CLOSURE PLAN
FOR
HUMPHREY IMPOUNDMENT

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

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

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1.0 INTRODUCTION

ARM Group LLC (ARM), on behalf of Tradepoint Atlantic, has prepared this Closure Plan 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 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 Closure Plan 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. Once the Time Mill Canal (TMC) was completed (ca. 1969), wastewater was directed through the HCWWTP prior to discharge. After the construction of the TMC, 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 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 Closure Plan 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. Humphrey Impoundment is included as a Special Study Area (SSA) under the Consent Order.

1.3. Closure Plan 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 Closure Plan are to provide for the protection of human health and the environment through the following primary means:

- recovery/control of non-aqueous phase liquids (NAPLs);
- capping the residual sludges, sediments, and soils in the impoundment with a stable, impermeable asphaltic cap to prevent direct contact exposures, promote surface water runoff, reduce surface water infiltration, and facilitate potential beneficial future reuse;
- the implementation of deed restrictions to prevent future uses of groundwater and to restrict future use of the site for commercial/recreational and residential uses: and
- the installation of a monitoring well network and implementation of a monitoring program.

To the extent practical and appropriate, the closure activities 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 hazardous 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

Based on sampling of the sludges, sediments, and soils at the Site (collectively referred to in this section as "soil"), the concentrations of lead, PCBs, and other constituents are well below the levels that would warrant evaluation of a removal remedy, especially given the relatively large volume of solid materials within the impoundment. 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. 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.

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. 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. Petroleum impacts, including a discussion of the analytical exceedance of the TPH/Oil & Grease PAL as well as borings with physical evidence of NAPL in the soil cores, are further discussed in Section 2.3 below. These NAPL impacts are

documented to be widespread in Parcel B14, and continued monitoring and/or appropriate response actions have been recommended.

2.2. GROUNDWATER

Exceedances of the PALs in groundwater below 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, benzo[a]anthracene, naphthalene, and pentachlorophenol), DRO, gasoline range organics (GRO), and Oil & Grease. The aqueous metal exceedances were relatively limited at the Site, and were documented at only four groundwater sample locations, with each location having only one metal exceedance each (manganese, hexavalent chromium, and vanadium). One location exhibited exceedances of four metals (chromium, iron, lead, and manganese). 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 adjacent to the TMC. Among the five SVOCs that were detected above their PALs, two of these analytes had exceedances observed in more than one aqueous sample (benzo[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 adjacent to the TMC) 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 permanent 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. NON-AQUEOUS PHASE LIQUID

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, this suggests that the NAPL is contained within the waste materials disposed of inside the impoundment area 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 a site worker.

- 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 total petroleum hydrocarbons (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 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. However, NAPL was encountered in a number of soil borings and piezometers constructed within the impoundment materials, and 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 should 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. 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.

- During the field investigation, an area of oil-stained ground was observed with the impoundment, near an oil baffle installed in the TMC. 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 disposal 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 entire impoundment will be capped. The Site is likely to be developed as an Automotive Roll-on, Roll-off (RORO) Distribution Center in the future under a separate Response and Development Work Plan.

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 was estimated, NAPL was sampled and analyzed for density and viscosity, and methane concentrations were measured. This investigation was proposed through the Pre-Design Investigation Work Plan (Revision 1 dated December 10, 2019) and subsequent Comment Response Letter (dated August 28, 2020).

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 suggests that potential NAPL in these areas may exist in the subsurface but may not have a path 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 identification.

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 at B14-038R-PZ suggest that NAPL transmissivity is significantly below the values considered recoverable and mobile.

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%. As described below, a methane venting system will be implemented to prevent accumulation under the cap.

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 only 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

This section presents the identification of corrective measure alternatives, followed by a screening of the alternatives against the RCRA threshold criteria (i.e., protection of human health and the environment; attainment of media cleanup objectives; and controlling the sources). The corrective measure alternatives were developed based on 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.

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 actions.

- Potential future inhalation and methane generation risks should be mitigated through appropriate containment actions.

- The selected remedy should prevent migration of subsurface NAPL.

4.3. DETAILED DESCRIPTION OF ALTERNATIVE 2 (FILLING AND CAPPING)

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 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 and monitoring program will ultimately be incorporated into the sitewide groundwater monitoring program.

4.4. INITIAL SCREENING OF ALTERNATIVES

Per applicable CMS guidance, this section presents a brief screening of the identified corrective measure alternatives against the RCRA 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 and the environment. However, Alternative 2 (Filling and Capping) would provide further protection of human health and the environment by preventing direct contact exposures through the placement of a cap and institutional controls.

- Attainment of Media Cleanup Objectives: Alternative 1 (No Action) would not meet all of the established media cleanup objectives, while Alternative 2 (Filling and Capping) would address all three of the established media cleanup objectives.

- Controlling the Sources: Historical sources of contamination to the impoundment have generally been eliminated already 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 contaminant sources. Alternative 2 (Filling and Capping) would facilitate and include removal of NAPL to the extent feasible. Capping of the impoundment will eliminate stormwater infiltration and help stabilize NAPL within the impoundment.

5.0 EVALUATION OF THE CORRECTIVE MEASURE ALTERNATIVES

5.1. GENERAL

This section presents a detailed evaluation of the corrective measure alternatives that were identified and developed in the previous section (i.e., Alternative 1 - No Action, and Alternative 2 - Filling and Capping). Pursuant to applicable CMS guidance, the evaluation has been conducted with respect to the following evaluation/balancing criteria: long-term effectiveness; implementability; short-term effectiveness; toxicity, mobility and volume reduction; community acceptance; state acceptance; and cost.

5.2. 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 NAPL and methane to the extent practicable, and the implementation of long-term inspection and maintenance requirements (institutional controls). This alternative eliminates stormwater infiltration and possible NAPL mobilization caused by infiltration.

5.3. REDUCTION IN TOXICITY, MOBILITY, OR VOLUME OF WASTES

This criterion generally refers to how much the corrective measures 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 sediments within the impoundment.

Alternative 2 – Filling and Capping: This alternative provides reduction in contaminant toxicity, mobility and volume through the collection and removal of NAPL to the extent practicable, and a reduction of mobility by limiting infiltration into the impoundment through the placement of a low permeability cap.

5.4. 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 corrective measure 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.

5.5. 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. This alternative also provides for the beneficial reuse of reclaimed material.

5.6. COMMUNITY ACCEPTANCE

This criterion refers to the known or anticipated community acceptance associated with the corrective measure alternatives. This criterion will be further evaluated through the 30-day public comment period that will be provided following remedy selection and issuance of a Statement of Basis by the USEPA.

- 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.

5.7. STATE ACCEPTANCE

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

- Alternative 1 – No Action: This alternative does not require any new permits.

- 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 Voluntary Cleanup Program (VCP).

5.8. COST

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

- Alternative 1 – No Action: This alternative does not involve any new costs.

- Alternative 2 – Filling and Capping: Implementation of this alternative is expected to costs several million dollars for sediment filling, handling, transportation, disposal, and capping, 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.

6.0 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 No Action Alternative, 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 alternative evaluation criteria;
- it meets the media cleanup goals;
- it can be readily implemented with proven technologies;
- it improves the site conditions and drainage;
- it is durable and provides for long-term protection of human health and the environment; and
- it can be conducted in accordance with applicable State regulations.

7.0 PROPOSED CLOSURE ACTIVITIES

7.1. GENERAL

Based on the results presented in the Phase II Investigation Report summarized above in Section 2, and results from the Pre-Design Investigation summarized above in Section 3, the proposed closure activities for Parcel B14 are generally as follows:

- recovery/control of non-aqueous phase liquids (NAPLs);
- filling of the impoundment with MDE-approved materials;
- capping the residual sludges, sediments, and soils in the impoundment with an impermeable asphaltic cap to prevent direct contact exposures, promote surface water runoff, reduce surface water infiltration, allow for safe venting of accumulated methane, allow for collection and removal of mobile NAPL, and facilitate potential beneficial future reuse;
- the implementation of deed restrictions to prevent future uses of groundwater and to restrict future use of the site for commercial/recreational and residential uses; and
- installation of a monitoring well network and implementation of a monitoring program that will ultimately be incorporated into the sitewide groundwater monitoring program.

More detailed descriptions of these measures and the associated plans for design, permitting, and implementation are presented in the following sections.

7.2. PLANNING AND PRE-DESIGN ACTIVITIES

To support the completion of final design details and plans for the Site closure, supplemental planning and pre-design activities will be conducted as generally outlined below:

- Sludge/Sediment Testing: Additional sampling and testing of the impounded sludges, sediments and soils will be conducted to support the evaluation of fill placement methods, dewatering and draining characteristics, settlement and strength properties, and related factors. The testing will involve the completion of Standard Penetration Test (SPT) and Cone Penetrometer Test (CPT) borings as well as the collection of representative samples for physical property testing of grain size, Atterberg limits, density, moisture content, and shear strength (by methods appropriate to the encountered materials). Representative undisturbed samples will be collected for laboratory consolidation testing.

Geotechnical Embankment Assessment: The integrity and structural stability of the perimeter embankment will be further evaluated to help ensure that such items as slope stability, bearing capacity, and/or NAPL migration will be addressed by the proposed fill placement and cover system within the impoundment. A geophysical survey is proposed to obtain a continuous profile of the perimeter embankment and identify areas of high saturation or other areas of potential concern. Additional SPT and CPT borings will be conducted along the embankment to help characterize the nature and strength of the berm and underling materials, and to help identify any sections of potential concern. Representative samples will be collected from the SPT borings for laboratory testing of grain size, Atterberg limits, density, moisture content, and strength (by methods appropriate to the encountered materials). The strength characteristics and proposed loading conditions will then be evaluated with an appropriate slope stability model to confirm an acceptable factor of safety against failure. If any potential instability is predicted, the filling plans will be modified (e.g., to include higher strength materials within the impoundment or adjacent to the embankment) and/or the embankment will be otherwise reinforced (e.g., soil buttress) as needed to achieve an acceptable factor of safety against failure. This study will also attempt to identify or better characterize any potential weaknesses, penetrations, or preferential flow pathways in the embankment so that any such locations can be property sealed or otherwise addressed prior to the start of soil placement activities.

7.3. PROJECT IMPLEMENTATION

Details of the proposed closure activities are presented in the following subsections of this Closure Plan, with additional details to be developed during the final design and permitting phase (to be conducted following approval of this Closure Plan and completion of the additional pre-design planning activities).

7.3.1. Erosion and Sediment Controls

Erosion and sediment controls will be installed prior to commencing any ground disturbance work. These controls will be constructed in accordance with the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control. The erosion and sediment control measures will generally include the following to prevent contaminated soils and sediments from exiting the Site:

- Work will generally be conducted within or adjacent to the impoundment, allowing for any eroded sediments to be captured within the embankment or berm of the impoundment. Perimeter erosion and sediment controls will be established to prevent sediment migration when the work activities get closer to or above the top of the embankment.

- Grading and fill placement will be conducted in a manner to provide for the control of stormwater runoff. The creation of steep slopes will be avoided to the extent possible to reduce potential erosion.

- To the extent possible, fill materials will be placed into the impoundment directly without interim stockpiling and double handling. If stockpiling is required, it will be conducted within the footprint of the impoundment if practical. Any stockpiles and equipment staging areas located beyond the impoundment will have proper perimeter erosion controls.

- The completed cap surface and enhanced drainage system will be installed as soon as practical to reduce potential erosion. Any large areas of exposed soil that are inactive for extended periods of time will be avoided to the extent possible, or will receive temporary stabilization if warranted.

- Truck hauling roads for the fill materials will be periodically inspected and maintained (e.g., repair rutting, sweeping of excessive dirt, etc.) to control erosion and sediment migration.

7.3.2. Dewatering

As early as practical in the project implementation, pumping and dewatering of retained stormwater will be conducted to remove free-standing stormwater to the extent possible and to help support fill placement and compaction activities. Dewatering will involve pumping of free-standing water from the surface of low-lying areas in the impoundment where water currently collects, supplemented by the pumping of subsurface water from depressed pits, sumps, wells, or trenches excavated below the current impoundment surface. Water and NAPL pumped from the impoundment will be passed through an oil-water separator, settling tank, or other method to provide for the removal of free-phase oils, with the treated water discharged directly to the HCWWTP, and the recovered oils sent off-site for beneficial use or disposal. The goal of the dewatering activities will be to allow fill placement and compaction to be conducted in dry conditions with conventional earthwork equipment.

7.3.3. Vegetation Removal

Prior to the placement of fill in any area, existing vegetation within that area will be cut down to the ground surface. The removed vegetation will be chipped and used for mulch elsewhere on Sparrows Point if suitable, or will be otherwise handled on-site or off-site in accordance will applicable regulations. Any large trees on the embankment of the impoundment will be removed carefully so that the embankment integrity is not compromised.

7.3.4. Cover System Construction

Based on the existing ground surface elevations across the impoundment, and as necessary to establish a cap that can freely drain surface water above the elevation of the existing perimeter embankment, 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 500,000 cubic yards. The proposed cover system construction activities are generally summarized below:

- Following completion of the impoundment surface water dewatering and vegetation removal activities, the surface of the impoundment will be inspected and assessed for its suitability to support low-ground-pressure (i.e., tracked) and other conventional earth-moving equipment, and overall homogeneity and grading. Depending on the consistency of the materials, the fill placement plans, some grading of the existing materials may be conducted prior to fill placement to support surface drainage and fill placement activities.

- If excessively soft or wet areas are encountered across the surface of the impoundment, such areas will be stabilized as necessary to allow for safe equipment operation and proper fill placement and compaction, and to help reduce potential future settlement or bearing capacity problems associated with future construction at the site. Depending on the nature and extent of the excessively soft or wet conditions, one or more of the following methods may be employed to provide a suitable surface for cover system construction: additional pumping and dewatering directly to the HCWWTP (after any necessary pretreatment) will be conducted; coarse, dry materials (e.g., broken concrete, rip-rap, coarse slag) will be pushed into the soft or wet materials to help increase their density and strength; and/or geotextile or geogrid reinforcement will be placed over the area. Chemical stabilization, reagent mixing, and other measures may be considered if necessary, but are not currently expected to be necessary or cost effective at this time. Vertical (e.g., wick) and/or horizontal (e.g., trench) drains may also be considered if appropriate to reduce the pore-water drainage distances and accelerate settlement of the materials. Surcharge loading may also be considered to accelerate settlement if warranted by the site conditions and construction plans. Following establishment of a suitable subgrade for fill placement, approved fill materials will be placed in approximately 10-inch loose lifts and compacted with approved compaction equipment to achieve a minimum acceptable density to be determined during the final design activities. The moisture content and degree of compaction will be periodically tested in the field with a nuclear density gauge to ensure acceptability. Water and NAPL levels will also be periodically monitored within and outside of the impoundment.

- The surface of the completed cap will be relatively flat, but will be constructed with a minimum slope of approximately 0.5% to promote drainage. The final surface of the cap

will be stabilized to prevent erosion, and drainage channels and stormwater management measures will be incorporated as required by the permit conditions. The final surface of the cover system is proposed to be asphalt. Provisions for safe collection and venting of generated methane will be incorporated into the cover system. Any potential vapor intrusion concerns associated with any future buildings proposed for the Site will be addressed as part of a future Response and Development Work Plan. Remedial processes to address methane presence will also be proposed.

7.3.5. Property Use Restrictions and Controls

As discussed earlier, and based on the results of the SLRA and the scope of the proposed remedial activities, the following property use restrictions and controls will be implemented to support the protectiveness provided by the cap:

- A deed restriction will be implemented to allow for industrial Site use only, with no portion of the Site allowed to be used for commercial/recreational or residential purposes unless a supplemental SLRA in a project-specific Response and Development Work Plan is approved by the MDE prior to non-industrial use of any portion of the Site.

- A deed restriction will be implemented to restrict future use of the Site groundwater for any purpose, unless otherwise approved in advance by the MDE.

- Institutional controls will 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. These institutional controls will require a written notice to the MDE of any future soil disturbance activities, proper management and characterization of any material disturbed at the Site, and appropriate health and safety measures for any excavations of substantial time periods. Construction Worker risks will be evaluated in site-specific Response and Development Work Plans as applicable.

- Institutional controls will be implemented to require further assessment or mitigation of the potential for human exposures via the vapor intrusion to indoor air pathway if an enclosed structure is proposed for construction in the vicinity of the south-central edge of the impoundment above and around the area where the exceeding groundwater sample was collected. This situation will need to be addressed in a Response and Development Work Plan prior to construction.

- Institutional controls will be implemented to require appropriate protocols for the mitigation of potential increased (NAPL) mobility and vapor migration in association with the construction of foundations, utilities, and other subsurface features that could

present such risks. These protocols will need to be addressed in a Response and Development Work Plan prior to construction.

- A well network will be installed and a monitoring program will be implemented as part of the sitewide groundwater monitoring program in order to ensure that NAPL and methane vapors do not migrate outside of the capped area.

- Institutional controls will provide for the long-term operation and maintenance of the cover system, as warranted.

7.3.6. Equipment Decontamination

Following completion of the work within the zone of potentially contaminated impoundment sludges and sediments, equipment will be properly decontaminated to prevent the tracking of contamination to other areas of the Site or off-site areas. Decontamination will generally involve dry brushing to remove any dirt and loose sediments, followed by steam-cleaning or high pressure water washing to remove any residual solids. Decontamination water will be pumped directly to the HCWWTP for treatment. Collected solids will be returned to the impoundment and placed below the cap.

7.3.7. Health and Safety Measures

A site-specific HASP will be developed to present the minimum requirements for worker health and safety protection for the project. All contractors working on the Site will be required to prepare their own HASP that provides a level of protection at least as much as that provided by the site-specific HASP, or on-site contactors may elect to adopt the HASP provided. The HASP for this project will be a minor modification to an earlier site-specific HASP developed for the site. As applicable, all workers performing remediation during the closure activities will be required to be OSHA-certified for hazardous waste operations.

7.3.8. Dust Control

Dust generation and migration will be monitored and controlled through the course of the earthmoving activities. In general, the overall dust control methods will include the following:

- Periodic site wetting and dust suppression of active work areas where dry materials are present. Over-spraying of water shall be avoided in order to prevent erosion or sediment control complications.
- Reduced vehicle speeds.
- Minimizing drop heights.
- Covering dry stockpiles with tarps.
- Stabilizing exposed surfaces as soon as possible.

General construction operations, including site grading, material hauling, and fill placement and compaction, will be performed at the Site. To limit worker exposure to contaminants borne on dust and windblown particulates, dust control measures will be implemented, if warranted, when the above activities are performed in areas where impacted materials are exposed or being handled. The action level proposed for the purpose of determining the need for dust suppression techniques (e.g., watering and/or misting) and/or continuous monitoring during the response and development activities on Site will be 3.0 mg/m³. The lowest of the site-specific dust action levels, OSHA PELs, and ACGIH TLV was selected as the proposed action level.

If visible dust is generated in the breathing zone, air monitoring will be implemented as follows:

- at the start of intrusive activities;
- periodically during intrusive activities (15-minute intervals);
- when contaminants other than those previously identified are being handled;
- when a different type of operation is initiated or conditions change;
- if personnel are working in areas with obvious particulate contamination; and
- if a sufficient reasonable interval has passed so that exposures may have significantly changed.

Air monitoring will be performed using a Met One Instrument, Inc. E-Sampler dust monitor or equivalent real-time air monitoring device. If the action level (3.0 mg/m³) is exceeded as a result of conditions occurring at the Site, operations will be stopped and dust suppression implemented. The background dust concentration will be utilized to evaluate whether Site activities are the source of the action level exceedance. Background concentrations will be based on measurements over a minimum of a one hour period at the upwind Site boundary. This upwind data will be used to calculate a time weighted average background dust concentration. The background dust concentration may need to be recalculated periodically during the work day, based on changed upwind conditions. Operations may be resumed once monitoring indicates that dust concentrations are below the action level.

As applicable, air monitoring will be conducted during response and development implementation activities in the immediate work zones and surrounding areas to assess levels of exposure to Site workers, establish that the work zone designations are valid, and verify that respiratory protection being worn by personnel, if needed, is adequate. Concurrent with the work zone air monitoring, perimeter air monitoring will also be performed to ensure contaminants are not migrating off-site. Perimeter monitoring will include monitoring along the perimeter of the Site, including both the downwind and upwind portions of the Site. The concentration measured in the downwind portion of the Site shall not exceed the concentration in the upwind portion. If exceedances attributable to Site conditions are identified downwind for more than five minutes, dust control measures and additional monitoring will be implemented.

The dust suppression measures may include wetting or misting through use of a hose connected to an available water supply or a water truck stationed on Site.

Dust control measures will be implemented as described above to address dust generated as a result of construction and response activities conducted on Site. However, based on the nature of the area and/or on-going activities surrounding the Site, it is possible that windblown particulates may come from surrounding areas. As discussed above, the dust concentration in the upwind portion of the Site will be considered when monitoring dust levels in the work zone. A pre-construction meeting will be held to discuss the potential of windblown particulates from other activities impacting the air monitoring required for this response plan. Site contact information will be provided to address the possibility of upwind dust impacts.

7.3.9. Project Oversight and Documentation

Construction Oversight by a qualified Environmental Professional (EP) will be conducted to ensure and document that the project is completed as planned and that appropriate environmental and safety protocols are followed. The following information will be collected during the course of the work:

- daily observations of construction activities including:
    - source of imported fill material;
    - locations and volumes of fill placement;
    - fill placement and compaction records; and
    - water management and treatment activities; and
- periodic photographs of the cap construction work.

Progress reports will be submitted to the MDE and EPA during and following the completion of the work at the general frequencies summarized below:

- Monthly: beginning one month after the start of fill placement work, monthly progress reports will be submitted to present the status of fill and capping activities.
- Final: a final report will be submitted within 60 days following the completion of the work to document that the work was completed in accordance with the approved design plan approvals and permits.

8.0 PERMITS, NOTIFICATIONS AND CONTINGENCIES

The participant and their contractors will comply with all local, state and federal laws and regulations by obtaining any necessary approvals and permits to conduct the activities proposed herein. The permits and approvals anticipated to be required for the currently proposed remedial activities are discussed below:

- Because the facility is a former industrial facility and a sludge impoundment that was part of a previous wastewater treatment operation, it is understood that a permit for wetlands disturbance will not be required (consistent with the ruling for the adjacent TMC).

- The detailed design plans will include proposed soil erosion and sediment control measures and stormwater management measures, and these plans will be submitted to the MDE and Baltimore County to obtain the required erosion control and stormwater management approvals for these plans.

Contingency measures will include the following:

1. the MDE will be notified immediately of any previously undiscovered contamination, problems with fill placement, and citations from regulatory entities related to health and safety practices or other issues; and

2. any significant change to the implementation schedule will be noted in the progress reports to MDE.

9.0 IMPLEMENTATION SCHEDULE

The currently anticipated project implementation schedule is shown below. Once the work is started, it will be conducted continuously throughout the year, weather permitting. This schedule is subject to change based on subsequent planning and design, weather conditions, contractor rate of progress, agency approvals, and other factors. Progress reports will be submitted to MDE and EPA periodically as noted earlier to document the progress of the work and any notable revisions to the project schedule.

Task	Projected Completion Date
Closure Plan Approval	July 1, 2021
Final Design and Permit Applications	February 15, 2021
USEPA Statement of Basis	February 28, 2021
Equipment Mobilization	July 1, 2021
Completion of Closure	July 1, 2022

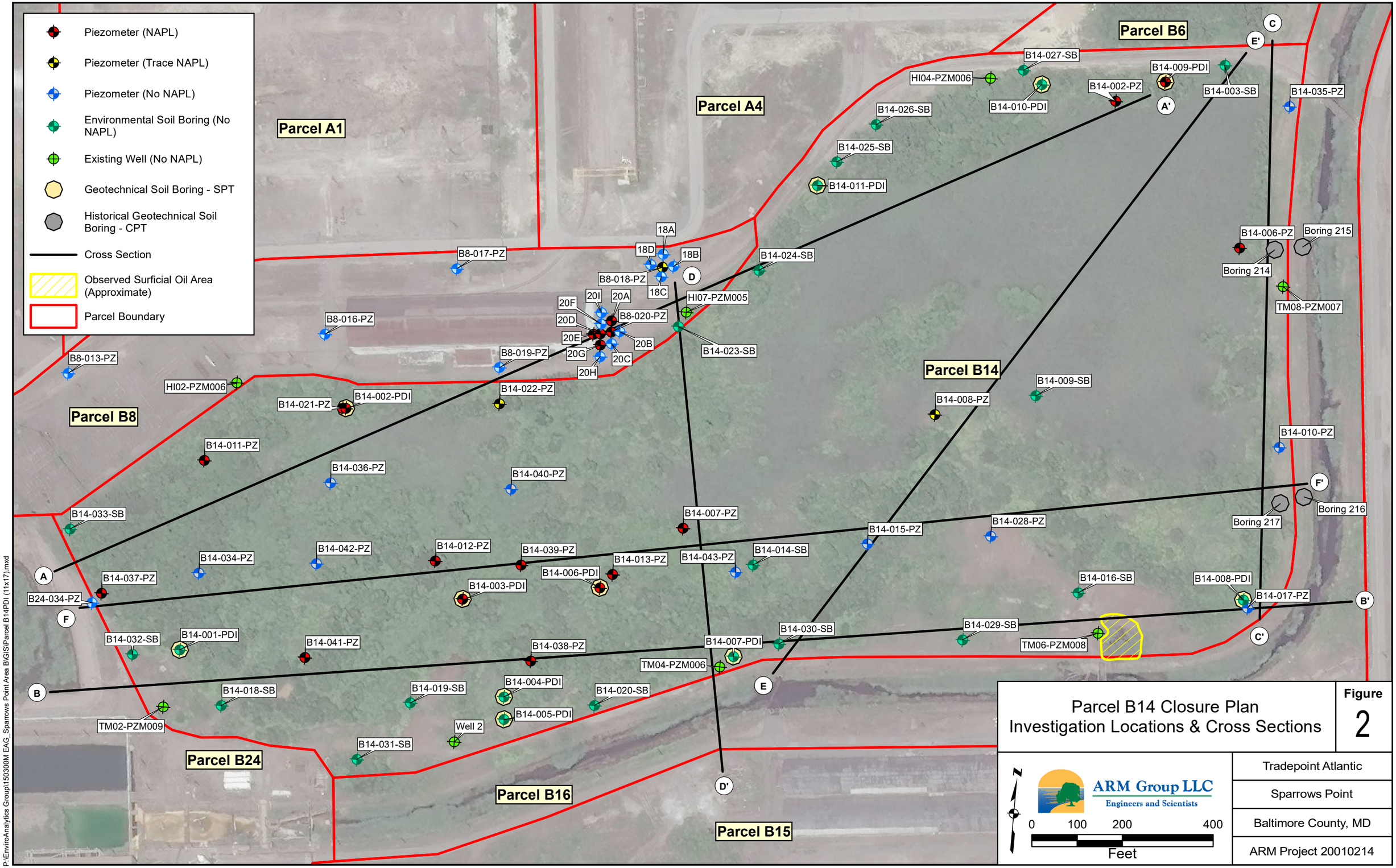
10.0 REFERENCES

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


Site Boundary
Parcel Boundaries
Private Property
Parcel A9
Parcel A5
Parcel A13
Parcel A7
Parcel A14
Parcel A11
Parcel A8
Parcel A12
Parcel A15
Parcel A2
Parcel A17
Parcel A18
Parcel A16
Parcel A6
Parcel A4
Parcel A3
Parcel A1
Parcel A10
Parcel B6
Parcel B8
Parcel B14
Parcel B22
Parcel B16
Parcel B21
Parcel B15
Parcel B24
Parcel B23
Parcel B25
Parcel B7
Parcel B1
Parcel B2
Parcel B3
Parcel B17
Parcel B19
Parcel B4
Parcel B5
Parcel B9
Parcel B18
Parcel B10
Parcel B13
Parcel B20
Parcel B11
Parcel B12
Tradepoint Atlantic
Area A and Area B Parcels
September 22, 2020
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 Closure Plan
Investigation Locations & Cross Sections

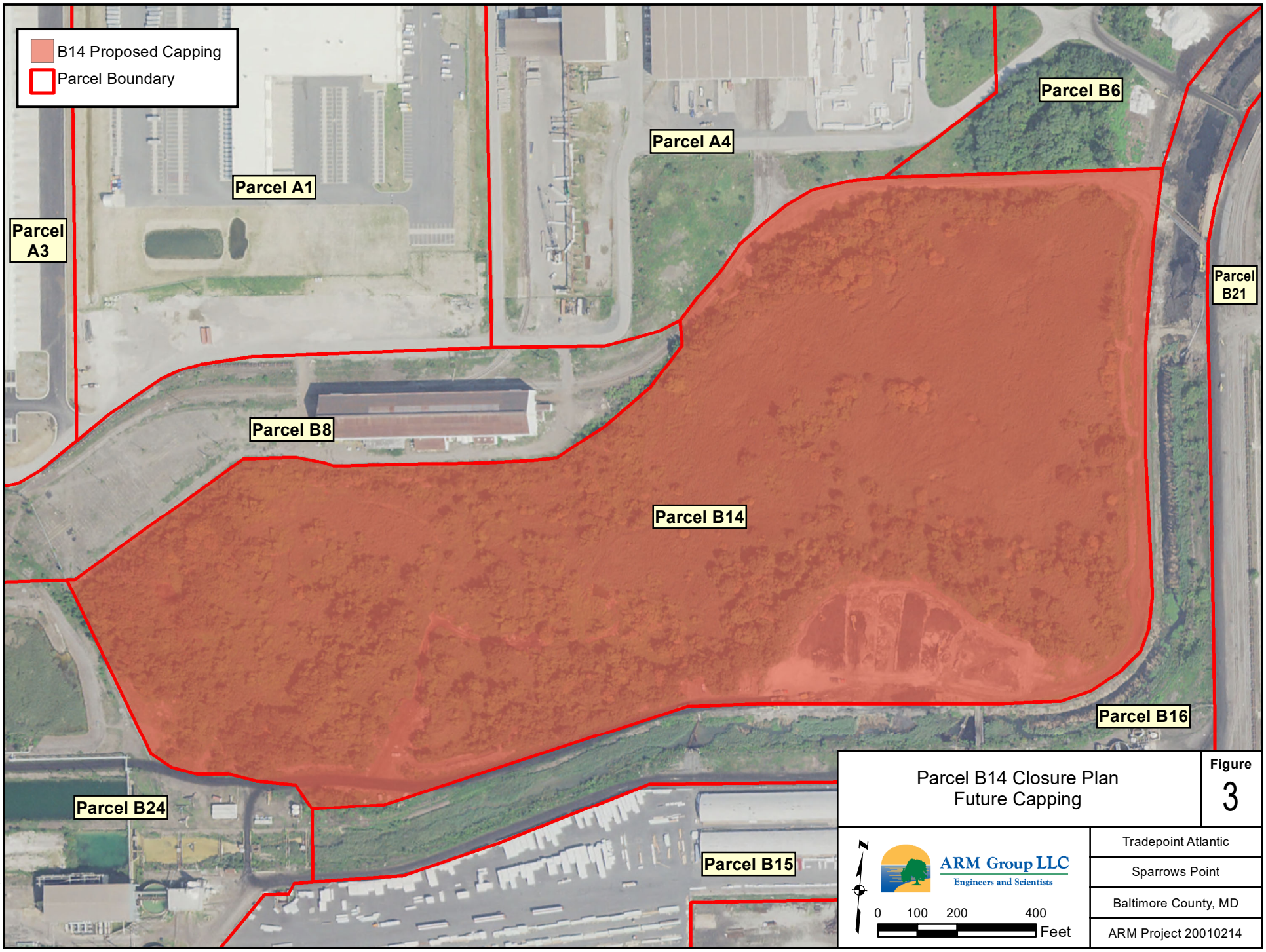
Figure 2

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


B14 Proposed Capping
Parcel Boundary
Parcel A1
Parcel A3
Parcel A4
Parcel B6
Parcel B8
Parcel B14
Parcel B16
Parcel B21
Parcel B24
Parcel B15
Parcel B14 Closure Plan
Future Capping
Figure
3
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 B14 PDI.mxd

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 Observed
NAPL Sheen
Hydrocarbon Odor

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
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Figure 5

Geologic Cross section

Section B-B'

LEGEND

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

12-02-2020 \\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\180589M EAG B14 Humphrey Impoundment\Documents\Cross Sections\B-B' (short v2).cro

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 Observed
- NAPL Sheen
- Hydrocarbon Odor
- Shallow Well Groundwater Elevation
- Inermediate 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'

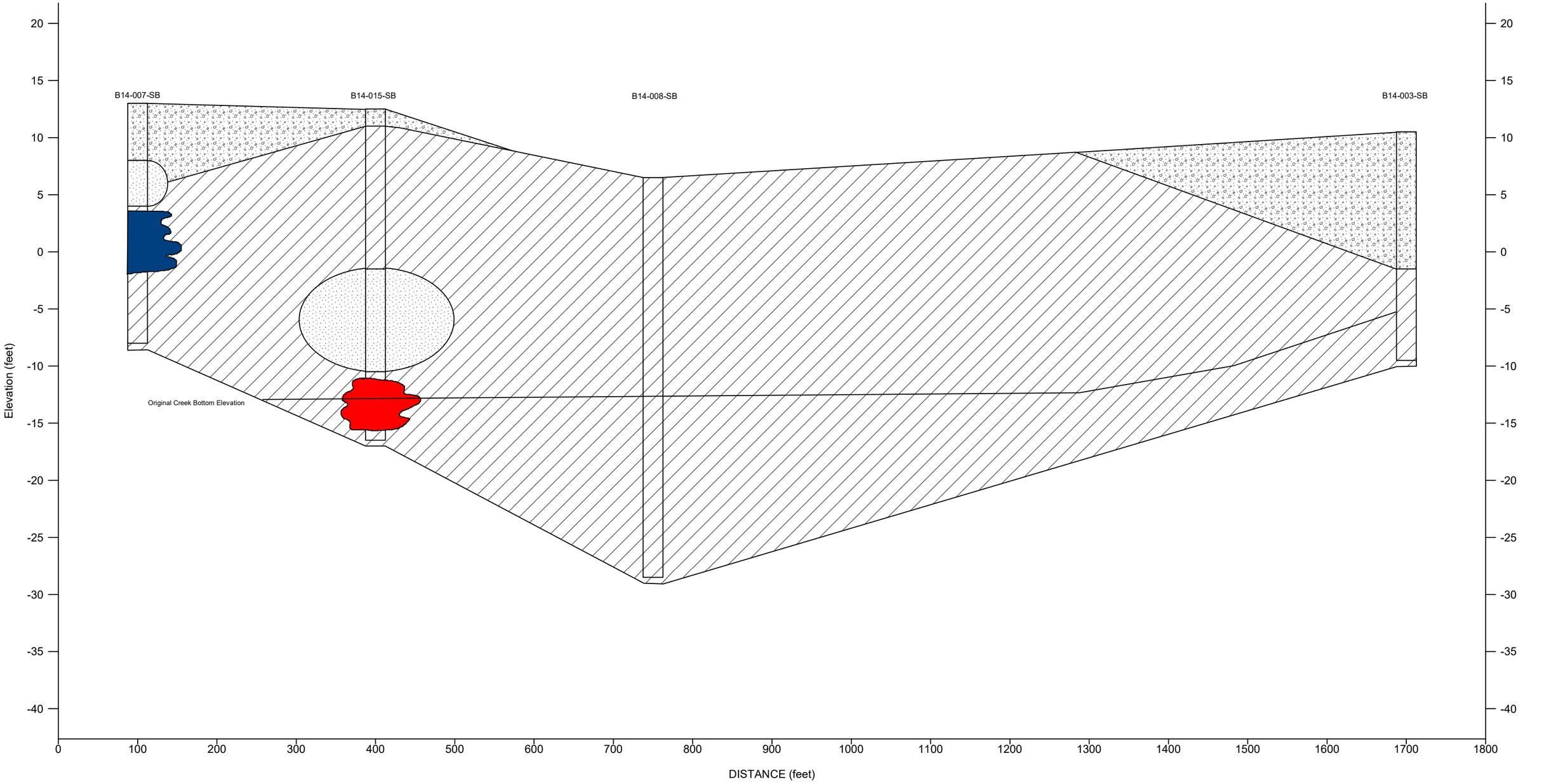
ARM Group LLC
Engineers and Scientists

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'

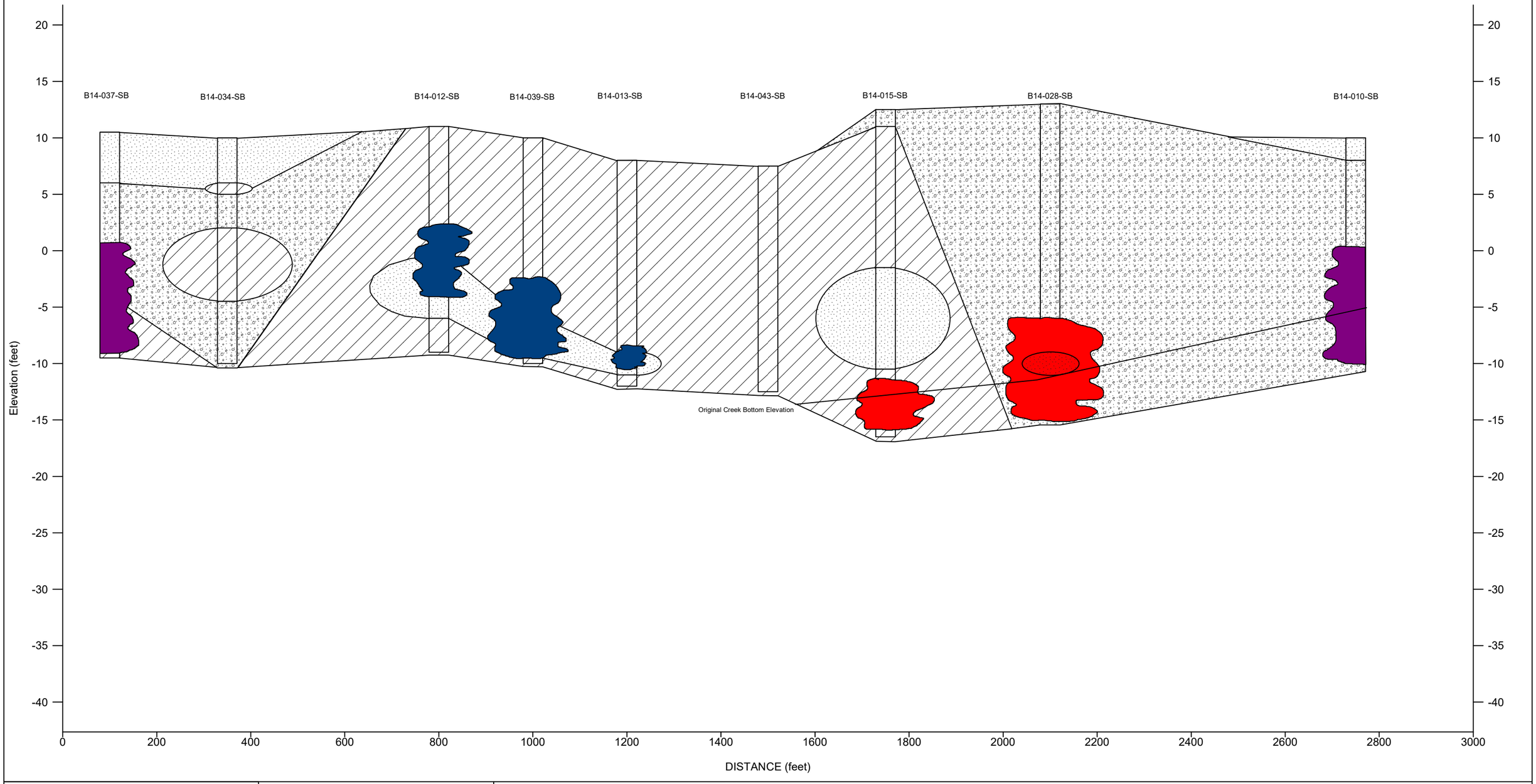
LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL Observed
- Hydrocarbon Odor

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

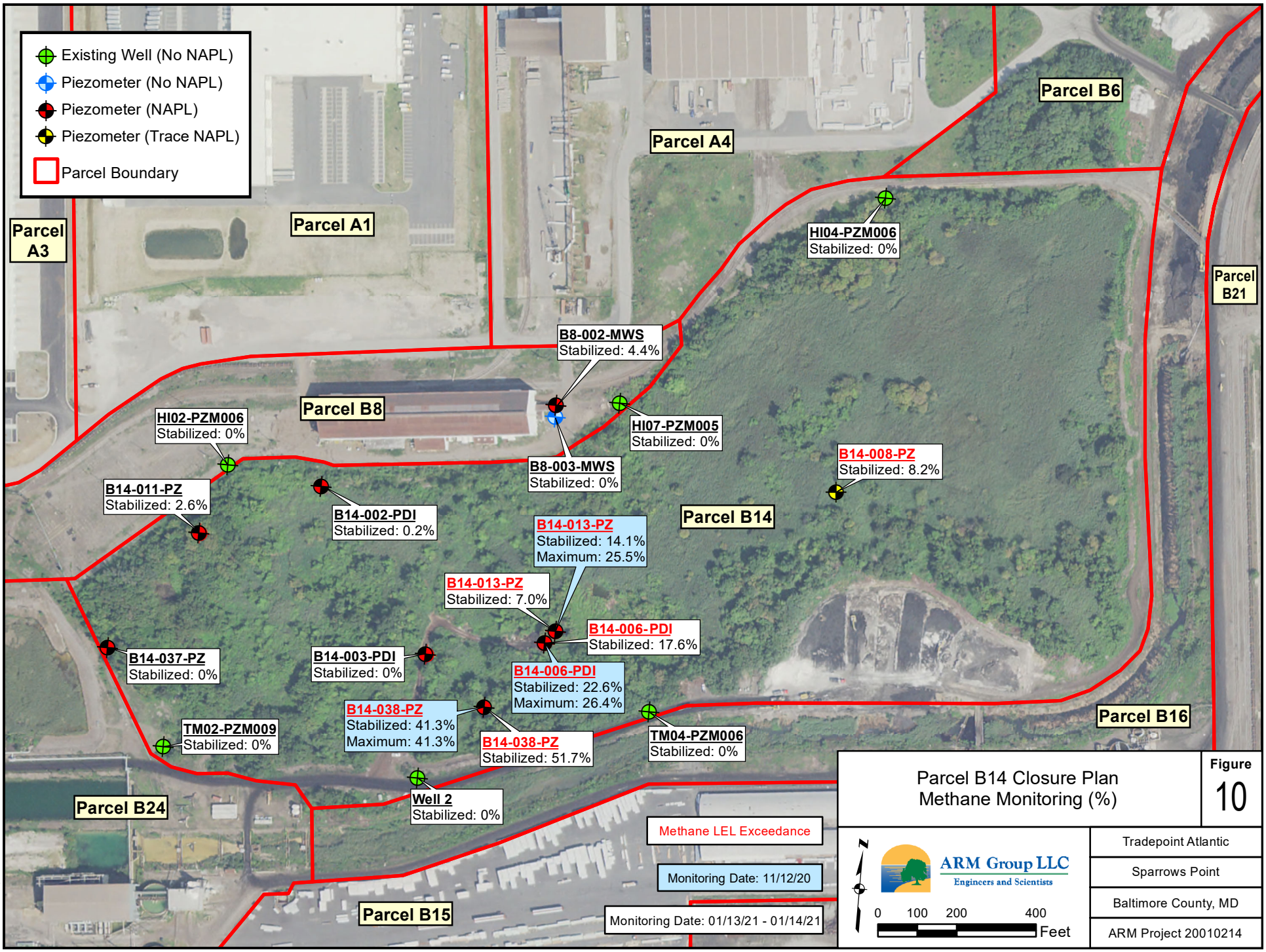
Geologic Cross section

Section F-F'

LEGEND

- Slag
- Sand
- Silt/Clay
- NAPL Observed
- NAPL Sheen
- Hydrocarbon Odor

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



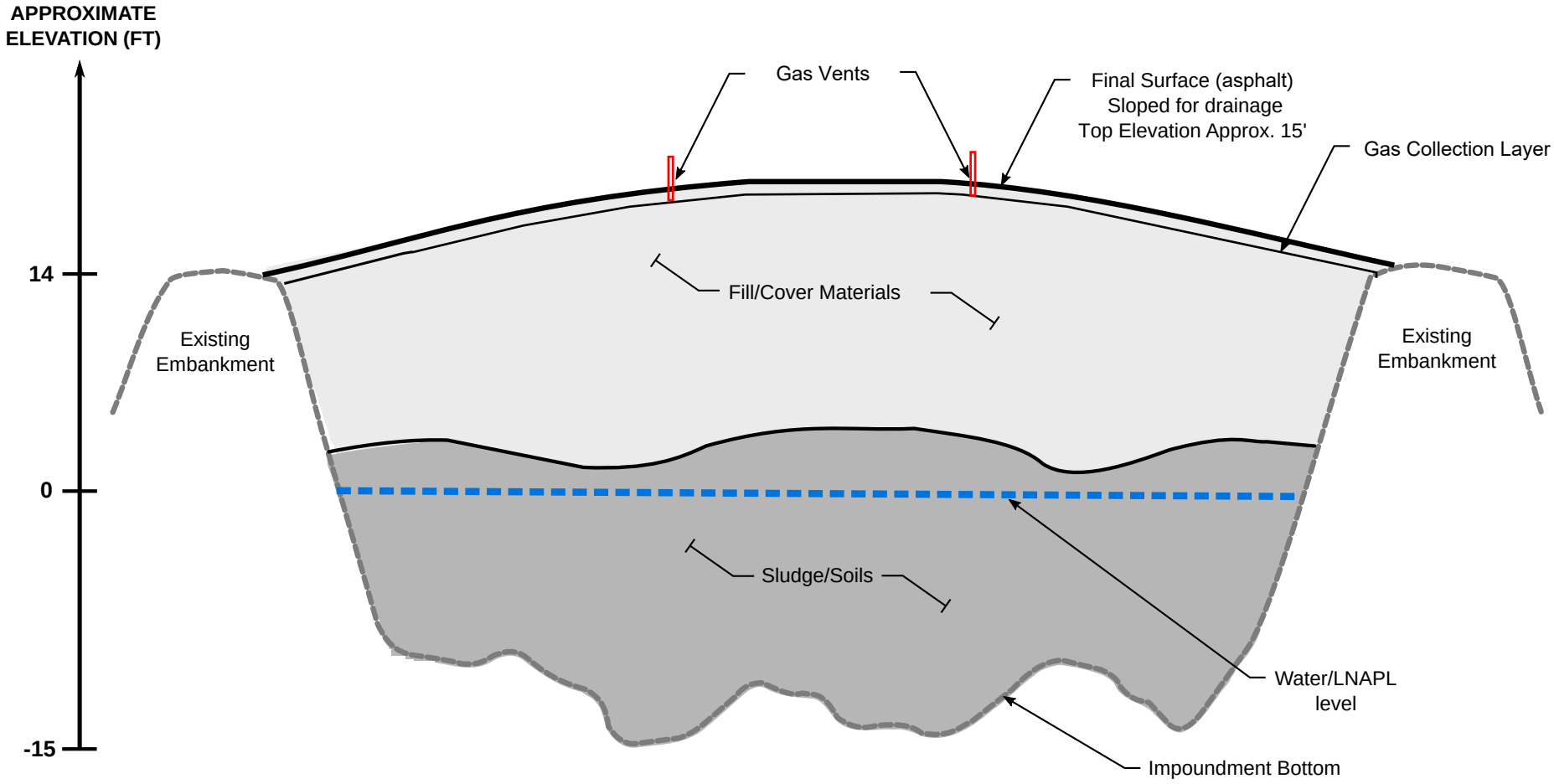
P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B14 PDI.mxd

Parcel B14 Closure Plan
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 - Closure Plan 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 Closure Plan

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 Closure Plan

	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 Closure Plan

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 (%)
B14-013-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
B14-038-PZ	41.3	12.5	0.9	45.3	10	*same as stabilized*			

NOTES:

ARM Group LLC

Table 3 - Methane Monitoring
Parcel B14 Closure Plan

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

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

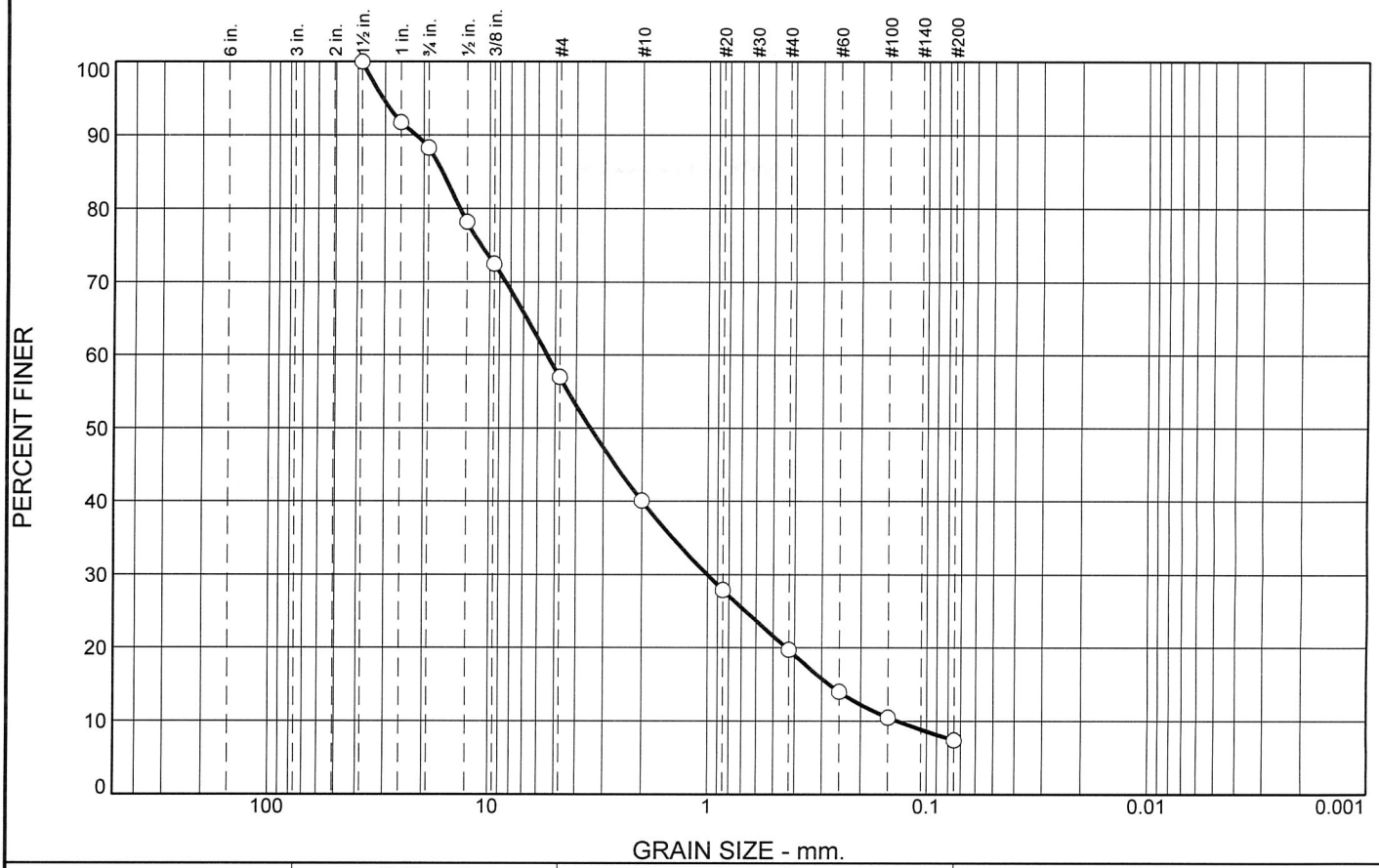
Received By: _____ Date: _____

☐ 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

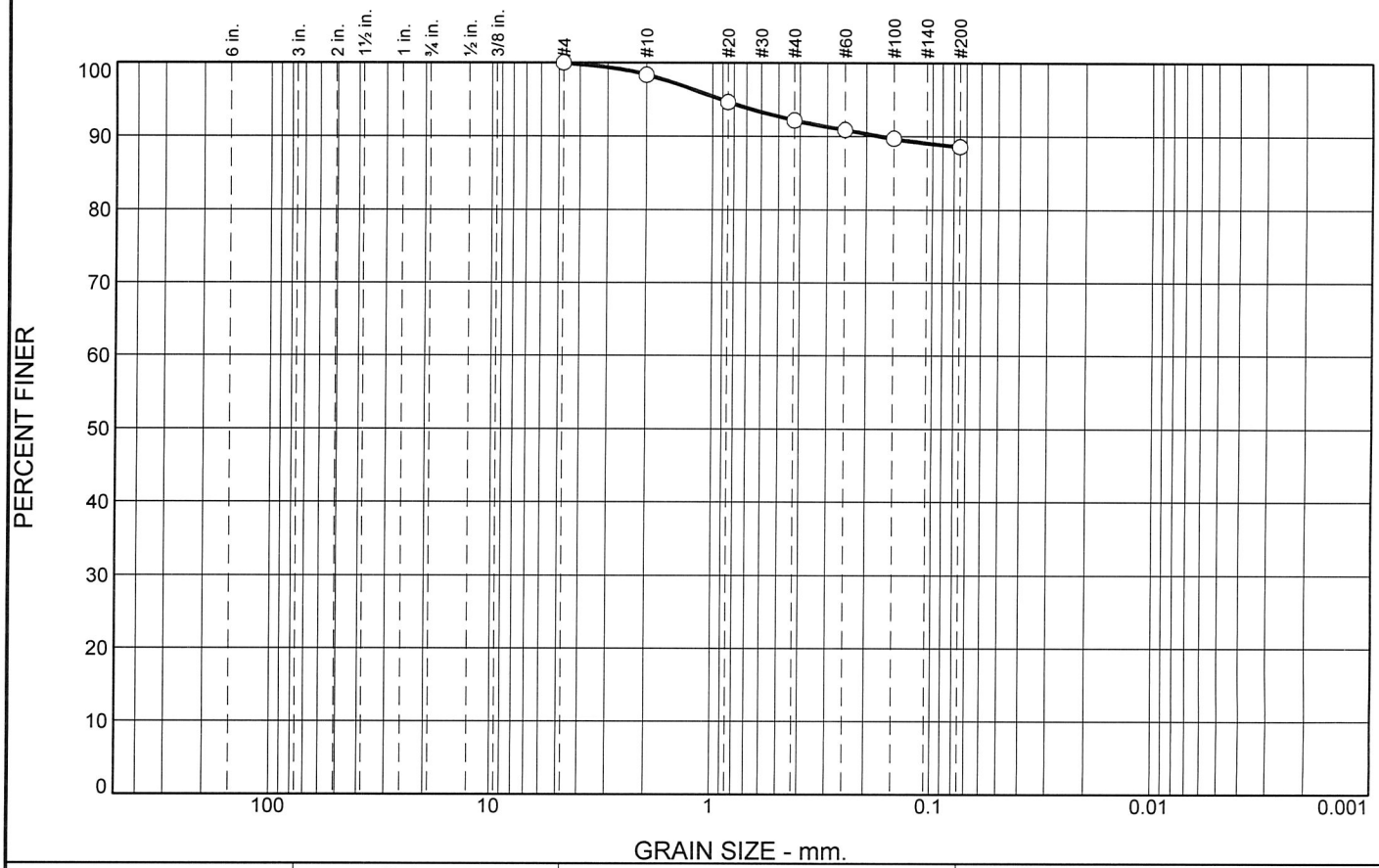
JLT Laboratories, Inc.

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

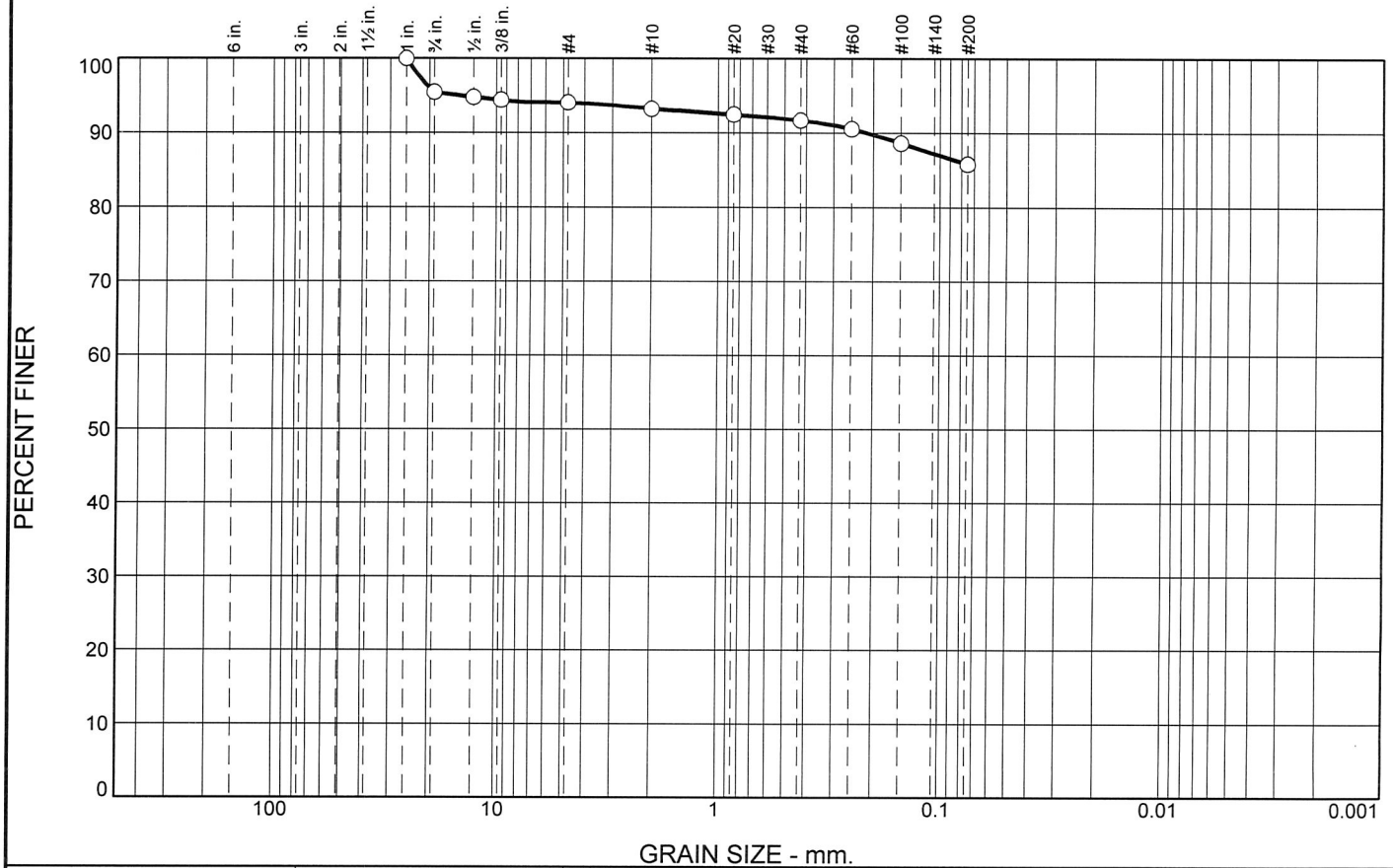
JLT Laboratories, Inc.

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

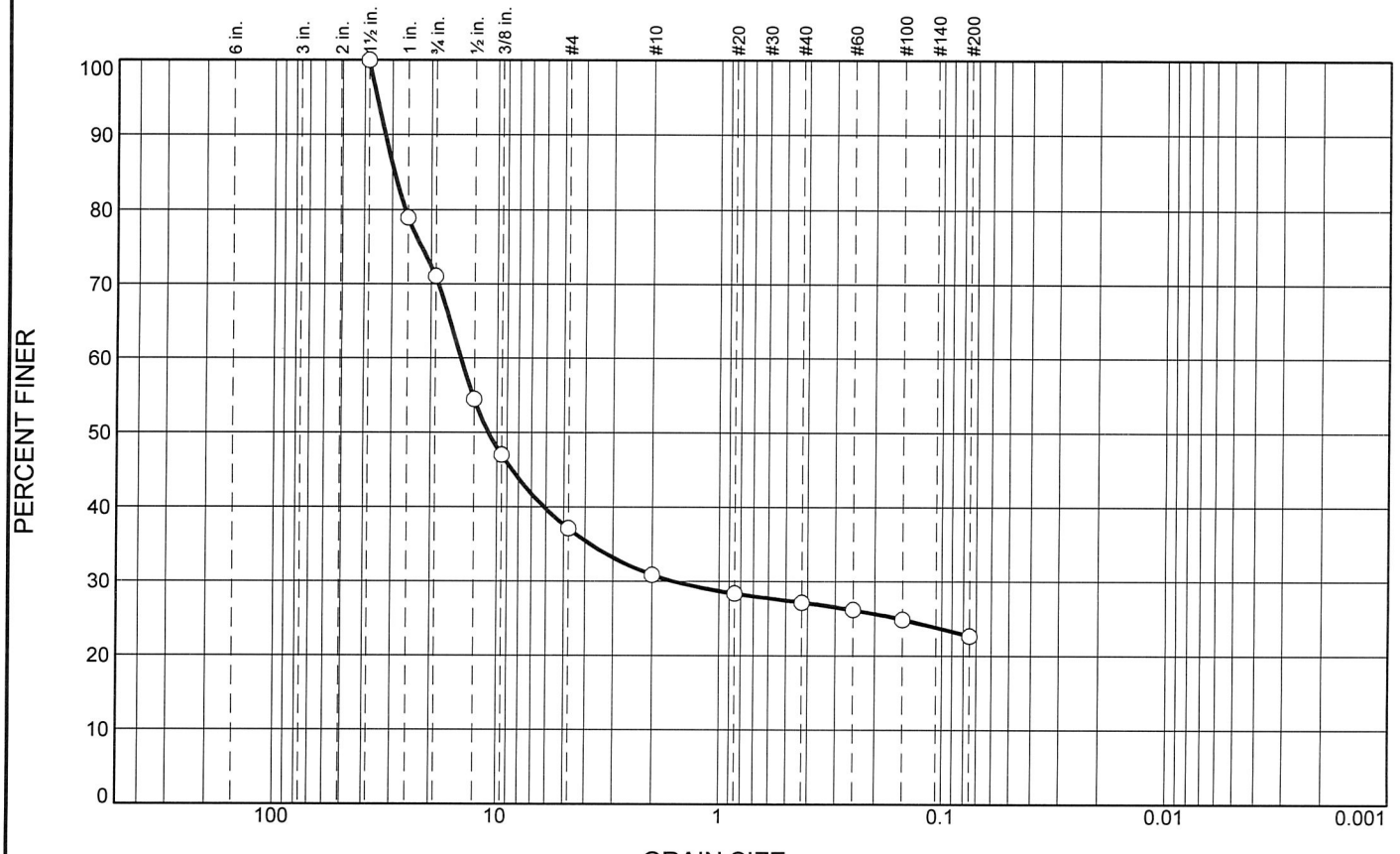
JLT Laboratories, Inc.

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

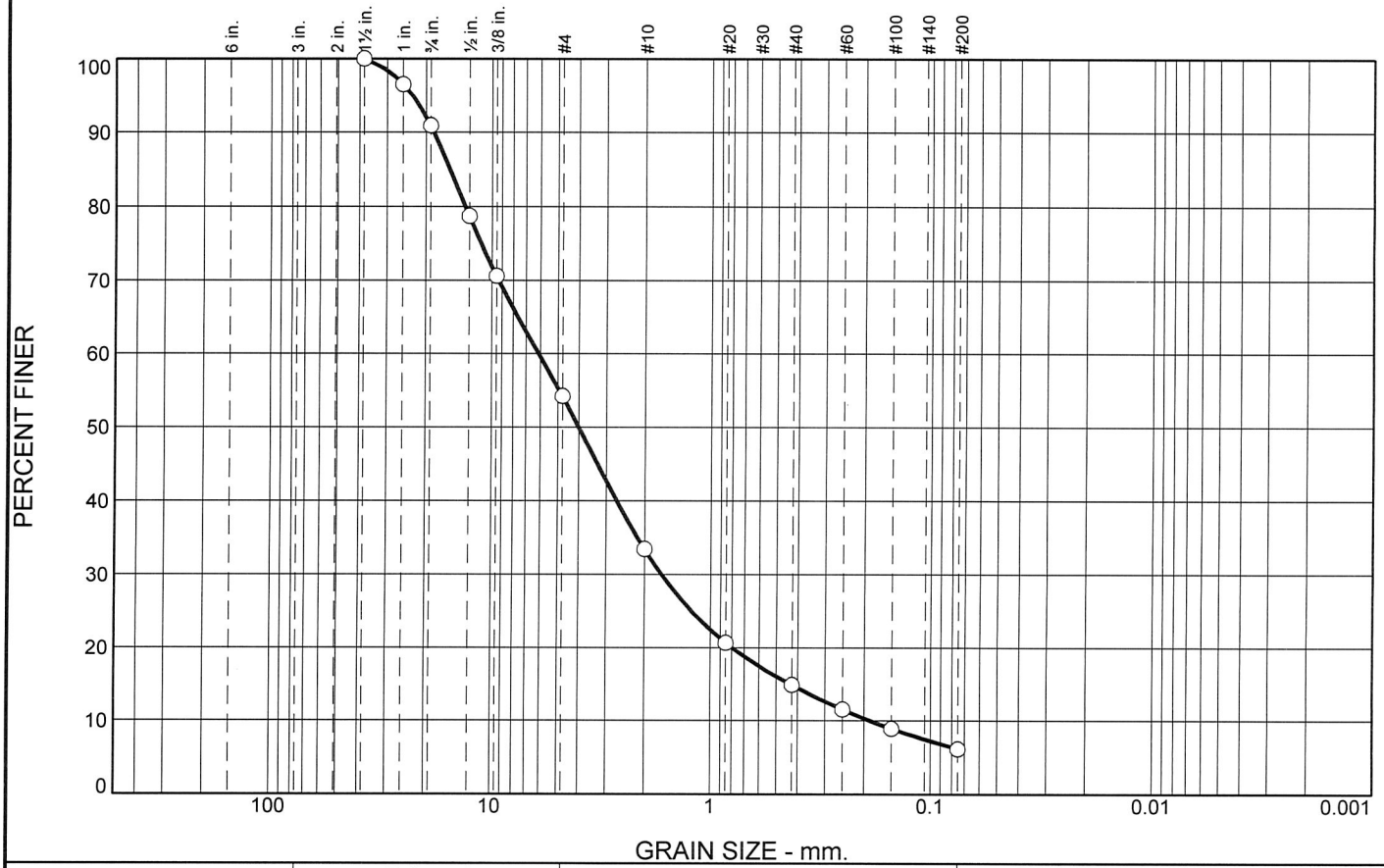
JLT Laboratories, Inc.

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

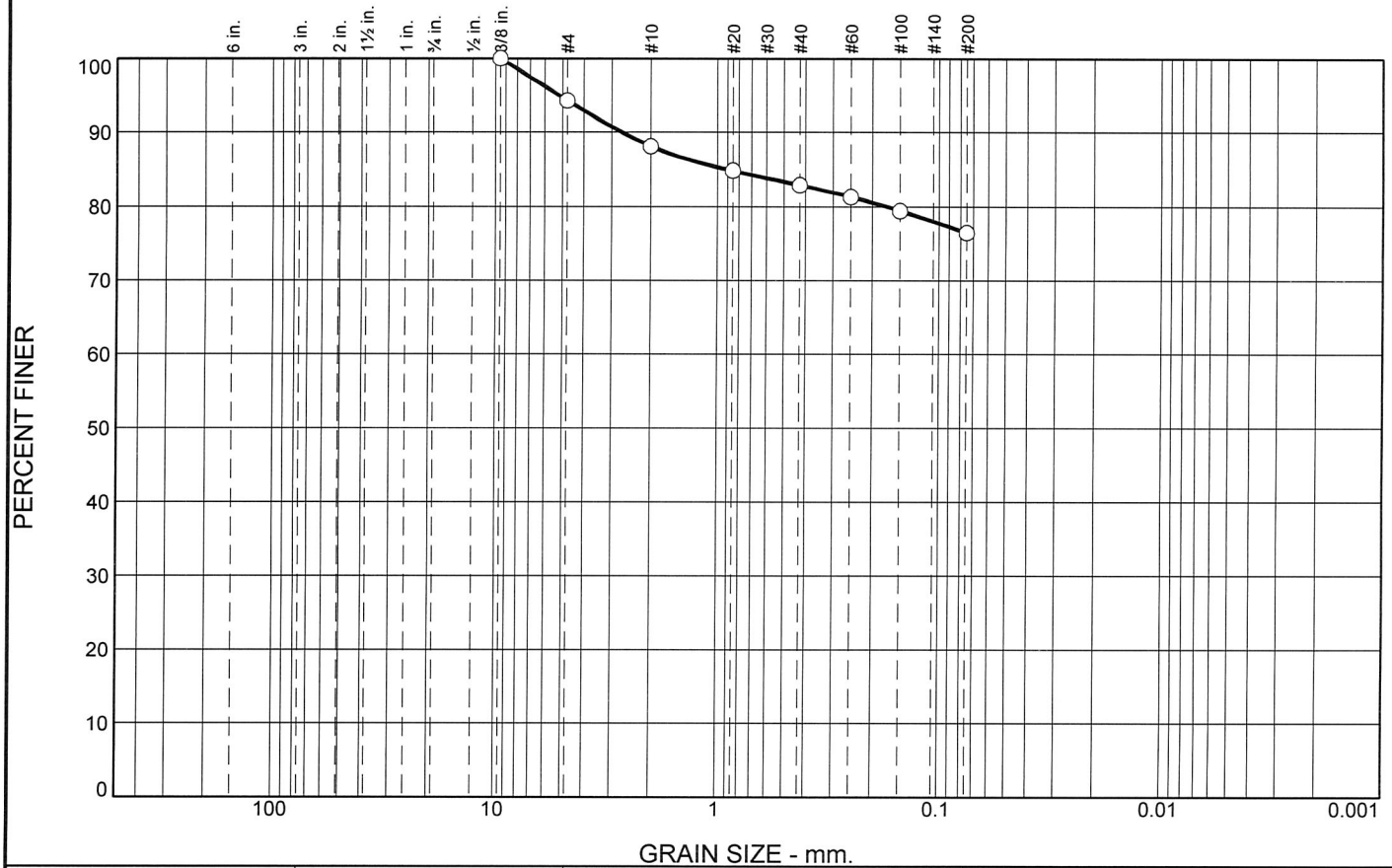
JLT Laboratories, Inc.

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

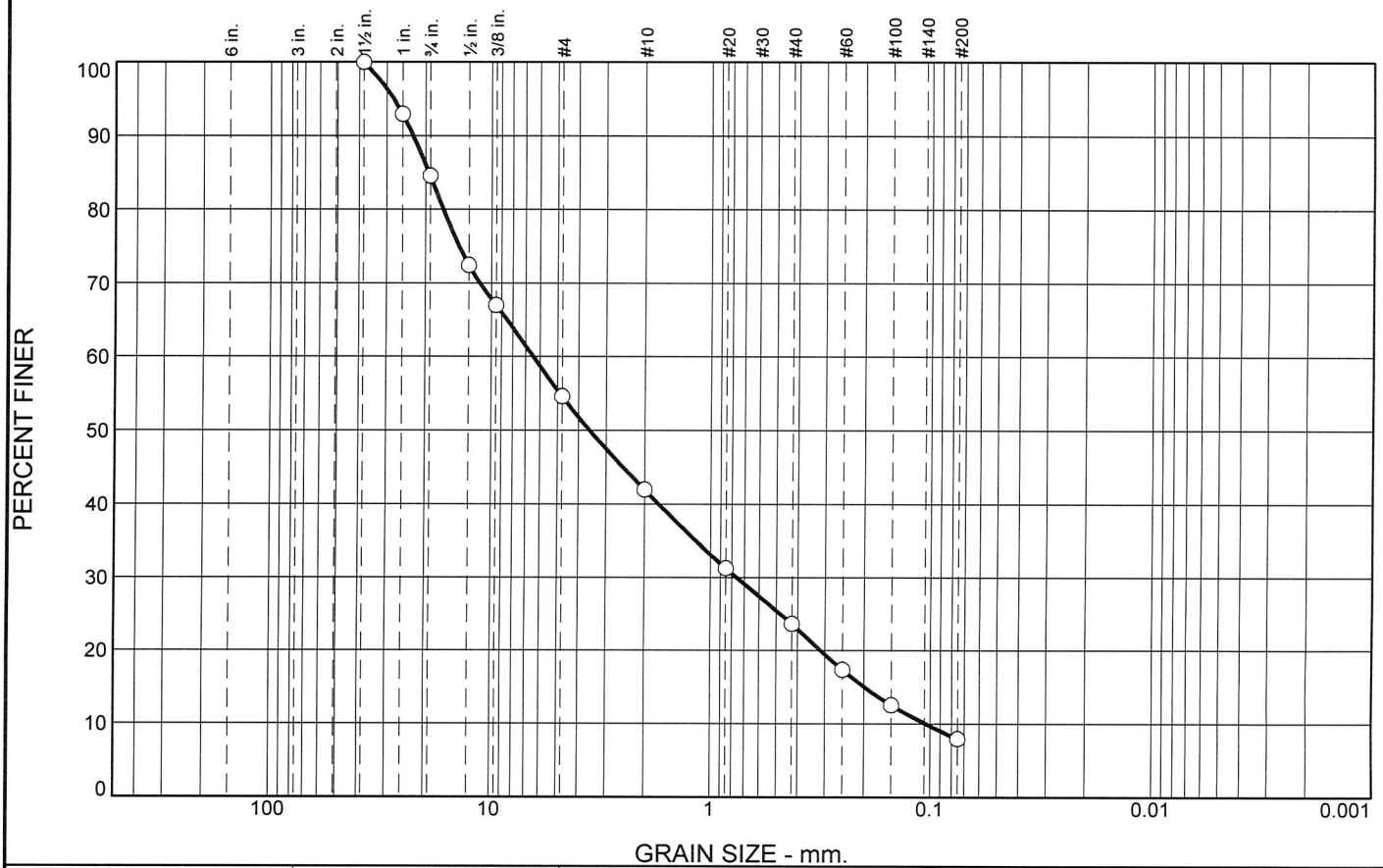
JLT Laboratories, Inc.

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

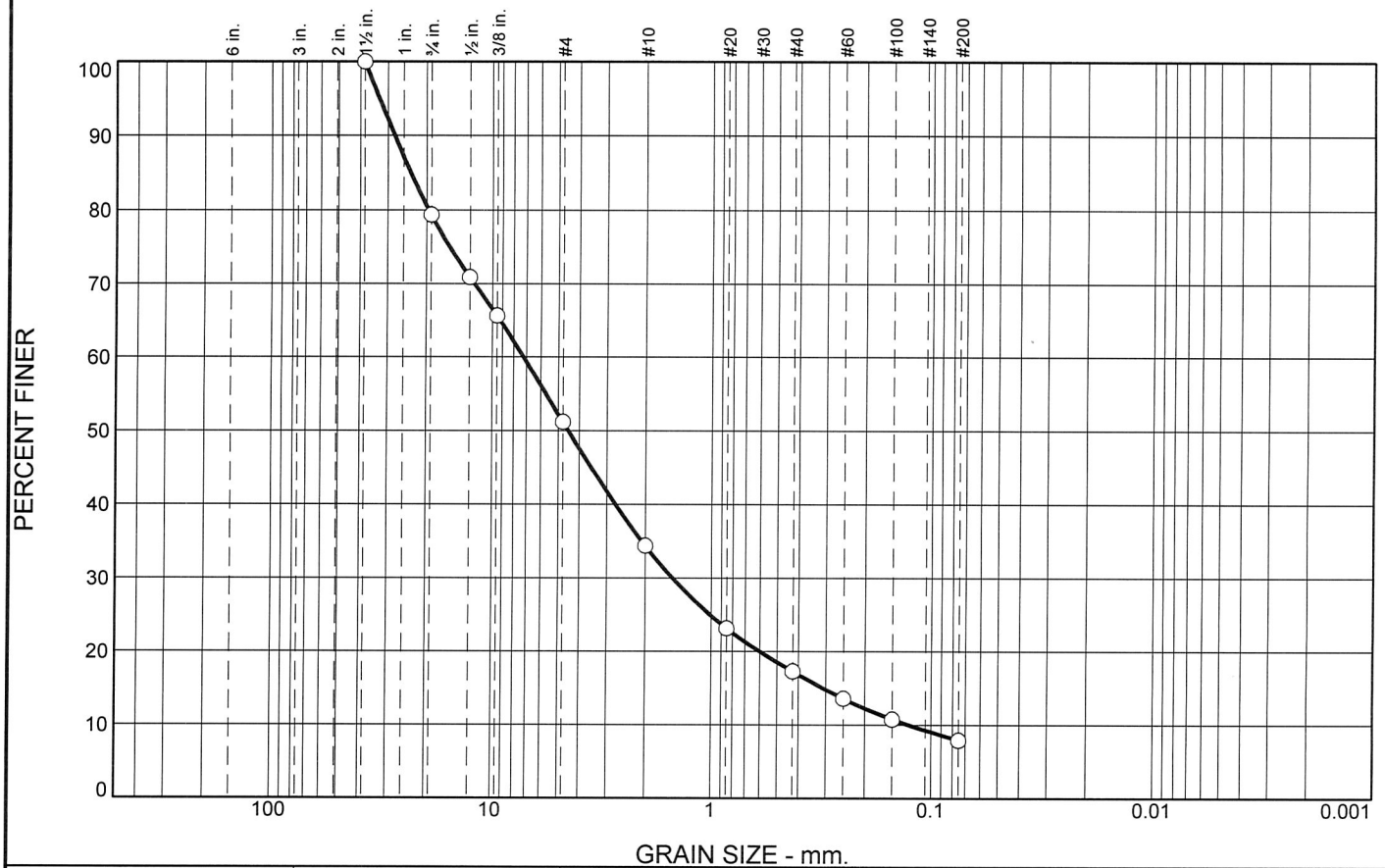
JLT Laboratories, Inc.

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

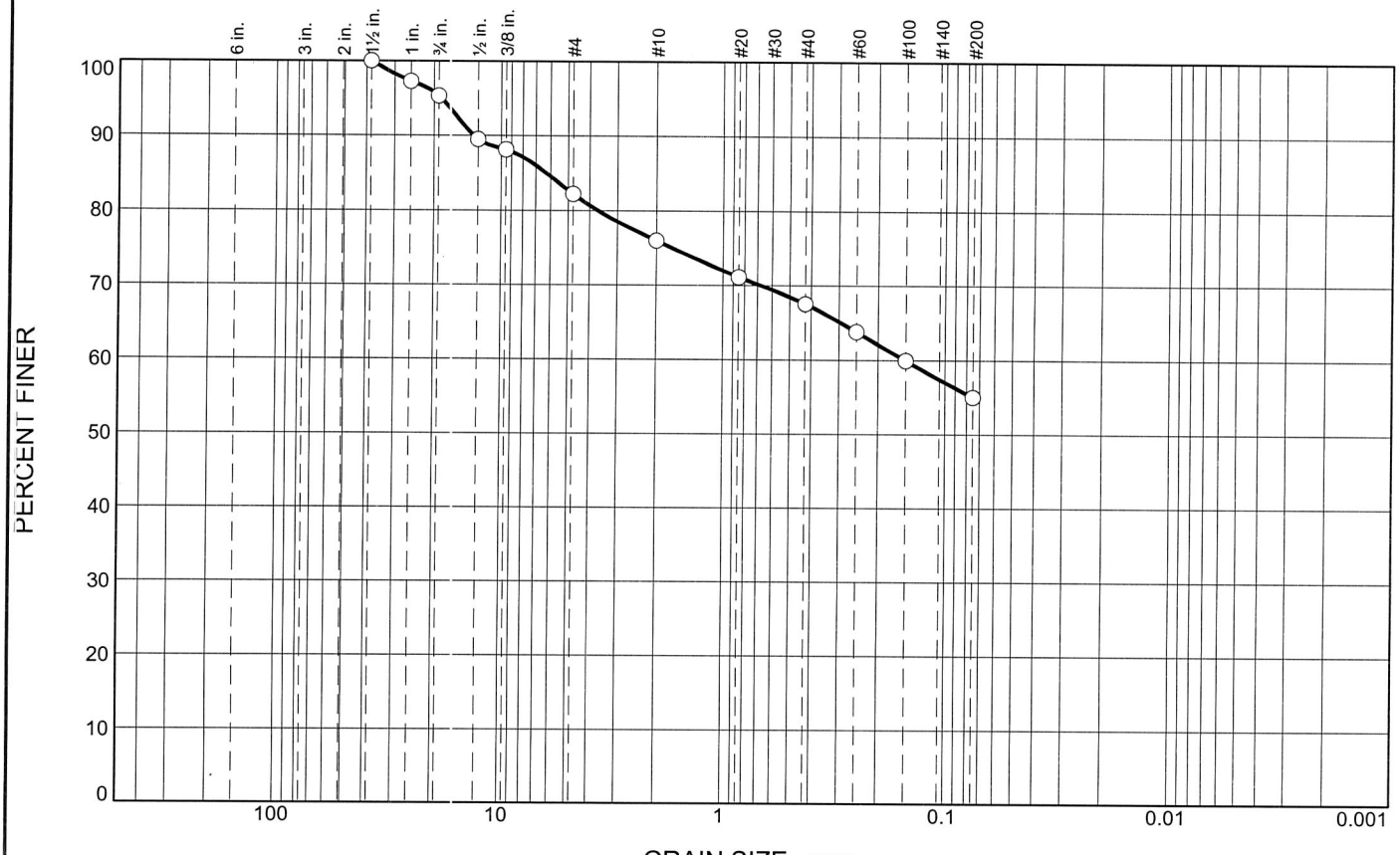
Relinquished By: [signature] Date: 10-9-2019
Received By: [signature] Date: 10-14-19

☐ 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.

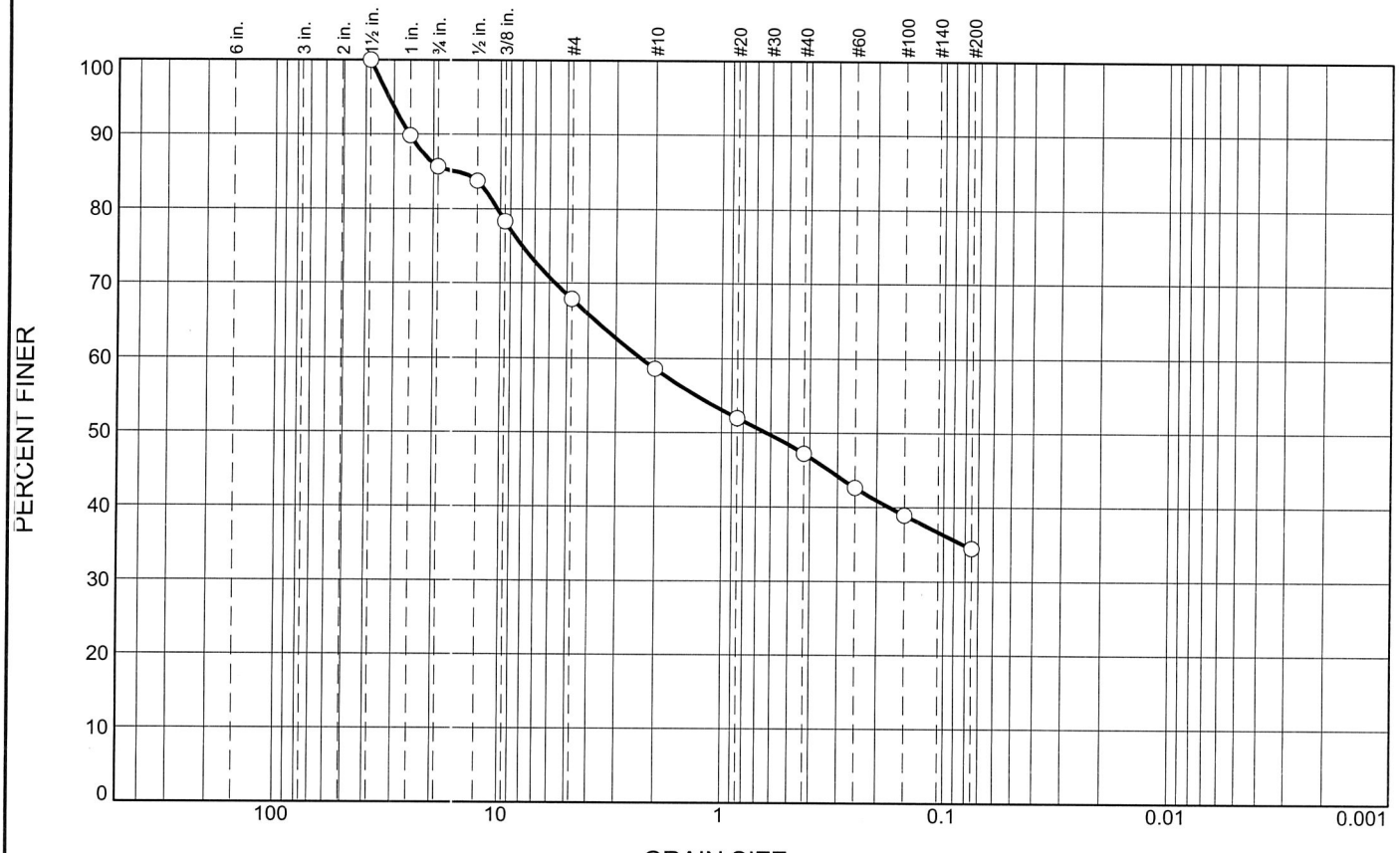
Canonsburg, PA

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.

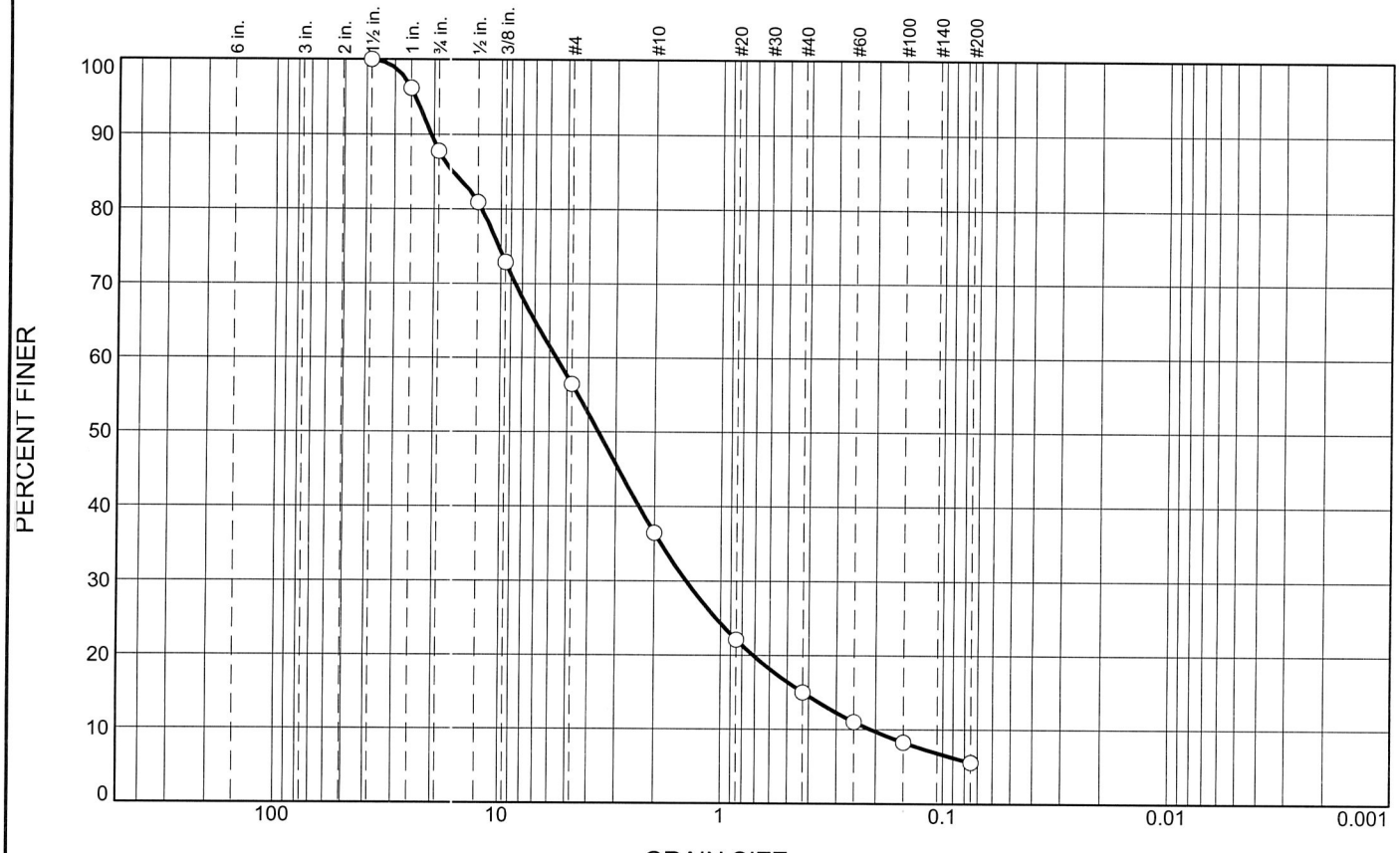
Canonsburg, PA

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.

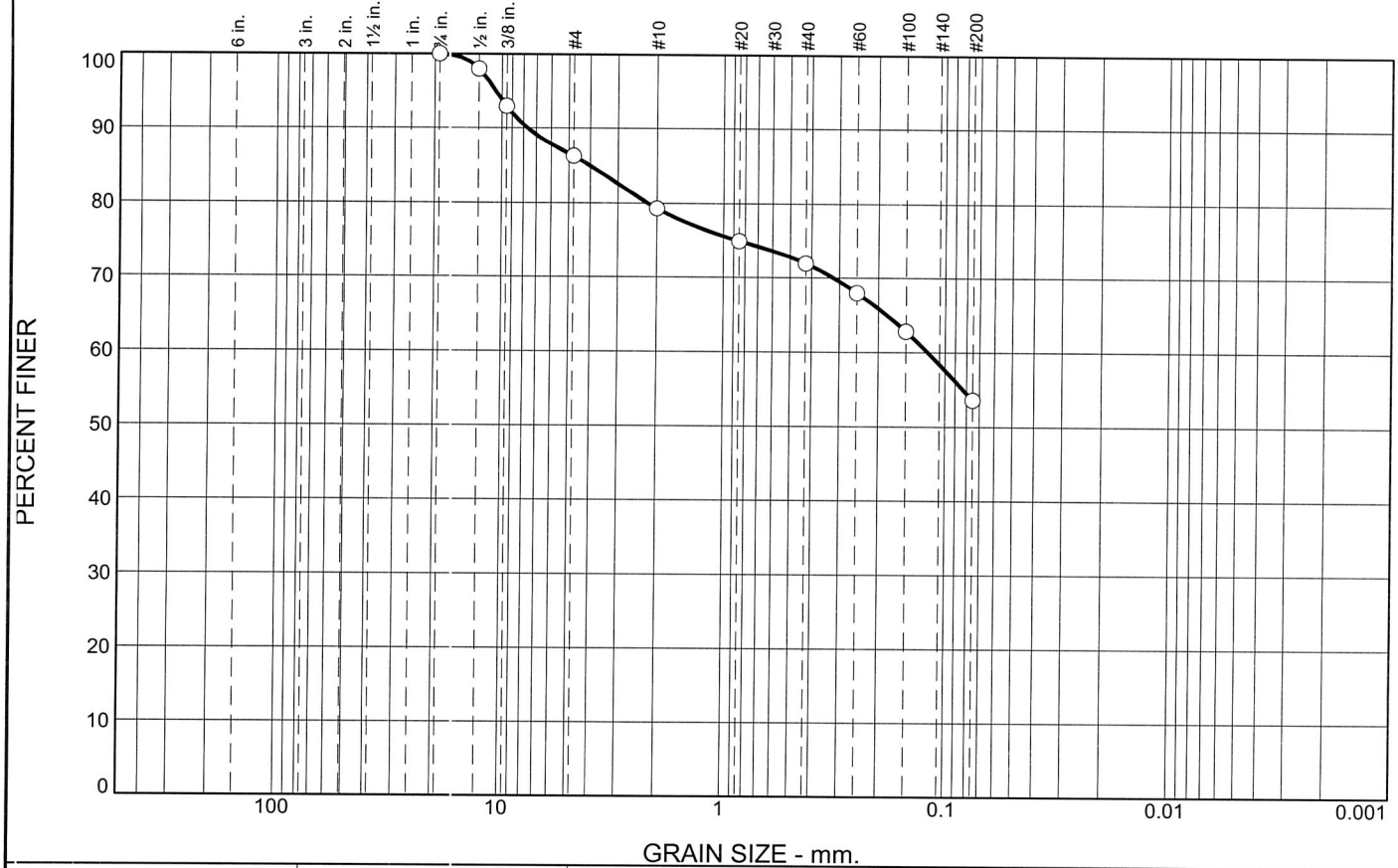
Canonsburg, PA

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

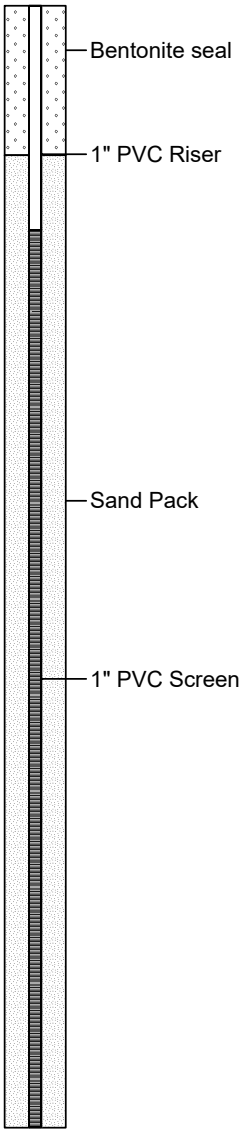
Boring ID: B14-006-PDI

(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

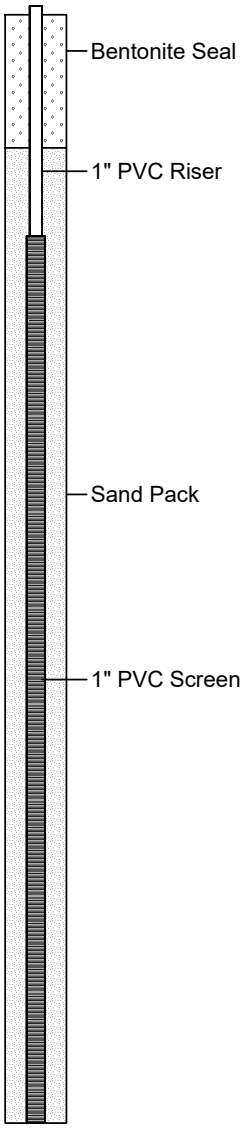
(page 1 of 1)

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 Closure Plan

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

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10450 Stancliff Road, Suite 210
Houston, TX 77099
877.835.8437

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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
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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

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877.835.8437

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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