard, light gray and reddish yellow, moist, low plasticity, cohesive	
18					NA	(16-18') No spoons	
20	0.0	5 6 6 10	31	100	ML	(18-19') SILT with very fine SAND, very firm, very light gray, moist, low plasticity, cohesive	
22					SW-SM	(19-20') SAND with SILT, fine to coarse, dense to medium dense, reddish yellow, wet, no plasticity, no cohesion	
24	0.0	4 4 5 6	32	100	CL	(20-23') No spoons collected (23-25') CLAY with SAND, very firm, reddish brown, moist, low plasticity, cohesive	
26						End of Boring	



Boring terminated at 25' bgs due to water and piezometer installation
TOC: Top of PVC casing
DTW: Depth to water
bgs: Below ground surface
AMSL: Above mean sea level

Riser Stickup: 2"
Riser: 0 - 5' bgs
Screen: 5 - 25' bgs [Slot Size: 0.010"]
Sand Pack: 3 - 25' bgs [Grain Size: WG #2]
Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]

ARM Group LLC
Engineers and Scientists

Boring ID: B14-010-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: M. Kedenburg, G.I.T.
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Driller	: Tim Moyer

Date Started	: 10/16/18 8:15
Date Completed	: 10/16/18 10:30
Northing	:
Easting	:
Total Depth	: 25'
Depth to Water	: 13
Borehole Diameter	: 4

Depth (ft.)	PID	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0							
	0.0	1 5 4 4	9	20	-	(0-1.6') No recovery	
2	0.0	3 1 1 2	2	10	ML/GW	(1.6-5.5') SANDY SILT and BRICK and SAND GRAVEL, firm, brown with red, dry, no plasticity, no cohesion	
4	0.0	2 2 3 3	5	35			
6	0.0	3 2 3 3	5	5	SC	(5.5-10') CLAYEY SAND, medium dense, yellowish brown, dry to moist, no plasticity, no cohesion	
8	0.0	2 2 3 7	4	65			
10	17.3	4 7 22 23	11	25			
12	0.0	19 50/1	>50	9	GW-GM	(11.5-13') BRICK and SLAG GRAVEL with SILT and few clay lenses, medium dense to dense, red and brown with gray, dry, no plasticity, no cohesion	Wet at 13' bgs
					SC	(13-14.4') CLAYEY SAND with few fine GRAVEL, medium dense, dark brownish gray, wet, no plasticity, no cohesion	
14	2.9	5 6 1 1	7	100	CL	(14.4-16') CLAY with trace SAND, very soft grading to soft, black with very light gray, very moist to moist, low plasticity, cohesive	Moderate oil-like odor from 14.4-16' bgs
16						(16-18') No spoons collected	
18	0.0	WOH WOH WOH WOH	0	100	CL	(18-20') CLAY to SANDY CLAY, very soft to firm, very light gray and reddish yellow, wet to moist and supersaturated in spots, low plasticity, cohesive	
20						(20-23') No spoons	
22							
24	0.2	WOH WOH WOH 2	0	100	ML	(23-24.8') SILT, soft to firm, light grayish brown, moist to very moist, low plasticity, cohesive	
					SP	(24.8-25') CLAYEY SAND, medium dense, reddish yellow, wet, no plasticity, no cohesion	
26						End of Boring	

Boring terminated 25' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

ARM Group LLC
Engineers and Scientists

Boring ID: B14-011-PDI

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 180589-1-2
Project Description	: Sparrow's Point - Parcel B14
Site Location	: Sparrow's Point, MD
ARM Representative	: M. Kedenburg, G.I.T.
Checked by	: M. Replogle, E.I.T.
Drilling Co.	: Allied Drilling Co.
Driller	: Tim Moyer

Date Started	: 10/16/18 11:15
Date Completed	: 10/16/18
Northing	:
Easting	:
Total Depth	:
Depth to Water	:
Borehole Diameter	:

Depth (ft.)	PID	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0							
	0.1	18 24 16 12	40	50	-	(0-1.6') No recovery	
2	0.0	11 11 11 15	22	75	ML/GW	(1.6-5.5') SANDY SILT and BRICK and SAND GRAVEL, firm, brown with red, dry, no plasticity, no cohesion	
4	0.8	7 9 6 5	15	25			
6	0.0	10 8 14 12	22	50	SC	(5.5-10') CLAYEY SAND, medium dense, yellowish brown, dry to moist, no plasticity, no cohesion	
8	0.0	13 16 13 17	29	35			
10	0.4	8 16 8 9	24	50			
12	0.0	6 9 12 8	21	75	GW-GM	(11.5-13') BRICK and SLAG GRAVEL with SILT and few clay lenses, medium dense to dense, red and brown with gray, dry, no plasticity, no cohesion	Wet at 13' bgs
14	1.8	1 7 12 33	19	50	SC	(13-14.4') CLAYEY SAND with few fine GRAVEL, medium dense, dark brownish gray, wet, no plasticity, no cohesion	
16					CL	(14.4-16') CLAY with trace SAND, very soft grading to soft, black with very light gray, very moist to moist, low plasticity, cohesive	Moderate oil-like odor from 14.4-16' bgs
18	0.8	11 14 17 16	31	75	CL	(16-18') No spoons collected (18-20') CLAY to SANDY CLAY, very soft to firm, very light gray and reddish yellow, wet to moist and supersaturated in spots, low plasticity, cohesive	
20						(20-23') No spoons	
22							
24	-	10 14 18 19	32	-	ML	(23-24.8') SILT, soft to firm, light grayish brown, moist to very moist, low plasticity, cohesive	
26					SP	(24.8-25') CLAYEY SAND, medium dense, reddish yellow, wet, no plasticity, no cohesion End of Boring	

Boring terminated 25' bgs.

bgs: Below ground surface
AMSL: Above mean sea level

APPENDIX C

NAPL Transmissivity Calculation
Parcel B14 CMS

NAPL Transmissivity at location B14-038R-PZ was calculated following the Applied NAPL Science Review method using the equation below:

$$T_n = \frac{Q_n \left(\ln \frac{R_{oi}}{r_w}\right)}{2\pi s_n}$$

Where:

T_n = NAPL transmissivity

Q_n = NAPL recharge rate

R_{oi} = radius of influence

R_w = effective well radius

S_n = NAPL drawdown

Simplifying assumptions:

$\ln(\frac{R_{oi}}{r_w})$ = 4.6 based on pilot test results (Applied NAPL Science Review)

S_n = maximum observed NAPL thickness (0.68 ft)

Q_n = NAPL recharge rate following well development

To find Q_n, the slope of the best-fit line through the NAPL volume vs. time plot was calculated. Only gauging data from first NAPL observation through maximum observed NAPL thickness were included. B14-038R-PZ is a 2-inch diameter well, so the thickness to volume conversion factor is 0.163.

Date	NAPL Thickness (ft)	NAPL Volume (ft^3)
9/28/2020	0.01	0.0002
9/29/2020	0.02	0.0004
10/1/2020	0.19	0.0041
10/2/2020	0.53	0.0115
10/5/2020	0.63	0.0137
10/6/2020	0.47	0.0102
10/7/2020	0.52	0.0113
10/8/2020	0.68	0.0148

Q_n = 0.00139 ft^3/day, so $T_n = \frac{0.00139\ ft^3/day * 0.46}{2 * \pi * 0.68\ ft}$ = $1.5*10^{-3}$ ft/day

APPENDIX D

UIN 0858EAC

Oil

Unit No. B14-038-P2

Unit:
Make
Model
Serial No.

Site Tradepoint Atlantic Project# 20010214

Compartment:
Name QU787333 Sample #2
Make
Model
Serial No.

Capacity: 0.0

Customer:

ALS ENVIRONMENTAL
301 Fulling Mill Rd
Middletown PA 17057
USA

DIAGNOSIS

No interpretation of results provided. Sample run for test data only.

ANALYST: Eric.Dunlap

Normal

LEGEND

Severe | Abnormal | Caution | Normal

DATE SAMPLED	11-Nov-20
DATE RECEIVED	08-Dec-20
DATE REPORTED	09-Dec-20

LAB NO.		41022635759
SIF NO.		38348656
TIME ON UNIT	Hrs	
TIME ON OIL	Hrs	
OIL BRAND		Unidentified
OIL TYPE		Unidentified
OIL GRADE		Unknown
OIL ADDED		
FILTER	Hrs	Not Applicable
OIL CHANGED		
WO NUMBER		

Physical Tests

Viscosity (cSt 40C)	96.1

Right Solutions • Right Partner

UIN 0858EAC

No Data Available	No Data Available
No Data Available	No Data Available
No Data Available	Filter Image Filter patch test is not performed Contact laboratory for more information

Since services are based on samples and information supplied by others, and since corrective actions, if any, are necessarily taken by others, these services are rendered without any warranty or liability of any kind beyond the actual amount paid to ALS Tribology for the services. Reported recommendations are based on interpretations of the generated test results and historical data. Certain test results appearing in this report may have been tested at other ALS laboratories within the Tribology divisional network.

ALS Environmental
Attn: Sue Scherer
301 Fulling Mill Rd
Middletown PA 17057
USA

0002 v1.9

U.S. Laboratories

Atlanta, Georgia - 420
5300 OakBrook Parkway
Building 200 Suite 245
Norcross, GA 30093
800.394.3669

Valley View, Ohio - 410
6180 Halle Dr. Suite D
Valley View, OH 44125
800.726.5400

Kansas City, Kansas - 430
935 Sunshine Road
Kansas City, KS 66115
800.332.8055

Phoenix, Arizona - 440
3319 West Earll Drive
Phoenix, AZ 85017
800.445.7930

Portland, Oregon - 401
4943 NW Front Avenue
Portland, OR 97210
800.770.4128

Canadian Laboratories

Burlington, Ontario - 450
5036 South Service Rd.
Burlington, ON L7L5Y7
905 332 9559

Edmonton, Alberta - 402
9450 17 Ave NW
Edmonton, AB T6N 1M9
888.489.0057

Sales & Marketing

Houston, Texas
10450 Stancliff Road, Suite 210
Houston, TX 77099
877.835.8437

International Locations

Australia
Brisbane, Perth, Sydney, Muswellbrook

South America
Santiago de Chile, Belo Horizonte, Brazil

New Zealand
Wellington

Southeast Asia
Kuala Lumpur, Singapore

Europe
Prague

TEST METHODS:

Acid Number:	ASTM D974/D664 (*M)
Base Number:	ASTM D4739 (*M)
Base Number (Perchloric):	ASTM D2896 (*M)
Fuel Dilution by GC:	ASTM D7593
Fuel Dilution Visc/Setaflash	In House
Fuel Soot ATR/IR:	ASTM D7686 (*M)
Soot by FTIR:	ASTM D7844
Glycol:	In House
Metals by ICP AES:	ASTM D5185 (*M)
Ox, NOx, SOx, FTIR:	ASTM E2412/D7418/D7414 D7415
PQ Index:	ASTM D8120 (*M)
Particle Count:	ASTM D7647 (*M) / ISO 4406
Viscosity:	ASTM D445 (*M) / D7279 (*M)
Water KF:	D6304 / E203 (*M)
Water Crackle:	In House

*M - Modified Method

UIN 0858E7B

Oil

Unit No. B14-038-P2

Unit:
Make
Model
Serial No.

Site Tradepoint Atlantic Project# 20010214

Compartment:
Name QU787333 Sample #1
Make
Model
Serial No.
Capacity: 0.0

Customer:

ALS ENVIRONMENTAL
301 Fulling Mill Rd
Middletown PA 17057
USA

DIAGNOSIS

No interpretation of results provided. Sample run for test data only.

ANALYST: Eric.Dunlap

Normal

LEGEND

Severe | Abnormal | Caution | Normal

DATE SAMPLED	11-Nov-20
DATE RECEIVED	08-Dec-20
DATE REPORTED	10-Dec-20

LAB NO.		41022635758
SIF NO.		38348655
TIME ON UNIT	Hrs	
TIME ON OIL	Hrs	
OIL BRAND		Unidentified
OIL TYPE		Unidentified
OIL GRADE		Unknown
OIL ADDED		
FILTER	Hrs	Not Applicable
OIL CHANGED		
WO NUMBER		

Additional

Specific Gravity @ 60F (D1298)	0.909
Density Specific Gravity (D1298)	0.9089

Right Solutions • Right Partner

Right Solutions • Right Partner

UIN 0858E7B

No Data Available	No Data Available
No Data Available	No Data Available
No Data Available	Filter Image Filter patch test is not performed Contact laboratory for more information

Since services are based on samples and information supplied by others, and since corrective actions, if any, are necessarily taken by others, these services are rendered without any warranty or liability of any kind beyond the actual amount paid to ALS Tribology for the services. Reported recommendations are based on interpretations of the generated test results and historical data. Certain test results appearing in this report may have been tested at other ALS laboratories within the Tribology divisional network.

ALS Environmental
Attn: Sue Scherer
301 Fulling Mill Rd
Middletown PA 17057
USA

0002 v1.9

U.S. Laboratories

Atlanta, Georgia - 420
5300 OakBrook Parkway
Building 200 Suite 245
Norcross, GA 30093
800.394.3669

Valley View, Ohio - 410
6180 Halle Dr. Suite D
Valley View, OH 44125
800.726.5400

Kansas City, Kansas - 430
935 Sunshine Road
Kansas City, KS 66115
800.332.8055

Phoenix, Arizona - 440
3319 West Earll Drive
Phoenix, AZ 85017
800.445.7930

Portland, Oregon - 401
4943 NW Front Avenue
Portland, OR 97210
800.770.4128

Canadian Laboratories

Burlington, Ontario - 450
5036 South Service Rd.
Burlington, ON L7L5Y7
905 332 9559

Edmonton, Alberta - 402
9450 17 Ave NW
Edmonton, AB T6N 1M9
888.489.0057

Sales & Marketing

Houston, Texas
10450 Stancliff Road, Suite 210
Houston, TX 77099
877.835.8437

International Locations

Australia
Brisbane, Perth, Sydney, Muswellbrook

South America
Santiago de Chile, Belo Horizonte, Brazil

New Zealand
Wellington

Southeast Asia
Kuala Lumpur, Singapore

Europe
Prague

TEST METHODS:

Acid Number:	ASTM D974/D664 (*M)
Base Number:	ASTM D4739 (*M)
Base Number (Perchloric):	ASTM D2896 (*M)
Fuel Dilution by GC:	ASTM D7593
Fuel Dilution Visc/Setaflash	In House
Fuel Soot ATR/IR:	ASTM D7686 (*M)
Soot by FTIR:	ASTM D7844
Glycol:	In House
Metals by ICP AES:	ASTM D5185 (*M)
Ox, NOx, SOx, FTIR:	ASTM E2412/D7418/D7414 D7415
PQ Index:	ASTM D8120 (*M)
Particle Count:	ASTM D7647 (*M) / ISO 4406
Viscosity:	ASTM D445 (*M) / D7279 (*M)
Water KF:	D6304 / E203 (*M)
Water Crackle:	In House

*M - Modified Method