HUMPHREY IMPOUNDMENTINTERIM MEASURES WORK PLAN

AREA B: PARCEL B14 TRADEPOINT ATLANTIC SPARROWS POINT, MARYLAND

Prepared For:



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1.0 INTRODUCTION

ARM Group LLC (ARM), on behalf of Tradepoint Atlantic, has prepared this Interim Measures (IM) Work Plan for a portion of the Tradepoint Atlantic property (formerly Sparrows Point Terminal, LLC) that has been designated as the Humphrey Impoundment located in 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 Humphrey Impoundment has been identified as a Special Study Area 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). This IM for the Humphrey Impoundment is proposed as a component of the final remedy for Parcel B14 for the impoundment and the wastes contained within the impoundment. Further evaluation and monitoring of groundwater is also proposed as part of the IM and as a component of the final remedy.

This Work Plan summarizes previous investigations of the Humphrey Impoundment; identifies and evaluates potential interim measures alternatives; and proposes an IM. The Removal and Disposal of the waste material alternative is given specific attention – if chosen this alternative would have to be implemented prior to the proposed IM. All other alternatives have been determined to be implementable following the completion of the IM. This IM also proposes gauging and sampling of groundwater and surface water in the vicinity of Humphrey Impoundment to further assess the interaction of the impoundment with groundwater and surface water and to monitor the effectiveness of the proposed IM at reducing migration of contaminants to groundwater and the potential need for additional contingent groundwater remedies as discussed in this plan. These gauging and sampling activities include the adjacent areas of Parcel B24 and portions of the Tin Mill Canal (TMC).

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



Between 1950 and 1970, Humphrey Creek existed as open water (the impoundment did not yet exist) and received wastewater from various steel processing areas including the Hot Strip Mill, Cold Sheet Mill, Tin Mill, and Rod & Wire Mill. Following construction of the TMC (ca. 1969), from 1970 to 1985 the Humphrey Impoundment was used as a dewatering area for on-site sludges and slurry materials generated from the Basic Oxygen Furnace (BOF) and various on-site water treatment plants. Materials that were dewatered within the impoundment included: Blast Oxygen Furnace (BOF) slurry; Blast Furnace G, H, J, K, and L thickener sludges; Humphrey Creek Waste Water Treatment Plant (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.

1.2. Interim Measures Objectives

This section summarizes the interim measures 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 Interim Measures objectives for the impoundment are to mitigate potential risks to current workers from the identified non-aqueous phase liquid (NAPL) contamination, and to reduce the migration of contaminants. These Interim Measures objectives are further discussed as follows:

- Control, minimize or eliminate releases or potential releases that pose actual or potential threats to human health or the environment;
- Prevent or minimize the further spread of contamination via the migration of NAPL and /or dissolved phase contaminants from the impoundment;
- Monitor the B14 wells for trends in dissolved phase contamination and NAPL;
- To the extent practicable, be consistent with remedies that meet the remedy performance standard.

The final Corrective Measures objectives will be addressed in the B14 Corrective Measures Study (CMS).

1.3. IMPOUNDMENT CHARACTERIZATION

Site-wide conditions were initially observed and summarized in the Phase II Investigation Report for Area B: Parcel B14 (Revision 0 dated March 27, 2018). Subsequent investigations were proposed and completed under the Pre-Design Investigation (PDI) Work Plan (Revision 1 dated December 10, 2019) and Comment Response Letter (dated August 28, 2020). Relevant Phase II soil boring and well/piezometer installation logs are provided as **Appendix A** and relevant PDI



soil boring and well/piezometer installation logs are provided as **Appendix B**. The results of these investigations were initially reported in the Closure Plan of Humphrey Impoundment (Revision 0 dated February 5, 2021) and subsequently summarized in the Humphrey Impoundment Corrective Measure Study (CMS) Report (Revision 1 dated September 8, 2021). Figures from the Phase II ESA identifying groundwater flow direction and soil and groundwater PAL exceedances are included in **Appendix C**.

Based on the SLRA included in the Phase II, there were no unacceptable risks to current or future Composite Workers from onsite soils. However, subsurface NAPL within the Site poses an unquantifiable risk to the potential future Construction Worker. Therefore, all ground intrusive Construction Workers will be OSHA HAZWOPER 40-hour certified to be protective against NAPL-related risks. The NAPL may also serve as a source for the dissolved phase groundwater impacts. In addition, the presence of NAPL and methane in the subsurface present a potential for vapor intrusion over much of the parcel.

Figure 2 shows the location of Humphrey Impoundment cross sections (**Figure 3** – **Figure 8**), which provide details related to current subsurface conditions. NAPL has been investigated both within the Site and around the perimeter of the Berm. During the Phase II Investigation, NAPL was encountered in 22 of 53 soil borings and 17 of 28 piezometers constructed within the impoundment materials. A total of 23 historical monitoring wells are located along the berm which surrounds the Site, and NAPL was not detected at any of these locations. Based on the distribution of observed NAPL, it appears to be discontinuous, and is often interspersed with relatively low soil concentrations.

Based on the documented presence of NAPL in numerous piezometers located inside of the impoundment and the absence of NAPL in groundwater monitoring wells located outside of the impoundment, as well as the results of the Pre-Design Investigation, discussed below, NAPL presence appears to be limited to within the waste materials disposed of inside the impoundment area.

1.3.1. NAPL Monitoring

A comprehensive NAPL investigation was completed for Parcel B14 within 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, indicating that NAPL is 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 impoundment and the absence of NAPL in groundwater monitoring wells located outside of the impoundment, as well as the results of the Pre-Design Investigation, discussed below, NAPL presence appears to be limited to within the waste materials disposed of inside the impoundment area and is considered immobile.



NAPL gauging and bail down testing was conducted from September 23, 2020, through November 24, 2020. The results of these gauging and bailing activities are recorded on **Table 2A**. Due to the presence of NAPL at B14-006-PDI, this location was utilized for NAPL gauging / bail down testing instead of permeability testing. Trace NAPL was observed in B14-013R-PZ beginning on October 1, 2020. Following NAPL accumulation, this location was included in the second round of NAPL gauging / bail down testing, as described below.

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). Due to the insufficient amount of NAPL accumulating in each of the proposed wells, gauging for the NAPL transmissivity calculation was conducted at B14-038R-PZ instead, and is described in the following section.

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

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. No NAPL has been detected at this interval at either location. This suggests that there is no mobile NAPL at the air-water interface. Subsurface heterogeneity potentially explains the variability observed at these locations with respect to NAPL detection.

1.3.2. NAPL Transmissivity Testing – Round 1

NAPL characterization and transmissivity testing was conducted to assess the mobility of NAPL and the potential for NAPL recovery. The Pre-Design Investigation Work Plan Comment Response Letter (dated August 28, 2020) initially identified four locations for NAPL gauging and transmissivity testing: B14-008-PZ, B14-011-PZ, B14-013-PZ, and B14-038R-PZ. However, based on NAPL observations in those locations and other newly installed wells, NAPL gauging / bail down testing was ultimately conducted at five locations: B14-006-PDI (added due to NAPL observations), B14-008R-PZ, B14-011R-PZ, B14-013R-PZ, and B14-038R-PZ.

In general, a minimum of 0.5 ft of NAPL is required for NAPL transmissivity calculations. Therefore, NAPL transmissivity (Tn) calculations could only be completed in one location: B14-013R-PZ. Despite being installed in areas of known subsurface NAPL, the amount of NAPL observed 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 ft²/day. The full calculation is included as **Appendix D**.

1.3.3. NAPL Transmissivity Testing – Round 2

Additional NAPL transmissivity testing was conducted at Parcel B14 in May 2021. Two locations were assessed: B14-013R-PZ and B14-038R-PZ. NAPL was removed through bailing and both wells were gauged before and after each removal event. Gauging and NAPL volume data are provided in **Table 2B**, along with calculated NAPL recharge rates.

Based on the stabilized NAPL recharge rates, a final transmissivity value for each well was calculated as described in **Appendix E**. To calculate transmissivity values, NAPL samples from each location were submitted to Torkelson Geochemistry, Inc. to measure NAPL densities, which are reported in **Appendix F**. Overall, NAPL is slightly less dense than water at both locations, which is consistent with the previously measured NAPL density at the Site, as reported in the Humphrey Impoundment CMS Report (Revision 1 dated September 8, 2021). NAPL transmissivities are calculated at 4.2e10⁻⁴ ft²/day at B14-013R-PZ and 2.4e10⁻³ ft²/day B14-038R-PZ.

The results of the transmissivity testing were again compared to guidance from ITRC from December 2009 titled Evaluating LNAPL Remedial Technologies for Achieving Project Goals (ITRC, 2009). The results at B14-013R-PZ and B14-038R-PZ indicate that NAPL transmissivity is significantly below the values considered recoverable and mobile. These interpretations are consistent with the previous NAPL transmissivity testing results. In addition, NAPL transmissivity calculations were unable to be completed at three locations (B14-006-PDI, B14-008R-PZ, and B14-011R-PZ). While B14-006-PDI had trace NAPL detections, it was not in significant enough quantities to enable removal. For B14-008R-PZ and B14-011R-PZ, NAPL was not identified to allow for any removal. Based on locations where NAPL was observed, significant removal of NAPL would be technically impracticable due to the low transmissivity values.

1.3.4. NAPL Characterization

NAPL was removed from B14-038R-PZ on November 11, November 18, November 24, and December 3, 2020 until sufficient volume was collected (approximately 150 mL) to perform viscosity, specific gravity, and density analysis. The results of this NAPL analysis are included as **Appendix G**. Overall, the NAPL density is 9% less than water, which suggests that the NAPL does not separate easily from water and that a NAPL-groundwater suspension may form during colder winter months. NAPL viscosity is 87.36 centipoises (cP), and is comparable to SAE-10 oil or olive oil at room temperature. As noted above, NAPL samples were collected at locations B14-013-PZ and B14-038R-PZ in May 2021 to assist in NAPL transmissivity calculations. Overall, this relatively high NAPL viscosity (approximately 30 times that of No. 2 fuel oil), coupled with low measured transmissivity, indicates that NAPL (where observed) is generally immobile.



1.3.5. Feasibility of NAPL Recovery

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 ft²/day." The guidance further indicates that "hydraulic or pneumatic recovery systems can practically reduce Tn to values between 0.1 and 0.8 ft²/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 ft²/day have been closed or granted no further remedial action based upon the impracticality of NAPL recoverability (irrespective of in-well NAPL thickness) remaining.

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

Thus the most expedient and reliable method to quickly remove a significant quantity of the NAPL present is through excavation. However, the distribution of the NAPL makes targeted excavation impractical so the viability of mass excavation as an interim measure is presented as an alternative in this IM.

1.3.6. Tin Mill Canal Surface Water Sampling

Surface water samples are routinely collected from the Tin Mill Canal at three locations: Storm Box #3 (Offsite Contribution), Canal Bridge (Mid Canal), and Mixing Zone (End of Canal). Data is available from 13 sampling rounds conducted between February and September 2021, including analysis for VOCs by EPA 624.1 and SVOCs by EPA 625 (at 10 of the 13 sampling rounds), which includes a representative sample of all of the same COPCs being considered in the HI. All surface water sampling results are included as an electronic attachment. Benzene and naphthalene were not detected above the laboratory detection limits in any sample collected from Canal Bridge (Mid Canal) or Mixing Zone (End of Canal), with the exception of one naphthalene detection (3.44 μ g/L) in the March 19, 2021 sample from the Mixing Zone. All surface water sampling results are included as an E-Attachment.



2.0 INTERIM MEASURES ANALYSIS

2.1. IDENTIFICATION OF INTERIM MEASURES ALTERNATIVES

This section presents the identification of Interim Measures alternatives evaluated in this Interim Measures Work Plan. This detailed evaluation focuses on Interim Measures; Section 5.0 discusses contingent remedies that could be implemented after the completion of the IM. The Removal and Disposal of waste material alternative is given specific attention – if chosen this alternative would have to be implemented prior to the proposed IM. All other alternatives have been determined to be implementable after the completion of the IM. The interim measure alternatives were developed based on the description of the current status, communications with the USEPA and the MDE, and professional experience with the identification of interim measure alternatives, and consist of the following:

- 1. <u>Alternative 1 No Action Alternative</u>: This alternative does not include the implementation of any interim measures, and essentially represents leaving the impoundment in its existing condition. This alternative does not address the Interim Measures objectives, but is presented as a baseline condition for comparison purposes.
- 2. Alternative 2 Filling and Capping: This alternative 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 to reduce contaminant mobility in groundwater; institutional controls to restrict future disturbance of the cap, and long-term perimeter groundwater monitoring. Approximately 52 acres of dry and wet land will need to be cleared prior to filling and capping. Based on the existing ground surface elevations across the impoundment, and as necessary to establish a cap that can freely drain surface water, the cover system construction is expected to require the placement and compaction of fill materials; with fill thickness ranging between 2 feet (minimum) to approximately 10 feet across approximately 50 acres, and a total volume of approximately 475,000 cubic yards. The cap design will also incorporate a vapor collection layer (approximately 4-inches of gravel) and appropriate vents (2-inch PVC) to allow for venting of generated methane.
- 3. <u>Alternative 3 Removal and Disposal</u>: This alternative would involve the excavation and off-site disposal of all contaminated soils and NAPLs, above and below the water table. Excavated materials would have to be dewatered, loaded and transported to an approved off-site disposal facility. Any regulated materials would be properly treated and disposed of at an approved waste facility. The excavated area would be backfilled with clean fill to facilitate the planned redevelopment.

Approximately 52 acres of dry and wet land will need to be cleared prior to removal and disposal of waste material. The costs for this alternative would depend on the need for any controls during excavation and handling (including wide-spread groundwater dewatering



and treatment), the amount of excavated material, and costs for off-site transportation, treatment and disposal. Alternative 3 assumes removal across the entire 50-acre impoundment area over an average depth interval of 22 ft (varies based on location within the existing Humphrey Impoundment), with 90% of soils being unsuitable and requiring offsite disposal, 10% of materials being suitable for reuse, and backfill to the surrounding ground surface elevation (approximately 12 ft amsl). Based on initial estimates, approximately 2.57 million tons would require offsite disposal, and approximately 1.84 million tons of fill would need to be imported and place.

2.2. INITIAL SCREENING OF REMEDIAL ALTERNATIVES

This section presents an initial screening of the identified remedial alternatives against the threshold criteria (i.e., protection of human health and the environment; attainment of interim measures objectives; and controlling the sources). Note, the standard threshold criteria "Attainment of Media Cleanup Objectives" will be addressed in the final Corrective Measures objectives in the B14 CMS.

The screening is summarized below.

2.2.1. Protection of Human Health and the Environment

- <u>Alternative 1 No Action Alternative:</u> Due to potential risks to future construction workers based on subsurface NAPL, potential vapors from NAPL, and potential methane vapors, Alternative 1 (No Action) would not be protective of human health or the environment.
- Alternative 2 Filling and Capping: Based on potential risks to construction workers, all ground intrusive Construction Workers will be OSHA 40-hr HAZWOPER certified to be protective against NAPL-related risks (including vapors) during implementation of Alternative 2 and all work will be conducted under an approved Health and Safety Plan. There is the potential for vapor inhalation risks to future Site Workers if a building was placed over areas with NAPL; however Alternative 2 does not include any proposed buildings. Risk to Construction Workers and Site Workers via dermal contact is anticipated to be reduced by Alternative 2 (placement of fill and capping material will prevent potential exposure to NAPL impacts). Risk to the environment is low, as current surface water results from the TMC do not show elevated concentrations downstream of the HI, and Alternative 2 would further reduce risk by reducing infiltration (currently Sparrows Point receives approximately 45 inches of rain per year, and due to the 'berm' around the HI, all precipitation infiltrates into the HI), reducing the groundwater gradient towards the TMC, and therefore reducing the rate of groundwater discharge from the HI to TMC (which would reduce potential adverse impacts to the environment). Enhanced groundwater and surface water monitoring would further ensure identification of any potential impacts. Alternative 2 meets this criteria.

<u>Alternative 3 – Remove and Disposal:</u> Alternative 3 has the potential to increase short-term exposure risks to onsite workers through increased mobilization and waste



treatment/handling. Based on potential risks to construction workers, all ground intrusive Construction Workers will be OSHA 40-hr HAZWOPER certified to be protective against NAPL-related risks during implementation of Alternative 3 and all work will be conducted under an approved Health and Safety Plan. Alternative 3 would provide protection of human health (including site workers and construction workers) and the environment in the long-term, as potential impacts will be removed from the site. Alternative 3 meets this criteria.

2.2.2. Attainment of Interim Measures Objectives

- <u>Alternative 1 No Action Alternative:</u> Alternative 1 would not meet any of the established Interim Measures Objectives.
- <u>Alternative 2 Filling and Capping:</u> Alternative 2 would address all of the established Interim Measures Objectives. Alternative 2 will control or minimize releases or potential releases, minimize the further spread of contaminants, allow for monitoring of trends, and be consistent with future remedies. Alternative 2 meets this criterion.
- <u>Alternative 3 Remove and Disposal:</u> Alternative 3 would address all of the established Interim Measures Objectives. Alternative 3 will eliminate releases or potential releases, prevent the further spread of contaminants, allow for monitoring of trends, and be consistent with future remedies. Alternative 3 meets this criterion.

The final Corrective Measures objectives (including media cleanup objectives) will be addressed in the B14 CMS.

2.2.3. Controlling the Sources

Historic sources of contamination to the area have previously been eliminated through the decommissioning and removal of the previous steel production operations at the Site. Residual contamination (including NAPL) remains onsite.

- <u>Alternative 1 No Action Alternative:</u> Alternative 1 would not provide any additional control of the existing contaminants (including NAPL).
- <u>Alternative 2 Filling and Capping:</u> Alternative 2 would reduce the potential for migration of impacted groundwater or NAPL (via reduced infiltration and groundwater gradients) and reduce potential exposure to the source (via capping and institutional controls). Alternative 2 meets this criterion.
- <u>Alternative 3 Remove and Disposal:</u> Alternative 3 would remove all residual contamination (including NAPL) from the Site, therefore eliminating the source. Alternative 3 meets this criterion.

Based on this initial screening, Alternative 1 (No Action) does not meet the threshold screening criteria for final remedy selection nor the stated IM objectives and has not been included in the detailed evaluation of alternatives section. Alternatives 2 and 3 (Filling & Capping and Removal & Disposal) would meet the IM objectives and would be consistent with the threshold criteria for



final remedy selection and will be retained for detailed evaluation in the following section of this report.

2.3. DETAILED EVALUATION OF ALTERNATIVES

This section presents a detailed evaluation of the remedial Alternatives 2 and 3 that were identified and screened in the previous section. This detailed evaluation has been conducted with respect to the following evaluation/balancing criteria: long-term effectiveness; toxicity, mobility and volume reduction; short-term effectiveness; implementability; community acceptance; state acceptance; and cost. This detailed evaluation focuses on Interim Measures; Section 5.0 discusses contingent remedies that could be implemented after the completion of the IM. A summary of the detailed evaluation of alternatives is presented on **Table 3**.

2.3.1. Long-Term Effectiveness

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

- Alternative 2 Filling and Capping: This alternative provides long-term effectiveness through the containment of contaminated sediments, the placement of an erosion-resistant and stable cap, the removal of methane to the extent practicable, the implementation of perimeter groundwater monitoring, and long-term inspection and maintenance requirements (institutional controls). This alternative eliminates stormwater infiltration and reduces possible contaminant mobilization caused by infiltration. This Alternative will be maintained in perpetuity, or until a Final Remedy is implemented. In addition, the completion of this Interim Measure would likely be required before any of the contingent remedies can occur.
- <u>Alternative 3 Removal and Disposal</u>: This alternative provides long-term effectiveness through the removal and off-site disposal of contaminated materials.

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

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

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



• <u>Alternative 3 – Removal and Disposal</u>: This alternative involves complete reduction in toxicity, mobility, and volume of the waste for the Site. However, the significant site disturbance associated with this alternative could increase contaminant mobility in the short term.

2.3.3. Short-Term Effectiveness

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

- Alternative 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 (all ground intrusive Construction Workers will be OSHA 40-hr HAZWOPER certified and all work will be conducted under an approved Health and Safety Plan.).
- <u>Alternative 3 Removal and Disposal</u>: This alternative presents a slightly increased risk of short-term direct contact exposures to the contaminated sediments in association with excavating 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 (all ground intrusive Construction Workers will be OSHA 40-hr HAZWOPER certified and all work will be conducted under an approved Health and Safety Plan.). However, when compared to Alternative 2, this alternative involves the handling and transportation of a larger volume of waste. Due to the size of the potential removal area (approximately 50 acres), implementation of this alternative could take several years. The short-term risks would be elevated for a significant period of time.

2.3.4. Implementability

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

• Alternative 2 – Filling and Capping: This alternative is readily implementable because it can be completed within a reasonable timeframe (anticipated to be one year for filling and capping), 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. Groundwater and surface water monitoring will also be conducted during implementation of the Alternative and after completion of the Alternative. Sampling is readily implementable, with the baseline sampling round already completed.



Alternative 3 – Removal and Disposal: This alternative presents significant implementation concerns because of potential short-term exposure risks, required airemission and odor controls, the removal of materials from below the groundwater table, and the handling and transportation of a relatively large volume of waste materials. Based on initial estimates, approximately 2.57 million tons would require offsite disposal, and approximately 1.84 million tons of fill would need to be imported and placed. Based on the distance to appropriate disposal facilities, trucks would only be able to make 1 trip per day. Assuming 80 trucks per day, 18 CY per truck, and 260 days of work per year, it would take approximately 4 years to transport all excavated material. In order to reduce the time frame for the alternative to within one year, approximately 10,000 tons of soil would need to be removed / transported each day. Based on the MDE's Solid Waste Management and Diversion Report (MDE, 2020), in CY 2019, the state of Maryland accepted approximately 9.59 million tons of solid waste (including 51,352 tons of industrial waste), with approximately 2.65 million tons of solid waste transported out of state for disposal (including 223,588 tons of 'Miscellaneous' solid waste which includes industrial waste). The large volume of NAPL contaminated material requiring offsite disposal (approximately 2.57 million tons) would likely need to be managed as industrial waste, and would represent a significant increase in the amount of industrial waste to be managed either within the state of Maryland or transported out of state; it would also be close to the entire annual solid waste volume exported from Maryland. This would strain the available permitted landfill capacity in Maryland and surrounding states. Most disposal facilities do not have the capacity to accept anything within this range of volume of waste (as evidenced by the amount of industrial waste accepted in Maryland previously). In addition, these estimates are based on the assumption that all soil will be non-hazardous.

2.3.5. Community Acceptance

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

- <u>Alternative 2 Filling and Capping</u>: 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.
- <u>Alternative 3 Removal and Disposal</u>: This alternative is potentially acceptable, but the transportation of large volumes of waste through any community is generally not favorable, and fugitive emissions and odors are expected to be a potential concern. Based on the approximate excavation volumes, this alternative could include 4 years of excavation, loading, and transportation. While impacts to the community can be controlled through the implementation of conventional best management practices, there will still be significant traffic impacts over an extended period of time (years) due to the amount of soil being transported.



2.3.6. State Acceptance

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

- <u>Alternative 2 Filling and Capping</u>: This alternative can be implemented in a manner consistent with applicable State permitting requirements, and is expected to be acceptable to the State because it addresses applicable requirements of the MDE-VCP.
- <u>Alternative 3 Removal and Disposal</u>: This alternative is potentially acceptable, and would likely not adversely impact any State permitting agencies. However, this option would dramatically increase the amount of waste sent to permitted landfill and be counter to waste diversion goals and may not be acceptable to the state receiving the large volume of waste.

2.3.7. Cost

This criterion addresses the anticipated short- and long-term costs associated with implementation of the remedial alternatives. A detailed evaluation of cost is summarized in **Tables 4A and 4B**.

- <u>Alternative 2 Filling and Capping</u>: Based on a preliminary cost estimate, implementation of this alternative is expected to cost approximately \$18.4 million dollars for installation of an impermeable cap with a vapor collection layer, although long-term inspection and maintenance costs are expected to be relatively low as the cap can generally function on its own without any active management.
 - <u>Alternative 3 Removal and Disposal</u>: Based on a preliminary cost estimate, implementation of this alternative is expected to cost approximately \$285 million dollars for excavation, transport, and offsite disposal of approximately 2.57 million tons of NAPL impacted soil, and backfill to the surrounding ground surface elevation (approximately 12 ft amsl).



3.0 RECOMMENDED INTERIM MEASURE

Based on the detailed evaluation of interim measure alternatives as presented in the following section, <u>Alternative 2 – Filling and Capping, is recommended for Parcel B14</u>. This alternative clearly satisfies the evaluation criteria better than the other potential alternatives, and is an appropriate and favorable interim measure alternative for the Humphrey Impoundment.

This alternative meets the IM objectives as discussed below:

• Control, minimize or eliminate releases or potential releases that pose actual or potential threats to human health or the environment.

There are no current worker exposures. However, the presence of NAPL in the subsurface presents a potential threat to human health. The proposed IM would minimize this threat by installing an asphalt cap over the contaminated subsurface material to prevent any direct contact. The proposed IM also prevents vapor buildup and safely vents vapors and methane to prevent potential inhalation exposures. While the surface water sampling to date has shown no significant impact to potential ecological receptors (refer to Section 1.3.6. Ten rounds of surface water sampling have been conducted for VOCs and SVOCs), the proposed IM would reduce the potential for release to the environment as discussed below.

• Prevent or minimize the further spread of contamination

Recovery of NAPL or removal and disposal of contaminated material were determined to be impracticable due to issues with implementability, short term effectiveness, community acceptance, and cost. Therefore, the proposed IM reduces the potential for migration of NAPL and/or dissolved phase contaminants away from the impoundment by eliminating standing water in the impoundment, installing an impermeable cap to improve drainage and reduce infiltration, and by minimizing the hydraulic gradient (via reduced infiltration into the HI and modifications to the canal elevation) to slow the spreading of contaminants in groundwater. Average annual rainfall at Sparrows Point is approximately 45 inches per year, which falls within the bermed impoundment area and is contained, there are no outfalls from the impoundment. All precipitation is captured by the impoundment and percolates into subsurface. The reduction of this infiltration will have a significant impact.

• To the extent practicable, be consistent with remedies that meet the remedy performance standard.

The proposed IM is consistent with and would not preclude potential additional contingent remedies that may be required to meet cleanup levels established in the site-wide groundwater CMS. These contingent remedies to meet the final remedy performance standards could be implemented outside the capped area, or would require filling of the impoundment to facilitate access and implementability.



3.1. DETAILED DESCRIPTION OF RECOMMENDED INTERIM MEASURE

The major components of the recommended IM (Alternative 2, Filling and Capping) are as follows:

- Prior to beginning earthwork, erosion and sediment controls will be installed. All work will occur within HI, and the berm will be maintained as long as possible prior to grading. Super Silt Fences will be installed along the canal. Stabilized construction entrances will be utilized. Existing vegetation (e.g., *Phragmites* and trees) within the limits of disturbance will be removed and segregated from the area 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.
- Material will be reclaimed and approved in accordance with the Revised Facility Wide Waste Minimization Plan (revised March 2021) and approved by the MDE Solid Waste Program and the MDE VCP. Currently, material recovered from the Coke Point Landfill has been identified for reclamation and placement in the HI. Screening, sampling, and analytic protocols have been developed for all categories of material expected to be encountered at the Coke Point Landfill. Any material that does not fall into the established categories will be identified and reported to the MDE and an appropriate sampling protocol will be established and implemented prior to moving the material in question. No material from other sources has been identified for reuse in the Humphrey Impoundment at this time. Material from sources other than the Coke Point Landfill will be handled in accordance with the Sparrows Point Material Management Plan and will be identified to the MDE. The appropriate sampling protocol will be established and implemented prior to moving the material in question.
- Fill material will be source from Coke Point Landfill and hauled within the TPA site only. It is anticipated that the filling will take 10-12 months to complete. The filling methodology includes:
 - o Prior to filling, check existing subgrade via proofroll with loaded dump truck
 - o Place material in 12" loose lifts
 - Compact material using sheepsfoot or similar equipment. Any material larger than
 6" will be removed from the lift
 - o Compaction will be checked via a soil proctor. Any areas which do not meet compaction requirements will be reworked until compaction is achieved.
 - o Once compaction is achieved, placement of the next lift will begin.
- 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 below the pavement (consisting of a minimum of 4-inches of asphalt or concrete over 4-inches of 57 stone or equivalent aggregate material).



The required minimum thicknesses of all site-wide paving sections which will serve as surface engineering controls are shown in the minimum capping section details provided in **Appendix H**. The cap will include appropriate vents to prevent accumulation of methane in areas where methane has been detected. **Appendix H** includes a typical cross-section of the impoundment with a cap, vapor collection layer, and venting system. This IM Work Plan presents a conceptual design of the methane collection system including the cap and vapor collection layer. The detailed methane collection system design will be included in a separate submittal, after additional methane data has been collected from temporary monitoring points to be installed during filling activities (as per the B14-1 RADWP [Revision 0 dated June 8, 2021]). The final elevation for most of the proposed cap would be between 11 and 12 feet amsl (including re-grading of the existing berm to a lower elevation where required).

- 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. These institutional controls will include appropriate measures for worker health and safety, material management, and cap restoration. These will remain in place until a Final Remedy is implemented.
- Between December 21, 2021, and January 5, 2022, ARM installed 11 new perimeter monitoring wells (HI10-MWS, HI11-MWS, HI12-MWS, HI13-MWS, HI15-MWS, HI16-MWS, HI17-MWS, HI18-MWS, HI19-MWS, HI20-MWS, HI22-MWS). ARM also installed replacement monitoring wells (HI14-MWS, HI14-MWI) for the damaged TM06 well pair. All existing monitoring wells (refer to Figure 1) will be gauged on a monthly basis during filling activities. In addition, 17 perimeter monitoring wells have been selected to represent "baseline" conditions; these monitoring wells will be sampled for a baseline event and then on a monthly basis during filling activities (anticipated to last between 10 and 12 months). Proposed monitoring well HI21-MWS will be added to this group of "baseline" monitoring wells once it is installed, bringing the number of "baseline" monitoring wells to 18. All baseline monitoring wells will be sampled for benzene and naphthalene on a monthly basis, with additional analyses (VOCs via 8260, SVOCs via 8270 and PAHs via 8270 SIM) on a quarterly basis for 18 baseline monitoring wells. Refer to Section 4.0 and Table 1 for additional details. Long-term monitoring will ultimately be incorporated into the sitewide groundwater monitoring program.
- Between November 17 and 19, 2021, ARM installed three monitoring wells as part of the TM04 delineation (TM04A-PZM006, TM04B-PZM006, and TM04C-PZM006) and one replacement monitoring well (TM08R-PZM007) for the damaged TM08-PZM007. The TM04 delineation wells were covered in a separate Work Plan submittal.



TPA plans to operate the TMC to maintain water elevations at 2 ft amsl (whenever weather conditions allow), to minimize exchange between surface water and groundwater. The TMC has previously been kept at lower elevations (i.e. 0 ft amsl) which has artificially depressed the groundwater table in the vicinity and increased the hydraulic gradient towards the TMC. By increasing the TMC water elevation to the level of the surrounding groundwater (about 2 ft amsl) (in addition to the proposed capping remedy that will reduce infiltration and the volume of groundwater), the groundwater gradient towards the TMC will be reduced and the rate of groundwater discharge from Humphrey Impoundment to TMC will also be reduced. After a storm event, the TMC would be pumped down to the 2 ft amsl level. Prior to significant predicted storm events the water elevation will be brought down to generate additional surge capacity immediately before the storm event. Available surface water data have been compiled and provided as an electronic attachment (refer to discussion in Section 1.3.6). These results show that surface water within the TMC is not adversely impacted by groundwater discharges from B14. Future groundwater sampling will consider precipitation events so that timing of groundwater and surface water sampling occurs at base flow, not impacted by recent precipitation events, and will include collection of TMC surface water elevation measurements during groundwater sampling events. In addition, a surface water sampling location adjacent to TM04-PZM006 is proposed as part of this IM.



4.0 MONITORING PLAN

4.1. PURPOSE

The proposed IM includes an extensive groundwater and surface water monitoring program to quantify the potential impact of the IM and subsequent development on groundwater flow and its relationship with the surrounding area and the Tin Mill Canal.

The TMC, shown on **Figure 1**, is a constructed swale that currently serves as a conveyance for stormwater runoff from an approximately 1,269 acre drainage area of the Sparrows Point site, including approximately 299 acres of off-site drainage from the nearby community of Edgemere. The TMC also receives a certain amount of groundwater, dependent on seasonal weather fluctuations and TMC operating parameters. Waters collected in the TMC are routed to the HCWWTP for treatment prior to discharge via the National Pollutant Discharge Elimination System (NPDES) permitted Outfall 014. The TMC is located in the central portion of the Sparrows Point property, south of Interstate 695 and Highway Route 158. The TMC is approximately 7,500 feet in length, 30 to 50 feet wide and 15 feet below grade. The canal was constructed from slag and includes numerous receiving outfalls from the site storm sewer system. The TMC historically conveyed wastewater discharged from numerous manufacturing facilities associated with former steelmaking and steel finishing operations at the Sparrows Point site. These wastewater streams were terminated once steel mill operations ceased.

TMC sediment removal and capping was completed in accordance with the approved TMC Maintenance Cleanup Work Plan (Revision 1, dated October 13, 2017). Excavation and removal of TMC sediment was conducted to address impacted sediment and return flow capacity to design specifications. Sediment excavation was also implemented to facilitate placement of a cap which serves as a barrier to prevent direct contact exposure risks and protect water quality in the canal discharging to Bear Creek. The cap was constructed of a non-erosive canal lining that will facilitate transport of future stormwater events with minimal future maintenance. The cap consists of a geotextile filter fabric overlain by #57 stone and rip-rap lining up to the final canal grade. The cap is not impermeable and does not eliminate groundwater flow to the TMC.

Development work associated with the Site was proposed through two separate Response and Development Work Plans (RADWPs). The Sub-Parcel B24-1 RADWP (Revision 0 dated May 21, 2021) proposed the construction of a Stormwater Management Regional Pond. The proposed pond will be a wet pond with an impermeable liner. The water quality volume for the proposed wet pond will be approximately 4,900,000 cubic feet. **Figure 9** shows the location of Parcel B24 cross sections (**Figure 10** – **Figure 12**), which focus on the location of the proposed Stormwater Management Regional Pond.

The Sub-Parcel B14-1 RADWP (Revision 0 dated June 8, 2021) proposed the construction of an automotive parking lot or laydown area covering most of the remaining area of the Site. Development of this area will involve significant regrading to between 11 and 12 feet above mean



sea level (amsl). This will generally involve filling the impoundment with MDE-approved material. Currently only material from the Coke Point Landfill Reclamation has been identified for potential placement in Humphrey Impoundment. Material will be reclaimed and approved in accordance with the *Revised Facility Wide Waste Minimization Plan* (revised March 2021) and approved by the MDE Solid Waste Program and the MDE VCP. Material from sources other than the Coke Point Landfill will be handled in accordance with the Sparrows Point Material Management Plan and will be identified to the MDE. The appropriate sampling protocol will be established and implemented prior to moving the material in question, upon approval from the MDE. Additionally, installation of surface capping within the Sub-Parcel will reduce stormwater infiltration.

Following development, the TMC is proposed to be kept at a stage of around 2 feet amsl, with elevation adjustments to account for anticipated storm events or other periods of increased runoff.

4.2. MONITORING WELL INSTALLATION

Between November 17 and 19, 2021, ARM installed three monitoring wells as part of the TM04 delineation (TM04A-PZM006, TM04B-PZM006, and TM04C-PZM006) and one replacement monitoring well (TM08R-PZM007) for the damaged TM08-PZM007. The TM04 delineation wells were covered in a separate Work Plan submittal.

Between December 21, 2021, and January 5, 2022, ARM installed 11 new perimeter monitoring wells (HI10-MWS, HI11-MWS, HI12-MWS, HI13-MWS, HI15-MWS, HI16-MWS, HI17-MWS, HI18-MWS, HI19-MWS, HI20-MWS, HI22-MWS). ARM also installed replacement monitoring wells (HI14-MWS, HI14-MWI) for the damaged TM06 well pair. Details regarding monitoring well installation will be provided under separate cover. Proposed monitoring well HI21-MWS remains to be installed; it has to be relocated due to access issues.

Three monitoring wells will be installed west of Sub-Parcel B24-1. The location of all existing and proposed monitoring wells are shown in **Figure 1**.

All proposed monitoring wells have been installed (with the exception of HI21-MWS) in order to record any potentiometric surface changes resulting from development. Final well depths, the screen length, and the screened interval will be determined in the field based on lithology and soil core saturation. The proposed monitoring wells will also be surveyed by a Maryland licensed surveyor following installation.

4.3. GROUNDWATER MONITORING

To assess potential impacts from the previously proposed development activities on groundwater flow direction, TPA will conduct groundwater gauging throughout the duration of the development activities. Gauging will be completed via manual monthly groundwater gauging and the installation of pressure transducers in key monitoring wells.



Figure 1 shows the location of all existing and proposed monitoring wells. All existing and proposed shallow monitoring wells will be gauged at the start of filling activities (to serve as a baseline) and then monthly during filling activities. These data will be used to determine lateral and vertical groundwater flow directions in the vicinity of the Site. The data will be evaluated prior to, during, and after development activities at the Site in order to identify any potential changes to groundwater flow directions as a result of development.

During groundwater monitoring events, each groundwater point will be checked for the presence of NAPL using an oil-water interface probe, in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 19 – Depth to Groundwater and NAPL Measurements.

Solinst Levelogger pressure transducers will be deployed within two monitoring wells (HI10-MWS and HI18-MWS) shown on **Figure 1**. The transducers will record pressure measurements at 15-minute intervals. Field personnel will ensure the transducers are working properly, service batteries, and extract data at least monthly. Pressure measurement data will be converted to water level elevation data by correcting for barometric pressure fluctuations, using a Barologger, and take into account datum elevations. A tipping bucket rain gauge will also be deployed to measure precipitation events that will be compared to corresponding stage and water level responses. These data will be compared graphically with canal stage data to identify the relationship between shallow groundwater elevation and canal stage, with particular interest in identifying temporal responses to storm events.

4.4. GROUNDWATER SAMPLING

Groundwater sampling will be conducted at 18 shallow perimeter monitoring wells ("baseline" monitoring wells): HI10-MWS, HI11-MWS, HI12-MWS, HI13-MWS, HI14-MWS, HI15-MWS, HI16-MWS, HI17-MWS, HI18-MWS, HI19-MWS, HI20-MWS, HI22-MWS, TM04-PZM006, TM08R-PZM007, HI04-PZM006, HI07-PZM005, and HI02-PZM006. All baseline monitoring wells are shown on **Figure 1**. Proposed monitoring well HI21-MWS will be added to this group of "baseline" monitoring wells once it is installed. Groundwater sampling will occur on a monthly basis, with analysis proposed as outlined below and in **Table 1**:

- Baseline groundwater sampling (at 18 monitoring well locations) with analysis for VOCs via 8260, SVOCs via 8270 and PAHs via 8270 SIM.
- Quarterly sampling during development activities at 18 baseline monitoring wells with analysis for VOCs via 8260, SVOCs via 8270 and PAHs via 8270 SIM (Months 1, 4, 7, etc).
- Monthly sampling during development activities at 18 baseline monitoring wells with analysis for benzene and naphthalene during other months (Months 2, 3, 5, 6, etc)

Groundwater samples will be collected from the monitoring wells in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 6 – Groundwater Sampling. Analytical methods, sample containers, preservatives, and holding times for the sample



analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

4.5. TMC MONITORING

Proposed gauging and sampling activities are summarized in **Table 1**.

Gauging data will be collected from the TMC using staff gauges and Solinst Levelogger pressure transducers at two surface water locations, one at the rail bridge northeast of HI, and one at the TMC outlet, as shown on **Figure 1**. Following installation, a survey of staff gauge datum elevations will be conducted by a Maryland licensed surveyor to enable computation of canal stage elevation and comparison with groundwater elevations. Pressure transducer data will be logged at 15-minute intervals and staff gauge readings will be taken by field personnel monthly.

4.6. TMC SAMPLING

Four surface water samples will be collected from the TMC as shown on **Figure 1**. One sample will be collected from just downstream from the TM04 well cluster, one at the rail bridge northeast of HI, one adjacent to HI15-MWS (which is approximately the midpoint between the two previously mentioned sample locations), and one at the TMC outlet. TMC sampling will be conducted concurrently with the proposed groundwater sampling.

- Baseline surface water sampling with analysis for VOCs via 8260, SVOCs via 8270 and PAHs via 8270 SIM.
- Quarterly surface water sampling during development activities (Months 1, 4, 7, 10, etc) with analysis for VOCs via 8260, SVOCs via 8270 and PAHs via 8270 SIM.
- Monthly surface water sampling during development activities for benzene and naphthalene during other months (Months 2, 3, 5, 6, etc)

The samples will be taken from the middle of the TMC and the middle of the water column at each location. Samples will be collected in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 4 – Surface Water Sampling.

4.7. QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

All groundwater and surface water samples will be collected using disposable equipment and placed on-ice in coolers for transport. Each cooler temperature will be measured and documented by the laboratory upon receipt.

Quality control (QC) samples are collected during field studies for various purposes, among which are to isolate site effects (control samples), to define background conditions (background sample), and to evaluate field/laboratory variability (spikes and blanks, trip blanks, duplicates, etc.).

The following QC samples will be submitted for analysis:

• Field Duplicates – at a rate of one per 20



- o Water for 8260 and 8270
- MS/MSD at a rate of one per 20
 - o Water for 8260 and 8270
- Trip Blank at a rate of one per cooler per day
 - o Water VOCs / benzene vis 8260

The QC samples will be collected and analyzed in accordance with the QAPP Worksheet 12 – Measurement Performance Criteria, QAPP Worksheet 20 – Field Quality Control and QAPP Worksheet 28 – Analytical Quality Control and Corrective Action.

4.8. MANAGEMENT OF INVESTIGATION-DERIVED WASTE

All investigation derived waste (IDW) procedures will be carried out in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 5 – Investigation-Derived Wastes Management. Purge water will be containerized and sampled prior to disposal.

4.9. REPORTING

On a monthly basis, preliminary tabulated results (both gauging and sampling results) will be provided for review. The monthly submittals will not include detailed evaluation but will form the basis for discussion on potential impacts from the proposed filling activities.

Semi-annual Interim Measures Progress Reports will be prepared to document the findings of the investigation and summarize groundwater and surface water sampling and gauging results. Following completion of the data collection, an Interim Measures Completion Report will summarize the overall findings of the gauging and sampling activities and interpret analytical results. Results will be presented in tabular and graphical formats as appropriate to best summarize the data for future use. The report will interpret the analytical results to fulfill the objectives listed below.

- Using groundwater contour maps and hydrographs from gauging data, evaluate current groundwater flow conditions and assess likely changes in shallow groundwater flow direction within and adjacent to the Site as a result of development activities;
- Evaluate the groundwater and surface water quality within and adjacent to the TMC to determine if dissolved-phase impacts observed at HI could contribute to TMC surface water impacts;
- Determine under what conditions groundwater discharges to the TMC in the vicinity of HI and under what conditions TMC surface water recharges to local groundwater.



4.10. SCHEDULE

The field activities presented herein (including sample analysis) are planned so that they may be completed within approximately one year of agency approval of this Work Plan. As noted above, gauging and sampling will occur prior to, during, and following Sub-Parcel B24-1 and Sub-Parcel B14-1 development.



5.0 CONTINGENT REMEDIES

The proposed IM includes an impermeable cap to prevent infiltration and reduce hydraulic gradients that drive migration of NAPL and dissolved phase contaminants. The IM also includes an extensive monitoring network and program to measure any changes in groundwater elevations, and to evaluate groundwater flow direction or contaminant migration. In the event that increases in contaminant migration are observed, contingent remedies can be implemented to address groundwater impacts. The implementation of the proposed filling and capping IM alternative does not preclude the implementation of a contingent remedy for control of NAPL or dissolved phase contaminant migration.

5.1. IMPOUNDMENT WIDE REMEDIES

As previously discussed, implementation of the proposed filling and capping IM alternative does not eliminate the implementation of a contingent remedy. If groundwater contaminant concentrations are detected at levels above applicable cleanup levels established in the Site Wide Groundwater CMS, then a contingent remedy (in addition to the proposed capping IM) may be considered in the B14 Corrective Measures Study. As part of the B14 CMS, multiple contingent remedies will be evaluated, including pump and treat, in-situ treatment (through the injection of specialized chemical reagents using direct push technology or injection wells for the stimulation of biological activity to degrade or destroy contaminants of concern), air sparge / vapor extraction, etc. Due to the high water table and standing water in the eastern portion of HI, all of these contingent remedies would likely require a portion of the Site to be filled prior to implementation.

5.2. PERIMETER REMEDIES

Transmissivity testing, as summarized in Section 1.3, has indicated that NAPL within HI is not recoverable and not mobile. As discussed in Section 4.2, new perimeter monitoring wells have been installed. Throughout the filling activities, monthly groundwater samples will be collected from 18 perimeter shallow monitoring wells ("baseline" monitoring wells), with monthly gauging (including NAPL checks) from all existing monitoring wells. If measurable NAPL is detected in any of the perimeter monitoring wells bordering the TMC, then the following steps would occur:

- MDE would be immediately notified.
- Enhanced Fluid Recovery (EFR) would be initiated at the monitoring well.
- Observation trenches would be installed to monitor the extent of observed NAPL. If needed, the observation trench could also be utilized as a NAPL cutoff/recovery trench. This would be the most effective means of containing any NAPL migration and specifically preventing discharge to the TMC. The equipment to install the trench is readily available on the TPA site and could be quickly mobilized to the HI. There is sufficient width outside the proposed fill and cap area to install a trench between the cap and the TMC if



necessary. The extent of the trench would be determined by test pits or borings to define the limits of NAPL.

Well TM04-PZM006, located along the southern boundary of HI and adjacent to the TMC, has had dissolved phase exceedances for benzene and naphthalene. Based on groundwater sampling results from 2001, 2004, 2017, and 2021, the groundwater concentrations at TM04-PZM006 appear fairly stable. Four additional monitoring wells were installed to delineate potential impacts around TM04-PZM006, and additional HI perimeter monitoring wells were installed in December 2021 and January 2022. Once baseline conditions have been established in the shallow monitoring wells along the TMC, dissolved phase action levels that would trigger a contingent remedy will be established in conjunction with MDE and EPA. Feasible contingent remedies for dissolved phase impacts would likely include:

- Air sparge curtain: this response action may be selected if the contaminants are volatile organic compounds, such as benzene or naphthalene. This response action will involve the injection of pressurized air through sparge wells into the saturated zone of the subsurface to volatilize and promote biodegradation of groundwater and soil contaminants. In sparge curtain applications, a vacuum is applied to the subsurface through extraction wells to remove the soil vapors from the subsurface. The air sparge curtain contingent remedy would consist of sparge wells installed to approximately 20 feet below ground surface at a spacing of 30 feet and extending between monitoring wells with dissolved phase concentrations below the action levels unless additional delineation shows the extent to be less. The idle air sparge equipment at Cell 2 could be mobilized for use in this area if necessary. An air sparge curtain could be readily installed, and this remediation method has been proven to be effective elsewhere on the TPA property.
- Activated carbon injections (i.e. Regenesis PlumeStop® Liquid Activated CarbonTM): this response action may be selected if the contaminants include less volatile organic compounds such as PAHs. This response action will involve the injection of liquified activated carbon into the subsurface. A carbon remedy would typically be injected through specialized wells at high pressures to disperse the activated carbon across an area upgradient of the point of compliance. Activated carbon can treat volatile and petroleum compounds through adsorption and biodegradation.

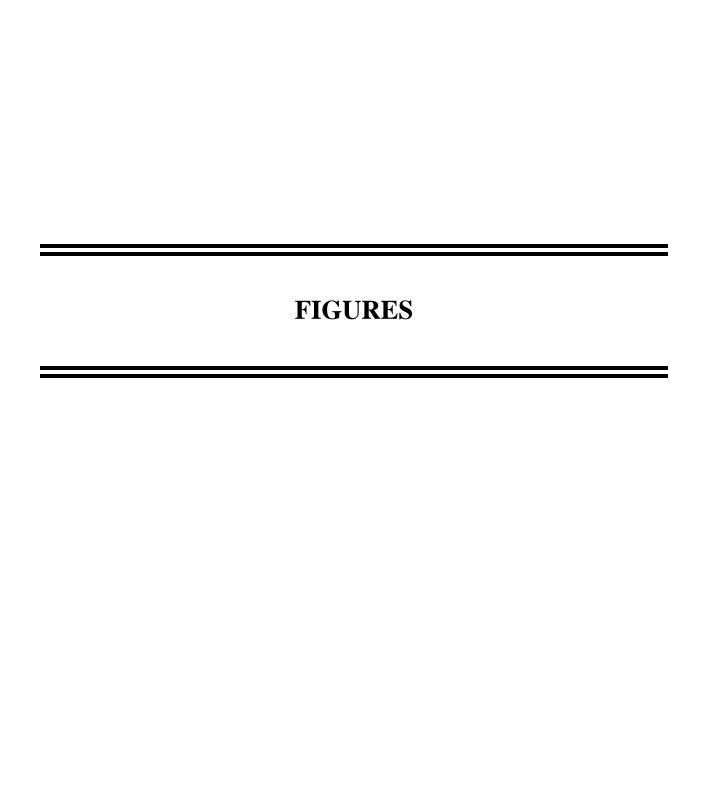
For either contingent remedy, all work would occur outside of the capped area, with the goal to prevent potential adverse impacts from the HI to the TMC.

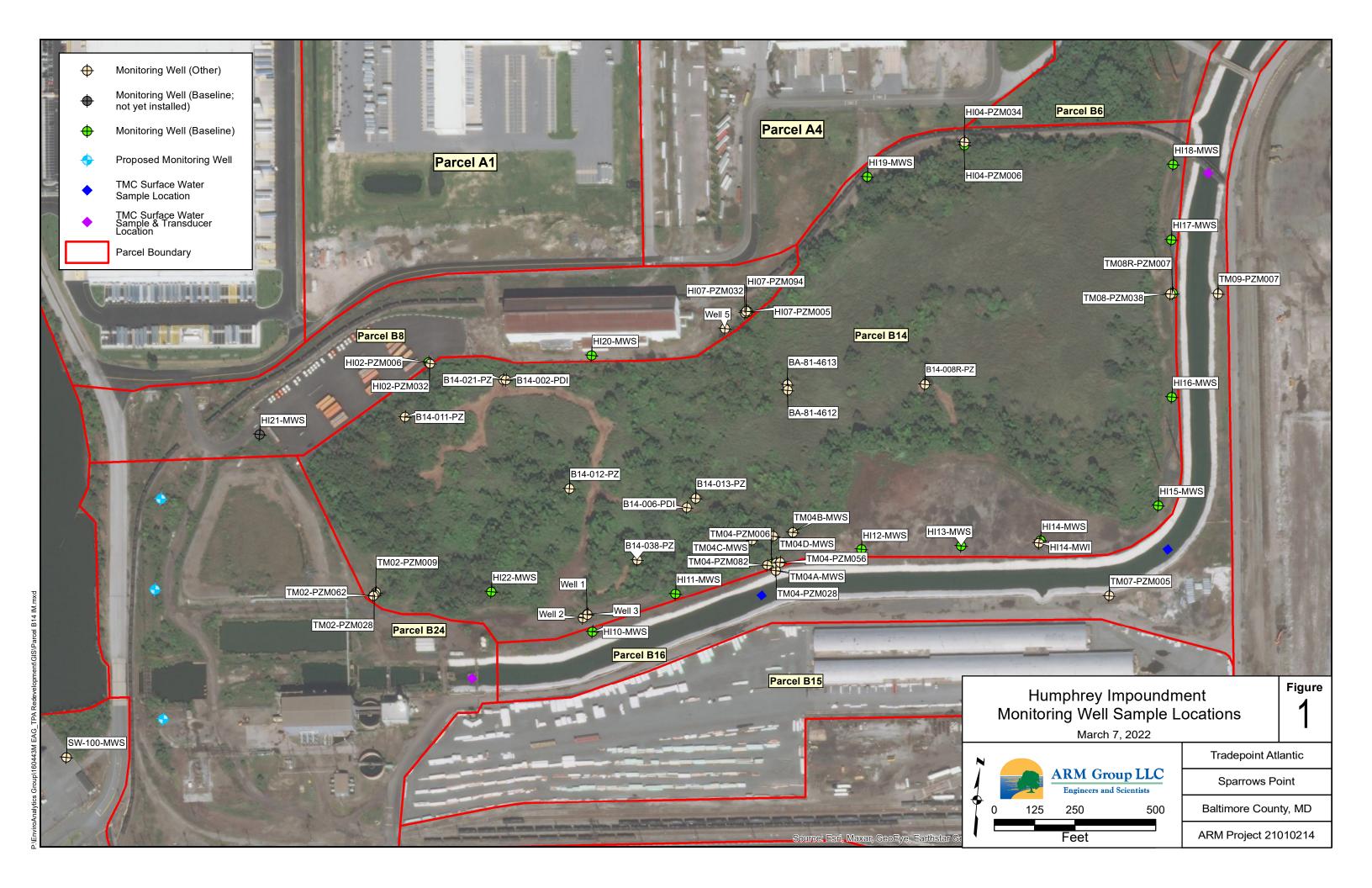


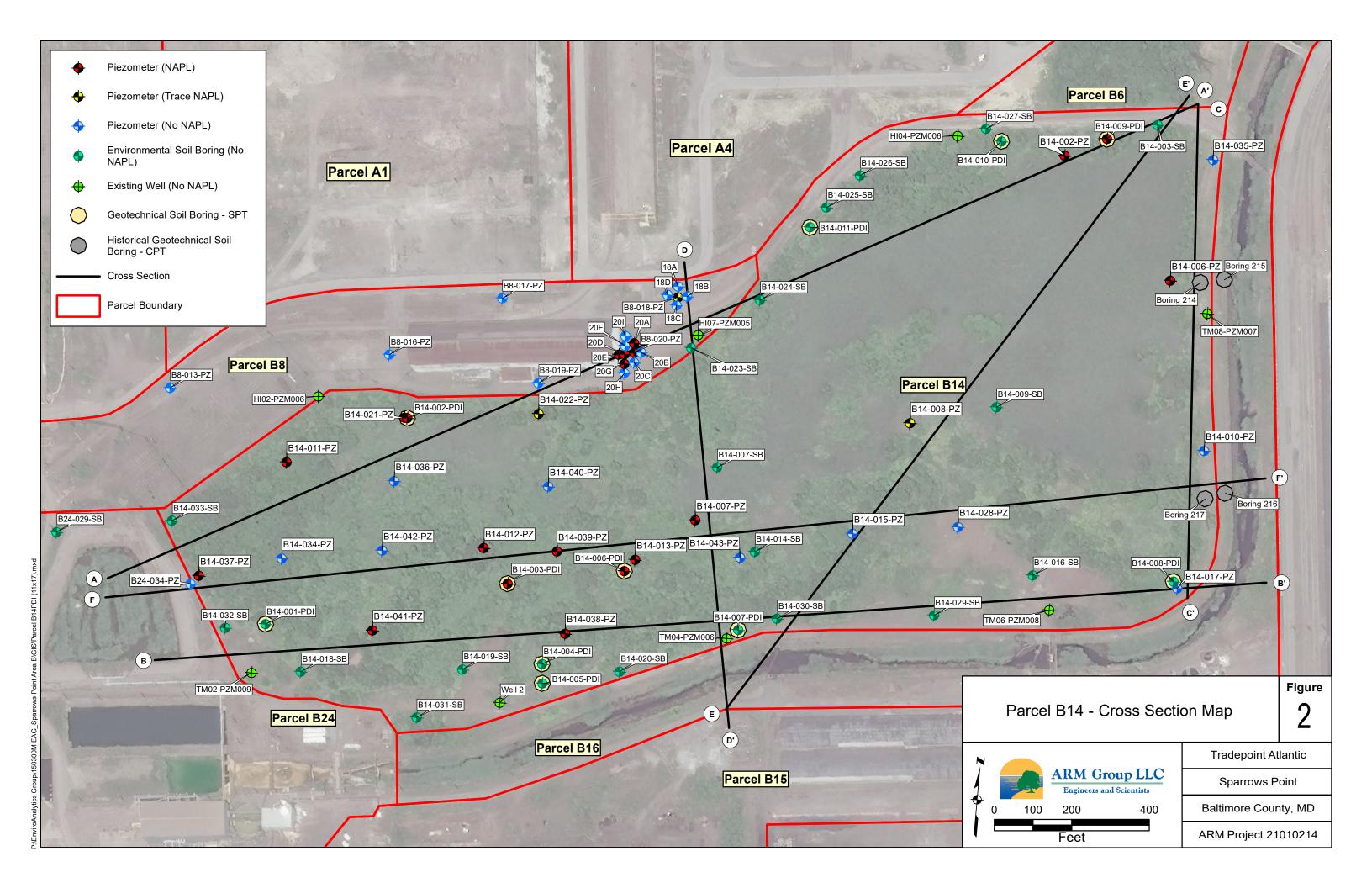
6.0 REFERENCES

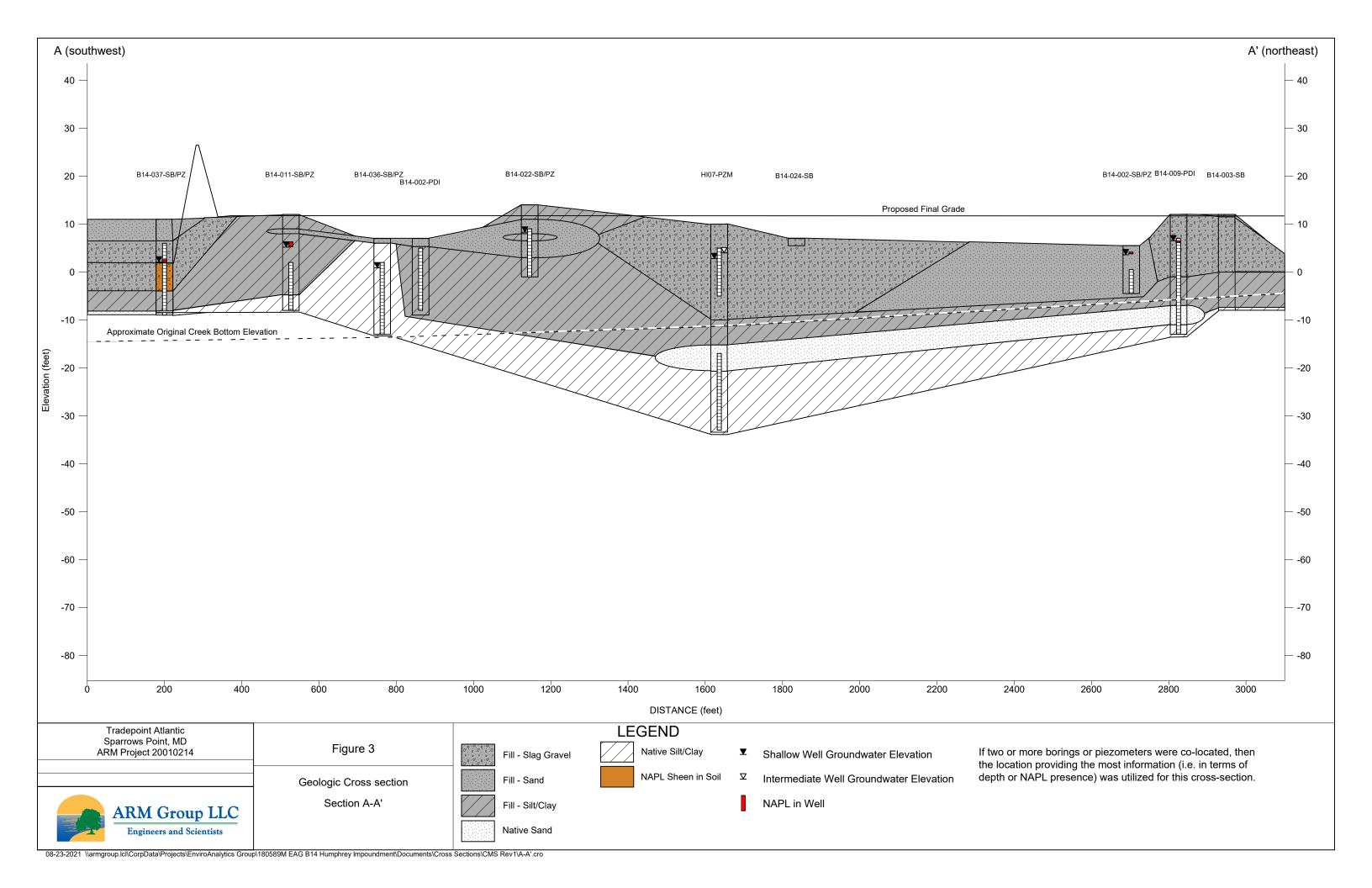
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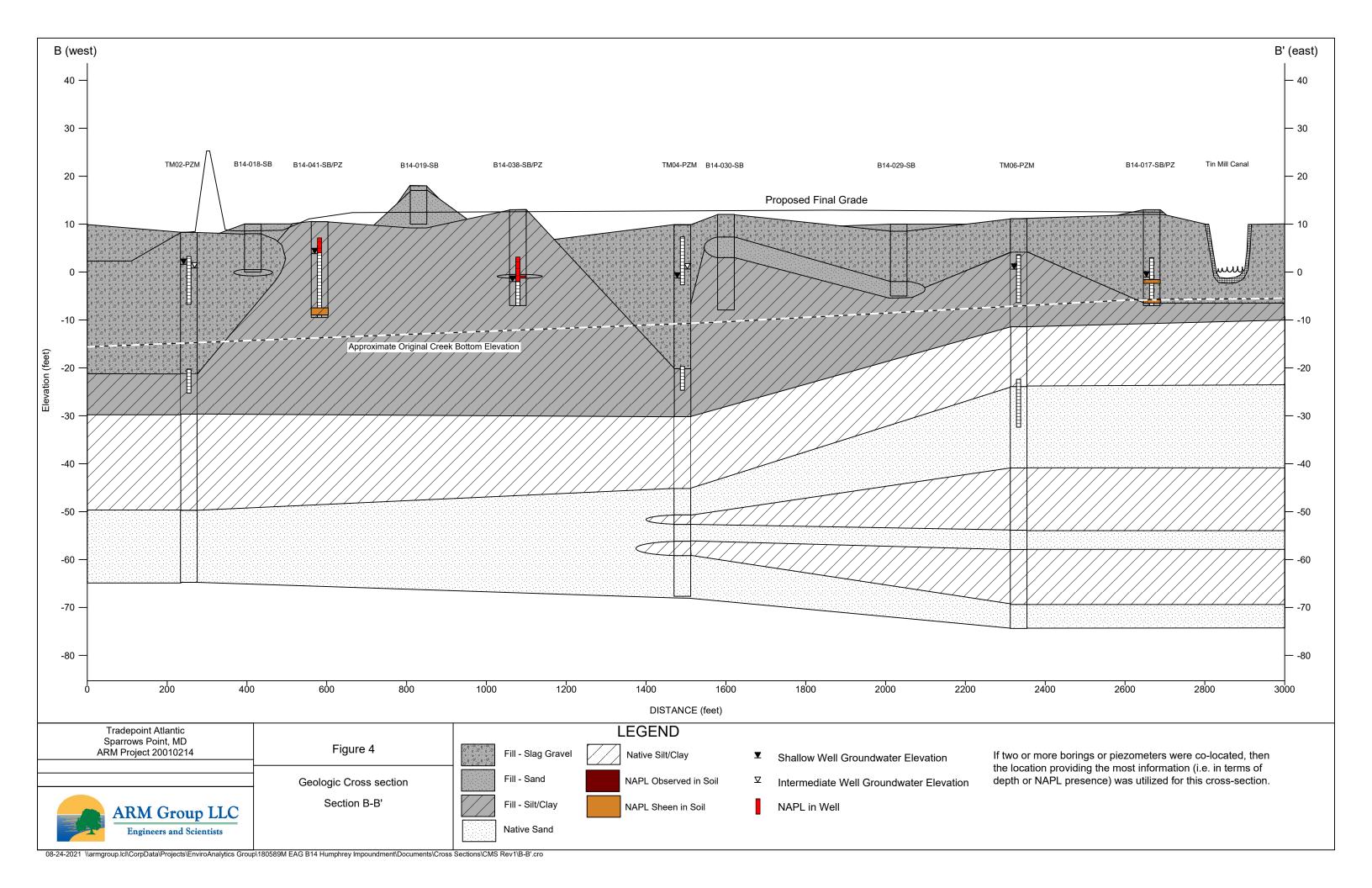


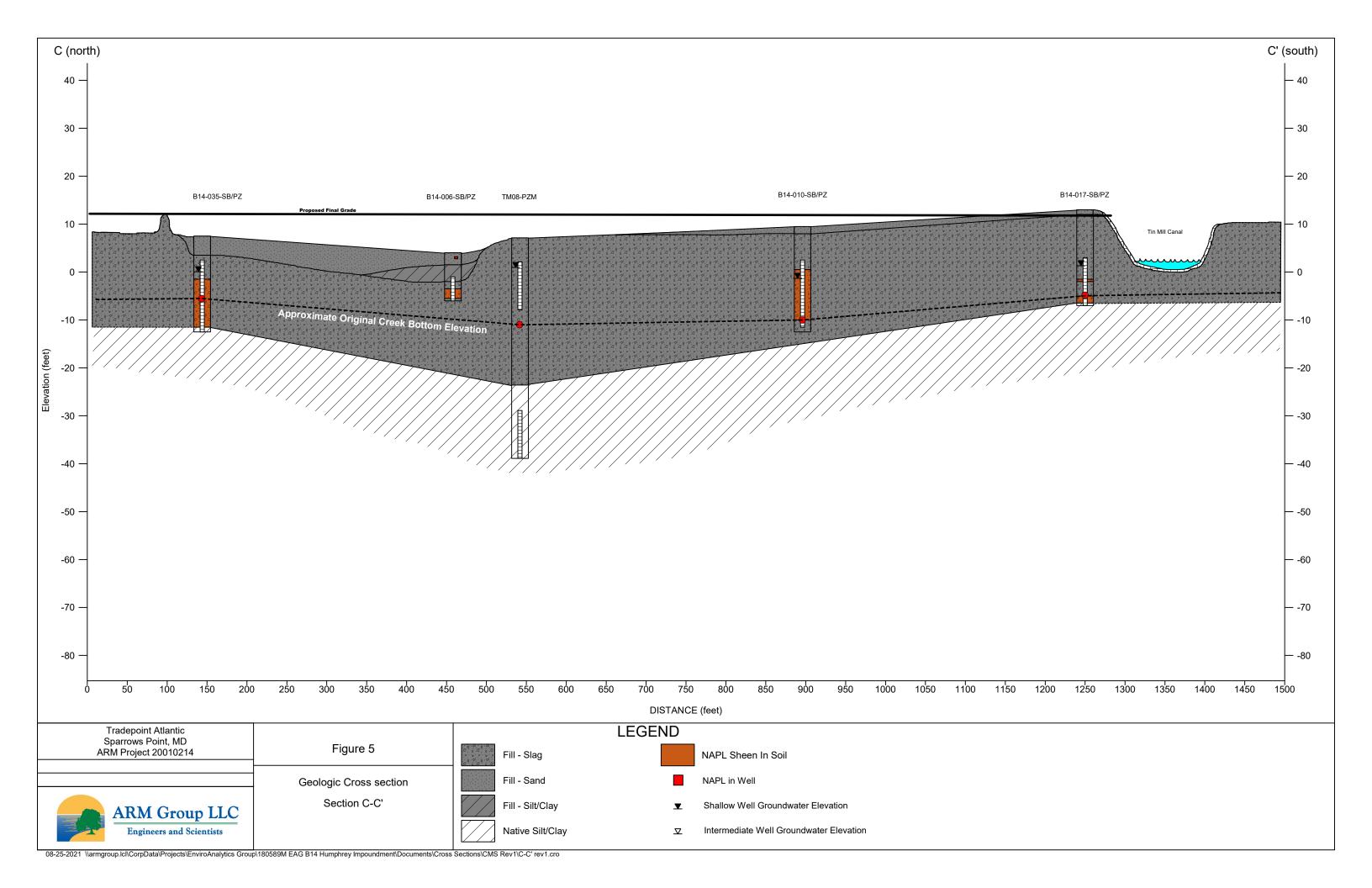


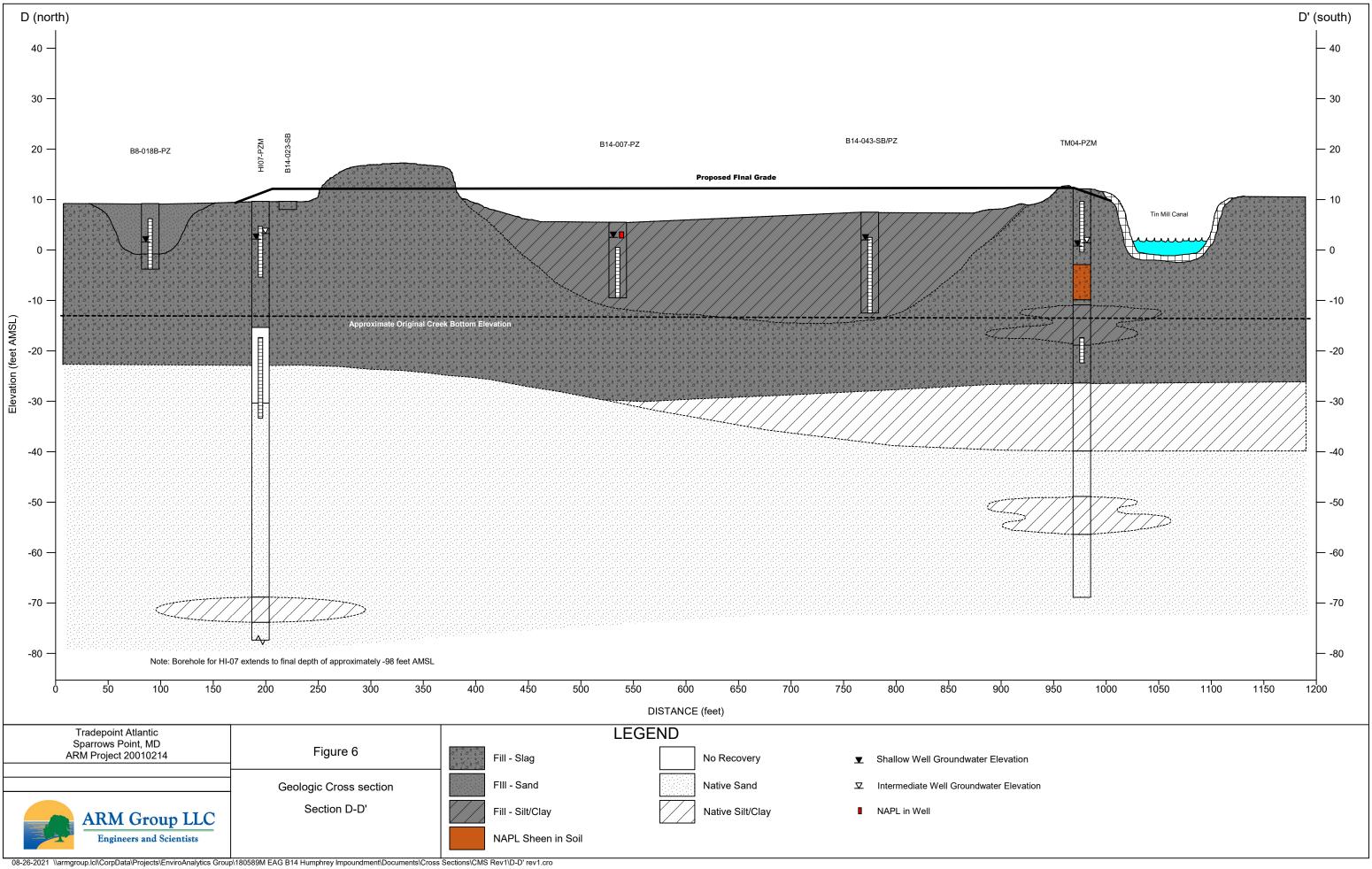


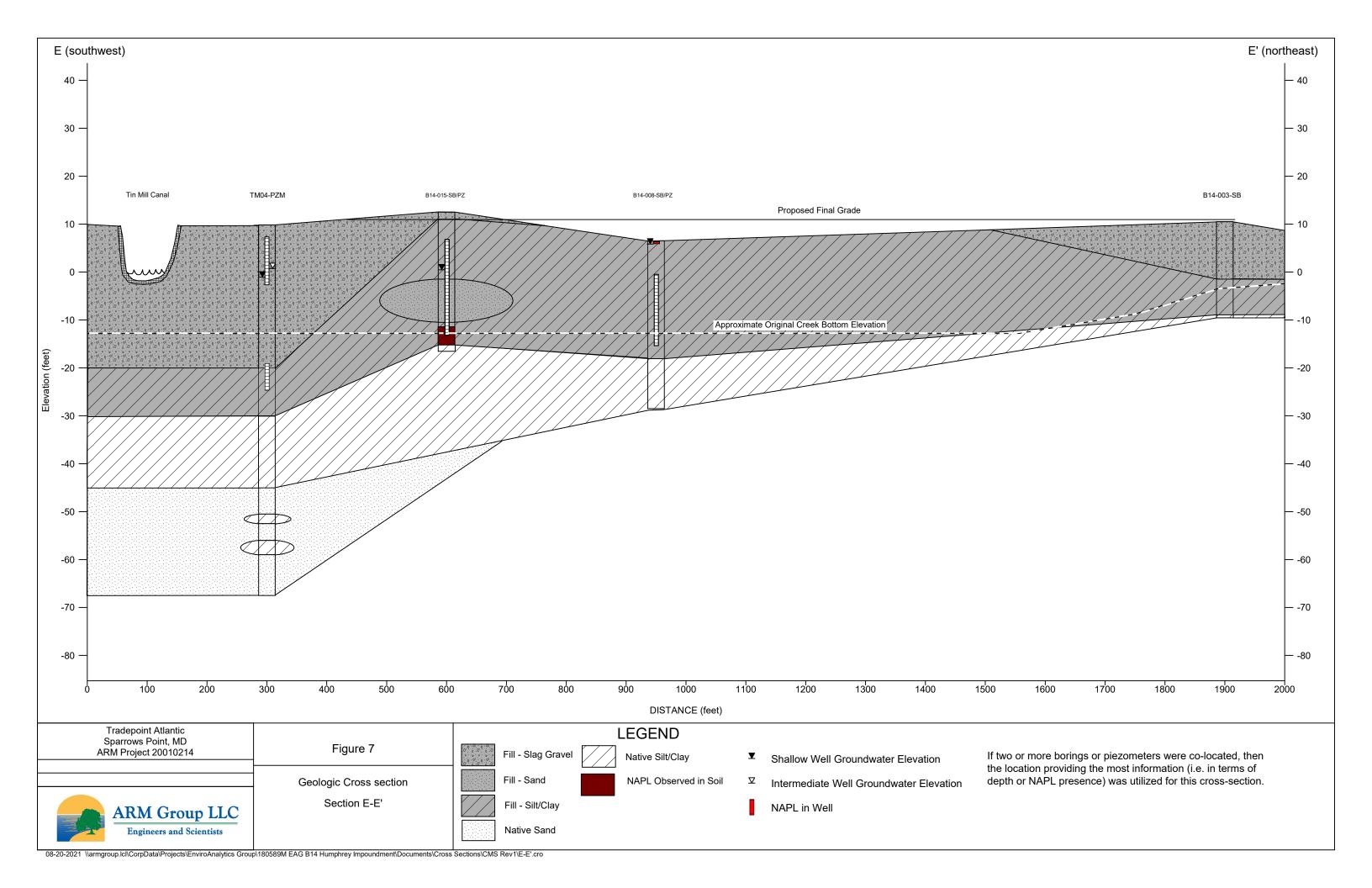


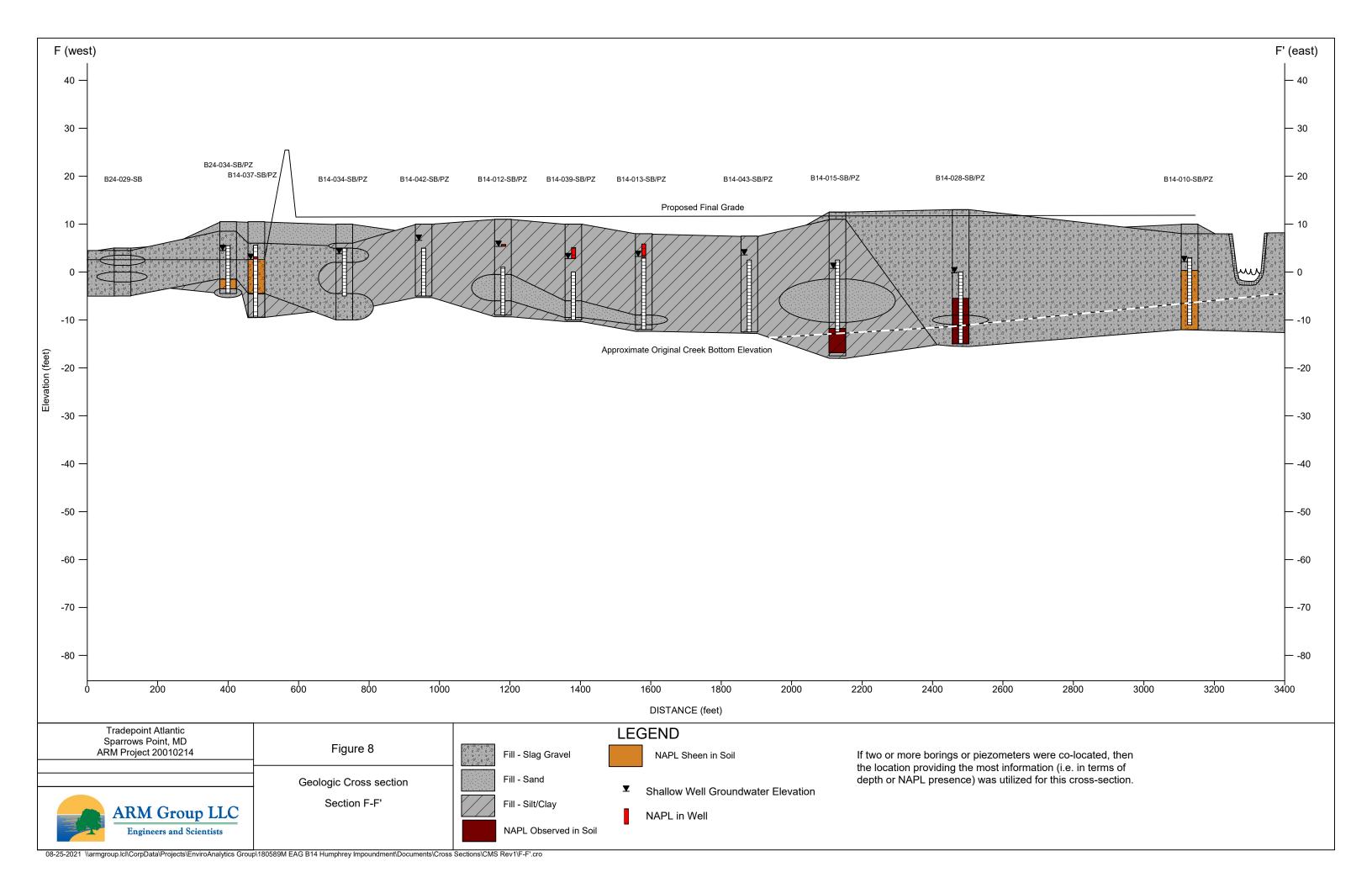


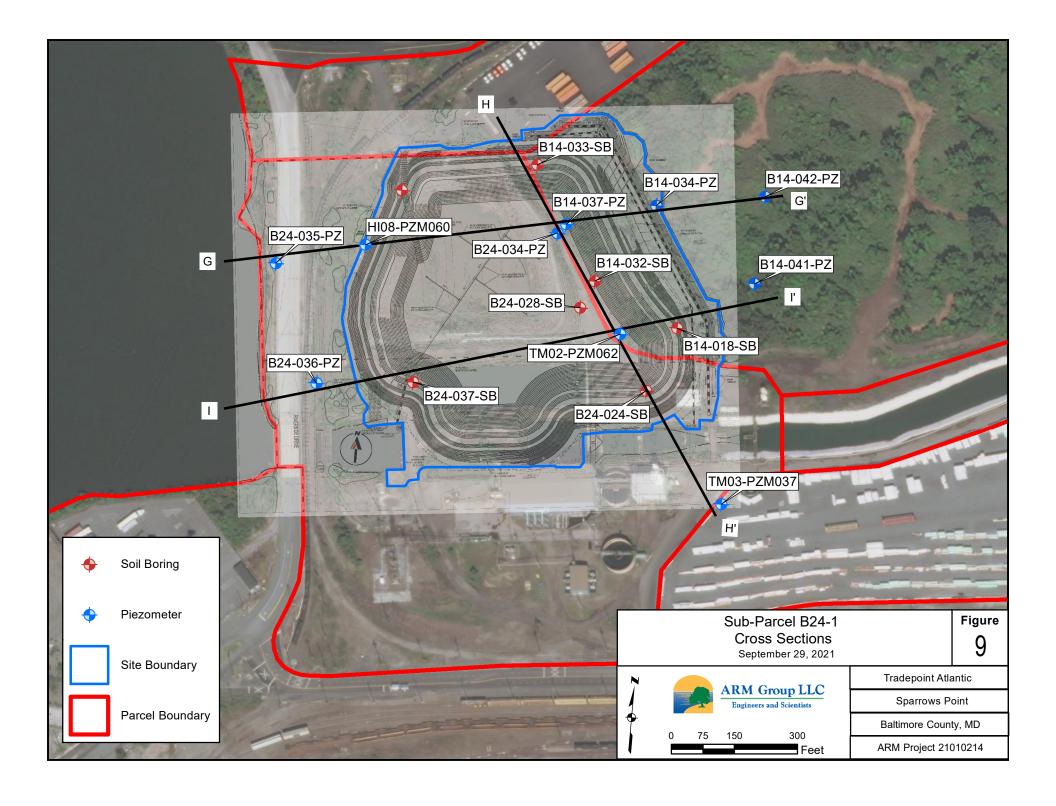


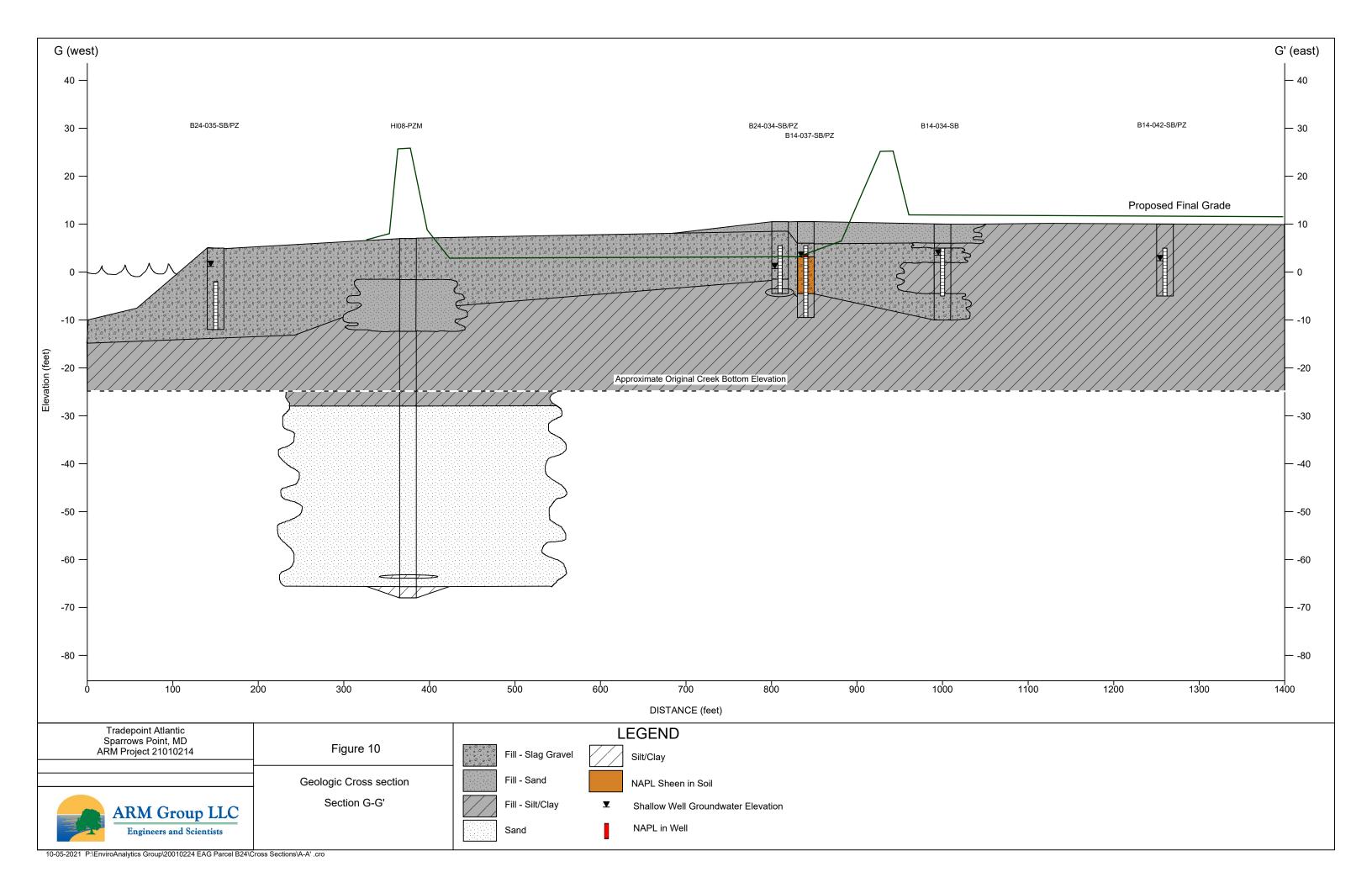


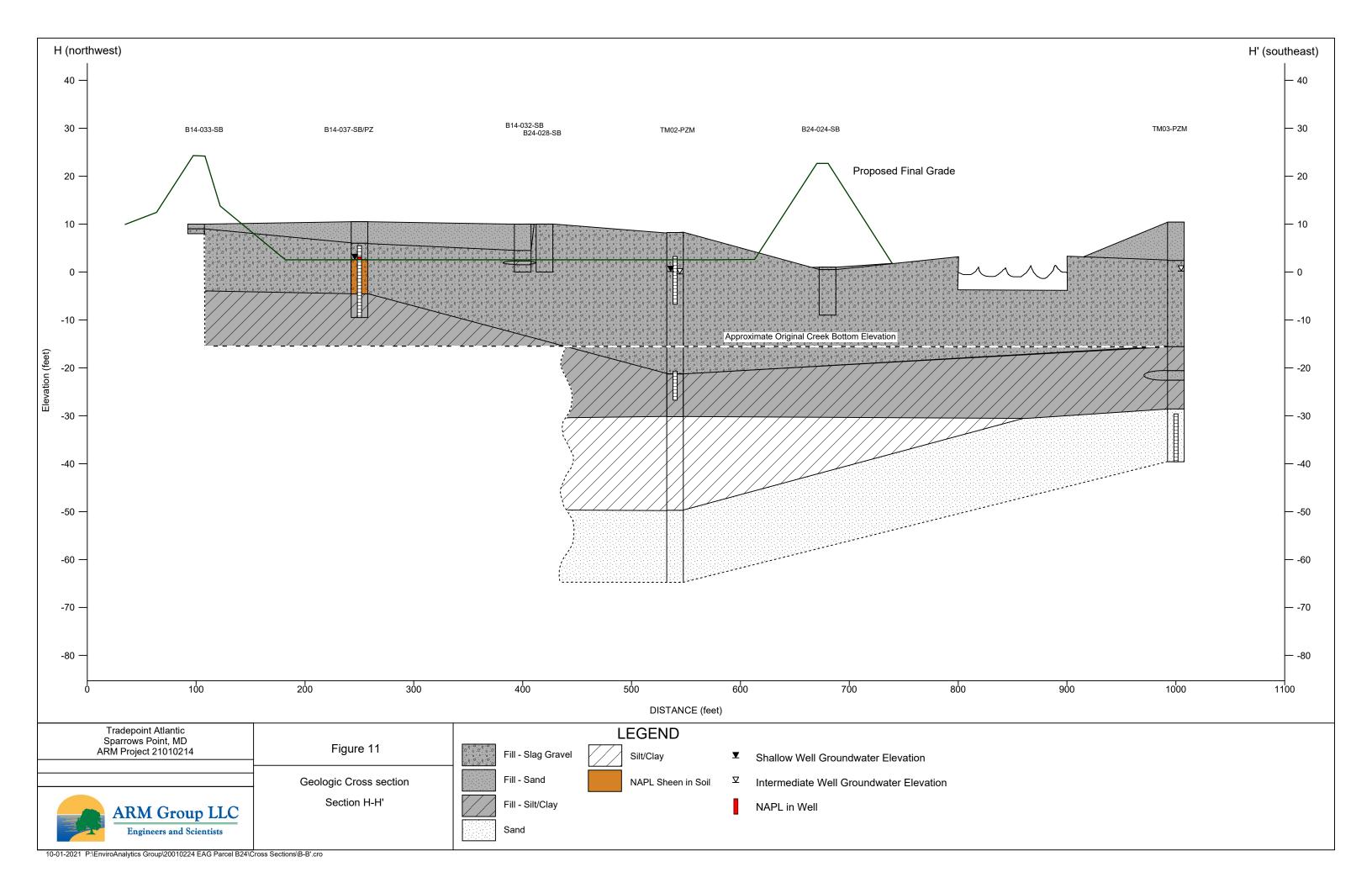


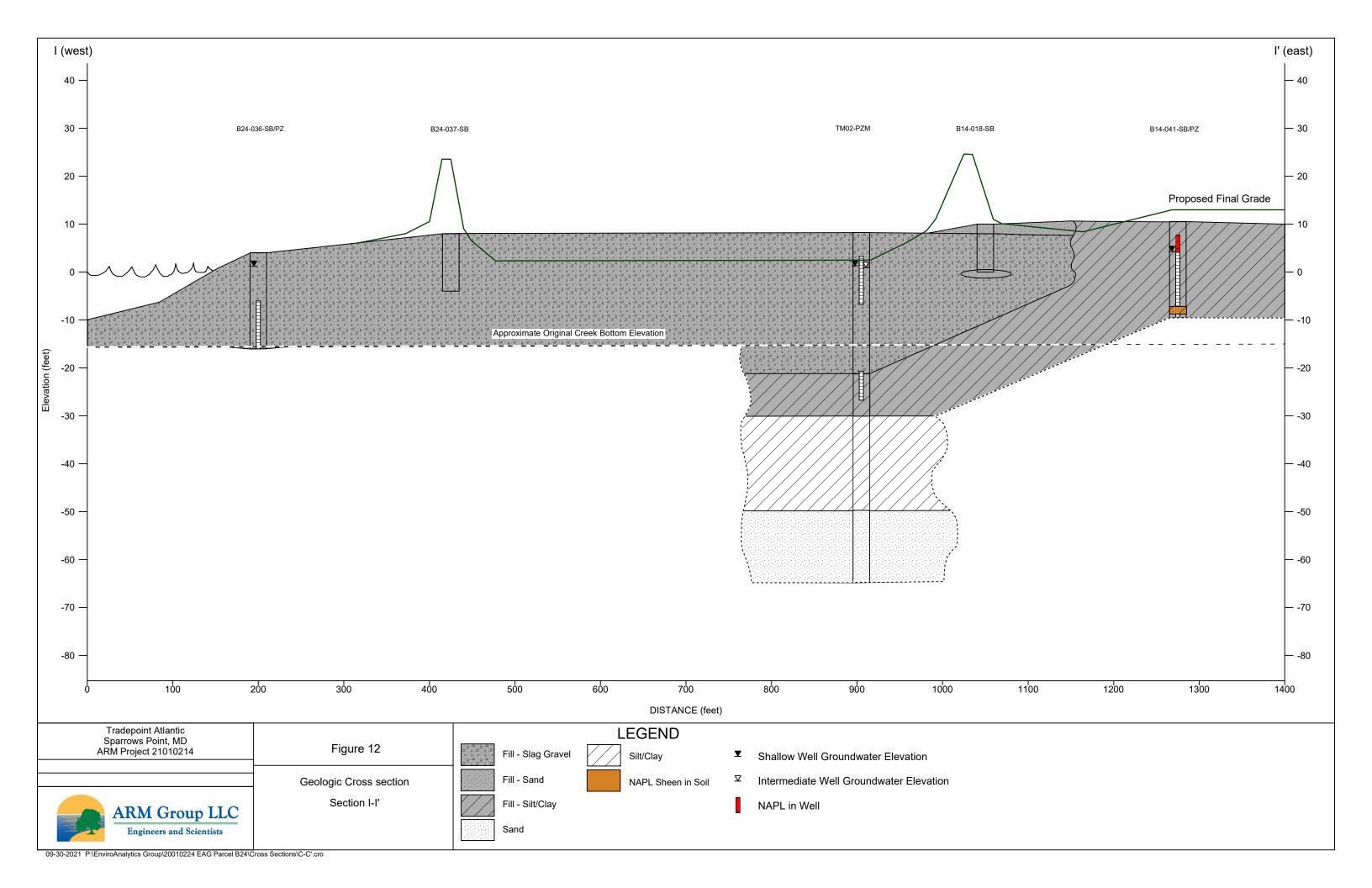












TABLES

Table 1 - Proposed Gauging and Sampling Summary

Groundwater Gauging										
Well Category	Number of Wells	Gauging Frequency								
HI10-MWS (to be included as a Baseline well)	1	15 Minutes (Transducer)								
HI18-MWS (to be included as a Baseline well)	1	15 Minutes (Transducer)								
Other Perimeter (Baseline) Wells: HI11-MWS, HI12-MWS, HI13-MWS, HI14-MWS, HI15-MWS, HI16-MWS, HI17-MWS, HI19-MWS, HI20-MWS, HI22-MWS, TM04-PZM006, TM08R-PZM007, HI04-PZM006, HI07-PZM005, HI02-PZM006. **HI21-MWS once it is installed.	15 (**16)	Monthly								
Other Existing Shallow Wells (subject to change as wells are abandoned during filling work)	up to 15	Monthly								
TM04 Delineation Wells: TM04A-PZM006, TM04B-PZM006, TM04C-PZM006	3	Monthly								
Proposed wells west of B24-1	3	Monthly								

Groundwater Sampling										
Well Category	Number of Wells	Sampling Frequency	Analytical Parameters*							
Existing Baseline Wells: HI10-MWS, HI11-MWS, HI12-MWS, HI13-MWS, HI14-MWS, HI15-MWS, HI16-MWS, HI17-MWS, HI18-MWS, HI19-MWS,		Full Sampling - Baseline, Month 1, 4, 7, 10 (quarterly)	VOCs by Method 8260, SVOCs by Method 8270, PAHs by 8270 SIM							
HI20-MWS, HI22-MWS, HI04-PZM006, HI07-PZM005, HI02-PZM006, TM04-PZM006, TM08R-PZM007. **HI21-MWS once it is installed.	17 (**18)	Alternate Sampling - Month 2 & 3, 5 & 6, 8 & 9, 11 & 12	Benzene and Naphthalene							

TMC Gauging									
Locaton Category	Number of Locations	Gauging Frequency							
TMC	2	15 Minutes (Transducer)							

TMC Sampling									
Locaton Category	Number of Locations	Sampling Frequency	Analtical Parameters*						
TMC	4***	Full Sampling - Baseline, Month 1, 4, 7, 10 (quarterly)	VOCs by Method 8260, SVOCs by Method 8270, PAHs by 8270 SIM						
		Reduced Sampling - Month 2 & 3, 5 & 6, 8 & 9, 11 & 12	Benzene and Naphthalene						

^{*}Benzene and Naphthalene to be analyzed via USEPA Method method 8260 and USEPA Method method 8270, respectively

^{**}Reflects changes once HI21-MWS is installed.

^{***}Fourth surface water sampling location added starting with Month 2.

Table 2A - Parcel B14 Summary of NAPL Gauging Activities

	F	314-006-PDI		B14-0	02-PDI (2nd	install)	B14-0	02-PDI (3rd i	nstall)		B14-003-PD	I		B14-009-PD	I		B14-008R-PZ	,
	Installat	ion Date: 9/16/2	020	Installa	tion Date: 10/	11/2018	Installa	tion Date: 9/1	5/2020	Installa	tion Date: 10	/11/2018	Installat	ion Date: 10/	/11/2018	Installa	tion Date: 9/1	7/2020
	Total Well	Depth (feet bgs) = 15	Total We	ll Depth (feet	bgs) = 15	Total Wel	Total Well Depth (feet bgs) = 15		Total Well Depth (feet bgs) = 15		Total Well Depth (feet bgs) = 25		bgs) = 25	Total We	Total Well Depth (feet bgs) = 20		
	Screen Int	erval (feet bgs) =	= 3-15	Screen Interval (feet bgs) = 2-15			Screen In	Screen Interval (feet bgs) = $3-15$		Screen Interval (feet bgs) = 3-15		Screen Interval (feet bgs) = 5-25		Screen Interval (feet bgs) = 5-20				
	Riser St	ick-Up (feet) = 2	2.91	Riser Stick-Up (feet) = 2.12			Riser S	tick-Up (feet)	= 3.43	Riser S	Riser Stick-Up (feet) = 2.14		Riser Stick-Up (feet) = 0.20		Riser Stick-Up (feet) = 2.61			
	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL
Date	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness
	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	,	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)
10/11/2018	NA	NA	NA	NM	6.34	NM	NA	NA	NA	NM	10.52	NM	NM	8.68	NM	NA	NA	NA
10/15/2018	NA	NA	NA	NM	5.28	NM	NA	NA	NA	NM	10.83	NM	NM	8.65	NM	NA	NA	NA
11/14/2018	NA	NA	NA	3.9	5.23	1.33	NA	NA	NA	NM	11.58	NM	trace	8.15	trace	NA	NA	NA
2/19/2019	NA	NA	NA	4.67	4.92	0.25	NA	NA	NA	9.77	9.79	0.02	7.88	7.97	0.09	NA	NA	NA
9/15/2020	NA	NA	NA	NM	NM	NM	NM	9.16	NM	NM	NM	NM	NM	NM	NM	NA	NA	NA
9/16/2020	-	10.43	-	NM	NM	NM	NM	7.99	NM	NM	NM	NM	NM	NM	NM	NA	NA	NA
9/17/2020	-	10.48	-	NM	NM	NM	NM	6.58	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/23/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/24/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/25/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.88/3.90*	-
9/28/2020	-	10.56	-	NM	NM	NM	NM	6.85	NM	NM	11.5	NM	NM	NM	NM	-	3.66	-
9/29/2020	10.55	10.56	0.01	NM	NM	NM	NM	6.82	NM	NM	NM	NM	NM	NM	NM	-	3.69	-
10/1/2020	trace	9.92	trace	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.19	-
10/2/2020	trace	9.96	trace	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.21	-
10/5/2020	10.24	10.41	0.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.44	-
10/6/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
10/7/2020	trace	10.12	trace	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.38	-
10/8/2020	10.25	10.38	0.13	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.45	-
10/20/2020	10.05	10.48	0.43	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	3.33	-
10/28/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11/6/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11/11/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11/16/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	2.67	-
11/18/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	2.72	-
11/24/2020	9.83	9.84	0.01	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	2.82	-

NA = Not Applicable NM = Not Measured *Pre-Development/Post-Development
^Pre-NAPL Removal/Post-NAPL Removal

SHADED = NAPL Detection

bgs = below ground surface

Table 2A - Parcel B14
Summary of NAPL Gauging Activities

		B14-011R-PZ			B14-013R-PZ			B14-038R-PZ		В	14-011-PZ-5-f	ì	В	14-013-PZ-5-f	ì
	Install	lation Date: 9/14	/2020	Installa	tion Date: 9/1	5/2020	Install	ation Date: 9/14/	2020	Installa	tion Date: 11/2	2/2020	Installa	tion Date: 11/2	2/2020
	Total W	ell Depth (feet b	gs) = 20	Total We	ll Depth (feet 1	bgs) = 20	Total Well Depth (feet bgs) = 20		Total Well Depth (feet bgs) = 5.5		g(s) = 5.5	Total Well Depth (feet bgs) = 5.5			
	Screen I	nterval (feet bgs)) = 5-20	Screen In	terval (feet bg	(s) = 5-20	Screen I	nterval (feet bgs)	= 5-20	Screen Interval (feet bgs) = $0.5-5.5$			Screen Interval (feet bgs) = $0.5-5.5$		
	Riser	Stick-Up (feet) =	= 3.18	Riser S	tick-Up (feet)	= 2.76	Riser	Stick-Up (feet) =	2.86	Riser S	tick-Up (feet)	= 2.97	Riser Stick-Up (feet) = 2.99		
	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL	Depth to	Depth to	NAPL
Date	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness	NAPL	Water	Thickness
	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)	(feet TOC)	(feet TOC)	(feet)
10/11/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/15/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11/14/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/19/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9/15/2020	NA	NA	NA	NM	NM	NM	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/16/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/17/2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/23/2020	NM	NM	NM	-	7.49/7.54*	-	-	13.84/17.86*	-	NA	NA	NA	NA	NA	NA
9/24/2020	NM	NM	NM	-	7.52	-	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/25/2020	-	8.14/8.60*	-	-	7.59	-	NM	NM	NM	NA	NA	NA	NA	NA	NA
9/28/2020	-	8.11	-	-	7.4	-	12.75	12.76	0.01	NA	NA	NA	NA	NA	NA
9/29/2020	-	8.14	-	-	7.41	-	12.8	12.82	0.02	NA	NA	NA	NA	NA	NA
10/1/2020	-	7.61	-	trace	6.77	trace	12.96	13.15	0.19	NA	NA	NA	NA	NA	NA
10/2/2020	-	7.59	-	trace	6.82	trace	13.02	13.55	0.53	NA	NA	NA	NA	NA	NA
10/5/2020	-	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	12.88	13.35	0.47	NA	NA	NA	NA	NA	NA
10/7/2020	-	7.78	-	7.02	7.05	0.03	12.68	13.2	0.52	NA	NA	NA	NA	NA	NA
10/8/2020	-	7.83	-	7.06	7.18	0.12	12.94	13.62	0.68	NA	NA	NA	NA	NA	NA
10/20/2020	-	7.73	-	7.03	7.18	0.15	12.8	13.45	0.65	NA	NA	NA	NA	NA	NA
10/28/2020	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	-	7.58	-	-	7.33	-
11/11/2020	-	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	-	6.31	-	trace	6.09	trace	11.7	11.91	0.21	-	6.46	-	-	6.46	-
11/18/2020	-	6.48	-	6.29	6.40	0.11	12.09	12.31	0.22	-	6.63	-	-	7.02	-
11/24/2020	-	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	-

Table 2B - Parcel B14 Summary of Round 2 NAPL Transmissivity Testing Results

						B14-013R-PZ					
<u>Date</u>	Time	Elapsed Time from Previous Removal Event (hrs)	Initial DTW (ft bgs)	Initial DTP (ft bgs)	Initial Thickness (ft)	NAPL Volume Removed (mL)	NAPL Volume Removed (ft ³)	Final DTW (ft bgs)	Final DTP (ft bgs)	Final Thickness (ft)	NAPL Recharge Rate (ft³/day)
5/10/2021	13:30	-	7.93	6.28	1.65	1,000	3.5E-02	7.50	7.19	0.31	-
5/11/2021	14:30	25.0	6.60	6.48	0.12	110	3.9E-03	6.45	trace	0.00	3.7E-03
5/12/2021	9:30	19.0	6.60	6.55	0.05	25.00	8.8E-04	6.60	trace	0.00	1.1E-03
5/13/2021	15:00	29.5	6.54	trace	0.00	10	3.5E-04	6.58	trace	0.00	2.9E-04
5/17/2021	11:30	96.5	6.74	trace	0.00	NA	NA	6.74	trace	0.00	NA
5/19/2021	10:30	139.5	6.92	6.88	0.04	10	3.5E-04	6.85	trace	0.00	6.1E-05
5/24/2021	11:30	121.0	7.20	7.00	0.20	10	3.5E-04	7.20	trace	0.00	7.0E-05
5/26/2021	10:30	47.0	7.71	trace	0.00	NA	NA	7.71	trace	0.00	NA
5/28/2021	9:00	93.5	7.45	7.30	0.15	10	3.5E-04	7.30	trace	0.00	9.1E-05

	B14-038R-PZ										
<u>Date</u>	Time	Elapsed Time from Previous Removal Event (hrs)	Initial DTW (ft bgs)	Initial DTP (ft bgs)	Initial Thickness (ft)	NAPL Volume Removed (mL)	NAPL Volume Removed (ft ³)	Final DTW (ft bgs)	Final DTP (ft bgs)	Final Thickness (ft)	NAPL Recharge Rate (ft³/day)
5/10/2021	12:30	-	14.88	12.05	2.83	2,400	8.5E-02		Emulsific	ed	-
5/10/2021	14:10	1.7	13.38	12.32	1.06	500	1.8E-02	13.00	12.82	0.18	2.5E-01
5/11/2021	13:30	25.0	13.95	12.21	1.74	1,000	3.5E-02	13.68	13.06	0.62	3.4E-02
5/12/2021	8:30	19.0	12.30	12.20	0.10	750	2.6E-02	12.95	12.9	0.05	3.3E-02
5/12/2021	13:30	5.0	12.95	12.44	0.51	300	1.1E-02	13.10	13.00	0.10	5.1E-02
5/13/2021	14:30	25.0	13.14	12.32	0.82	333	1.2E-02	12.90	12.81	0.09	1.1E-02
5/14/2021	10:00	19.5	13.20	12.40	0.80	250	8.8E-03	12.70	12.65	0.05	1.1E-02
5/14/2021	14:00	6.0	12.75	12.33	0.42	100	3.5E-03	12.69	trace	0.00	1.4E-02
5/17/2021	10:30	72.5	14.08	12.44	1.64	200	7.1E-03	13.10	trace	0.00	2.3E-03
5/17/2021	14:30	6.0	12.60	12.50	0.10	60	2.1E-03	12.75	trace	0.00	8.5E-03
5/19/2021	10:00	43.5	13.03	12.44	0.59	200	7.1E-03	12.85	trace	0.00	3.9E-03
5/21/2021	9:00	47.0	13.20	12.65	0.55	70	2.5E-03	13.00	12.90	0.10	1.3E-03
5/24/2021	10:30	73.5	12.90	12.65	0.25	175	6.2E-03	12.90	trace	0.00	2.0E-03
5/26/2021	10:00	47.5	12.55	12.42	0.13	55	1.9E-03	12.63	trace	0.00	9.8E-04
5/28/2021	8:30	46.5	12.90	12.60	0.30	50	1.8E-03	12.87	trace	0.00	9.1E-04

DTW = Depth to water

DTP = Depth to product

TOC = Top of casing

bgs = below ground surface

NA = No NAPL removed

Table 3 - Summary of Remedial Alternatives Evaluation Parcel B14 / Humprehy Impoundment CMS

CRITERIA	Alternative 2 Filling and Capping	Alternative 3 Removal and Disposal
Description	 In-place containment of materials below an impermeable asphaltic cap. Cap design will incorporate a vapor collection layer and appropriate vents to allow for venting of generated methane. Property use restrictions and long-term monitoring and maintenance to ensure that controls remain effective. 	- Excavate contaminated materials and transport to approved off-site disposal facility RCRA-hazardous materials would require treatment and/or disposal at an approved hazardous waste facility.
Long-Term Effectiveness	- Capping will provide for long-term control of direct contact exposures Sub-slab vapor barrier and venting system and utility backfill controls will prevent unacceptable inhalation risks Long-term monitoring will be conducted to ensure long-term effectiveness.	- Provides long-term effectiveness through removal and off-site disposal of contaminated materials.
Reduction of Toxicity, Mobility and Volume (TMV) by Treatment	- No active reduction in toxicity or volume, but may reduce mobility by reducing infiltration.	- Will reduce toxicity, mobility, and volume for the Site.
Short-Term Effectiveness	- Slightly increased risk of short-term direct contact exposures, but can be controlled through BMPs and worker health and safety.	- Slightly increased risk of short-term direct contact exposures, but can be controlled through BMPs and worker health and safety.
Implementability	- Can be readily implemented with available and proven technologies.	- Potential short-term exposure risks, excavation of materials from below the groundwater table, materials handling and transportation (most disposal facilities do not have the capacity to accept this volume of waste on a daily or weekly basis), and other factors present significant implementation concerns.
Community Acceptance	- Expected to be acceptable because it reduces risks and increases short and long term protection of human health and the environment.	- Transportation of large volumes of waste through any community is generally not favorable. - Significant traffic impacts for extended period of time.
State Acceptance	- Expected to be acceptable because it meets remedial objectives and evaluation criteria.	- Potentially acceptable, but the relocation of large volumes of waste may be counter to waste diversion goals and may not be acceptable to the state receiving the large volume of waste.
Estimated Cost	\$18.4 million	\$285 million
Conclusion	Cost-effectively meets cleanup objectives and evaluation criteria. RECOMMENDED.	Implementation concerns, increased short-term exposure risks, and extremely high cost. NOT RECOMMENDED.

Notes:

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

Table 4A - Preliminary Estimate of Site Remediation Costs Alternative No. 2 - Filling & Capping Parcel B14 - Humphrey's Impoundment Sparrows Point, MD

Item Description	Quantity	Unit	Unit Cost	Item Cost
I. Site Preparation				
Project Management/Health and Safety	3%			\$486,561
Erosion and Sedimentation Controls	6,500	LF	\$11	\$71,500
II. Site Clearing - Dry Acreage				
Dry Acreage Clearing, Grinding, and Stockpiling	33	Dry Acres	\$8,279	\$273,200
III. Site Clearing - Wet Acreage				
Wet Acreage Clearing, Grinding, and Stockpiling	19	Wet Acres	\$45,552	\$865,500
Dewatering Allowance	19	Wet Acres	\$10,000	\$190,000
IV. Site Fill				
Excavate, haul, place, and compact fill from CPLF to HI	860,855	NT	\$5.68	\$4,889,700
Material Allowance	50,000	NT	\$10.50	\$525,000
V. Cover System Construction				
Grab and Go	98,223	NT	\$5.68	\$557,900
GAB	48,818	NT	\$5.68	\$277,300
GAB Value	48,818	NT	\$4.85	\$236,800
Pave	50	Acres	\$140,000	\$7,000,000
Vapor Collection Layer - Backfilling (gravel layer; 2,178,000 sq ft x 4 in deep)	26,889	CY	\$50	\$1,344,444
2" PVC within gravel (30 ft spacing from centers)	117,730	LF	\$0.50	\$58,865
VI. Construction Oversight and Support				
Engineering Oversight and Testing	10%			\$1,621,871
Preliminary Cost Estimate				\$18,399,000

Notes:

- Estimated cost is preliminary and subject to change based on future studies, evaluations, design, etc.
- Estimated cost does not include contingency, permitting, long-term O&M, and other items not shown
- Assumes 52 acres for clearing and 50 acres for filling
- Assumes between 2 and 10 ft of fill will be placed across the 50 acre area (depending on the existing elevation)
- Assumes 1 CY of soil is approximately 1.4 tons.

Table 4B - Preliminary Estimate of Site Remediation Costs Alternative No. 3 - Removal and Disposal Parcel B14 - Humphrey's Impoundment Sparrows Point, MD

Item Description	Quantity	Unit	Unit Cost	Item Cost
II. Site Preparation				
Project Management/Health and Safety	3%			\$7,546,639
Erosion and Sedimentation Controls	6,500	LF	\$11	\$71,500
II. Site Clearing - Dry Acreage				
Dry Acreage Clearing, Grinding, and Stockpiling	33	Dry Acres	\$8,279	\$273,200
III. Site Clearing - Wet Acreage		•		
Wet Acreage Clearing, Grinding, and Stockpiling	19	Wet Acres	\$45,552	\$865,500
Dewatering Allowance	19	Wet Acres	\$10,000	\$190,000
III. Excavation				
Soil Excavation (50 acres x 22 ft deep)	2,484,533	NT	\$5	\$12,422,667
Relocation/Treatment/Disposal of Unsuitable Materials (assume 90%)	2,571,492	NT	\$88	\$226,291,296
Backfilling (assumes 10% material can be re-used)	248,453	NT	\$4	\$993,813
Excavate, haul, place, and compact fill from CPLF to HI	1,839,200	NT	\$5.68	\$10,446,656
Dewatering (400 gpm system)	4	Per 12 months	\$266,410	\$1,065,640
IV. Construction Oversight and Support				
Engineering Oversight and Testing	10%			\$25,155,463
Preliminary Cost Estimate				\$285,322,000

Notes:

- Estimated cost is preliminary and subject to change based on future studies, evaluations, design, etc.
- Estimated cost does not include contingency, permitting, long-term O&M, and other items not shown
- Assumes 52 acres for clearing and 50 acres for filling
- Assumes soil excavation of approximately 22 ft across the 50 acre area
- Assumes 90% of soil will be disposed of offsite, 10% re-used
- Assumes 1 CY of soil is approximately 1.4 tons.
- Based on the distance to appropriate disposal facilities, trucks would only be able to make 1 trip per day. Assuming 80 trucks per day, 18 CY per truck, and 260 days of work per year, it would take approximately 4 years to transport all excavated material.

APPENDIX A



Boring ID: B14-002-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group ARM Project No. : 150300M-17-3

ARM Project No. : 150300M-17-3
Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD

ARM Representative : L. Perrin; M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Ryan Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/14/17
Piezometer Installation Date : 9/14/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

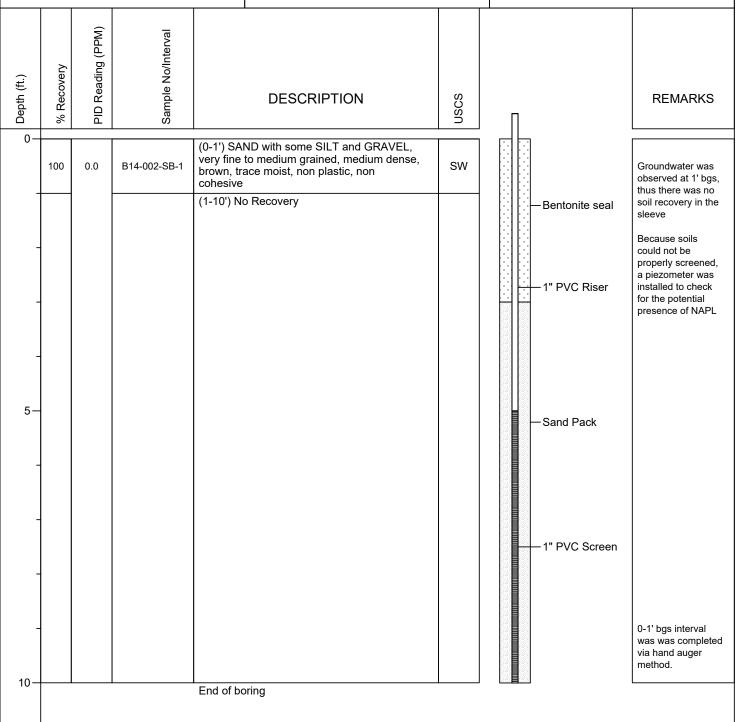
Northing (US ft) : 570756.78

Easting (US ft) : 1459350.57

0-Hr DTW : 11.84' TOC

48-Hr DTW : 4.45' TOC

No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 10' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bon\B14-002-SB.bon

Riser Stickup: 2.80' Riser: 0 - 5' bgs

Screen: 5 - 10' bgs [Slot Size: 0.010"] Sand Pack: 3 - 10' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-003-SB

12-05-2017 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\Boring Logs\\(\mathcal{Q}_b\) bor

Total Borehole Depth: 20' bgs.

Boring terminated at 20' bgs due to water.

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: L. Perrin ARM Representative : L. Glumac Checked by Drilling Company : Allied Drilling Co.

Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Date : 9/13/17

Weather : Cloudy, 70s

Northing (US ft) : 570855.57

Easting (US ft) : 1459561.37

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-				(0-0 5') \$	ANDY SILT, soft, brown, dry, non plastic, non	ML	Light organic matter present
		-	B14-003-SB-1	cohesive			Light organic matter present
_		0.4		COBBLE	SLAG, SAND and GRAVEL-sized and some -sized, brown with trace black and gray grading to rown, dry, non plastic, non cohesive		
	72	0.6			,,		
		0.2					
5-		0.1	B14-003-SB-5				
5-		-					
-		_				sw/gw	
-							
<u>-</u>	60	0.8					
10-		0.5					Wet at 9' bgs
[] [] 10-		1.6					
		-					
-		-					
-	8			(12-19.7')	CLAYEY SILT with trace SAND, soft, black, low		
-				plasticity,	cohesive		
- - - - -		-					
15-		-					Moderate odor
		-				ML	No product sheen
5		-				IVIL	
- i	40						
20-	40	-					
5 -		-					
3		-		(40.7.00)	CILTY CLAY firm light grounds grow as int learn	CL	
20-				\plasticity,			
				End of bo	pring		



Boring ID: B14-006-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group : 150300M-17-3 ARM Project No.

Project Description : Sparrows Point - Parcel B14

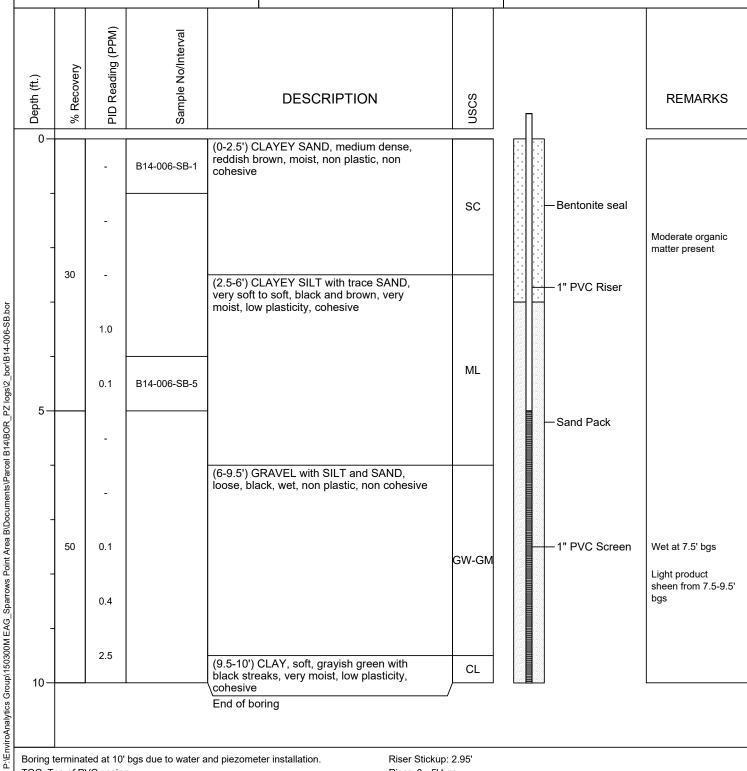
Site Location : Sparrows Point, MD

ARM Representative : L. Perrin; M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T. **Drilling Company** : Allied Drilling Co.

Driller : Mike Garvine **Drilling Equipment** : Geoprobe 7822DT Soil Boring Installation Date : 9/13/17 Piezometer Installation Date : 9/14/17 Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25' Riser/Screen Diameter : 1"

Northing (US ft) : 570478.47 Easting (US ft) : 1459634.31 0-Hr DTW : 3.61' TOC 48-Hr DTW : 4.12' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 10' 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: 2.95' Riser: 0 - 5' bgs

Screen: 5 - 10' bgs [Slot Size: 0.010"] Sand Pack: 3 - 10' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-007-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

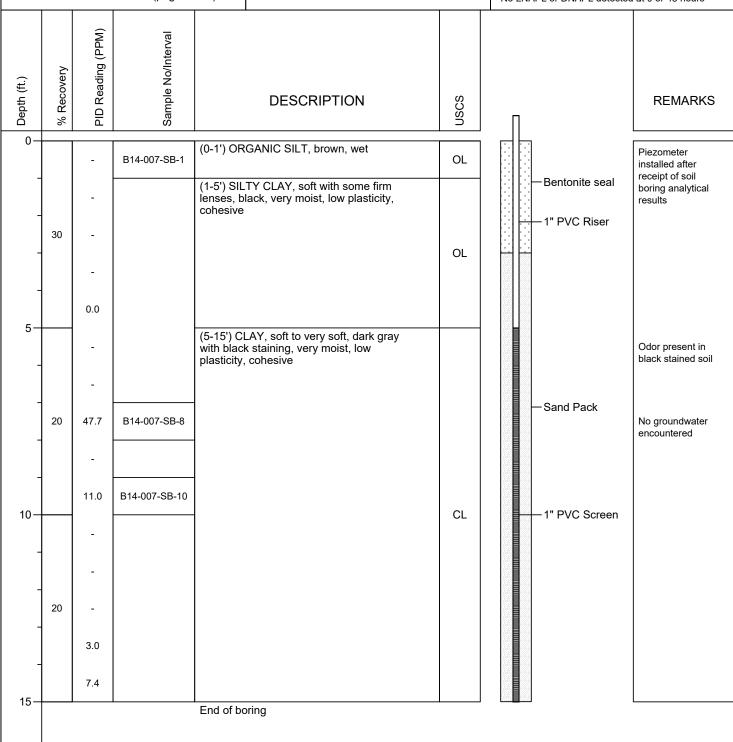
Site Location : Sparrows Point, MD ARM Representative : M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/7/17
Piezometer Installation Date : 11/16/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569875.57
Easting (US ft) : 1458505.37
0-Hr DTW : 5.84' TOC
48-Hr DTW : 5.90' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 15' bgs due to rig stuck.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

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Riser Stickup: 2.70' Riser: 0 - 5' bgs

Screen: 5 - 15' bgs [Slot Size: 0.010"] Sand Pack: 3 - 15' bgs [Grain Size: WG #2]

Bentonite Seal: 0 - 3' bgs [Grain Size: granular (30-50 mesh)]



Boring ID: B14-008-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

: 150300M-17-3 ARM Project No.

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

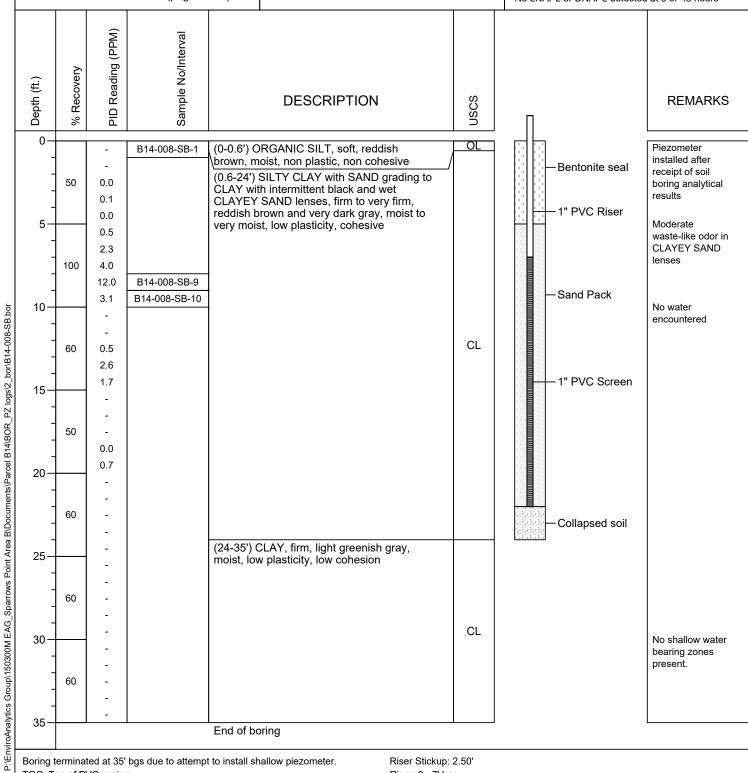
ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.

Drilling Company : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Soil Boring Installation Date : 9/12/17 Piezometer Installation Date : 11/15/17 Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25' Riser/Screen Diameter : 1"

Northing (US ft) : 569996.32 Easting (US ft) : 1459083.74 0-Hr DTW : 6.85' TOC 48-Hr DTW : 3.48' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 35' bgs due to attempt to install shallow piezometer.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface

AMSL: Above mean sea level

Riser Stickup: 2.50' Riser: 0 - 7' bgs

Screen: 7 - 22' bgs [Slot Size: 0.010"] Sand Pack: 5 - 22' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 5' bgs [Grain Size: 3/8" chips]



Boring ID: B14-009-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: L. Perrin ARM Representative : L. Glumac Checked by Drilling Company : Allied Drilling Co.

Driller : Ryan Sites **Drilling Equipment** : Hand Auger Date : 9/15/17

Weather : Sunny, 70s

Northing (US ft) : 570093.81

Easting (US ft) : 1459210.00

			(page 1	· · · /			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-				(0-3.5') C	CLAYEY SAND and GRAVEL, soft, brownish red,		
				wet, non	plastic, non cohesive		Heavy organic matter
		9.1	B14-009-SB-1				Wet at 3" bgs- possible stormwater or groundwater
-							
-		-				SC/GC	
	100	-					
-							
		-		(3.5-5') S brownish	SILTY CLAY with some SAND and GRAVEL, firm, red, wet, non plastic, non cohesive		
-		0.0	B14-009-SB-5			CL	
5-				End of bo	oring		

Total Borehole Depth: 5' bgs.

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Boring terminated at 5' bgs due to maximum hand auger depth.



Boring ID: B14-010-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group ARM Project No. : 150300M-17-3

ARM Project No. : 150300M-17-3
Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD

 $\label{eq:ARM-Representative} \textbf{ARM Representative} \quad : \textbf{L. Perrin}; \textbf{M. Replogle}, \textbf{E.I.T}.$

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : Ryan Sites
Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/13/17
Piezometer Installation Date : 9/13/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 570027.32
Easting (US ft) : 1459753.99
0-Hr DTW : 11.02' TOC
48-Hr DTW : 11.14' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

			(page 1	ot 1)			No LNAPL or DNAPL detected at 0 or	48 hours
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	USCS	RI	EMARKS
0-				(0-1 5') 9	SILTY SAND, loose, brown, dry,		Trace	organic
	1	-	B14-010-SB-1	non plast	tic, non cohesive	SM		present
5-	68	1.0 1.0 4.1 0.6	B14-010-SB-5	with SAN and gray	SLAG GRAVEL, fine to coarse, ND, medium dense to dense, gray ish brown, dry, non plasticity, non y; with CLAY from 3.5-4' bgs	GW	Trace	large ic SLAG
10-	60	0.9 28.0 1.3		SILT, red	BRICK and SLAG GRAVEL with ddish brown, dry then wet at 7' bgs, tic, non cohesive	GW-GM	Wet at	t 7' bgs
10-	40	- - -		(9.5-20') black, we	SLAG GRAVEL with some SILT, et, non plastic, non cohesive			rate sheen, or (9.5-20'
15 -	50	-				GP		
20-	0			(20-22') I	No recovery oring			
<u> </u>	1							

Boring terminated at 22' 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

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-010-SB.bor

Riser Stickup: 3.52' Riser: 0 - 7' bgs

Screen: 7 - 21' bgs [Slot Size: 0.010"] Sand Pack: 3 - 22' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-011-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

: 150300M-17-3 ARM Project No.

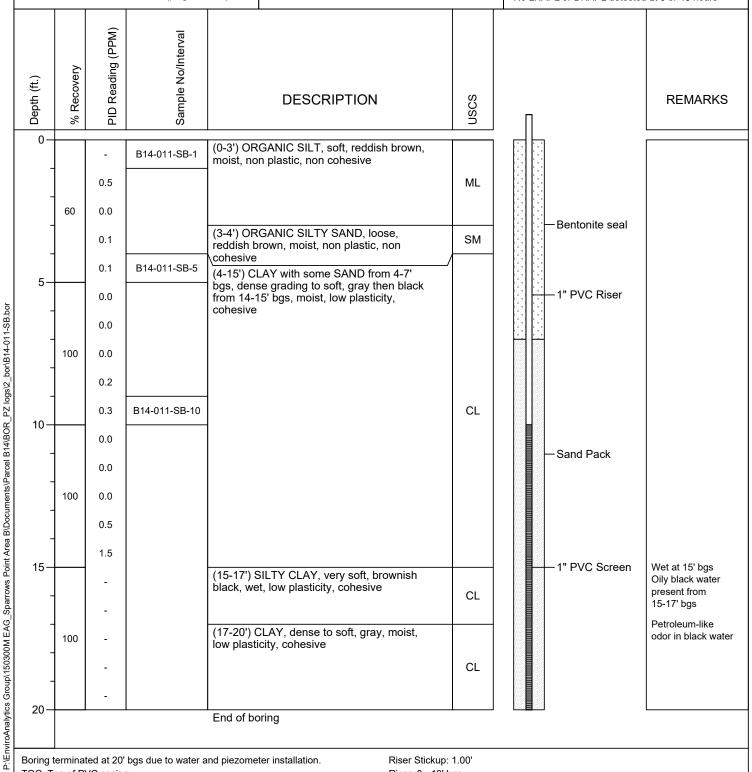
Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD ARM Representative : M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T. **Drilling Company** : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Soil Boring Installation Date : 9/7/17 Piezometer Installation Date : 9/7/17 Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25" Riser/Screen Diameter : 1"

Northing (US ft) : 569792.54 Easting (US ft) : 1457396.68 0-Hr DTW : 5.10' TOC 48-Hr DTW : 5.65' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' 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: 1.00' Riser: 0 - 10' bgs

Screen: 10 - 20' bgs [Slot Size: 0.010"] Sand Pack: 7 - 20' bgs [Grain Size: WG #2] Bentonite Seal: 0-7' bgs [Grain Size: 3/8" chips]



Boring ID: B14-012-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin; M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.

Drilling Company : Allied Drilling Co.

Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/6/17
Piezometer Installation Date : 9/15/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569615.62
Easting (US ft) : 1457923.32
0-Hr DTW : 9.26' TOC
48-Hr DTW : 9.16' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

									AFE OF DIVAFE detecte	
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	I	nscs	П		REMARKS
0-	82	- 0.0 0.0	B14-012-SB-1	moist to (1.1-2') S brownish (2-2.7') S dense, d plastic, n	DRGANIC SILT, soft, dar dry, non plastic, non coh GANDY CLAY, dense, da red, dry, low plasticity, GAND, fine grained, with ark reddish brown, dry, r on cohesive	ark cohesive CLAY,	OL CL SP		— Bentonite seal	Piezometer installed after receipt of soil boring analytical results
5 - -	80	0.0		brownish brown, d	SILTY CLAY, dense grad red with trace dark gray ry then very moist at 6' b , cohesive	/ish	CL		—1" PVC Riser	
10-		53.6 215.2 -	B14-012-SB-9 B14-012-SB-10	(9-10') S gray, ver	ILTY CLAY, firm, dark bi y moist, low plasticity, co	rownish ohesive	CL			Sludge-like odor 8-15' bgs
- - 15—	60	- 22.8 14.2		(11.5-17' medium cohesive) SAND, fine to medium dense, gray, wet, non pl	grained, astic, non	sw		— Sand Pack — 1" PVC Screen	Wet at 11.5' bgs
- -	20	- - -		(17-20') s moist, lo	SILTY CLAY, soft, black w plasticity, cohesive	, very	CL			
20-		25.5		End of bo	oring					

Boring terminated at 20' 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

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bon\B14-012-SB.bor

Riser Stickup: 3.05' Riser: 0 - 10' bgs

Screen: 10 - 20' bgs [Slot Size: 0.010"] Sand Pack: 8 - 20' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 8' bgs [Grain Size: 3/8" chips]



Boring ID: B14-013-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : M. Replogle, E.I.T.; L. Perrin

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/7/17
Piezometer Installation Date : 11/21/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569629.46
Easting (US ft) : 1458273.70
0-Hr DTW : 7.60' TOC
48-Hr DTW : 8.01' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

			(page i				No LNAPL of DNAPL detec	led at 0 of 46 flours
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	Π	REMARKS
0-		-	B14-013-SB-1	non plas	RGANIC SILT, loose, brown, dry, stic, non cohesive	OL	Bentonite seal	Piezometer installed after
-		1.0		(1-3') CL dark redo plasticity	AYEY SILT with GRAVEL, firm, dish grayish brown, moist, low	ML	Deficience sear	receipt of soil boring analytical results
-	70	0.2		(3-8') SIL	LTY CLAY with trace GRAVEL, firm			Clay breaks on flat
		0.0		to soft, d to very m	lark reddish grayish brown, moist noist, low plasticity, cohesive		1" PVC Riser	planes into cubes
5-		1.5				CL		
-	400	2.1						
-	100	10.6 28.7	B14-013-SB-9	(8-10') C	CLAY, medium firm, dark gray, moist, plasticity, cohesive			
- 10-		18.8	B14-013-SB-10	modium	placetory, contents	CL	—Sand Pack	
-		-		soft, dark	') CLAY with some SAND, medium k grayish black, very moist, medium , cohesive		—Sand Pack —1" PVC Screen	
-	60	3.3					1" PVC Screen	
-		2.3				CL		
15—		0.8						
-	70	-			') SILTY SAND, loose, black wet, stic, non cohesive	SM		Wet at 16' bgs Black oily water present
-	70	1.9 1.7		plasticity	') CLAY, soft, black, wet, low ', cohesive ') SAND, loose, black, wet, non	CL SP		Petroleum-like odor in black water
20-		2.0		plastic, n (18.5-20)	non cohesive ') CLAY, soft, black, wet, medium	_/ CL		
20-				∖plasticity End of be	, cohesive oring	_/		

Boring terminated at 20' bgs due to water.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bon\B14-013-SB.bor

Riser Stickup: 2.90' Riser: 0 - 5' bgs

Screen: 5 - 20' bgs [Slot Size: 0.010"] Sand Pack: 3 - 20' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-014-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14
Site Location : Sparrows Point, MD

ARM Representative : L. Perrin Checked by : L. Glumac

Drilling Company : Allied Drilling Company : Mike Garvine

Drilling Equipment : Hand Auger

Date : 9/29/17

Weather : Sunny, 70s

Northing (US ft) : 569667.79

	3 ()	
: Allied Drilling Co.	Easting (US ft)	: 1458621.48
: Mike Garvine		

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-		6.7	B14-0014-SB-1	(0-1') SAI plastic, no	ND with SILT, dense, medium brown, dry, non on cohesive	SW-SM	Moderate organic matter
		-		(1-2') CL/plasticity,	AYEY SILT, firm, reddish brown, moist, low cohesive	ML	
-	100	-		dry, non (2.5-5') S	ILTY SAND, very fine to fine, medium dense, black, blastic, non cohesive ILTY CLAY with trace SAND, very firm, reddish y to moist, low plasticity, cohesive	SM	Some metallic grains present from 2-2.5' bgs
		-				CL	No water encountered
_		6.5	B14-014-SB-5				
5-				End of bo	oring	·	

Total Borehole Depth: 5' bgs.

Boring terminated at 5' bgs due to maximum hand auger depth.



Boring ID: B14-015-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/12/17
Piezometer Installation Date : 9/12/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569735.70
Easting (US ft) : 1458868.76
0-Hr DTW : 14.18' TOC
48-Hr DTW : 14.06' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

			(page 1	of 1)			No LNAPL or DNAPL detected at 0 or 48 hours			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	П		REMARKS	
0-				l			H			
_		-	B14-015-SB-1	(0-1.5') S brown m	SLAG GRAVEL, fine, loose, reddish noist, non plastic, non cohesive	GP				
_		-			CLAY with SILT, firm to very firm,					
	62	0.0		reddish b	prown, moist, low plasticity,			─Bentonite seal		
		0.0		cohesive					Clay breaks on flat	
		0.0	B14-015-SB-5			CL		-2" PVC Riser	planes into cubes	
5-		-								
-		0.0								
-	72	0.0								
. -		0.7		(8-14.5')	CLAYEY SAND with large BRICK					
10-		0.0	B14-015-SB-10	COBBLE	S, medium dense, reddish brown					
10-		0.0	B14-010-0B-10	with yello	ow and gray, moist, non plastic,					
-		-				sc				
		-								
- 	20	-								
[] _		-						—Sand Pack		
[] 15—		0.0		(14.5-16') SILTY CLAY, soft, gray with					
		-		black stre	eaks, very moist, low plasticity,	CL			Moderate sheen	
1		-		cohesive) SILTY SAND, medium dense, dark	1			with trace	
-	4	-		brown an	nd very dark gray, wet, non			-2" PVC Screen	petroleum-like product with	
-		-		plasticity	, non cohesive				moderate odor	
-		-								
20-		-				CL			Wet at 19.2' bgs	
-		_								
-	40	_								
-	"	_								
-		_		(0.4.0.00)) OLAY (6. 1. 1					
25—		-		(24.2-28' moist. lov) CLAY, soft, dark gray, very w plasticity, cohesive				Possible saturated	
		-]		CL			product present from 24.2-28' bgs	
-		-								
-	60	-				\perp		—Bentonite seal		
30-		-		(28-30') (black stre cohesive	CLAY, firm, grayish green with eaks, moist, low plasticity,	CL				
] 30-				End of bo	oring	- -		•		

Boring terminated at 30' due to water and piezometer installation.

TOC: Top of PVC casing DTW: Depth to water

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-015-SB.bor

bgs: Below ground surface AMSL: Above mean sea level Riser Stickup: 2.25' Riser: 0 - 10' bgs

Screen: 10 - 25' bgs [Slot Size: 0.010"] Sand Pack: 8 - 25' bgs [Grain Size: WG #2]

Bentonite Seal: 0 - 3' bgs, 25-30' bgs [Grain Size: 3/8" chips]



Boring ID: B14-016-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: L. Perrin ARM Representative : L. Glumac Checked by

Drilling Company : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Date : 9/12/17

Weather : Cloudy, 70s

Northing (US ft) : 569669.64

Easting (US ft) : 1459341.40

			(page 1	····			_
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	NSCS	REMARKS
0-		-	B14-016-SB-1	(0-2') SA plastic, n	ND with SILT, medium dense, brown, dry, non on cohesive	SW-SM	Organic matter present
5 5	28	- 0.1 1.5		GRAVEL	SAND, very fine to very coarse, with coarse BRICK., meidum dense, brown and yellow with trace gray, plastic, non cohesive	SW-SM	
5	70	1.3	B14-016-SB-7.5	large coa	n-native SAND, with some fine GRAVEL, and with arse GRAVEL from 6-7' bgs, medium dense, fine to rained, brown and light brown with trace yellow, moist at 8' bgs	SW	
10-		0.1	B14-016-SB-10	GRAVEL	AND, medium to very coarse with fine to coarse with some fine metallic grains, medium dense to oist, non plastic, non cohesive	SW/GW	
	40	-		medium) SAND with fine BRICK GRAVEL and SILT, fine to grained, medium dense, brown, yellow, and grayish ret, non plastic, non cohesive		
15—		0.0				SW/GW	Wet at 13' bgs
15-				(14.8-15' low plast End of bo) SANDY CLAY, firm, reddish brown, very moist, icity, cohesive bring	CL	

Total Borehole Depth: 15' bgs.

12-05-2017 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\Boring Logs\\(\alpha \)_bor

Boring terminated at 15' bgs due to water.



Boring ID: B14-017-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

: 150300M-17-3 ARM Project No.

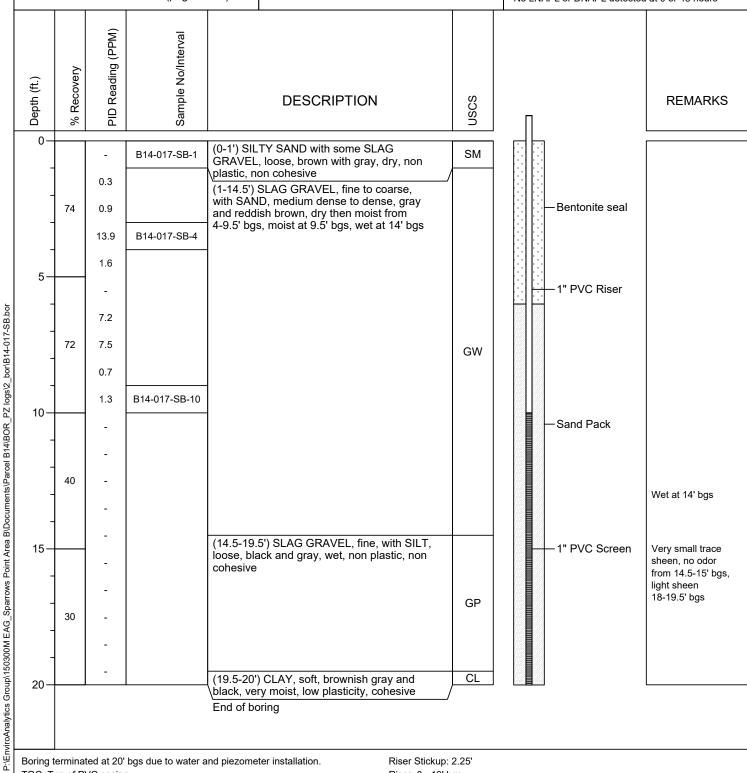
Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin; M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T. **Drilling Company** : Allied Drilling Co.

Driller : Mike Garvine **Drilling Equipment** : Geoprobe 7822DT Soil Boring Installation Date : 9/13/17 Piezometer Installation Date : 9/13/17 Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25' Riser/Screen Diameter : 1"

Northing (US ft) : 569668.86 Easting (US ft) : 1459715.98 0-Hr DTW : 12.63' TOC 48-Hr DTW : 12.76' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' 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: 2.25' Riser: 0 - 10' bgs

Screen: 10 - 20' bgs [Slot Size: 0.010"] Sand Pack: 6 - 20' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 6' bgs [Grain Size: 3/8" chips]



Boring ID: B14-018-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description Site Location : Sparrows Point, MD

: L. Perrin ARM Representative Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Date : 9/14/17

Weather : Sunny, 70s

Northing (US ft) : 569256.96

Easting (US ft) : 1457480.89

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval	DESCRIPTION	USCS	REMARKS
0-			σ			
0-		-	B14-018-SB-1	(0-1') SILTY SAND with some GRAVEL, medium dense, brown, moist, non plastic, non cohesive	SM	Light organic matter present
_		1.6		(1-2') CONCRETE, light gray, dry, non plastic, non cohesive	NA	
-	90	1.5		(2-9.5') SAND and GRAVEL with some SILT, medium dense, brown, dry, then moist at 8' bgs, then wet at 9' bgs, non plastic, non cohesive		
_		2.9				
_		0.9	B14-018-SB-5			
5-		0.7			SW/GW	
_		2.9				
_	94	2.9				
_		3.1				
10-		2.9		(9.5-10') Non-native SAND with CLAY, medium dense, brown and greenish gray, wet, non plastic, non cohesive	SW/CL	Wet at 9.5' bgs

Total Borehole Depth: 10' bgs.

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Boring terminated at 10' bgs due to water.



Boring ID: B14-019-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14
Site Location : Sparrows Point, MD

ARM Representative : L. Perrin Checked by : L. Glumac

Drilling Company : Allied Drilling Co.
Driller : Mike Garvine
Drilling Equipment : Geoprobe 7822DT

Date : 9/6/17

Weather : Cloudy, 70s

Northing (US ft) : 569299.17

Easting (US ft) : 1457895.77

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-		-	B14-019-SB-1	(0-1') SIL dense, re	TY SAND with SLAG GRAVEL, loose to medium ddish brown, moist, non plastic, non cohesive	SM	
-		1.3		(1-8') SLA dense, lig plastic, no	AG SAND and GRAVEL with trace SILT, medium ght brown, gray, and dark gray, dry to moist, non on cohesive		
-	78	63.7					
		69.6	B14-019-SB-4				
5-		2.1				SW/GW	
-		37.0					No water encountered
_	58	7.9					
_		6.8					
				End of bo	oring		
10-	orehole D	enth: 8' h	ns .				

Total Borehole Depth: 8' bgs.

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Boring terminated at 8' bgs due to refusal.



Boring ID: B14-020-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : M. Replogle Checked by : L. Glumac **Drilling Company** : Allied Drilling Co.

Driller : Mike Garvine

: Hand Auger

Drilling Equipment

Easting (US ft)

Date

Weather

: 9/11/17 : Sunny, 60s

Northing (US ft) : 569329.33 : 1458300.45

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval	DESCRIPTION	uscs	REMARKS
0-					•	
, ,	100	0.0	B14-020-SB-1	(0-1') SANDY SILT TOPSOIL with some SILT and GRAVEL, loose, brown, dry, non plastic, non cohesive	ML	No water accountered
_	100	0.0		(1-2') SLAG SAND and GRAVEL, loose, brown and gray, dry, non plastic, non cohesive	SW/GW	No water encountered
				End of boring		

Total Borehole Depth: 2' bgs.

Boring terminated at 2' bgs due to hand auger refusal.



Boring ID: B14-021-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

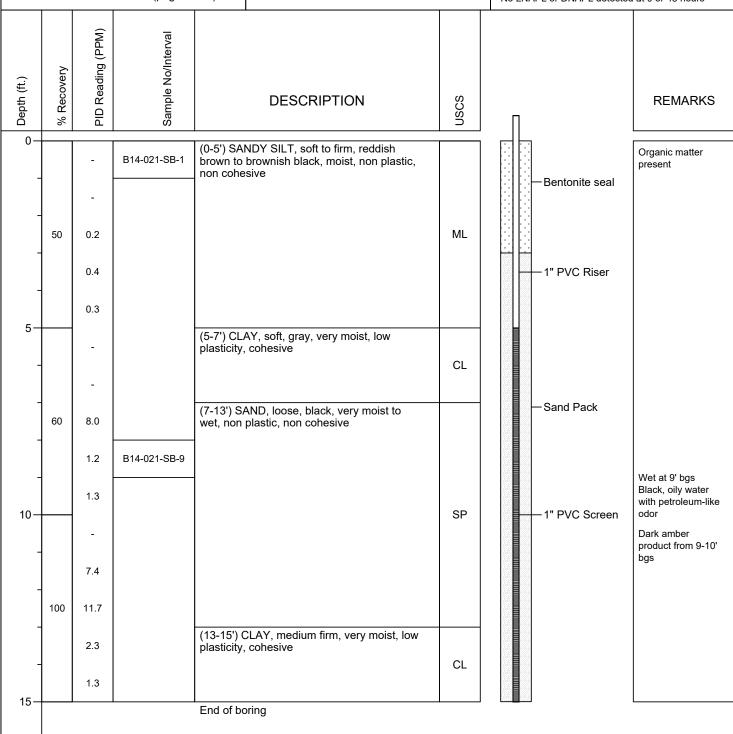
Site Location : Sparrows Point, MD ARM Representative : M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/7/17
Piezometer Installation Date : 9/7/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569933.44
Easting (US ft) : 1457689.82
0-Hr DTW : 3.80' TOC
48-Hr DTW : 4.01' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



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

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Riser Stickup: 0.97' Riser: 0 - 5' bgs

Screen: 5 - 15' bgs [Slot Size: 0.010"] Sand Pack: 3 - 15' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-022-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

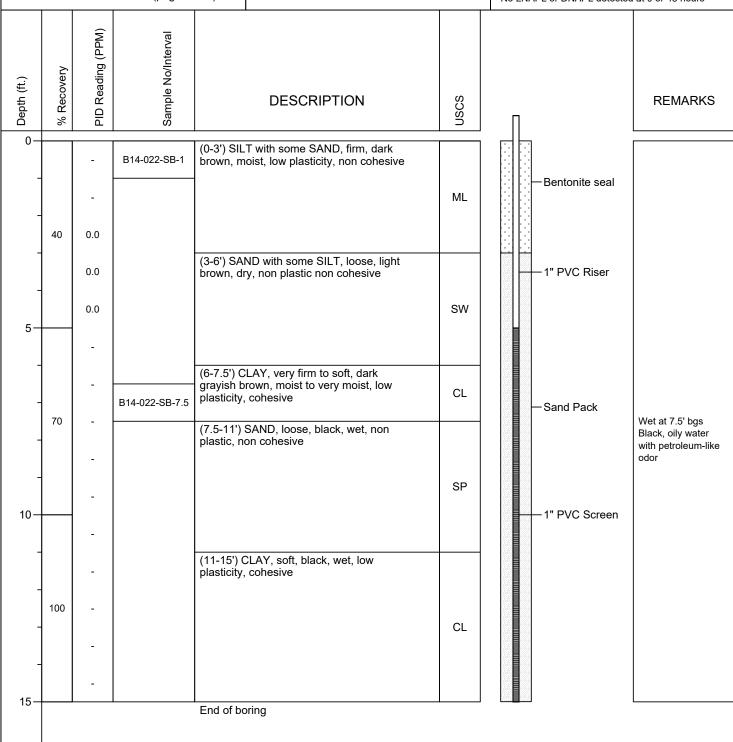
Site Location : Sparrows Point, MD ARM Representative : M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/7/17
Piezometer Installation Date : 9/7/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569972.88
Easting (US ft) : 1458033.97
0-Hr DTW : 5.67' TOC
48-Hr DTW : 5.74' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



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

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Riser Stickup: 0.80' Riser: 0 - 5' bgs

Screen: 5 - 15' bgs [Slot Size: 0.010"]
Sand Pack: 3 - 15' bgs [Grain Size: WG #2]
Bentonite Seal: 0 - 3' bgs [Grain Size: 3/8" chips]



Boring ID: B14-023-SB

Boring terminated at 1.6' bgs due to hand auger refusal.

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Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Brad Toribio

Drilling Equipment : Hand auger Date : 9/15/17

Weather : Sunny, 80s

Northing (US ft) : 570176.87

Easting (US ft) : 1458411.99

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	USCS	REMARKS
0-	-			(0.4.01)	lan metico CAND with some CLAC CDAVE		
	100	0.0	B14-023-SB-1	trace SIL cohesive	Non-native SAND with some SLAG GRAVEL and T, medium dense, brown, dry, non plastic, non	SW/GW	
-							No water encountered
		0.0					
				End of bo	oring		
-							
5-							
Total Bo	orehole D	epth: 1.6'					



Boring ID: B14-024-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: L. Perrin ARM Representative : L. Glumac Checked by

Drilling Company : Allied Drilling Co. Driller : Ryan Sites

Drilling Equipment : Hand auger Date : 9/15/17

Weather : Sunny, 80s

Northing (US ft) : 570315.85

Easting (US ft) : 1458578.16

			(page 1	01 1)					
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESC	RIPTION		USCS	REMARKS
0-	-						<u>_</u> _		
Ü	100	0.8	B14-024-SB-1	(0-1.5') S and gray	AND and SLAG GRA ish brown, dry, non pla	VEL, medium dense, browr astic non cohesive		SW/GW	
-		0.5							No water encountered
				End of bo	orina				
_									

Total Borehole Depth: 1.5' bgs.

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Boring terminated at 1.5' bgs due to hand auger refusal.



Boring ID: B14-025-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description

: L. Glumac

Site Location : Sparrows Point, MD : L. Perrin ARM Representative

Drilling Company : Allied Drilling Co. Driller : Ryan Sites

Checked by

Drilling Equipment : Geoprobe 7822DT Date : 9/14/17

Weather : Sunny, 70s

Northing (US ft) : 570568.67

Easting (US ft) : 1458728.25

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	0 0 0	USCS	REMARKS
0-		-	B14-025-SB-1	(0-8.7') S dry, non p	ELAG GRAVEL and SAND, gray and grayish brown plastic, non cohesive	,		
-	60	0.8						
5-		2.7	B14-025-SB-5			SW/	/GW	
_		-						
_	42	0.9						
-		0.2		plastic, no (9.2-10')	BRICK GRAVEL, medium dense, red, dry, non on cohesive SAND, medium dense, brown and yellow, wet, non on cohesive		SP NA	Wet at 9.2' bgs Abundant WOOD fragments
10-				End of bo	oring	'	!	

Total Borehole Depth: 10' bgs.

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Boring terminated at 10' bgs due to water.



Boring ID: B14-026-SB

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: L. Perrin ARM Representative Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Ryan Sites

Drilling Equipment : Geoprobe 7822DT Date : 9/14/17

Weather : Sunny, 70s

Northing (US ft) : 570658.38

Easting (US ft) : 1458807.40

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-		0.0	D44 000 CD 4	(0-0.6') O cohesive	RGANIC SILT, soft, dry, brown, non plastic, non	OL	
-		0.2	B14-026-SB-1	(0.6-3.5') dense, lig	SAND with SILT, fine to medium, medium dense ght brown and brown, dry, non plastic, non cohesiv	to /e	
		2.0					
-						SW-SM	
	92	0.2					
		0.2		(5 - 1) 0			
				dry, low p	LAY, hard, reddish yellow and light brownish gray plasticity, cohesive	, CL	
5-		0.1		(4-8.5') S bgs, very cohesive	ANDY SILT with trace BRICK GRAVEL from 4-5' firm, black with trace red, moist, non plastic, non		
5		-					
-		-				ML	WOOD fragments with creosote-like odor present from 7-9.8' bgs
_	60	2.6					
=			B14-026-SB-8.5				
		3.9		(8.5-9.8')	CLAYEY SAND, dark brownish red, wet, non on cohesive		Wet at 8.5' bgs
Ī		3.6		1		SC	
10-				(9.8-10') \brown an	CONCRETE GRAVEL, medium dense, very pale d brown, wet, non plastic, non cohesive	NA NA	
				End of bo			

Total Borehole Depth: 10' bgs.

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Boring terminated at 10' bgs due to water.



Boring ID: B14-027-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description

Site Location : Sparrows Point, MD : L. Perrin ARM Representative Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Ryan Sites

Drilling Equipment : Geoprobe 7822DT Date : 9/14/17

Weather : Sunny, 80s

Northing (US ft) : 570806.21

Easting (US ft) : 1459120.62

			(page 1	···			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-				(0.41) 64	ND, very fine to medium, with CLAY and fine		
		-	B14-027-SB-1	GRAVEL	., medium dense, reddish yellow and light brown,	SW-SC	
		0.2		(1-2') SA	on plastic, non cohesive, NDY CLAY with some GRAVEL, very firm to hard,	CL	
	80	0.2		dry to mo	oist, light brown with trace gray and yellow, low , cohesive	sw/gw	
1		2.9		(2-2.8') S	GAND with some GRAVEL, fine to coarse, medium rown with gray, moist, non plastic, non cohesive	CL	
1		0.1	B14-027-SB-5	(2.8-3.7') cohesive	CLAY, hard, very pale brown, moist, low plasticity,	SW-SC	
5				(3.7-4.5')	SAND with CLAY and GRAVEL, dense, very pale ery moist, non plastic, non cohesive	/	
-		_		(4.5-7.5')	CLAY, hard, very pale brown, moist, low plasticity,	CL	
_		-		cohesive	•		
	18	-			SAND and BRICK GRAVEL with CLAY, medium		
		-		dense, b plastic, n	rown with trace yellow and red, very moist, non on cohesive	SW-SC	
-		0.0	B14-027-SB-10	(9-14.3')	SANDY CLAY with GRAVEL, firm, brown with trace moist, low plasticity, cohesive)	
10		_		reu, very	moist, low plasticity, coriesive		No water encountered
-							
		-				CL	
	0.4	-					
		-					
1		2.7		(14.3-17.	.7') SILTY CLAY, soft, black, very moist, low		
15		_		plasticity	, cohesive		
-						CL	
		-					
	50	0.2		(17.7-20') CLAY with trace SAND from 19.8-20' bgs, hard,		
		0.0		very pale	brown, dry to moist, low plasticity, cohesive	CL	
		0.0					
20			I	End of bo	oring		l

Total Borehole Depth: 20' bgs.

Boring terminated at 20' bgs due to maximum allowable depth.



Boring ID: B14-028-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD ARM Representative : M. Replogle, E.I.T.

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.
Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/11/17
Piezometer Installation Date : 9/11/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569759.83
Easting (US ft) : 1459127.34
0-Hr DTW : 16.30' TOC
48-Hr DTW : 16.29' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

			(page i	01 1)			No LNAPL or D	NAPL detected	at 0 or 48 hours
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	П		REMARKS
0-	80	- 1.7 5.1 6.0	B14-028-SB-1	SAND ar plastic, n	SILTY SAND, brown, and SLAG ad GRAVEL, gray, loose, dry, non on cohesive	SM			
5-		1.8 3.1		GRAVEL	VEATHERED SANDSTONE, . and COBBLE-sized, light yellowish reddish yellow at 5.5' bgs, dry	GW	Bento	onite seal	
	100	7.6 20.5 10.9	B14-028-SB-8	dark gray (7-9.5') G GRAVEL	AG SAND and GRAVEL, loose, ,, dry, non plastic, non cohesive GRAVELLY CLAY with some SLAG ., firm, gray and reddish yellow moist, medium plasticity, cohesive	SW/GW CL	1" P\	√C Riser	
10 -	90	4.1 - 7.3 11.1 2.1 4.2	B14-028-SB-10	(9.5-15.5 loose, da SANDST	') SLAG SAND and GRAVEL, irk gray, with some WEATHERED ONE pockets, SAND-sized, light i brown, dry, non plastic, non	SW/GW			
20 -	80			SLAG, lo non cohe (17-18') \$ wet at 17 (18-19') \$ dense, d. cohesive (19-21.5' medium cohesive (21.5-23, black, we (23.5-28' BRICK G	SAND, loose, brown, moist then '.5' bgs, non plastic, non cohesive SLAG SAND and GRAVEL, medium ark gray, wet, non plastic, non) SLAG GRAVEL with SAND, dense, black, wet, non plastic, non	sw/gw /sw/gw /sw/gw /sw/gw		d Pack	Wet at 17.5' bgs Petroleum type odor, very oily feel, heavy sheen, black product from 19-28' bgs
30-	100	-		cohesive End of bo	· · · · · · · · · · · · · · · · · · ·				

Boring terminated at 28' bgs due to refusal and piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bov\B14.028-SB.bor

Riser Stickup: 3.20' Riser: 0 - 13' bgs



Boring ID: B14-029-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description Site Location : Sparrows Point, MD

ARM Representative : M. Replogle Checked by : L. Glumac Drilling Company : Allied Drilling Co.

Driller : Mike Garvine Drilling Equipment : Geoprobe 7822DT Date : 9/11/17 Weather : Sunny, 70s

Northing (US ft) : 569543.96

Easting (US ft) : 1459096.23

				(page i	- /			
Depth (ft.)	(11.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
	0-		-	B14-029-SB-1	(0-1.5') S cohesive	ILTY SAND, loose, brown, dry, non plastic, non	SM	
	5	50	- 0.8 7.3 2.4 - 3.0 2.4 1.6	B14-029-SB-5		GRAVELLY SAND with some shiny large GRAVEL, dense, alternating 1 to 3-inch layers of dark gray, brown, light gray, and brown, non plastic, non	SW/GW	
'	-		-					
	-	10	-		(12-15') § non cohe	SAND, loose, dark grayish brown, wet, non plastic, sive	sw	Wet at 14.5' bgs
1	15			l	End of bo	pring		<u> </u>

Total Borehole Depth: 15' bgs.

12-05-2017 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\Boring Logs\\(\Z_bor\\B14-029-SB.bor

Boring terminated at 15' bgs due to water.



Boring ID: B14-030-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : M. Replogle
Checked by : L. Glumac
Drilling Company : Allied Drilling Co.

Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT

Date : 9/11/17

Weather : Sunny, 60s

Northing (US ft) : 569500.04

Easting (US ft) : 1458693.62

				,			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-		16.0	B14-030-SB-1	(0-0.5') S	SILTY TOPSOIL, loose, brown, moist, non plastic, non	ML	
-	100	30.3	B14-030-3B-1	cohesive (0.5-4.7') then blac	SLAG SAND and GRAVEL, loose, brownish gray sk at 2.2' bgs, dry, non plastic, non cohesive		
		76.0				SW/GW	
-		15.4					
- 5-	50	-		(4.7 ₋ 0') S	SAND with trace GRAVEL, medium dense, light		
5-		-	B14-030-SB-6	vellowish	n brown, dry, non plastic, non cohesive, with 6-inch NDY SLAG layer from 8-8.5' bgs		
_		24.2		DIACK SA	INDI SLAG layer Holli 6-6.5 bgs	sw	Petroleum-like odor from 2.2-4' bgs, 8-8.5' bgs, 14-15' bgs
	70	5.3					
_		6.7					
10-		34.3	B14-030-SB-10	(9-18') C gray at 1	LAY, very firm to medium firm at 14' bgs, yellow to 0' bgs, moist, low plasticity, cohesive		
10-		-					
=		-					
_	80	-					
-		-				CL	
-		_					
15—							
-		-					
-		-					
-	10	-					
_		-		firm, gray	CLAY with some SAND from 19.5-20' bgs, medium y CLAY and reddish yellow SAND, moist but wet at s, low plasticity, cohesive	CL	Wet at 19.5' bgs
20-				End of bo	oring		

Total Borehole Depth: 20' bgs.

12-05-2017 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\Boring Logs\\(\mathcal{Z}\)_bon\B14-030-SB.bor

Boring terminated at 20' bgs due to water.



Boring ID: B14-031-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description Site Location : Sparrows Point, MD

: L. Perrin ARM Representative Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Date : 9/6/17

Weather : Cloudy, 70s

Northing (US ft) : 569165.32

Easting (US ft) : 1457788.99

			(page 1	, 			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-			· 	(0-1') SA	NDY SILT, firm, brown, moist, low plasticity,		
		-	B14-031-SB-1	cohesive	e	ML	
-		6.7		coarse, v	SAND, fine to very coarse, and GRAVEL, fine to with yellow BRICK COBBLES from 7-7.5' bgs, and AY lenses, medium dense to dense, brown, dry the bgs, non plastic, non cohesive	n	
_	80	29.8					
		0.6					
5-		3.4				SW/GW	
_		-					
_		11.3	B14-031-SB-7				
	78	7.7					Wat at 9' has
_		0.0		(8.5-10') SAND-si	SLAG, fine GRAVEL and medium to very coarse ized, medium dense to dense, light gray and light gray, wet, non-plastic, non cohesive		Wet at 8' bgs
		0.0		DIOWINSI	i gray, wet, non-plastic, non conesive	GP/SW	
10 —				End of bo	•		

Total Borehole Depth: 10' bgs.

12-05-2017 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\Boring Logs\\(\gegre{2}\)-bor\\B14-031-SB.bor

Boring terminated at 10' bgs due to water.



Boring ID: B14-032-SB

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

: Sparrows Point - Parcel B14 Project Description Site Location : Sparrows Point, MD

: L. Perrin ARM Representative Checked by : L. Glumac

Drilling Company : Allied Drilling Co. Driller : Mike Garvine

Drilling Equipment : Geoprobe 7822DT Date : 9/6/17

Weather : Cloudy, 70s

Northing (US ft) : 569352.73

Easting (US ft) : 1457276.14

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	USCS	REMARKS
0-				(0-5.5') S	AND, fine to medium, with some SLAG and BRICK		
		-	B14-032-SB-1	GRAVEL dry, non p	with trace SILT, loose to medium dense, brown, plastic, non cohesive		
		-					
_	62	8.9				SW	
		10.7					
5-		0.9					
		0.0		(5.5-7.7') dense, lig cohesive	SLAG, SAND and fine GRAVEL, medium dense to the brownish gray, dry to moist, non plastic, non)	
_		0.0		Conesive		SW/GP	
	90	10.5					
-			B14-032-SB-8.5	(7.7-8.5') cohesive	CLAY, very firm, brown, moist, low plasticity,	CL	
_		15.4		∖plastic, n	BRICK GRAVEL, dense, yellow, dry to moist, non on cohesive	GP	Wet at 8.5' bgs
		3.7		(8.7-10') brown, w	SLAG GRAVEL, fine, with SAND, medium dense, et, non plastic, non cohesive	GP	
10-				End of bo	pring		

Total Borehole Depth: 10' bgs.

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Boring terminated at 10' bgs due to water.



Boring ID: B14-033-SB

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin : L. Glumac Checked by Drilling Company : Allied Drilling Co.

Driller : Brad Toribio Northing (US ft)

Date

Weather

: 569615.97 Easting (US ft) : 1457115.43

: 9/15/17

: Sunny, 80s

Drilling Equipment : hand auger

			(page 1	of 1)			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	REMARKS
0-				(0-1') SIL	TY SAND, medium dense, light brown grading to		Light organic matter
_	100	1.8	B14-033-SB-1		ry, non plastic, non cohesive	SM	No water encountered
	100	0.5		(1-2') SAI grayish b	ND with SLAG GRAVEL, medium dense, dark rown, dry to moist, non plastic, non cohesive	SW/GW	
				End of bo	pring		

Total Borehole Depth: 2' bgs.

Boring terminated at 2' bgs due to hand auger refusal.



Boring ID: B14-034-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : M. Replogle, E.I.T.; L. Perrin

Checked by : M. Replogle, E.I.T. : Allied Drilling Co. **Drilling Company**

: Mike Garvine Driller **Drilling Equipment** : Geoprobe 7822DT Soil Boring Installation Date : 9/6/17 : 11/21/17 Piezometer Installation Date Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25" Riser/Screen Diameter : 1"

Northing (US ft) : 569543.46 Easting (US ft) : 1457406.41 0-Hr DTW : 13.08' TOC 48-Hr DTW : 10.74' TOC No LNAPL or DNAPL detected at 0 or 48 hours

-			(PPM)	Interval				NO LIVARE OF DIVARE detected	a at 0 of 40 flours
-	Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	П	REMARKS
	0-	49	- 0.0 0.0	B14-034-SB-1	(0-4') SIL dark yelld cohesive	TY SAND, medium dense to dense, owish brown, dry, non plastic, non	SM	Bentonite seal	Piezometer installed after receipt of soil boring analytical results Moderate organics present
	5-	0.0 B14-034-SB-5				CLAY, hard, brownish gray, strong nd yellowish red, dry, low , cohesive	CL		
or\B14-034-SB.bor	-	80	6.4 5.3		very coar	SLAG and BRICK, fine GRAVEL to se SAND-sized, dark brown, own, and yellow, wet, non plastic, ssive	GW/SW	— Sand Pack	Wet at 6' bgs
rows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-034-SB.bor	- 10- - -	84	18.3		(8.5-14.5 moist, lov	') CLAY, firm to soft, light gray, v plasticity, cohesive	CL	— Sand Pack — 1" PVC Screen	
08-01-2018 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point A	15 — - - -	70	- - - -		(14.5-20' dense, ve non cohe) SLAG, SAND and GRAVEL, ery dark brown, wet, non plastic, sive	sw/gw		
oAnalytics G.	20-		-		End of bo	oring			
08-01-2018 P:\Envir	TOC: To DTW: D bgs: Be	op of P epth to low gro	VC casin	ace			ogs 5' bgs [Slot \$ 3 - 15' bgs [G	Size: 0.010"] Grain Size: WG #2] [Grain Size: 3/8" chips]	



Boring ID: B14-035-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : M. Replogle, E.I.T.
Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/15/17
Piezometer Installation Date : 11/16/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

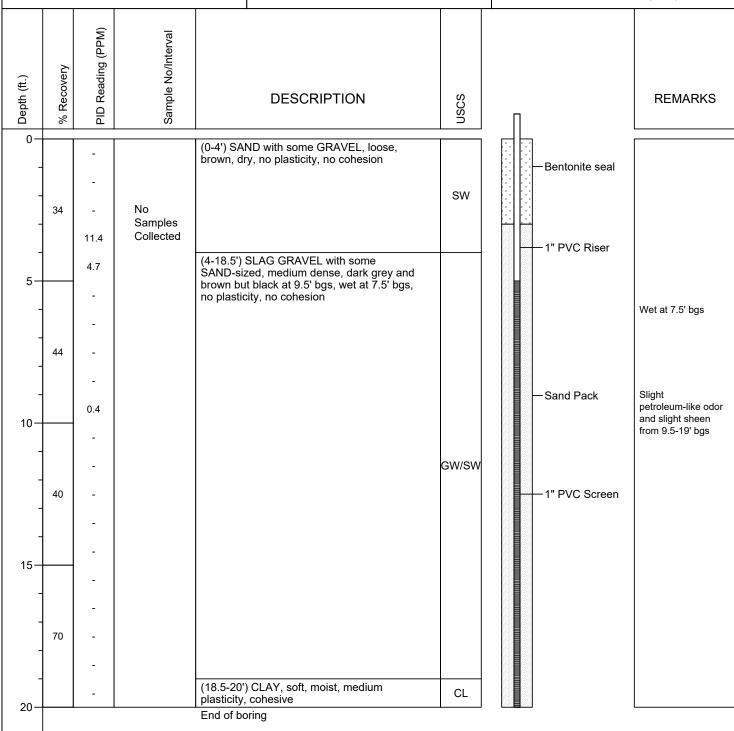
Northing (US ft) : 570777.84

Easting (US ft) : 1459711.44

0-Hr DTW : 8.75' TOC

48-Hr DTW : 8.68' TOC

No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' 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

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08-01-2018

Riser Stickup: 2.90' Riser: 0 - 5' bgs



Boring ID: B14-036-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/22/17
Piezometer Installation Date : 11/22/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569767.58

Easting (US ft) : 1457678.02

0-Hr DTW : 5.43' TOC

48-Hr DTW : 5.10' TOC

No LNAPL or DNAPL detected at 0 or 48 hours

Colored Colo				(page 1	or 1)			No LNAPL or DNAPL detected	I at 0 or 48 hours
1	Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	П	REMARKS
1-15 CLAY, soft, greenish gray, moist to very moist, low plasticity, cohesive 1" PVC Riser 1" PVC Riser 1" PVC Riser 1" PVC Screen 1" PVC Screen	0-		-		(0-1') SIL brown, m	TY SAND, medium dense, reddish noist, no plasticity, no cohesion	SM		
Samples Collected	_		-		(1-15') Cl very mois	LAY, soft, greenish gray, moist to st, low plasticity, cohesive		Bentonite seal	
5	_	20		Samples				1" PVC Riser	
- 20	5-		0.0						
60 0.0 0.0 0.0 0.0	_		-						
60 0.0 0.0 0.0 0.0	-	20	-						
60 0.0 0.0 0.0 0.0	_		-				CL		
60 0.0 0.0 0.0 0.0	10-		0.0					— Sand Pack	
60 0.0 0.0 0.0 0.0	-		-						
60 0.0 0.0 0.0 0.0	_	40						1" DVC Saroon	
60 0.0 0.0 0.0 0.0	-	40						T PVC Scieen	
60 0.0 0.0 0.0 0.0	-		0.0						
20	15-		-		(15-20') 8	Soils not logged		E3469 - 1000 1000 1000 1000 1000 1000 1000 1	
20	-		-						
20	-	60					CL		
20	_								
	20-		0.0		End of bo	pring			

Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

08-01-2018 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\(\)2_bon\B14-036-SB.bor

Riser Stickup: 2.76' Riser: 0 - 5' bgs



Boring ID: B14-037-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14
Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

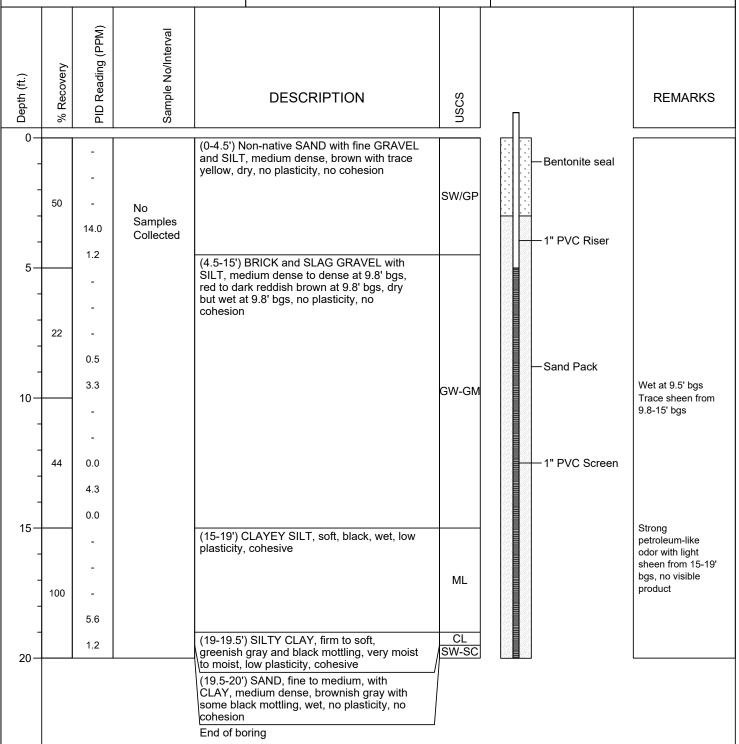
Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/14/17
Piezometer Installation Date : 11/14/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569480.98
Easting (US ft) : 1457196.68
0-Hr DTW : 11.11' TOC
48-Hr DTW : 10.90' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface

AMSL: Above mean sea level

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Riser Stickup: 2.96' Riser: 0 - 5' bgs



Boring ID: B14-038-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.

Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/14/17
Piezometer Installation Date : 11/14/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569414.22
Easting (US ft) : 1458151.98
0-Hr DTW : 18.99' TOC
48-Hr DTW : 18.25' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

			(page i	01 1)		No LNAPL or DNAPL detected at 0 or 48 hours			
Depth (ft.)	% Recovery	PID Reading (PPM)	Sample No/Interval		DESCRIPTION	nscs	П	REMARKS	
0 1 1 1 1 1 1 1 1 1	20 24 50	- 0.6 0.2 24.7 4.1 0.0	No Samples Collected	firm to verblack streplasticity, (13.5-14. gray and cohesion (14.2-17. moist, low gray with	SILTY CLAY with some SAND, ery firm, brownish red with trace eaks from 12.5-13' bgs, moist, low, cohesive 2') SAND, fine to medium, greenish black, wet, no plasticity, no 5') SILTY CLAY, firm, black, very w plasticity, cohesive 1) CLAY, firm to very firm, greenish a some black streaks, moist, low, cohesive	CL SW	— Bentonite seal — 1" PVC Riser — Sand Pack — 1" PVC Screen	Wet at 13.5' bgs Trace visible product at 14' bgs Moderate petroleum-like odor from 13.5-17.5' bgs	
20-		1.2		End of bo		CL			

Boring terminated at 20' 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

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Riser Stickup: 2.69' Riser: 0 - 10' bgs



Boring ID: B14-039-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.

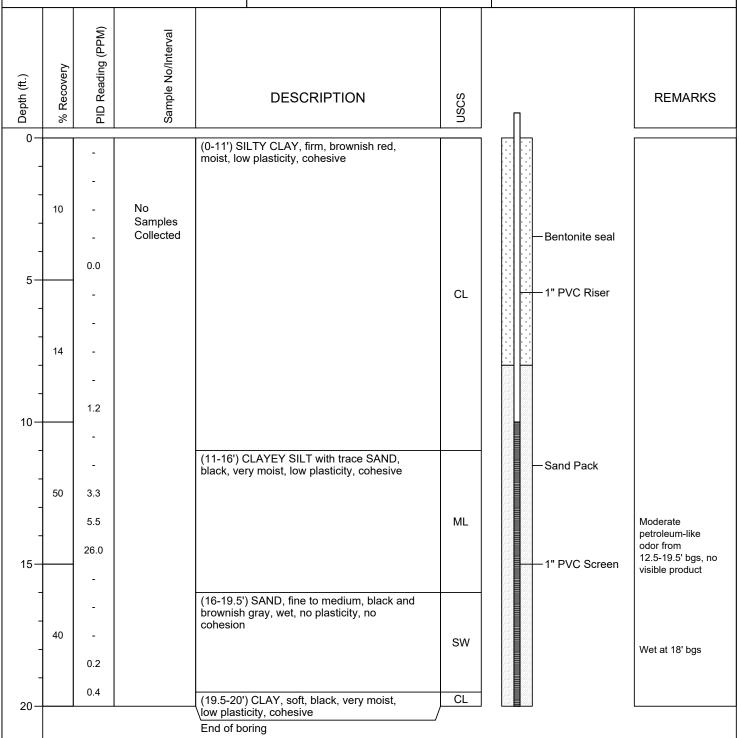
Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/14/17
Piezometer Installation Date : 11/14/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569623.49
Easting (US ft) : 1458112.05
0-Hr DTW : 9.75' TOC
48-Hr DTW : 9.28' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' 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

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08-01-2018

Riser Stickup: 2.70' Riser: 0 - 10' bgs



Boring ID: B14-040-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

: 150300M-17-3 ARM Project No.

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

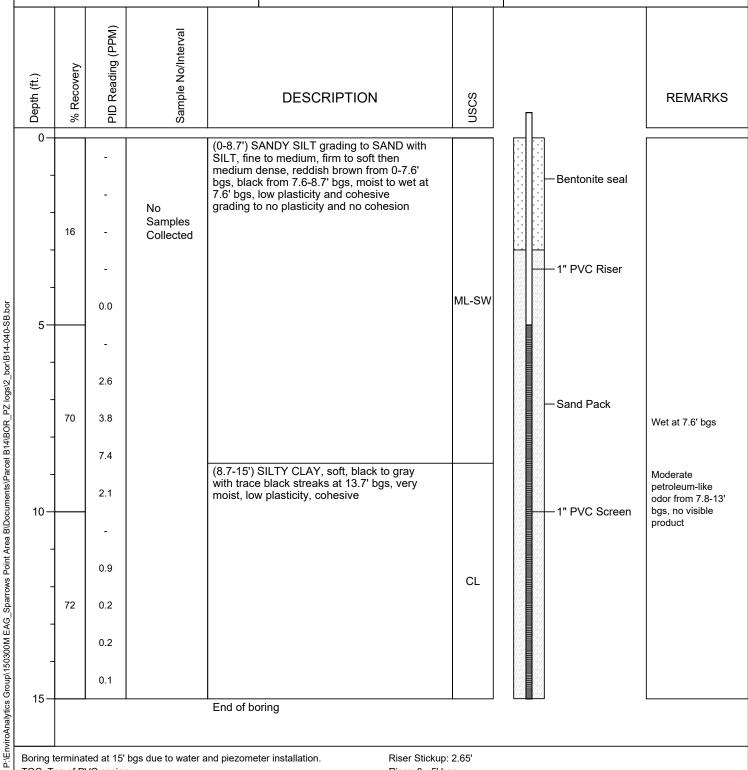
ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T. **Drilling Company** : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT Soil Boring Installation Date : 11/22/17 Piezometer Installation Date : 11/22/17 Casing/Riser/Screen Type : PVC **Borehole Diameter** : 2.25' Riser/Screen Diameter : 1"

Northing (US ft) : 569788.42 Easting (US ft) : 1458075.59 0-Hr DTW : 8.68' TOC 48-Hr DTW : 8.73' TOC No LNAPL or DNAPL detected at 0 or 48 hours



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 Stickup: 2.65' Riser: 0 - 5' bgs



Boring ID: B14-041-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

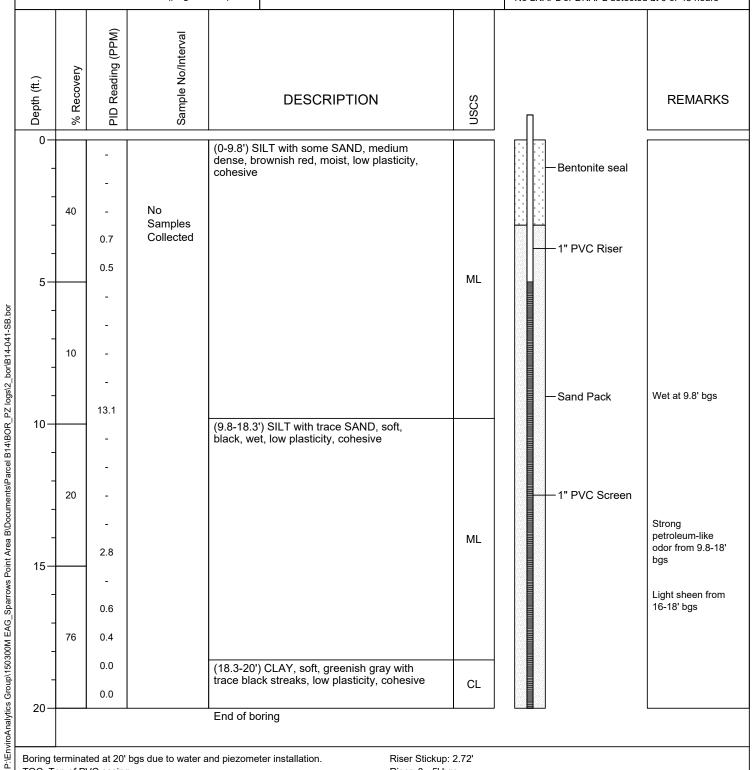
ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T. **Drilling Company** : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT Soil Boring Installation Date : 11/14/17 Piezometer Installation Date : 11/14/17 Casing/Riser/Screen Type : PVC Borehole Diameter : 2.25" Riser/Screen Diameter : 1"

Northing (US ft) : 569378.69 Easting (US ft) : 1457655.45 0-Hr DTW : 8.08' TOC 48-Hr DTW : 6.92' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' 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

08-01-2018

Riser Stickup: 2.72' Riser: 0 - 5' bgs



Boring ID: B14-042-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14
Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

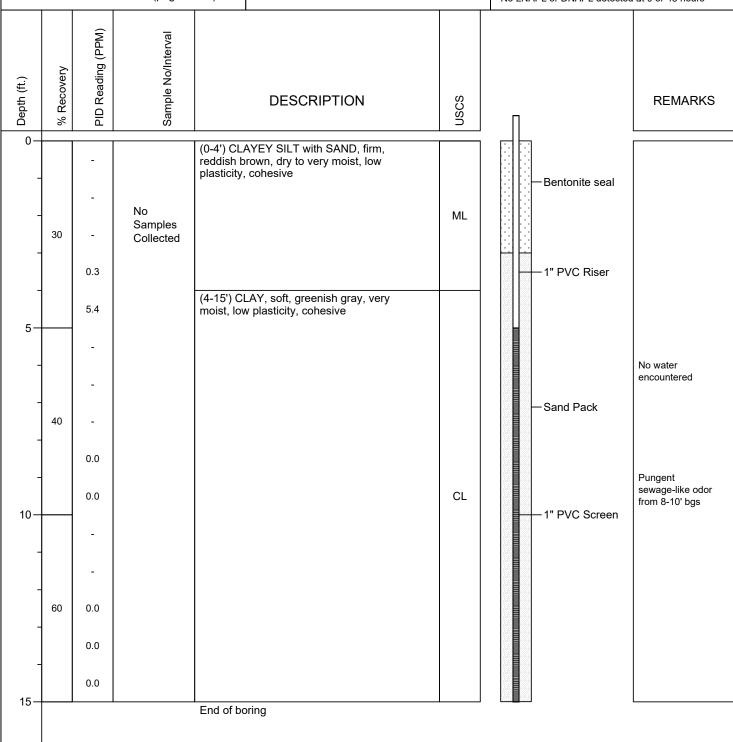
Checked by : M. Replogle, E.I.T.
Drilling Company : Allied Drilling Co.

Driller : R. Sites

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/21/17
Piezometer Installation Date : 11/21/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569587.03
Easting (US ft) : 1457662.39
0-Hr DTW : 15.05' TOC
48-Hr DTW : 7.01' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 15' bgs due to piezometer installation.

TOC: Top of PVC casing
DTW: Depth to water
bgs: Below ground surface
AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bon\B14-042-SB.bor

Riser Stickup: 2.86' Riser: 0 - 5' bgs



Boring ID: B14-043-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14

: Allied Drilling Co.

Site Location : Sparrows Point, MD
ARM Representative : M. Replogle, E.I.T.
Checked by : M. Replogle, E.I.T.

Driller : R. Sites

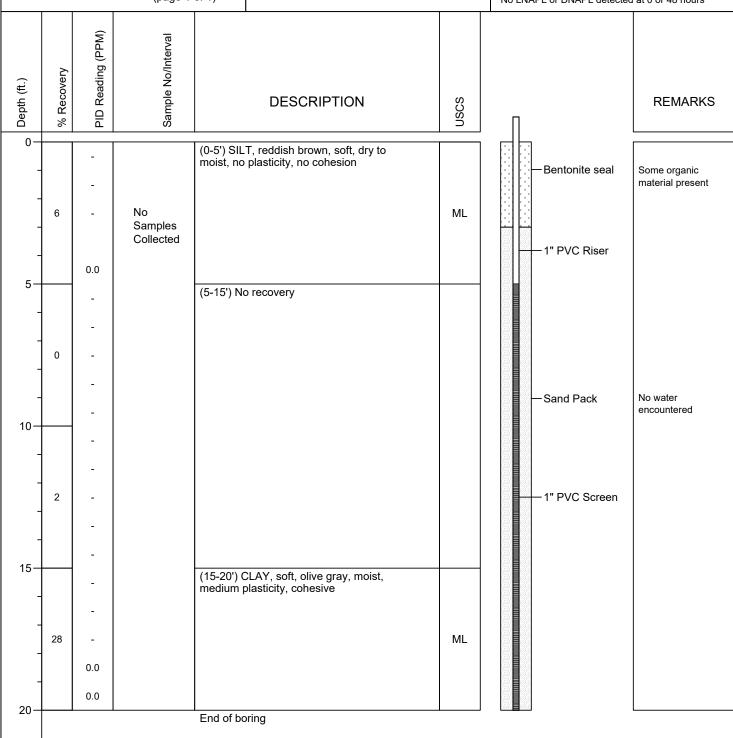
Drilling Company

Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 11/16/17
Piezometer Installation Date : 11/16/17
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569649.38

Easting (US ft) : 1458584.70
0-Hr DTW : 6.53' TOC
48-Hr DTW : 6.55' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

08-01-2018 P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR, PZ logs\(\)2_bon\B14-043-SB.bor

Riser Stickup: 2.98' Riser: 0 - 5' bgs



Boring ID: B14-044-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.

Drilling Company : GSI

Driller : Don Marchese
Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/20/2018
Piezometer Installation Date : 9/20/2018
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

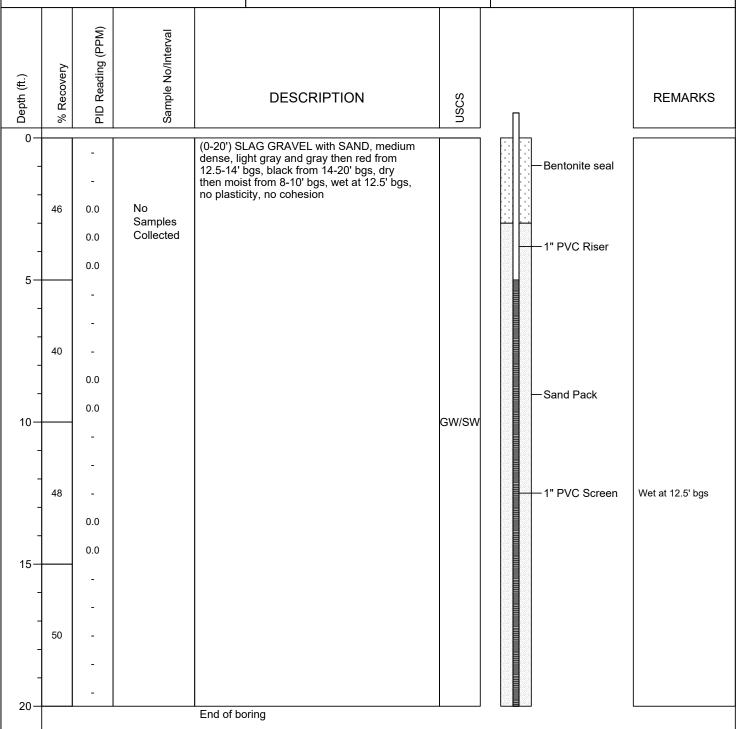
Northing (US ft) : 569295.33

Easting (US ft) : 1456738.31

0-Hr DTW : 12.67' TOC

48-Hr DTW : 12.73' TOC

No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-044-SB.bor

Riser Stickup: 3.71' Riser: 0 - 5' bgs



Boring ID: B14-045-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

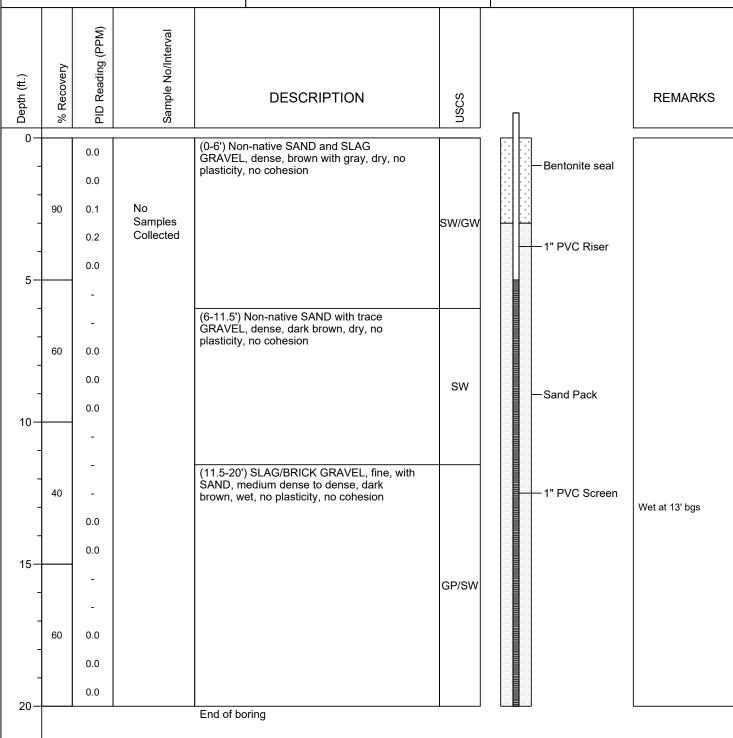
Checked by : M. Replogle, E.I.T.

Drilling Company : GSI

Driller : Don Marchese
Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/20/2018
Piezometer Installation Date : 9/20/2018
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569334.24
Easting (US ft) : 1457253.56
0-Hr DTW : 12.19' TOC
48-Hr DTW : 12.02' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-045-SB.bor

Riser Stickup: 3.31' Riser: 0 - 5' bgs



Boring ID: B14-046-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Perrin

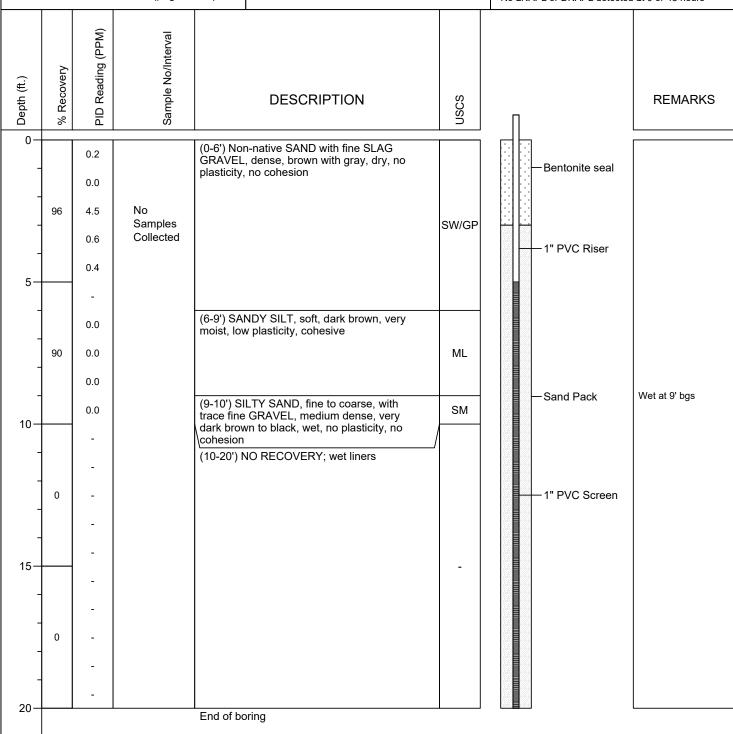
Checked by : M. Replogle, E.I.T.

Drilling Company : GSI

Driller : Don Marchese
Drilling Equipment : Geoprobe 7822DT

Soil Boring Installation Date : 9/20/2018
Piezometer Installation Date : 9/20/2018
Casing/Riser/Screen Type : PVC
Borehole Diameter : 2.25"
Riser/Screen Diameter : 1"

Northing (US ft) : 569607.40
Easting (US ft) : 1457066.87
0-Hr DTW : 10.91' TOC
48-Hr DTW : 10.86' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\Documents\Parcel B14\BOR_PZ logs\2_bor\B14-046-SB.bor

Riser Stickup: 3.47' Riser: 0 - 5' bgs



Boring ID: B14-047-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 150300M-17-3

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

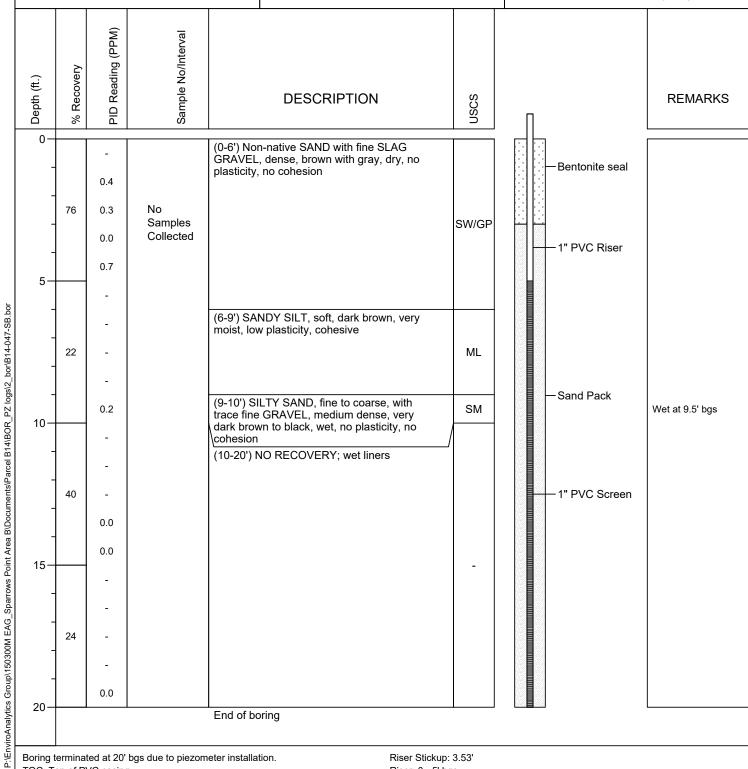
ARM Representative : L. Perrin

Checked by : M. Replogle, E.I.T.

Drilling Company : GSI

Driller : Don Marchese **Drilling Equipment** : Geoprobe 7822DT Soil Boring Installation Date : 9/20/2018 Piezometer Installation Date : 9/20/2018 Casing/Riser/Screen Type : PVC Borehole Diameter : 2.25" Riser/Screen Diameter : 1"

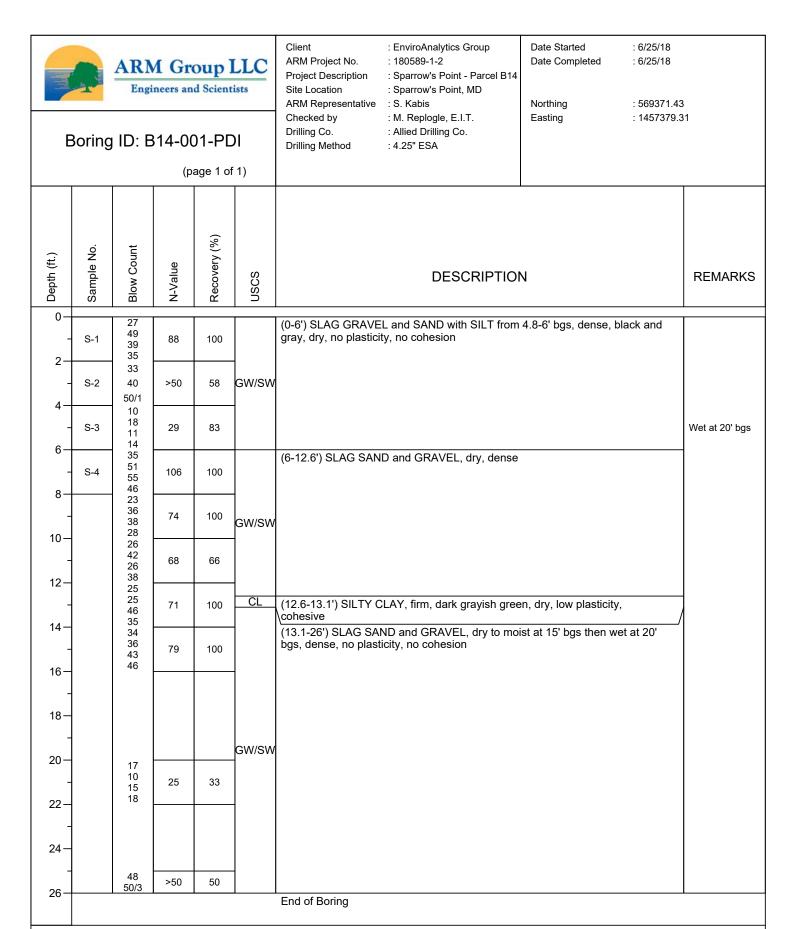
Northing (US ft) : 569742.29 Easting (US ft) : 1457172.08 0-Hr DTW : 11.09' TOC 48-Hr DTW : 10.97' TOC No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to piezometer installation.

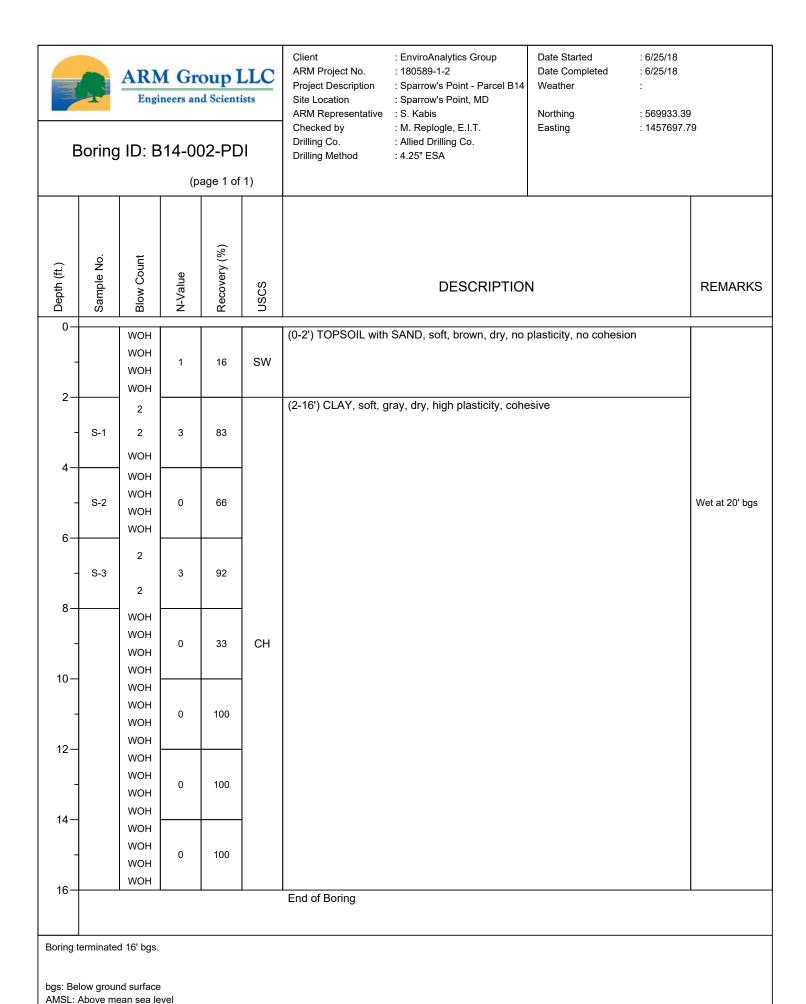
TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface AMSL: Above mean sea level Riser Stickup: 3.53' Riser: 0 - 5' bgs

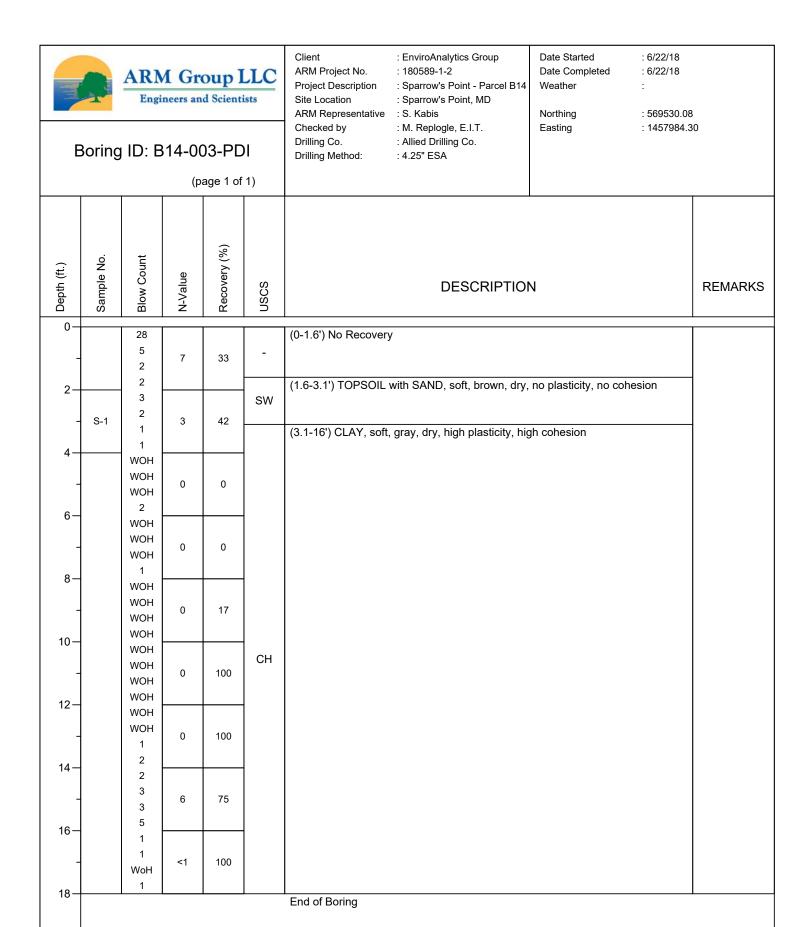
APPENDIX B



Boring terminated 26' bgs.

bgs: Below ground surface AMSL: Above mean sea level





Boring terminated 18' bgs.

bgs: Below ground surface AMSL: Above mean sea level



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

Boring ID: B14-004-PDI

Boring ID: B 14-004-PDI					<i>)</i>	Drilling Method: : 4.25" ESA		
			(p:	age 1 of	1)			
Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	nscs	DESCRIPTION	N RI	EMARKS
0-		1				(0-2.5') CLAYEY SILT, hard, brown, dry, low plas	sticity, cohesive	
- 2-		WOH WOH		33	CL			
- 4-		WOH WOH WOH	0	42	ML	(2.5-4.5') SILT, dense, brown, dry, medium plasti	city, medium cohesion	
- 6—		WOH 1 WOH WOH	1	0		(4.5-8') CLAY, soft, brown, high plasticity, cohesi	ve	
-	S-1	WOH WOH WOH	0	0	CH			
8-		4 16 47	63	17	ML	(8-9') SANDY SILT, dense, pale brown to gray, d cohesion (9-10') Fractured SLAG	ry, no plasticity, no	
10 —		42			NA			
-		8 19 10 6	29	100	ML	(10-12') SILT with GRAVEL, dense, no plasticity,		
12-	S-2	2 3 2 3	5	100		(12-16') CLAY, gray, soft, high plasticity, cohesiv	odo	ht oleum-like r from 16' bgs
14 - -	S-3	WOH 1 1	2	75	CH			
16		1		<u> </u>		End of Boring		
						•		
Paring t	orminata	d 18' has						

Boring terminated 18' bgs.

bgs: Below ground surface AMSL: Above mean sea level



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

Boring ID: B14-005-PDI

Bolling ID. B14-000-1 B1						Drilling Method : 4.25" ESA	
			(p	age 1 o	f 1)		
Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	nscs	DESCRIPTION	REMARKS
0-	S-1	10 6 7 7	13	66		(0-8') SLAG GRAVEL with SAND, coarse, dense, black, dry, no plasticity, no cohesion	
2— - 4—	S-2	5 5 7 13	12	50	GW		
- 6—	S-3	6 6 5 5 4	11	50	J		Wet at 10' bgs
- 8—		4 5	8	58			
10	S-4	1 1 1 WOH	2	66	CL	(8-11') CLAY, soft, reddish brown, wet, no plasticity, no cohesion	
12-	S-5	1 3 16 23	19	75		(11-16') SLAG GRAVEL, dense, dry, gray, no plasticity, no cohesion	
- 14 —		6 11 10 7	21	50	GW		
- 16-		4 49 50/1		33			
-						(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 <i>-</i> -		3				(25-27') CLAY, soft to firm, gray, dry, high plasticity, cohesive	
26-		WOH WOH 1	0	100	СН		
28-						End of Boring	
Boring to	erminate	d 27' bgs.					

bgs: Below ground surface AMSL: Above mean sea level



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

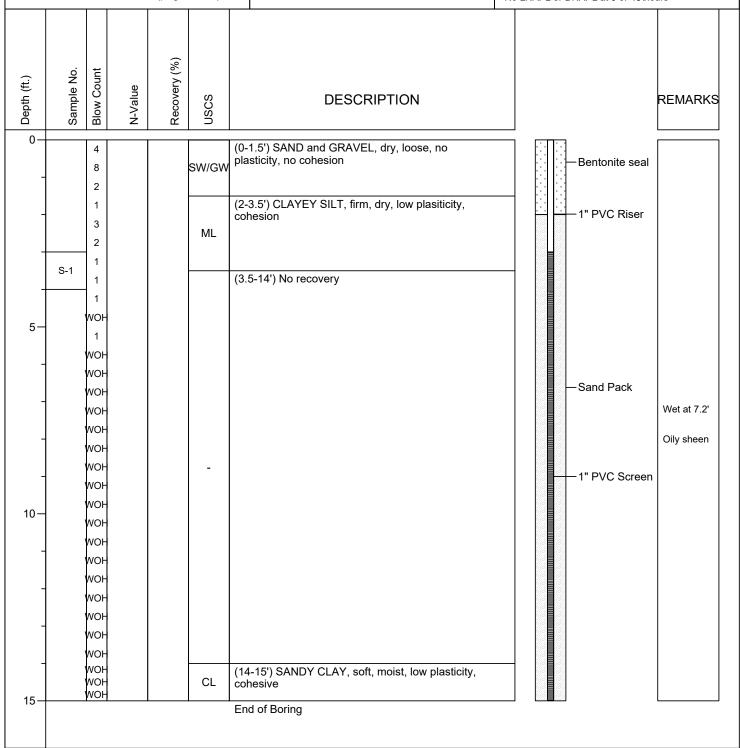
Checked by : M. Replogle, E.I.T.

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



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



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

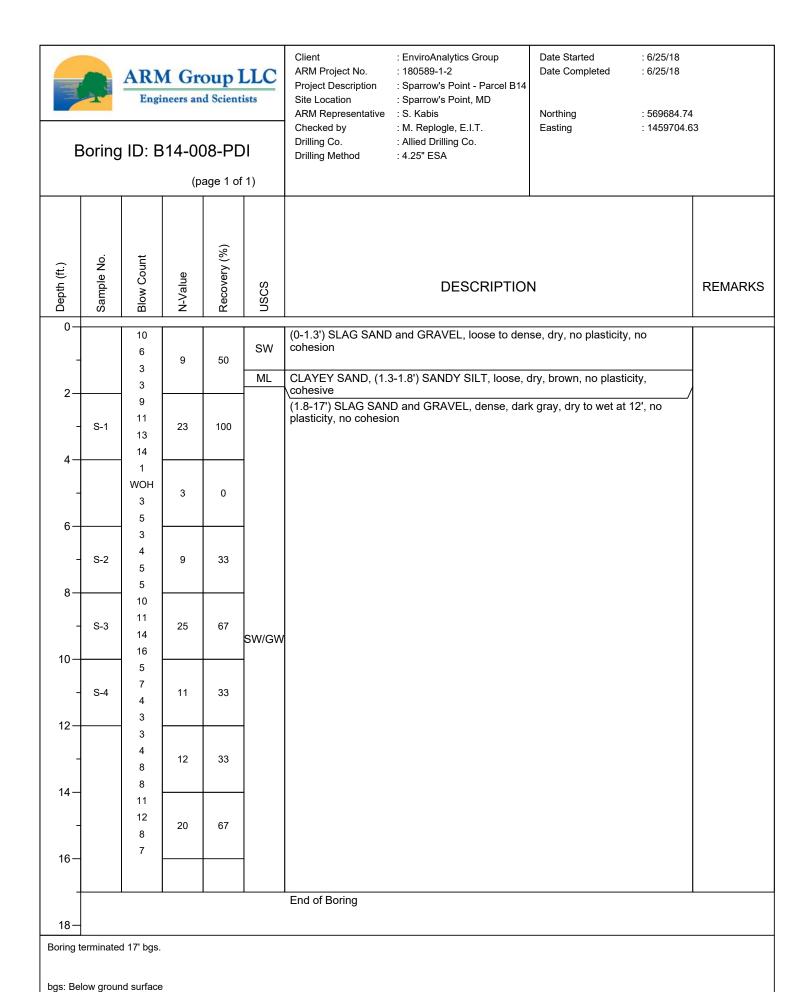
Northing : 569462.73 Easting : 1458596.31

Boring ID: B14-007-PDI

			(p:	age 1 of	1)		
Depth (ft.)	Sample No.	Blow Count	N-Value	Recovery (%)	nscs	DESCRIPTION	REMARKS
0		2 22 29 11	51	75		(1-11') SLAG GRAVEL, loose, black to brown, no plasticity, no cohesion	
2	S-1	14 13 12 15	25	58			
6-		4 14 9 10	23	67	GW		
8-		11 9 10 10	19	67			
10-		9 9 16 8	25	75			
12-		10 23 24 26	47	67		(11.5-14.5') SAND with ROCK fragments from 12-14' bgs, loose, moist to	-
-		8 14 14 19	28	33	SW	wet at 12' bgs, no plasticity, cohesive	
14 —		_	-	0	SW	(14.5-15') SAND, coarse, loose, gray, wet, no plasticity, cohesive	1
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			SW	(20-21.2') SAND, loose, gray, wet, low plasticity, cohesive	1
22-		11 16	18	58		(21.2-22') Fractured SLAG and ROCK, black (22-25') NO RECOVERY - ADVANCED AUGERS to 25' bgs	-
24 –			-	0	-		
26		8 18	11	02	sw	(25-26') SAND, loose, gray, wet, low plasticity, cohesive]
26		23 29	41	92	GW	(26-27') Fractured SLAG, black	
28-						End of Boring	

Boring terminated 18' bgs.

bgs: Below ground surface AMSL: Above mean sea level



AMSL: Above mean sea level



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

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

E	The state of the s	ARN Engi	14-0°	d Scient	tists	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	
Depth (ft.)	PID	Blow Count	N-Value	Recovery (%)	nscs	DESCRIPTION	REMARKS
0-	0.0	1 5 4	9	20	-	(0-1.6') No recovery	
2-		4 3			_	(1.6-5.5') SANDY SILT and BRICK and SAND GRAVEL, firm, brown with red,	
-	0.0	1 1 2	2	10	ML/GW	dry, no plasticity, no cohesion	
4-	0.0	2 2 3	5	35			
6-	0.0	3 3 2 3 3	5	5		(5.5-10') CLAYEY SAND, medium dense, yellowish brown, dry to moist, no plasticity, no cohesion	
8-	0.0	3 2 2 3	4	65	sc		
10-	17.3	7 4 7	11	25			
12-	0.0	22 23 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
14-		5			sc	(13-14.4') CLAYEY SAND with few fine GRAVEL, medium dense, dark brownish gray, wet, no plasticity, no cohesion	
-	2.9	6 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
16-		1				(16-18') No spoons collected	from 14.4-16' bgs
18-	0.0	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-		WOH				(20-23') No spoons	

(23-24.8') SILT, soft to firm, light grayish brown, moist to very moist, low plasticity, cohesive

(24.8-25') CLAYEY SAND, medium dense, reddish yellow, wet, no plasticity,

Boring terminated 25' bgs.

0.2

WOH WOH

 ML

no cohesion

End of Boring

100

22-

24-

26-

bgs: Below ground surface AMSL: Above mean sea level

E	Boring	ARM Group LLC Engineers and Scientists 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. Depth to Water : Depth to Water : Borehole Diameter :					
Depth (ft.)	PID	Blow Count	N-Value	Recovery (%)	USCS	DESCRIPTION	REMARKS
0-	0.1	18 24 16	40	50	-	(0-1.6') No recovery	
2-	0.0	12 11 11	22	75		(1.6-5.5') SANDY SILT and BRICK and SAND GRAVEL, firm, brown with red, dry, no plasticity, no cohesion	
4-	0.0	11 15 7	22	75	ML/GW		
6-	0.8	9 6 5	15	25		(5.5-10') CLAYEY SAND, medium dense, yellowish brown, dry to moist, no	
_	0.0	10 8 14	22	50		plasticity, no cohesion	
8-	0.0	12 13 16 13	29	35	sc		
10-	0.4	17 8 16 8	24	50	_		
12-		9 6 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	-
14-	0.0	12 8 1	21	75	sc	cohesion (13-14.4') CLAYEY SAND with few fine GRAVEL, medium dense, dark brownish gray, wet, no plasticity, no cohesion	Wet at 13' bgs
-	1.8	7 12 33	19	50	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
16-						(16-18') No spoons collected	from 14.4-16' bgs
18-	0.8	11 14 17 16	31	75	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	
24-	-	10 14 18	32	-	ML	(23-24.8') SILT, soft to firm, light grayish brown, moist to very moist, low plasticity, cohesive	
26-		19		I	<u>S</u> ₽	(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



Boring ID: B14-008R-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 20010406

Project Description : Sparrows Point - Parcel B14

Site Location : Sparrows Point, MD ARM Representative : L. Glumac

Checked by : M. Hritz, E.I.T.

Drilling Company : Connelly

Driller : Brandon

Drilling Equipment : Hollow Stem

Soil Boring Installation Date : 09/16/2020 Piezometer Installation Date : 09/17/2020

Casing/Riser/Screen Type : PVC

Bit/Auger Size (in.) : 7.75 OD (4.25 ID)

 Riser/Screen Diameter
 : 2 inch

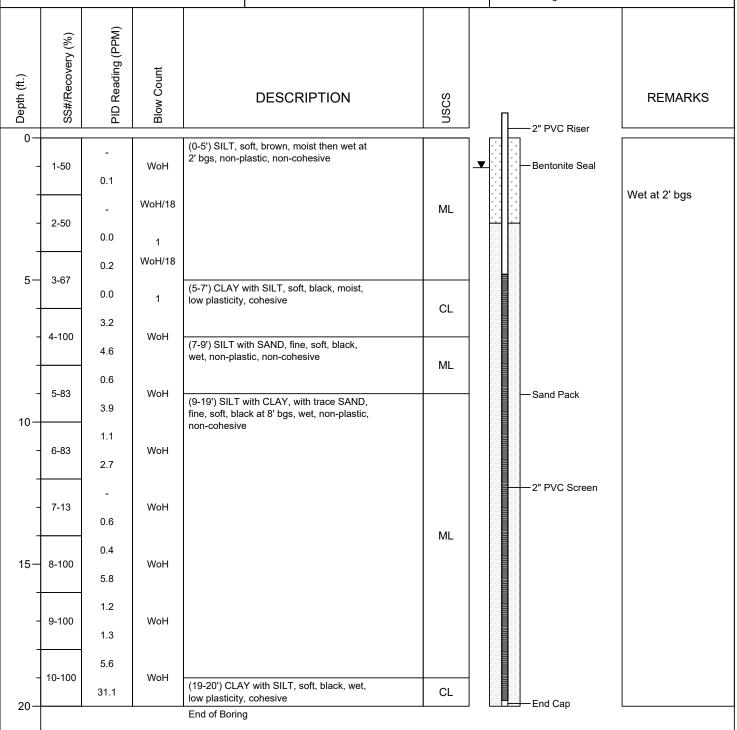
 Northing (US ft)
 : 570022.44

 Easting (US ft)
 : 1458992.03

 Static DTW
 : 3.66' TOC

 No LNAPL or DNAPL detected at 0 hours or

static reading :



Boring terminated at 20' bgs due to water and piezometer installation

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface WoH: Weight of hammer

Riser Stickup: 2.61' ags

Riser: 0 - 5' bgs

Screen: 5 - 20' bgs [Slot Size: 0.010"] Sand Pack: 3 - 20' bgs [Grain Size: WG #2]

Bentonite Seal: 0 - 3' bgs [Grain Size: bentonite chips]



Boring ID: B14-011R-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 20010406

Drilling Equipment

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

: Hollow Stem

ARM Representative : L. Glumac
Checked by : M. Hritz, E.I.T.
Drilling Company : Connelly
Driller : Brandon

Northing (US ft) : 569792.54
Easting (US ft) : 1457396.68
48-Hr DTW : 8.00' TOC
No LNAPL or DNAPL detected at 0 or 48 hours

: 09/14/2020

: 09/14/2020

: 7.75 OD (4.25 ID)

: PVC

: 2 inch

Soil Boring Installation Date

Piezometer Installation Date

Casing/Riser/Screen Type

Bit/Auger Diameter

Riser/Screen Diameter

PID Reading (PPM) SS#/Recovery (%) Blow Count Depth (ft.) DESCRIPTION **USCS** REMARKS 2" PVC Riser 0 1 (0-2') SILT, loose, brown, dry, non-plastic, non-cohesive 1 Bentonite Seal 1-21 ML1 8.6 2 2 (2-6') CLAY with some SILT, medium to hard, gray with yellowish red mottling, dry, 2 2-25 low plasticity, cohesive 2 0.3 3 CL 1 V 2 3-50 1 0.5 1 Wet at 6' bgs WoH (6-7') SILT with CLAY, soft, gray, wet, ML WoH non-plastic, non-cohesive 4-50 WoH (7-8') CLAY with some SILT, firm to hard. 0.3 CL WoH gray with yellowish red mottling, dry, low plasticity, cohesive WoH 0.7 (8-20') CLAY with SILT, very soft, black WoH 5-58 Sand Pack then black with gray at 14' bgs, moist, low WoH 1.1 plasticity, cohesive WoH 10-WoH 0.1 WoH 6-100 WoH 0.0 WoH WoH 2" PVC Screen WoH 7-50 1 1.2 1 CL WoH WoH 15-8-58 WoH 0.0 WoH WoH 0.0 WoH 9-75 1 0.0 WoH WoH 10-50 WoH 0.0 End Cap 20 End of Boring

Boring terminated at 20' bgs due to water and piezometer installation

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface WoH: Weight of hammer

Riser Stickup: 3.18' ags

Riser: 0 - 5' bgs

Screen: 5 - 20' bgs [Slot Size: 0.010"]
Sand Pack: 3 - 20' bgs [Grain Size: WG #2]

Bentonite Seal: 0 - 3' bgs [Grain Size: bentonite chips]



Boring ID: B14-013R-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 20010406

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Glumac
Checked by : M. Hritz, E.I.T.
Drilling Company : Connelly
Driller : Brandon

Drilling Equipment : Hollow Stem

Soil Boring Installation Date : 09/15/2020 Piezometer Installation Date : 09/15/2020

Casing/Riser/Screen Type : PVC

Bit/Auger Diameter : 7.75 OD (4.25 ID)

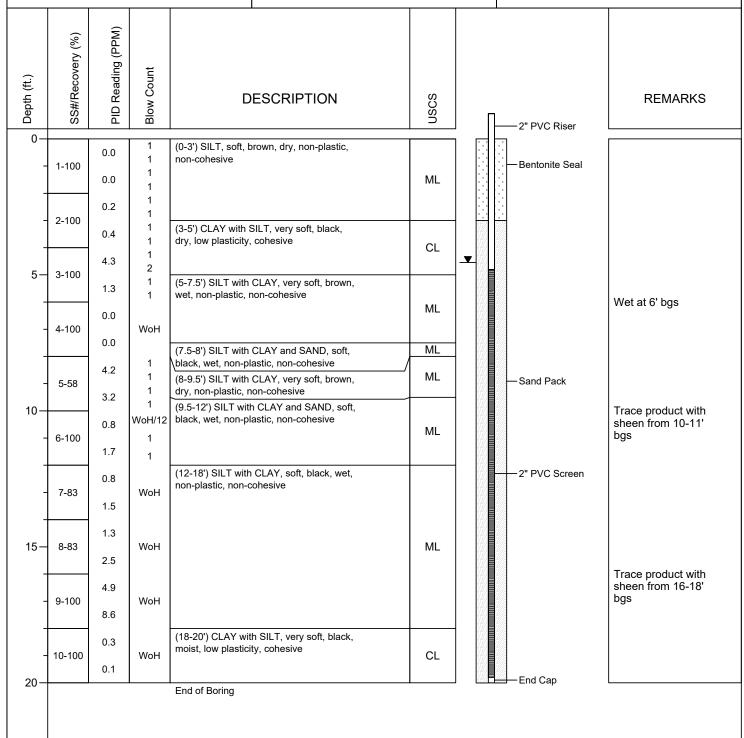
 Riser/Screen Diameter
 : 2 inch

 Northing (US ft)
 : 569619.97

 Easting (US ft)
 : 1458315.17

 48-Hr DTW
 : 7.31' TOC

 No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to water and piezometer installation

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface WoH: Weight of hammer Riser Stickup: 2.76' ags

Riser: 0 - 5' bgs

Screen: 5 - 20' bgs [Slot Size: 0.010"] Sand Pack: 3 - 20' bgs [Grain Size: WG #2] Bentonite Seal: 0 - 3' bgs [Grain Size: bentonite chips]



Boring ID: B14-038R-SB/PZ

(page 1 of 1)

Client : EnviroAnalytics Group

ARM Project No. : 20010406

Project Description : Sparrows Point - Parcel B14 Site Location : Sparrows Point, MD

ARM Representative : L. Glumac
Checked by : M. Hritz, E.I.T.

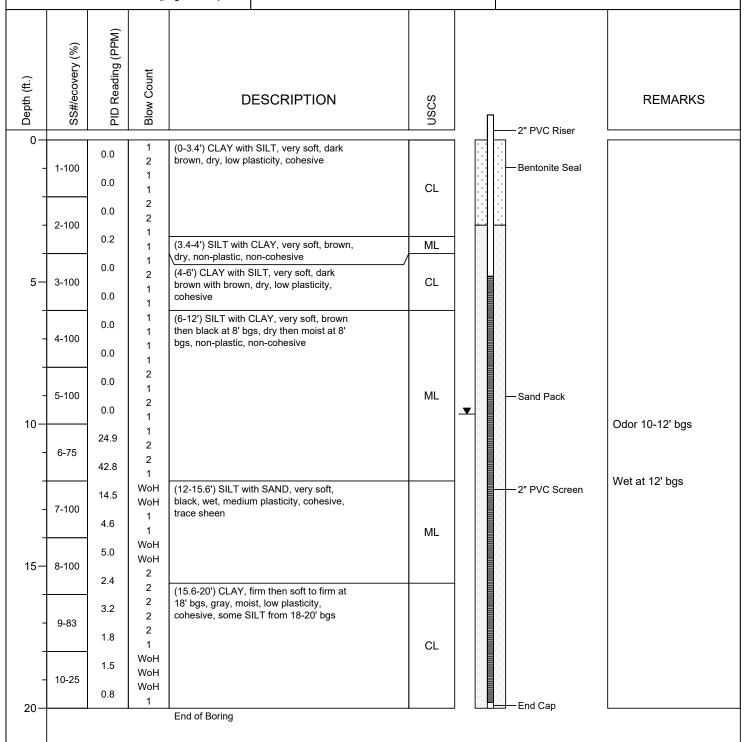
Drilling Company : Connelly
Driller : Brandon
Drilling Equipment : Hollow Stem

Soil Boring Installation Date : 09/14/2020 Piezometer Installation Date : 09/14/2020

Casing/Riser/Screen Type : PVC

Bit/Auger Diameter : 7.75 OD (4.25 ID)

Riser/Screen Diameter : 2 inch
Northing (US ft) : 569414.22
Easting (US ft) : 1458151.98
48-Hr DTW : 12.51' TOC
No LNAPL or DNAPL detected at 0 or 48 hours



Boring terminated at 20' bgs due to water and piezometer installation

TOC: Top of PVC casing DTW: Depth to water bgs: Below ground surface WoH: Weight of hammer

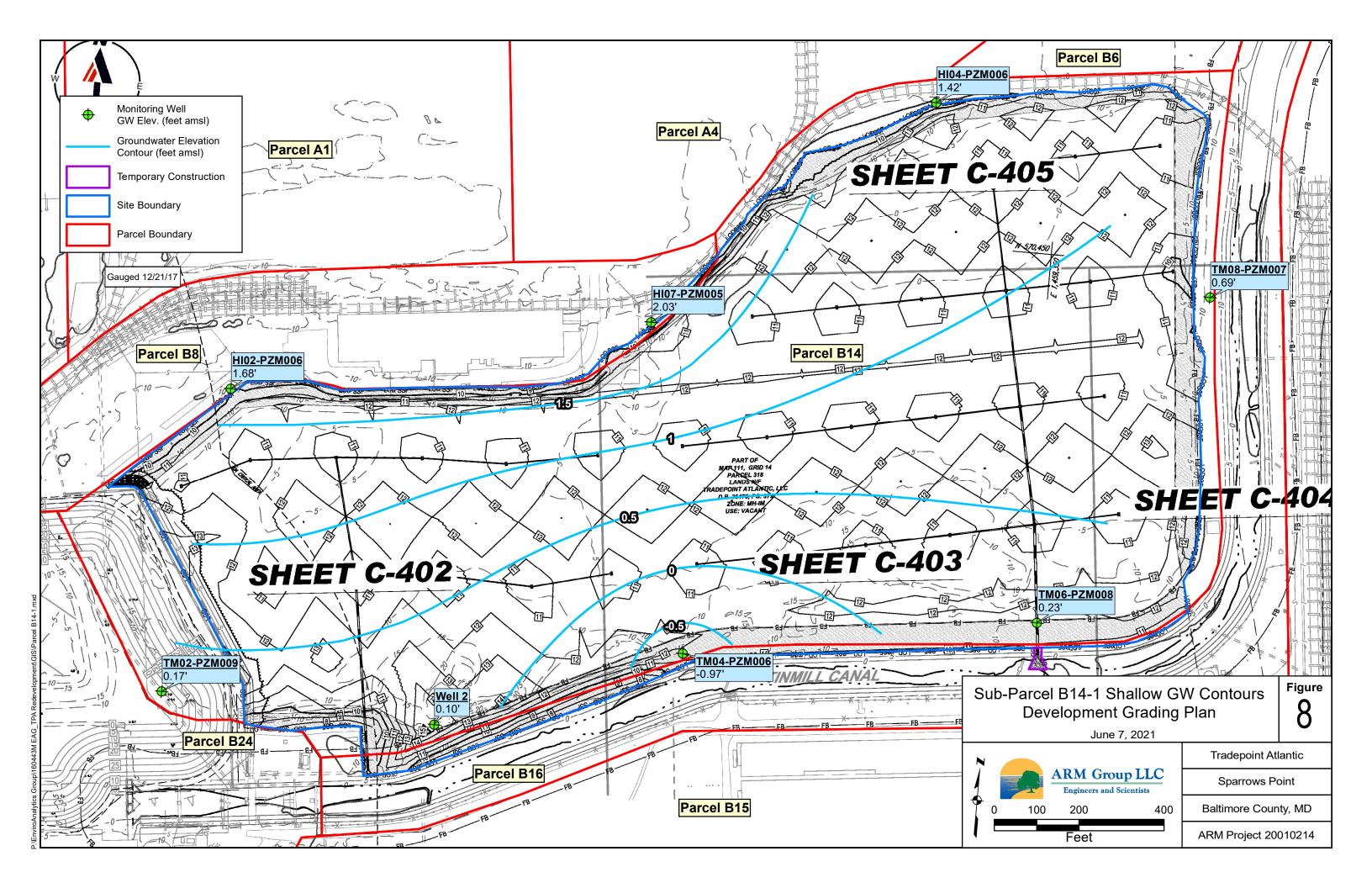
Riser Stickup: 2.86' ags

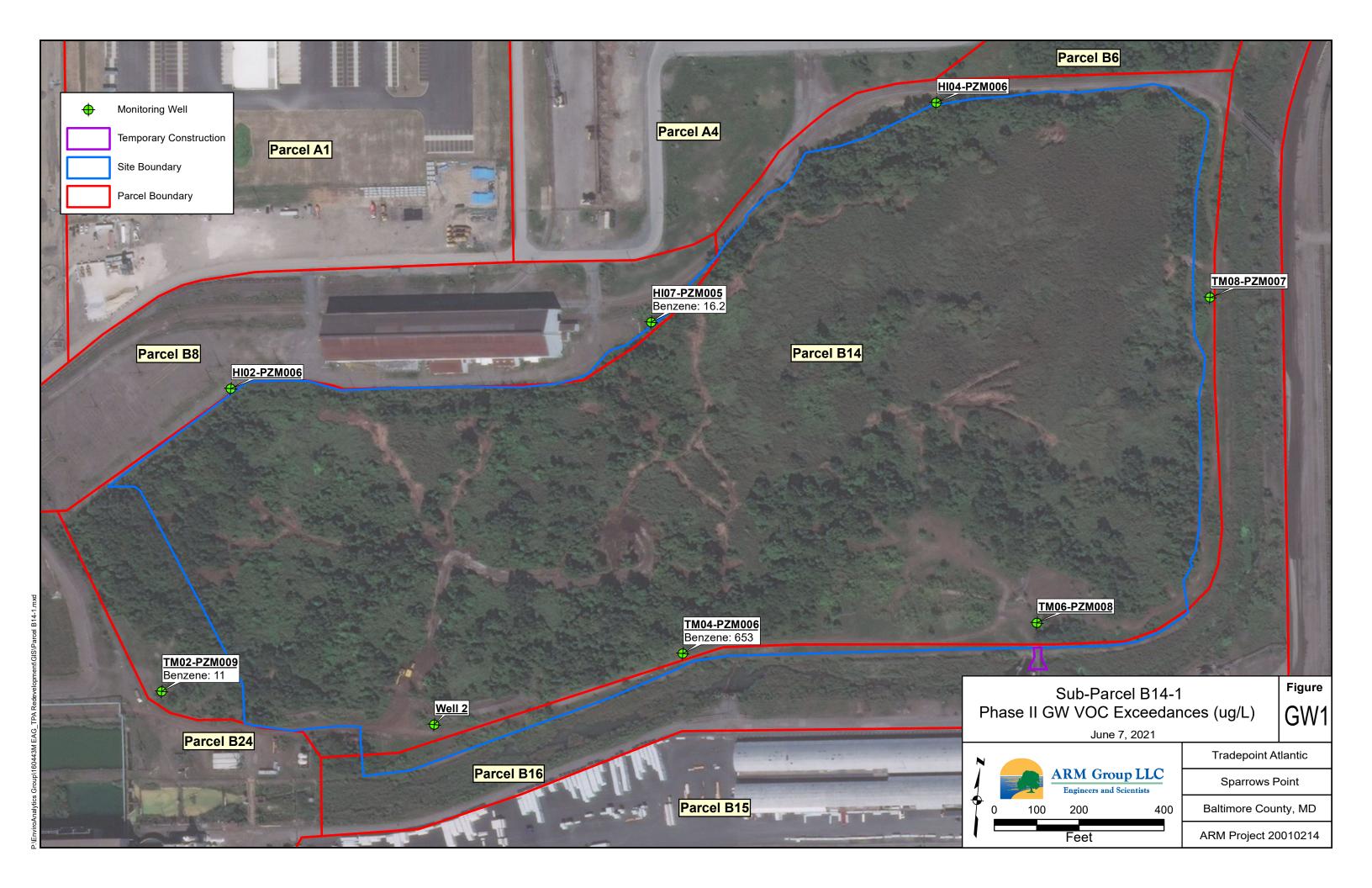
Riser: 0 - 5' bgs

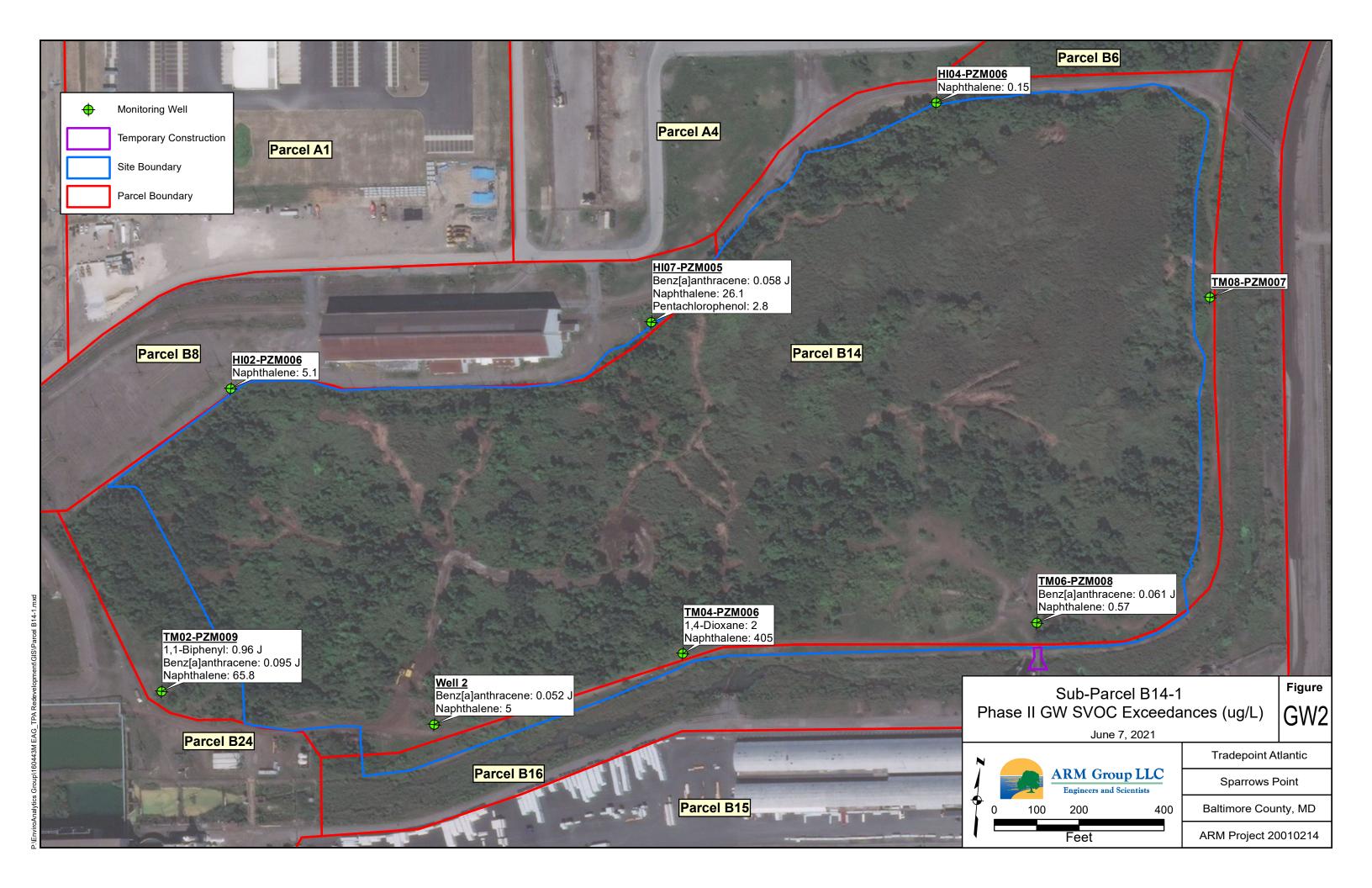
Screen: 5 - 20' bgs [Slot Size: 0.010"]
Sand Pack: 3 - 20' bgs [Grain Size: WG #2]

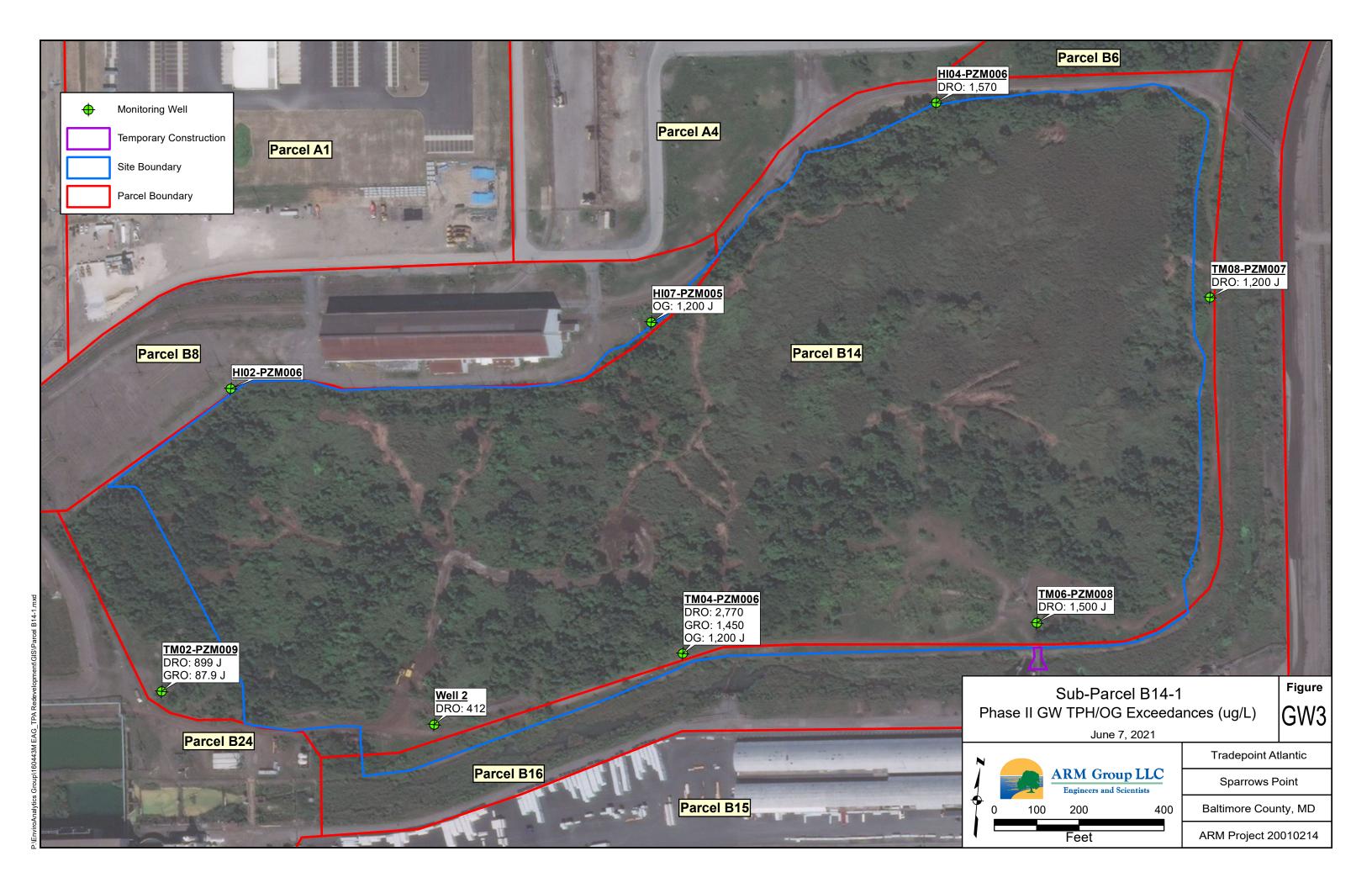
Bentonite Seal: 0 - 3' bgs [Grain Size: bentonite chips]

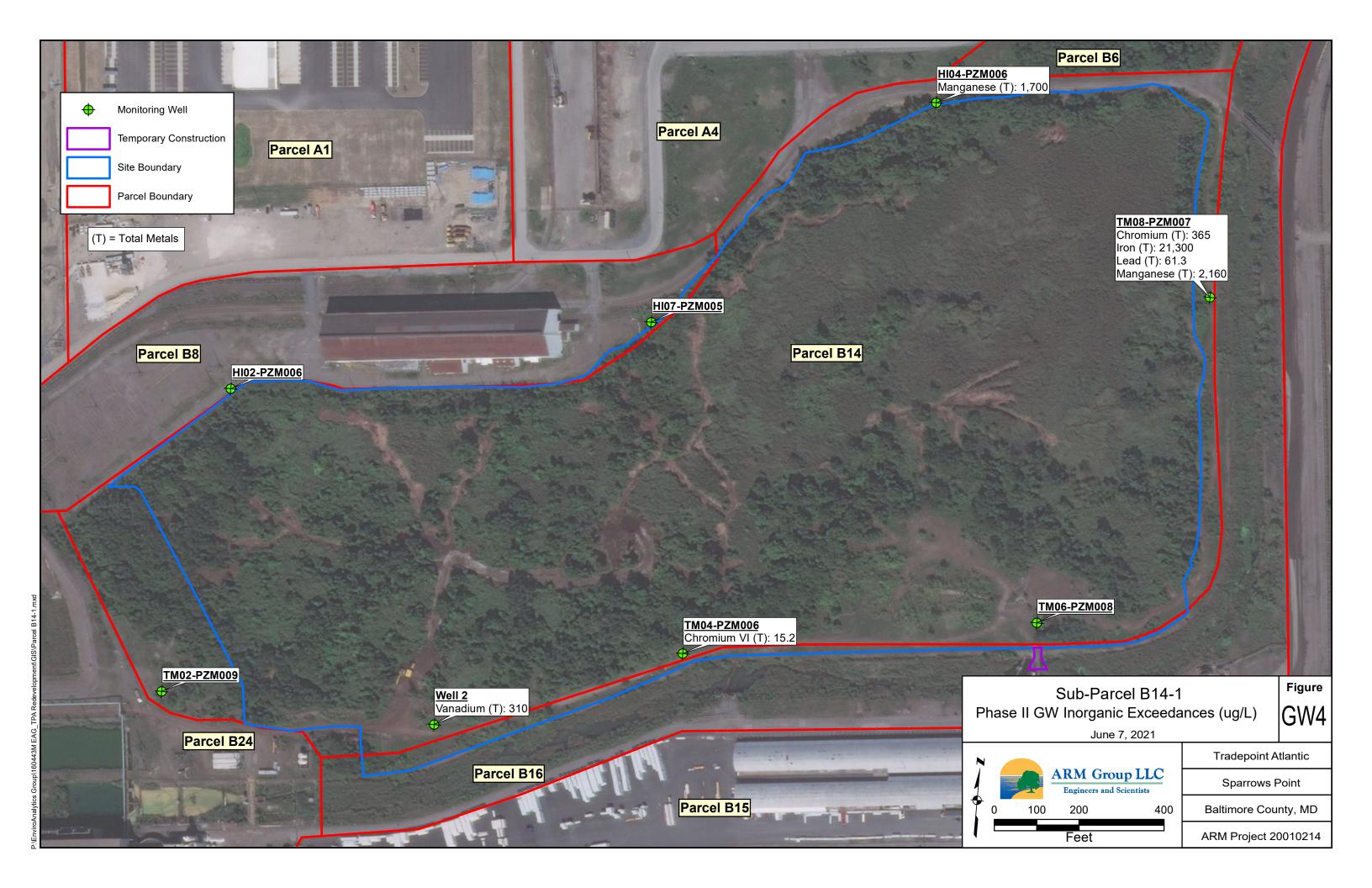
APPENDIX C

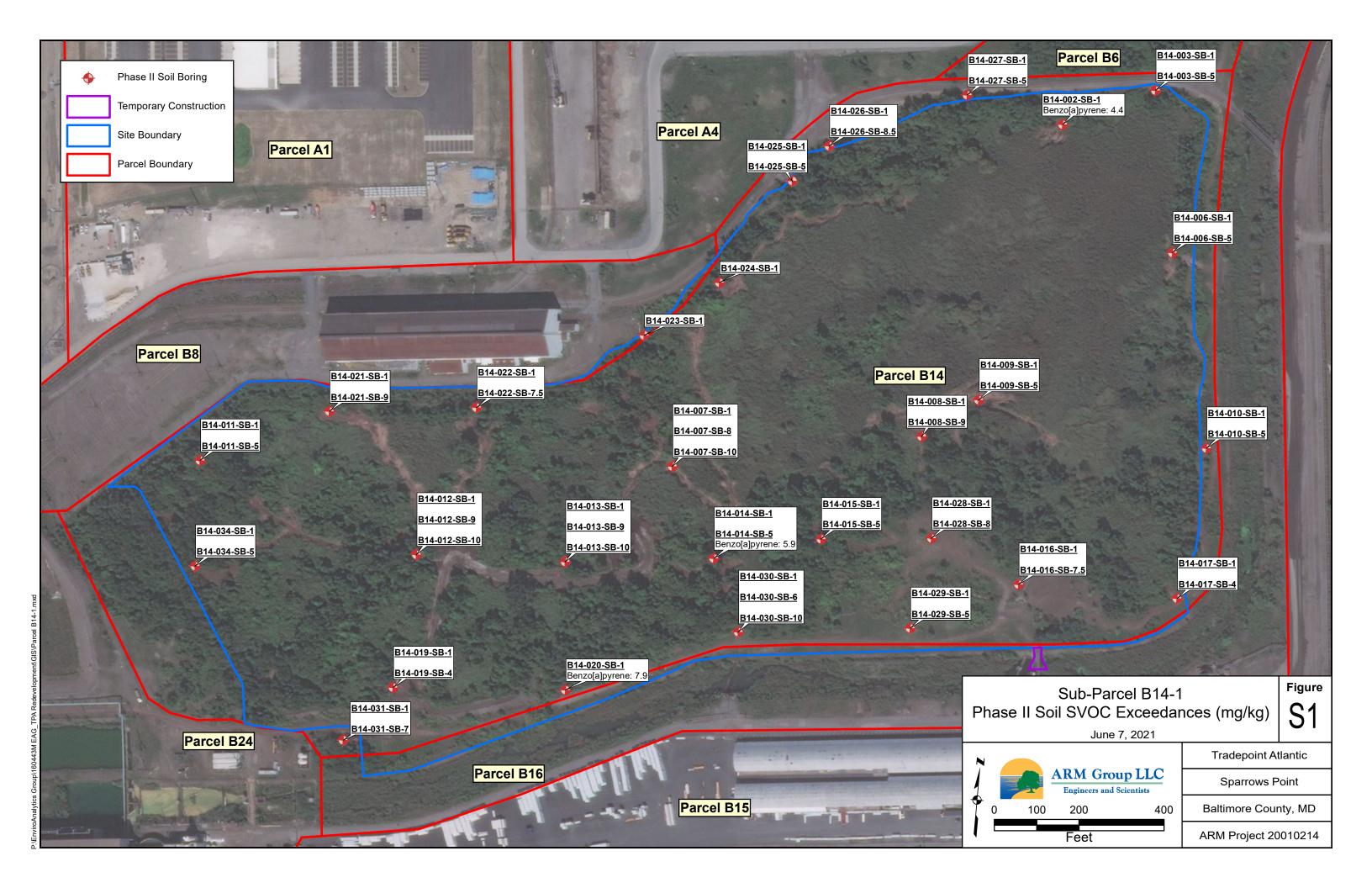


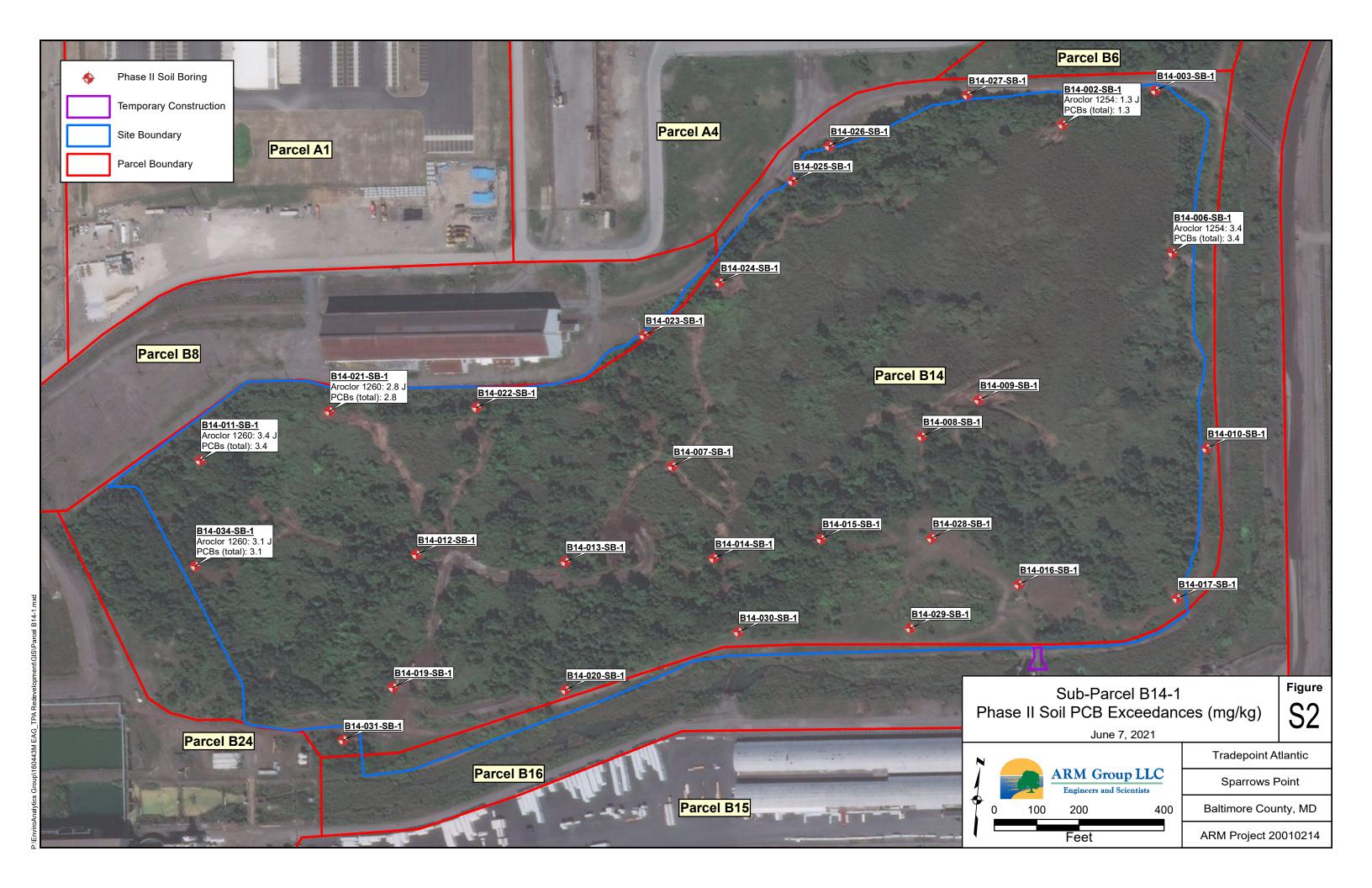


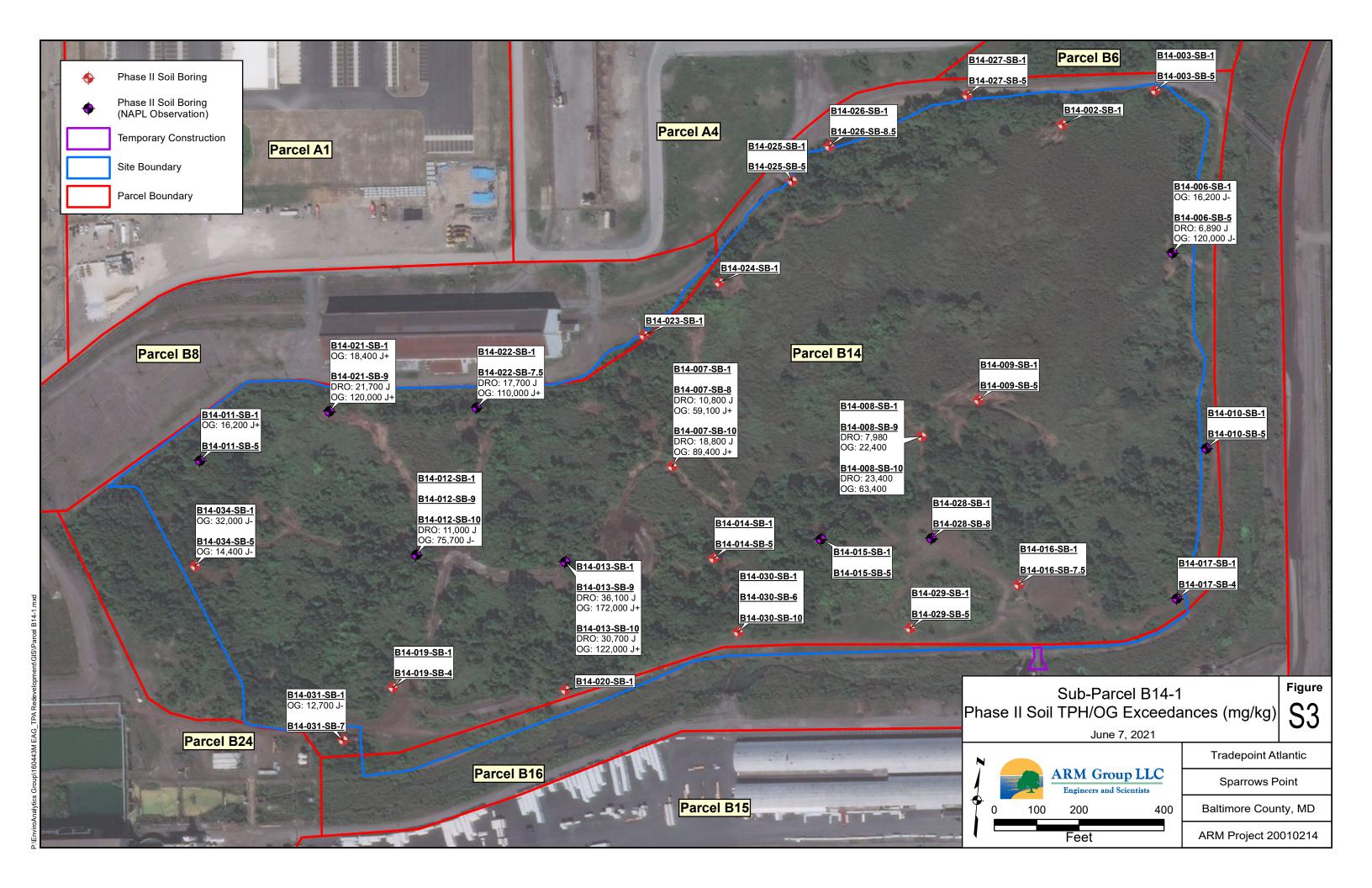












APPENDIX D

NAPL Transmissivity Calculation Parcel B14 CMS

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

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

Where:

 $T_n = NAPL$ transmissivity

 $Q_n = NAPL$ recharge rate

 $R_{oi} = radius of influence$

R_w = effective well radius

 $S_n = NAPL drawdown$

Simplifying assumptions:

 $ln(\frac{R_{0i}}{r_w}) = 4.6$ 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 0.0218.

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

$$Q_n = 0.00139 \text{ ft}^3/\text{day}$$
, so $T_n = \frac{0.00139 ft^3/\text{day} * 4.6}{2 * \pi * 0.68 ft} = 1.5*10^{-3} \text{ ft/day}$

APPENDIX E

NAPL Transmissivity Calculation Parcel B14

NAPL Transmissivity at locations B14-013R-PZ and B14-038R-PZ were calculated following the manual skimming method defined in the ASTM standard E2856-13 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 (ft²/day)

 $Q_n = NAPL$ recharge rate (ft^3/day)

 $R_{oi} = radius of influence (ft)$

 $R_w = \text{effective well radius (ft)}$

 $S_n = NAPL drawdown (ft)$

Simplifying assumptions:

Q_n = stabilized NAPL recharge rate at the end of the gauging and removal process

 $ln(\frac{R_{0i}}{r_w}) = 4.6$ based on cited pilot test results (Applied NAPL Science Review)

 $s_n = b_n(1 - \rho_r)$, given unconfined conditions

Where:

 b_n = initial NAPL thickness

$$\rho_r = \frac{\rho_{NAPL}}{\rho_{water}}$$

Therefore, based on the initial NAPL thicknesses given in **Table 2B** and the NAPL densities from **Appendix E**,

$$S_n = 1.65 \text{ ft} * (1 - \frac{0.9038}{0.9991}) = 0.157 \text{ ft for B14-013R-PZ and}$$

$$S_n = 2.83 \text{ ft} * (1 - \frac{0.8993}{0.9991}) = 0.283 \text{ ft for B14-038R-PZ}.$$

Based on the calculated stabilized NAPL recharge rates given in Table 2B,

$$T_n = \frac{(9.1*10^{-5} ft^3/day)*4.6}{2*\pi*0.157 ft} = 4.2*10^{-4} ft^2/day$$
 for B14-013R-PZ and

$$T_n = \frac{(9.1*10^{-4} ft^3/day)*4.6}{2*\pi*0.283 ft} = 2.4*10^{-3} ft^2/day$$
 for B14-038R-PZ.

APPENDIX F



UIN 0858EAC

Oil

B14-038-P2 Unit No.

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













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





UIN 0858EAC

U.S. Laboratories

No Data Available	No Data Available	1
		Ka
No Data Available	No Data Available	Bu
No Data Available	Filter Image	
. To Data / Trailable	Filter patch test is not performed Contact laboratory for more information	Ne
		Ac Ba
		Ba Fu Fu Fu
Since services are based on samples and information supplied by others, and services are rendered without any warranty or liability of any kind beyond the recommendations are based on interpretations of the generated test results at	actual amount paid to ALS Tribology for the services. Reported	Sc GI Me

Atlanta, Georgia - 420

5300 OakBrook Parkway
Building 200 Suite 245
Norcross, GA 30093
800.394.3669

Valley View, Ohio - 410
Valley View, OH 44125
800.726.5400

Ansas City, Kansas - 430 Phoenix, Arizona - 440
935 Sunshine Road 3319 West Earll Drive
Kansas City, KS 66115 Phoenix, AZ 85017
800.332.8055 800.445.7930

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

Canadian Laboratories

Burlington, Ontario - 450 Edmonton, Alberta - 402 5036 South Service Rd. 9450 17 Ave NW

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

9450 17 Ave NW Edmonton, AB T6N 1M9 888.489.0057

Sales & Marketing Houston, Texas

10450 Stancliff Road, Suite 210 Houston, TX 77099 877.835.8437

International Locations

Australia

Brisbane, Perth, Sydney, Muswellbrook

South America

Santiago de Chile, Belo Horizonte, Brazil

lew Zealand Southeast Asia
Wellington 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

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

tested at other ALS laboratories within the Tribology divisional network.



UIN 0858E7B

Oil

B14-038-P2 Unit No.

Unit: Make Model Serial No.

Tradepoint Atlantic Project# Site

20010214

Compartment:

QU787333 Sample #1 Name 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













Right Solutions • Right Partner

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

Additional

OIL ADDED **FILTER**

OIL CHANGED WO NUMBER

Specific Gravity @ 60F (D1298) Density Specific Gravity

Hrs

(D1298)

0.909 0.9089

Not Applicable





0858E7B

No Data Available	No Data Available	,
		Ka
No Data Available	No Data Available	Bu
No Data Available	Filter Image Filter patch test is not performed Contact laboratory for more information	Ne
		Ad Ba Ba
Since services are based on samples and information supplied by others, and services are rendered without any warranty or liability of any kind beyond the a recommendations are based on interpretations of the generated test results at	actual amount paid to ALS Tribology for the services. Reported	Fu Fu So GI

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

Valley View, Ohio - 410 6180 Halle Dr. Suite D Valley View, OH44125

Building 200 Suite 245 Norcross, GA 30093 800.394.3669

800.726.5400

ansas 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 Edmonton, Alberta - 402

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

9450 17 Ave NW Edmonton, AB T6N 1M9 888.489.0057

Sales & Marketing

Houston, Texas

10450 Stancliff Road, Suite 210 Houston, TX 77099 877.835.8437

International Locations

Australia

Brisbane, Perth, Sydney, Muswellbrook

South America

Santiago de Chile, Belo Horizonte, Brazil

lew Zealand Wellington

Southeast Asia Kuala Lumpur, Singapore Europe Prague

TEST METHODS:

Acid Number:

ASTM D974/D664 (*M) ASTM D4739 (*M)

Base Number: Base Number (Perchloric): Fuel Dilution by GC:

ASTM D2896 (*M) ASTM D7593

Fuel Dilution Visc/Setaflash Fuel Soot ATR/IR:

In House 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

APPENDIX G



Torkelson Geochemistry, Inc. CHAIN-0 2528 S. Columbia Place Phone: 918-749-8441 e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Tulsa, OK 74114-3233

Fax: 918-749-6005

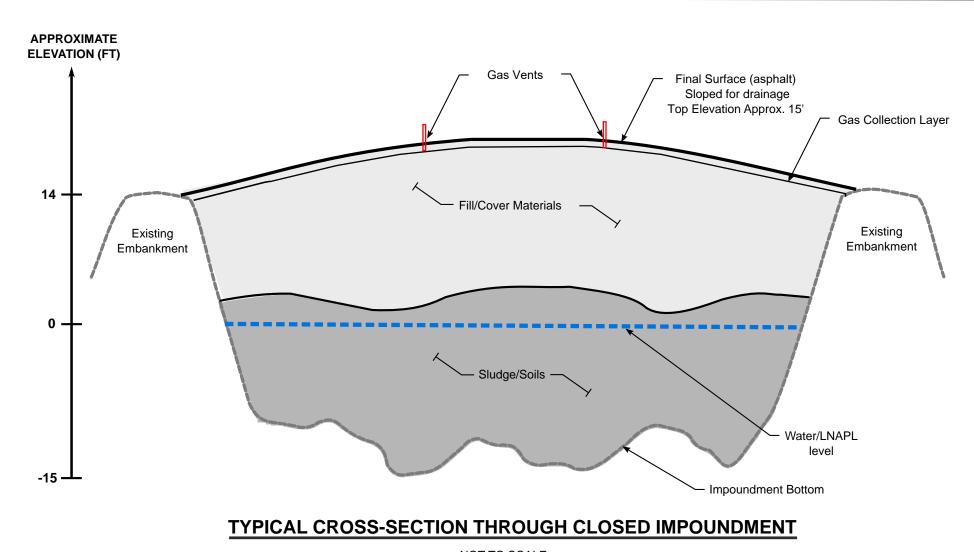
Page ____ of ___

Project: 1 Location: Proj. No P.O. Sampled B	- - - -	Report/Bill To: Tradepoint Atlantic Address: 1600 Sparrows Pt Blud Sparrows Point MD 21219 Phone: B Tworkowski 240-461-0750 Fax: e-mail: btworkowski D tradepointallanic.com													Additional Instructions Report to btworkowski@ tradepoint attantic.com ahamilton@armgroup.net mnewman@tradepointatlantic.com rclarcy@armgroup.net Requested Purn-Around Time: Standard				
ITEM NO	, SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO	# OF Vials	PRESE	RVATIV		GC Characterization		rface Tension	П			creic Gravity	STED			REMARKS
1	B14-013	5-10-21			٦				Ĭ	1					1				
2	B14-038	5-10-21	 		2	1			1 1	1			\dagger	1	1	1	1	T	
3	C095-MWS	5-13-21			٦				1										
4	B11-026-MWS	5-13-21			2			\prod	1	1				T	\Box				
5		4-19-21			瓦	11		П	1	1			\top	T	$ \cdot $		1	T	
6		5-20-21							í	1	†							1	
7	C0179-PZ	6-2-21			1				1								T		
8	B13-107-PZ	6-2-21	1		٦				i								T		
9																			
10																		S	
			RELINQUISHED BY						-	DATE TIME 6/7/21 1500			1	177	ACCEPTED BY DATE TIME WILL BIST 6-9-21 0815				

Torkelson Geochemistry, Inc. **Physical Properties Measurements** Viscosity of NAPL | Surface Tension | Interfacial Tension | Surface Tension Sample TGI Job Density of Temperature of NAPL (centipoise) Air/Water NAPL/Water Air/NAPL Measurements (gm/ml) (dynes/cm) (dynes/cm) (dynes/cm) 60F B11-026-MWS 21042 0.9296 409 NR NR NR 24 NR NR 60F B13-107-PZ 21042 0.9726 NR B14-013 21042 0.9038 463 NR NR NR 60F B14-038 21042 0.8993 476 NR NR NR 60F C005D-PZ 21042 0.8953 NR NR 60F 23 NR C095-MWS 60F 21042 0.9576 480 NR NR NR C0179-PZ 120 NR NR NR 60F 21042 0.9231 C0212B-PZ 21042 1.1730 4880 NR NR NR 60F

NR = Not Requested

APPENDIX H



NOT TO SCALE

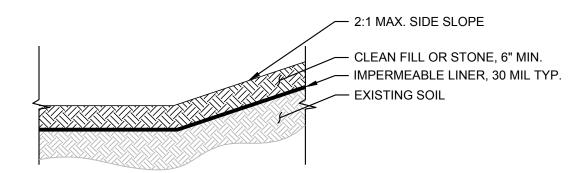
Sub-Parcel B14-1
Typical Cross-Section
J*}^Â, 2021

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD

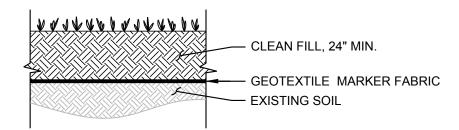
ARM Project 20010214

Figure
7

2:1 MAX. SIDE SLOPE CLEAN FILL OR STONE, 12" MIN. CLAY LAYER, 12" MIN. **EXISTING SOIL**



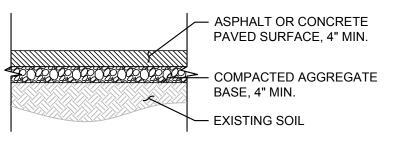
TYPICAL POND SECTIONS



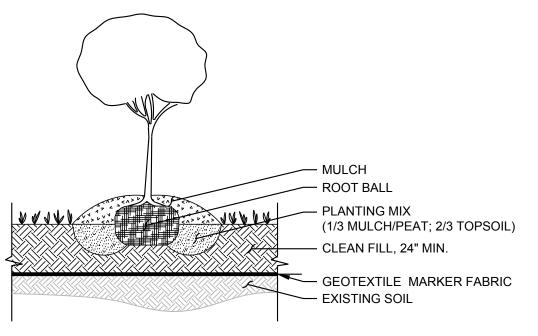
TYPICAL LANDSCAPE SECTION NOT TO SCALE

GEOTEXTILE MARKER FABRIC SPECIFICATIONS

THE GEOTEXTILE MARKER FABRIC SHALL BE A NONWOVEN PERVIOUS SHEET OF POLYPROPYLENE MATERIAL. ADD STABILIZERS AND/OR INHIBITORS TO THE BASE MATERIAL, AS NEEDED, TO MAKE THE FILAMENTS RESISTANT TO DETERIORATION BY ULTRAVIOLET LIGHT, OXIDATION AND HEAT EXPOSURE. REGRIND MATERIAL, WHICH CONSISTS OF EDGE TRIMMINGS AND OTHER SCRAPS THAT HAVE NEVER REACHED THE CONSUMER, MAY BE USED TO PRODUCE THE GEOTEXTILE. POST-CONSUMER RECYCLED MATERIAL MAY BE USED. GEOTEXTILE SHALL BE FORMED INTO A NETWORK SUCH THAT THE FILAMENTS OR YARNS RETAIN DIMENSIONAL STABILITY RELATIVE TO EACH OTHER, INCLUDING THE EDGES. GEOTEXTILES SHALL MEET THE REQUIREMENTS SPECIFIED IN TABLE 1. WHERE APPLICABLE, TABLE 1 PROPERTY VALUES REPRESENT THE MINIMUM AVERAGE ROLL VALUES IN THE WEAKEST PRINCIPAL DIRECTION. VALUES FOR APPARENT OPENING SIZE (AOS) REPRESENT MAXIMUM AVERAGE ROLL VALUES



TYPICAL PAVING SECTION NOT TO SCALE



TYPICAL PLANTING SECTION

TCDNG'3"

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value				
	V - 100 (0.00 (0.00) . (0.00 (0.00) . (0.00)		MD	CD			
Grab Tensile Strength	ASTM D4632	lbs (N)	120 (534)	120 (534)			
Grab Tensile Elongation	ASTM D4632	%	50	50			
Trapezoid Tear Strength	ASTM D4533	lbs (N)	50 (223)	50 (223)			
CBR Puncture Strength	310 (1380)						
	Maximum Opening Size						
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	70 (0.212)				
	Minimum Roll Value						
Permittivity	ASTM D4491	sec ⁻¹	1.7				
Flow Rate	ASTM D4491	gal/min/ft2 (l/min/m2)	135 (5500)				
	Minimum Test Value						
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70				