Road and Utility Investigation Report (B22)

Developed in Support of Construction Activities for
Area B: Parcel B22, Phase 1

Tradepoint Atlantic
Sparrows Point, Maryland

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ARM Project 160443M-5

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Attachments

1.0 INTRODUCTION

1.1. INTRODUCTION

ARM Group Inc. (ARM), on behalf of EnviroAnalytics Group (EAG), has prepared the following Road and Utility Investigation Report to document existing conditions and provide a Construction Worker risk assessment in support of infrastructure construction activities related to the Development of Parcel B22, Phase 1. The Phase 1 development area consists of approximately 71.6 acres in the southern portion of Parcel B22, but some minor roadway and utility construction is proposed outside of the main development area beyond the parcel boundary. This investigation and assessment was conducted in accordance with the Road and Utility Investigation Plan (B22) Revision 1 dated November 29, 2016 which was submitted to the agencies for their review and approval.

Tradepoint Atlantic is proposing to construct an access road and three primary utility lines (two water lines – one potable and one industrial, and a BGE gas line) to the south of Parcel B22, outside of the areas which have previously been investigated by Phase II Investigations. This Road and Utility Investigation Report presents the analytical results for the areas where utility trenching and roadway installation will be completed. This report also includes a construction worker risk assessment, defines necessary health and safety considerations which are warranted based on the results of the risk assessment (as applicable), and provides guidance for the management of excavated materials.

Site characterization of the proposed areas was performed in compliance with requirements pursuant to the following:

- Administrative Consent Order (ACO) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the Maryland Department of the Environment (effective September 12, 2014); and
- Settlement Agreement and Covenant Not to Sue (SA) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the United States Environmental Protection Agency (effective November 25, 2014).

1.2. ENVIRONMENTAL INVESTIGATION

The purpose of this investigation was to identify existing soil conditions in the vicinity of the proposed road/utility construction work. Across the whole Tradepoint Atlantic property, several buildings and facilities may have been historical sources of environmental contamination.

Ten (10) soil borings were completed along the alignment of the proposed roadway and utilities. The locations of the samples were selected to provide coverage in the vicinity of each primary

utility and the proposed roadway. Locations were adjusted based on a review of available historical steel plant records and drawings to provide coverage of any features which could potentially have resulted in a past release to the environment. The first document to be reviewed was the Recognized Environmental Condition (REC) Location Map provided in the Phase I Environmental Site Assessment (ESA) prepared by Weaver Boos Consultants dated May 19, 2014. Weaver Boos completed site visits of Sparrows Point from February 19 through 21, 2014, for the purpose of characterizing current conditions at the former steel plant. No RECs were identified in the vicinity of the proposed road/utilities. Following the review of the REC Location Map, four (4) sets of historical site drawings were reviewed to identify additional potential sampling targets. These site drawings included the 5000 Set (Plant Arrangement), the 5100 Set (Plant Index), the 5500 Set (Plant Sewer Lines), and a set of drawings indicating coke oven gas distribution drip leg locations. Sampling target locations would be identified if the historical site drawings depicted industrial activities or a specific feature at a location that may have been a source of environmental contamination. One boring was placed directly adjacent to a substation in order to investigate any potential impacts related to this feature. The remaining borings provide general coverage along the alignment of the roadway and utility corridors.

The locations of the proposed utilities and roadway alignment are provided on **Figure 1**, along with the locations of the completed borings and corresponding identification numbers. This figure shows an aerial image of the area toward the south end of Parcel B22 which was investigated.

Information regarding the project organization, field activities and sampling methods, sampling equipment, sample handling and management procedures, the laboratory analytical methods and selected laboratory, quality control and quality assurance procedures, and investigation-derived waste (IDW) management methods is described in detail in the QAPP that has been developed to support the investigation and remediation of the Tradepoint Atlantic Site (Quality Assurance Project Plan, ARM Group Inc., April 5, 2016). All site characterization activities were conducted in accordance with a site-specific Health and Safety Plan (HASP), which was provided as Appendix B of the approved Area B: Parcel B22 Phase II Investigation Work Plan dated June 2, 2016. Boring locations were cleared with the Miss Utility system and utility personnel currently working on the property prior to the completion of any soil borings.

2.0 FIELD ACTIVITIES AND PROCEDURES

2.1. SOIL INVESTIGATION

Soil samples were collected from the locations identified on **Figure 1** in accordance with procedures referenced in the QAPP Worksheet 21 – Field SOPs (Standard Operating Procedures), SOP No. 009 – Sub-Surface Soil Sampling. Regarding soil sampling depth, a shallow sample was collected from the 0 to 1 foot depth interval, and a deeper sample was collected from the 4 to 5 foot depth interval. Each boring provided two analytical soil samples, yielding a total of 20 samples for this investigation. It should be noted that no soil samples were collected from a depth that is below the water table. If asphalt and/or roadway sub-base occupied the 0 to 1 foot below ground surface (bgs) sample, the interval was shifted to the depth of the first observed underlying soil interval. In the event of refusal prior to collecting the 5 foot sample, the deeper sample was collected from the lowest possible interval (at least 4.5 feet bgs in each case). Borings were completed as close as possible to the proposed locations using a hand-held GPS unit as guidance.

After soil sampling was concluded at a location, down-hole soil sampling equipment was decontaminated according to procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 016 Equipment Decontamination. The decontamination procedures used during the course of this investigation include Decontamination Area (Section 3.1 of the SOP), Decontamination of Sampling Equipment (Section 3.5), Decontamination of Measurement Devices & Monitoring Equipment (Section 3.7), Decontamination of Subsurface Drilling Equipment (Section 3.8), and Document and Record Keeping (Section 5).

All soil samples were analyzed for TCL-SVOCs, TAL-Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide. During field screening of the soil cores, any sample interval which exceeded a PID reading of 10 ppm was also analyzed for TCL-VOCs. Additionally, the shallow soil samples from the 0-1 foot bgs interval were also analyzed for PCBs. For shallow samples that were shifted below the 0-1 foot interval, the new interval was still collected as a surface soil sample and analyzed for PCBs. 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.

2.2. SAMPLE DOCUMENTATION AND ANALYSIS

Samples were documented using a project specific identification code for the proposed roadway and utility construction (in this case the format R1-XXX-SB was used). Data from this investigation may also be incorporated into the Phase II Investigation Report for additional parcels in which fieldwork has not yet been completed (currently Parcel B2 and Parcel B3).

Pace Analytical Services, Inc. (PACE) of Greensburg, Pennsylvania performed the laboratory analysis for this project. The specific list of compounds and analytes that the soil samples were analyzed for, as well as the quantitation limits and project action limits, is provided in QAPP Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits.

2.3. MANAGEMENT OF INVESTIGATION DERIVED WASTE

All investigation derived waste (IDW) procedures were carried out in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 005 – Investigation-Derived Wastes Management.

3.0 DATA VALIDATION

For the road/utility investigation, a representative 50% of the complete analytical dataset was required to undergo data validation in accordance with the Road and Utility Investigation Work Plan dated November 29, 2016. However, since all samples were collected in a single field day and are present on a single laboratory report, the full analytical dataset has been submitted for validation.

All data validation procedures will be carried out in accordance with the QAPP Worksheet 34 – Data Verification and Validation Inputs, QAPP Worksheet 35 – Data Verification Procedures, and QAPP Worksheet 36 – Data Validation Procedures.

If the results of the data validation impact the results or recommendations of the screening level risk assessment provided in the Section 4.0, a revised report will be submitted to the agencies. However, if the data validation process does not impact the results of the risk assessment (i.e., none of the analytical results included in the risk assessment are rejected for any sample) a revision to this report will not be mandatory. The agencies will be notified of any data validation results pertinent to the road/utility risk assessment.

4.0 SCREENING LEVEL RISK ASSESSMENT

The results of the environmental investigation and subsequent risk assessment are presented in this Screening Level Risk Assessment (SLRA) for approval by the agencies prior to the installation of the proposed road/utilities. The SLRA includes an evaluation of any necessary health and safety protocols or response measures which are warranted based on the completed risk assessment. The analytical results for parameters detected in soil are summarized and compared to relevant screening levels in the attached **Table 1** (Organics) and **Table 2** (Inorganics). The laboratory Certificates of Analysis (including Chains of Custody) have been included as electronic attachments. The data validation reports have not yet been received following this investigation. Soil boring logs including lithologic information have been included as **Appendix A**. Please note that unless otherwise indicated, all Unified Soil Classification System (USCS) group symbols provided on the attached boring logs are from visual observations, and not from laboratory testing.

4.1. ANALYSIS PROCESS

A human health SLRA was completed for soils to further evaluate the Site conditions in support of the design of necessary response measures or site-specific health and safety protocols. Ten (10) soil borings were completed along the alignment of the proposed roadway and utilities, providing 20 samples to be included in the risk assessment. The data were evaluated to assess risk for the Construction Worker scenario for temporary construction activities associated with utility and road improvements. The SLRA included the following evaluation process:

Identification of Constituents of Potential Concern (COPCs): Compounds that are present at concentrations at or above the EPA Regional Screening Levels (RSLs) set at a target cancer risk of 1E-6 or target non-cancer Hazard Quotient (HQ) of 0.1 were identified as COPCs to be included in the SLRA.

Identification of Exposure Units (EUs): The development area for the proposed utilities/roads was analyzed as a single exposure unit (approximately 19.3 ac).

Exposure Point Concentrations (EPCs): The COPC soil data for surface (0-1 ft) and subsurface (>1 ft) depths were pooled to accurately assess exposure for Construction Workers grading and/or trenching within the identified roadway and utility corridors. This dataset was used for estimation of potential exposure point concentrations to soil within the exposure unit during construction activities. A statistical analysis was performed for each COPC data set using the ProUCL software (version 5.0) developed by the USEPA to determine representative reasonable maximum exposure (RME) values for the EPC for each constituent. The RME value is typically the 95% Upper Confidence Limit (UCL) of the mean. For lead, the arithmetic mean for the pooled dataset was

calculated for comparison to the Adult Lead Model-based values. If applicable, all PCB results equaling or exceeding 50 mg/kg would be delineated for excavation and removal, and all remaining PCBs would be included in the EPC and risk ratio calculations.

Risk Ratios: The soil EPCs were compared to site-specific Soil Screening Levels (SSLs) for the Construction Worker based on equations derived in the USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24, December 2002). For this Construction Worker scenario, site-specific risk-based SSLs were calculated for a range of potential exposure frequencies. These site specific SSLs were used to calculate risk ratios based on a target cancer risk of 1E-6 and a target non-cancer HQ of 1. For each exposure frequency, risk ratios for the carcinogens were summed to develop a screening level estimate of the cumulative cancer risk. The risk ratios for the non-carcinogens were segregated and summed by target organ to develop a screening level estimate of the cumulative non-cancer hazard. These calculated risk ratios were used to determine the exposure frequency that would result in risk ratios equivalent to a cumulative cancer risk of 1E-5 or hazard index of 1 for any individual target organ. This analysis indicated that an exposure frequency of 115 days would be allowable before additional worker protections or more detailed job safety evaluations might be needed. Therefore, the risk ratios presented herein are based upon an exposure frequency of 115 work days.

Assessment of Lead: For lead, the arithmetic mean concentrations for surface soil and subsurface soils for the EU were pooled and compared to the applicable RSL (800 mg/kg) as an initial screening. If the mean concentration for the EU was below the applicable RSL, the EU was identified as requiring no further action for lead. If the mean concentration exceeded the RSL, the mean value would be compared to calculated Adult Lead Model values (ALM Version dated 6/21/2009 updated with the August 2, 2016 OLEM Directive) with inputs of 1.7 for the geometric standard deviation and a blood baseline lead level of 0.7 ug/dL. The ALM calculation generates a soil lead concentration of 2,737 mg/kg, which is the most conservative (i.e., lowest) concentration which would yield a probability of 5% of a blood lead concentration of 10 ug/dL. If the arithmetic mean concentration for the EU was below 2,737 mg/kg, the EU was identified as requiring no further action for lead. For lead, all results equaling or exceeding 10,000 mg/kg would be delineated for possible excavation and removal (if applicable).

Assessment of TPH-DRO/GRO and Oil & Grease: EPCs were not calculated for TPH-DRO/GRO or Oil & Grease. Instead, the individual results were compared to the Project Action Limit (PAL) set to a HQ of 1 (6,200 mg/kg). Any TPH/Oil & Grease PAL exceedances or non-aqueous phase liquid (NAPL) observations near the proposed subsurface utilities would be delineated. If TPH/Oil & Grease PAL exceedances or free

phase NAPL were identified near a proposed subsurface utility, a plan would be required to prevent mobilization of the petroleum and/or Oil & Grease to these features, which may include removal, stabilization, sealing of utilities, etc. An evaluation of the TPH/Oil & Grease exceedances and the potential for product migration which could ultimately lead to exposure risks is presented following the SLRA results in Section 4.3.

Risk Characterization Approach: For the road/utility EU, if the risk ratio for each non-carcinogenic COPC or cumulative target organ did not exceed 1 (with the exception of lead), and the sum of the risk ratios for the carcinogenic COPCs did not exceed a cumulative cancer risk of 1E-5, then a no further action determination was recommended.

If the estimate of cumulative cancer risk exceeded 1E-5, but was less than 1E-4, then site-specific health and safety requirements would be considered to be an acceptable risk mitigation measure for the Construction Worker. The efficacy of health and safety measures for elevated non-cancer hazard would be evaluated in terms of the magnitude of the exceedance and other factors such as bioavailability of the COPC. Similarly, for lead, if the results of the ALM indicated that the mean concentrations would present a 5% to 10% probability of a blood concentration of 10 ug/dL for the EU, then health and safety requirements would be an acceptable risk mitigation measure. The mean soil lead concentrations corresponding to ALM probabilities of 5% and 10% are 2,737 mg/kg, and 3,417 mg/kg, respectively.

If the sum of the risk ratios for carcinogens exceeded a cumulative cancer risk of 1E-4, further analysis of site conditions would be required including the consideration of toxicity reduction in any proposal for Construction Worker risk mitigation. The magnitude of non-carcinogen hazard exceedances and bioavailability of the COPC would also dictate further analysis of site conditions including consideration of toxicity reduction in any proposal for Construction Worker risk mitigation. In addition, if the ALM indicated that the mean concentrations would present a >10% probability of a blood concentration of 10 ug/dL for the EU, further analysis of site conditions including toxicity reduction would be evaluated such that the probability would be reduced to less than 10% for the Construction Worker after toxicity reduction.

4.2. ROAD AND UTILITY INVESTIGATION SLRA RESULTS AND RISK CHARACTERIZATION

EPCs for each identified COPC were calculated for the single pooled soil dataset. As indicated above, the EPCs for lead are the average (i.e., arithmetic mean) values for each dataset. ProUCL output tables (with computed UCLs) derived from the data for each COPC in soils are provided as electronic attachments, with computations presented and EPCs calculated for COPCs within the single pooled dataset for the exposure unit. The ProUCL input tables are also included as electronic attachments. The calculated EPCs are shown in **Table 3**. Risk ratios for the estimates

of potential EPCs for the Construction Worker scenario were calculated for a range of potential exposure frequencies to determine the exposure frequency that would result in calculated risk ratios equivalent to a cumulative cancer risk of 1E-5 or hazard index of 1 for any individual target organ. This analysis indicated that an exposure frequency of 115 days would be allowable before additional worker protections or more detailed job safety evaluations might be needed. The calculated risk ratios using the 115-day exposure frequency are shown in **Table 4**. The variables entered for calculation of site-specific SSLs (EU area, input assumptions, and exposure frequency) are indicated as notes on the table. The spreadsheet used for computation of the 115-day Construction Worker SSLs is included as **Appendix B**.

The cumulative carcinogenic risk was computed to be 3E-7 for the pooled soil dataset using a 115-day exposure frequency, which is less than the regulatory carcinogenic risk level for no further action (1E-5). None of the non-carcinogens caused a cumulative HI to exceed 1 for any target organ system for the pooled soil dataset using the 115-day exposure frequency. These results indicate that site-specific health and safety protocols or further action would be required only if the duration of intrusive activities in the proposed road and utility construction schedule exceeds 115 days. According to the work schedule provided by Tradepoint Atlantic, the total duration of intrusive construction activities is projected to be 111 days, with the following intervals associated with specific milestones: Demolition – 5 days; Grub & Grade – 5 days; Tradepoint Ave Waterline – 22 days; Industrial Water Line Relocation – 32 days; Electric/Communications Duct Bank – 25 days; and Stormwater – 22 days. Therefore, additional worker protection measures are not necessary.

The average lead value in the pooled soil dataset was 38.4 mg/kg, below the applicable RSL of 800 mg/kg. The screening criterion for lead was set at an EU arithmetic mean of 800 mg/kg based on the RSL, with a secondary limit of 2,737 mg/kg based on the Adult Lead Model developed by the USEPA (corresponding to a 5% probability of a blood lead level of 10 ug/dL).

4.3. MIGRATION ASSESSMENT FOR ELEVATED TPH/OIL & GREASE

Elevated Oil & Grease was identified above the PAL (6,200 mg/kg) at three soil boring locations in the proposed road/utility development area (R1-007-SB-1 at 14,600 mg/kg, R1-008-SB-1.5 at 12,300 mg/kg, and R1-010-SB-1 at 11,900 mg/kg). TPH was also analyzed at each of the soil boring locations (including locations with elevated Oil & Grease), and this analysis confirmed that petroleum was not present above the action limit of 6,200 mg/kg. Although no physical evidence of NAPL was noted in the soil cores, the elevated levels of Oil & Grease indicate the possibility that free-phase NAPL may be present in the vicinity of these boring locations. NAPL in close proximity to the proposed underground utilities would raise the concern that utility construction could create pathways for migration of NAPL, vapors, or impacted water to surface water discharges or to off-site receptors. The Oil & Grease exceedances were detected in shallow soils only, and the underlying subsurface soil samples did not show elevated detections.

Therefore, the extent of the Oil & Grease contamination appears to be limited to shallow impacts, and the proposed utilities (to be installed at a greater depth) are not likely to act as migration pathways.

However, based on the magnitude of the Oil & Grease concentrations (in the low percent range), further delineation at three boring locations is required, in accordance with the approved Work Plan, to determine whether Oil & Grease is present that may be mobilized by the utility construction.

It is recommended that delineation be completed during construction activities using backhoe trenches to investigate for the presence of NAPL along the proposed pipeline alignment. Trenches will be perpendicular spaced every 50 feet along the alignment wherever impacted soil is encountered and will extend out to a distance of 10 feet from the centerline of the proposed utility. The use of trenching will allow for better examination of the extent and the nature of soil impacts than can be achieved via additional Geoprobe borings. Soil will be examined in the field for physical evidence of the presence of NAPL. In addition, samples of excavated soil will be analyzed with a field test kit to identify and properly manage Oil & Grease impacted soil. The selected test kit (Oil Sticks™) provides a straightforward field test to determine if hydrocarbons are present in soil and extractable (i.e. could mobilize as a NAPL). Oil Sticks™ change from a pale blue to a deep blue color when they come in contact with free product, which can be extracted from soils via a simple field procedure. If extractable hydrocarbons are identified in Site soils, disposal requirements will be determined using the quantitative PetroFLAG™ hydrocarbon analysis system. The PetroFLAG™ kit is capable of measuring naturally occurring waxes and oils, such as vegetable-based oils, as well as petroleum hydrocarbons, which is advantageous for the purpose of identifying soils containing Oil & Grease.

Contingency measures should be developed to ensure that, in the event that further delineation indicates deeper or more widespread Oil & Grease impacts, the utilities will be constructed in a manner that will prevent the migration of the Oil & Grease, and that excavated material will be properly managed. In addition, this contingency plan will specify procedures to be followed if unidentified pockets of contamination (including NAPL) are encountered during excavation or utility construction. The Utility Excavation NAPL Contingency Plan (**Appendix C**) provides protocols and procedures to delineate elevated TPH/Oil & Grease and prevent mobilization of NAPL along the utility if NAPL is encountered during the construction activities.

Key utility trenching and installations should be monitored through daily inspections by an environmental professional (EP). Utility trenches are to be over-excavated to a minimum of one foot on all sides of the proposed utility. All utility trenches are required to be backfilled with bedding and backfill materials meeting the MDE definition of clean fill. Excavated materials impacted above the Oil & Grease PAL (6,200 mg/kg) are generally suitable as fill under areas to

be paved (under the proposed road or within Parcel B22, Phase 1). However, elevated Oil & Grease locations with detections in the low percentage range should be segregated for disposal at the on-site nonhazardous landfill (Greys Landfill). If screening of excavated materials by the EP indicates the presence of conditions of potential concern (i.e., sustained elevated PID readings, visual staining, unsuitable waste materials, etc.), such materials shall be segregated for additional sampling and special management. If excavated and stockpiled, such materials should be covered with a plastic tarp to minimize potential exposures and erosion.

4.4. MANAGEMENT OF PCB-CONTAMINATED MEDIA

There were no PCB concentrations identified within the proposed road/utility development area above the PALs specified in the QAPP. Soils or contaminated media containing total PCB concentrations less than the PALs specified in the QAPP may be left in place without additional assessment. Only one sample (R1-001-SB-1) had a detection of PCBs during this investigation, with a negligible detection of 0.115 mg/kg of Aroclor 1262 (and total PCBs).

5.0 FINDINGS AND RECOMMENDATIONS

The objective of this Road and Utility Investigation was to fully characterize the nature and extent of contamination within the proposed road/utility development area. During the Investigation, a total of 20 soil samples were collected from 10 boring locations and analyzed to define the nature and extent of existing contamination. The sampling and analysis plan for this investigation provided general coverage of the proposed alignments, and also targeted specific features which represented potential environmental releases (limited to one substation). Soil samples were analyzed for TCL-SVOCs, TAL-Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide. Shallow soil samples (0-1 foot bgs) were analyzed for PCBs. During field screening of the soil cores, any sample interval which exceeded a PID reading of 10 ppm was also analyzed for TCL-VOCs. The samples collected during this study have provided analytical data regarding current conditions within the proposed road and utility development area and facilitated the identification of potential contaminant releases. Soil conditions have been adequately characterized to support the risk assessment provided herein and associated response action planning, if necessary.

The data were evaluated to determine the maximum exposure frequency that would yield acceptable risk ratios for the Construction Worker scenario during these temporary road/utility construction activities. The COPC soil datasets for surface (0-1 ft) and subsurface (>1 ft) depths were pooled to create a more robust single dataset for risk assessment.

Risk ratios for the estimates of potential EPCs for the Construction Worker scenario are presented for a 115-day exposure frequency. This site-specific exposure frequency was determined to be acceptable for the Construction Worker assessment without requirements for additional worker protection measures or a more detailed job safety analysis. The carcinogenic risk was computed to be 3E-7 for the pooled soil dataset using a 115-day exposure frequency. Based on this value, the cancer risk is acceptable for the Construction Worker scenario without any further action. None of the non-carcinogens caused a cumulative HI to exceed 1 for any target organ system for the pooled soil dataset using the 115-day exposure frequency. According to the work schedule provided by Tradepoint Atlantic, the total duration of intrusive construction activities is projected to be 111 days; therefore, no specific additional worker health and safety measures would be required for the proposed road/utility construction.

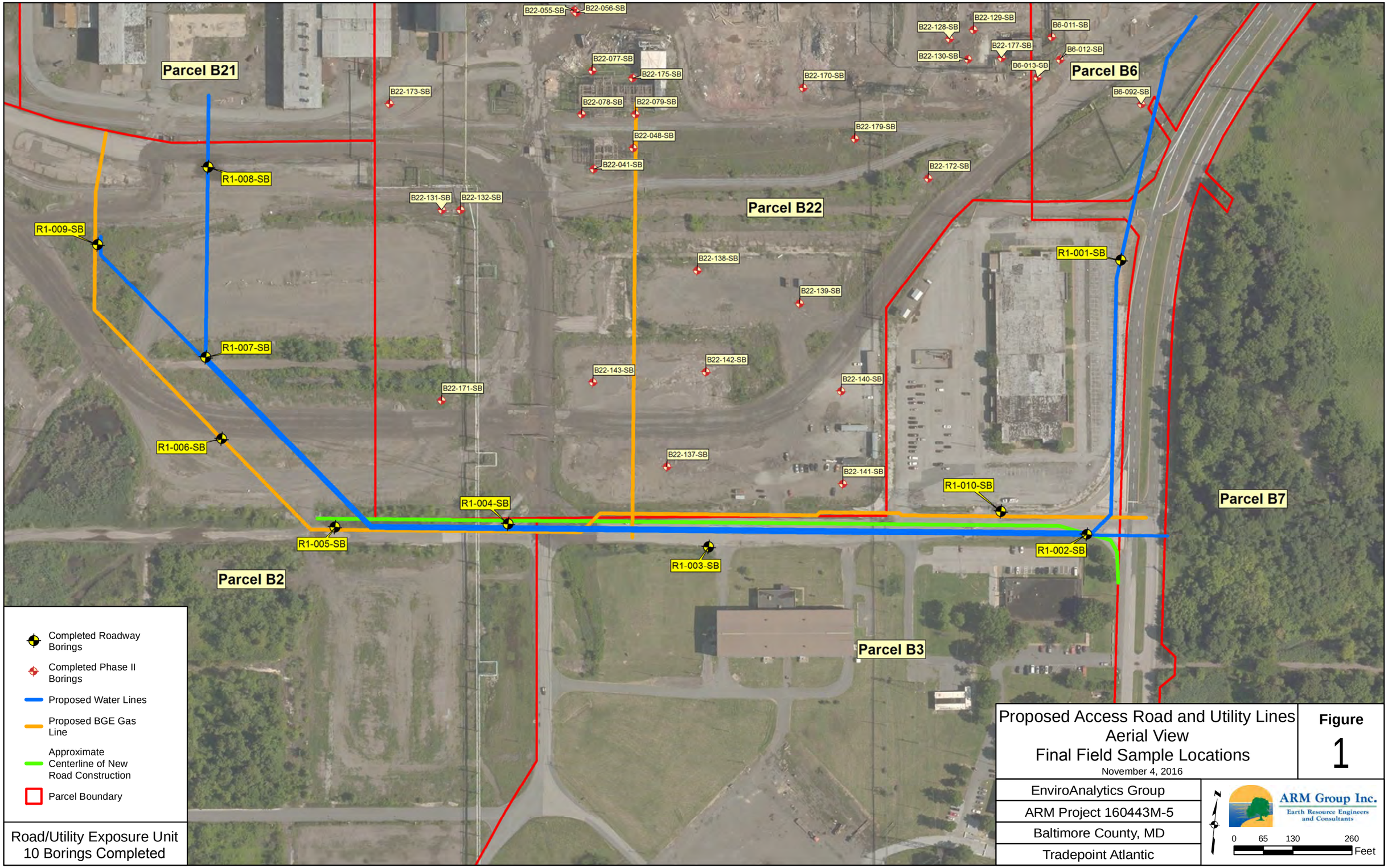
Elevated Oil & Grease was identified above the PAL (6,200 mg/kg) in surface samples at three soil boring locations in the proposed road/utility development area (R1-007-SB, R1-008-SB, and R1-010-SB). No elevated detections of TPH-DRO/GRO or physical evidence of NAPL in the soil cores were noted. Because no Oil & Grease exceedances were detected in subsurface soils, it does not appear that the impacts have migrated to the subsurface where utility corridors could potentially act as migration pathways. However, further delineation is required at the three Oil & Grease impacted locations in accordance with the approved Work Plan. These delineation

activities are recommended to be completed during the road/utility construction. Soil in the backhoe trenches will be visually inspected and screened using the Oil Sticks™ field test kit to determine the presence or absence of extractable hydrocarbons. If extractable hydrocarbons are present, appropriate disposal requirements will be determined using the quantitative PetroFLAG™ test kit. The PetroFLAG™ kit is able to identify naturally occurring waxes and oils, such as vegetable oils, which is advantageous for the purpose of identifying soils containing Oil & Grease.

Unidentified pockets of contamination (including NAPL) may still be encountered during construction despite the prior investigations conducted on areas of the Tradepoint Atlantic property. Therefore, it is important to have procedures in place for properly addressing response and construction when NAPL may be encountered. The Utility Excavation NAPL Contingency Plan (**Appendix C**) provides protocols and procedures to delineate elevated detections of TPH/Oil & Grease and prevent mobilization of any encountered NAPL along the utility. If NAPL-contaminated soils are observed during construction, delineation using field test kits (Oil Sticks™ and PetroFLAG™) is recommended to define and properly manage Oil & Grease impacted soil within the utility excavation areas.

Each boring location was cleared with the Miss Utility system and utility personnel currently working on the property prior to the completion of any soil borings. However, during the Road and Utility Investigation, a gas line was encountered at boring location R1-002-SB at a depth of approximately 3 feet bgs. It was determined that this gas line has been abandoned; however, additional evaluation may be needed prior to the installation of proposed utilities and/or roadways in the area.

FIGURES



Proposed Access Road and Utility Lines
Aerial View
Final Field Sample Locations
November 4, 2016

Figure
1

EnviroAnalytics Group
ARM Project 160443M-5
Baltimore County, MD
Tradepoint Atlantic

ARM Group Inc.
Earth Resource Engineers and Consultants

0 65 130 260
Feet

TABLES

Table 1
Summary of Organics Detected in Soil
Parcel B22 - Road and Utility Investigation Area
Tradepoint Atlantic
Sparrows Point, Maryland

Parameter	Units	COPC Screening Level (C)	COPC Screening Level (NC)	R1-001-SB-1	R1-001-SB-5	R1-002-SB-1	R1-002-SB-5	R1-003-SB-1	R1-003-SB-5	R1-004-SB-1.5	R1-004-SB-5	R1-005-SB-1.5	R1-005-SB-5	R1-006-SB-1	R1-006-SB-5
Volatile Inorganic Compounds															
Acetone	mg/kg		6.7E+04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.013 U	N/A	N/A	N/A
Semi-Volatile Organic Compounds*															
1,1-Biphenyl	mg/kg	4.1E+02	2.0E+01	**0.025 J**	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.36**
2,4-Dimethylphenol	mg/kg		1.6E+03	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.14**
2,4-Dinitrotoluene	mg/kg	7.4E+00	1.6E+02	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	**0.09**	0.081 U	**0.10**	0.081 U	0.072 U	**0.08**
2,6-Dinitrotoluene	mg/kg	1.5E+00	2.5E+01	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	**0.13**	0.081 U	0.072 U	0.075 U
2-Chloronaphthalene	mg/kg		6.0E+03	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	**0.77**	0.081 U	**0.79**	0.081 U	0.072 U	0.075 U
2-Methylnaphthalene	mg/kg		3.0E+02	**0.09**	0.0082 U	**0.02**	0.0081 U	0.074 U	0.0077 U	0.077 U	**0.0034 J**	0.078 U	0.0082 U	**0.0028 J**	**4.90**
2-Methylphenol	mg/kg		4.1E+03	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.08**
3&4-Methylphenol(m&p Cresol)[¥]	mg/kg		4.1E+03	0.16 U	0.16 U	0.17 U	0.16 U	0.15 U	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	**0.063 J**
3,3'-Dichlorobenzidine	mg/kg	5.1E+00		0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	**0.024 J**	0.081 U	0.072 U	0.075 U
Acenaphthene	mg/kg		4.5E+03	**0.016 J**	0.0082 U	**0.0028 J**	0.0081 U	0.074 U	0.0077 U	0.077 U	**0.00068 J**	0.078 U	0.0082 U	0.0072 U	**0.06**
Acenaphthylene	mg/kg			**0.049 J**	0.0082 U	**0.0034 J**	0.0081 U	0.074 U	0.0077 U	0.077 U	**0.00095 J**	0.078 U	0.0082 U	0.0072 U	**0.04**
Acetophenone	mg/kg		1.2E+04	**0.027 J**	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.38**
Anthracene	mg/kg		2.3E+04	**0.10**	0.0082 U	**0.01**	0.0081 U	**0.0073 J**	0.0077 U	**0.0089 J**	**0.0023 J**	0.078 U	0.0082 U	**0.0047 J**	**0.04**
Benzaldehyde	mg/kg	8.2E+02	1.2E+04	**0.18**	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**1.30**
Benzo[a]anthracene	mg/kg	2.9E+00		**0.75**	**0.0014 J**	**0.06**	0.0081 U	**0.061 J**	**0.00094 J**	**0.043 J**	**0.0019 J**	**0.02 J**	0.0082 U	**0.02**	**0.16**
Benzo[a]pyrene	mg/kg	2.9E-01		**0.93**	0.0082 U	**0.06**	0.0081 U	**0.055 J**	0.0077 U	**0.031 J**	0.0081 U	**0.0098 J**	0.0082 U	**0.0048 J**	**0.10**
Benzo[b]fluoranthene	mg/kg	2.9E+00		**2.30**	**0.0013 J**	**0.14**	0.0081 U	**0.10**	0.0077 U	**0.083 I**	**0.0018 J**	**0.026 J**	0.0082 U	**0.03**	**0.18**
Benzo[g,h,i]perylene	mg/kg			**0.44**	0.0082 U	**0.04**	0.0081 U	**0.025 J**	0.0077 U	**0.013 J**	0.0081 U	0.078 U	0.0082 U	**0.01**	**0.04**
Benzo[k]fluoranthene	mg/kg	2.9E+01		**1.80**	0.0082 U	**0.11**	0.0081 U	**0.051 J**	0.0077 U	**0.067 J**	**0.0014 J**	**0.021 J**	0.0082 U	**0.03**	**0.15**
bis(2-Ethylhexyl)phthalate	mg/kg	1.6E+02	1.6E+03	**0.34**	0.08 U	**0.028 J**	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.034 J**
Carbazole	mg/kg			**0.09**	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.12**
Chrysene	mg/kg	2.9E+02		**1.30**	**0.00091 J**	**0.08**	0.0081 U	**0.073 J**	0.0077 U	**0.048 J**	**0.0012 J**	**0.018 J**	0.0082 U	**0.03**	**0.24**
Dibenz[a,h]anthracene	mg/kg	2.9E-01		**0.14**	0.0082 U	**0.02**	0.0081 U	0.074 U	0.0077 U	0.077 U	0.0081 U	0.078 U	0.0082 U	**0.0023 J**	**0.02**
Di-n-butylphthalate	mg/kg		8.2E+03	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	**0.017 J**	**0.043 J**
Di-n-ocytlphthalate	mg/kg		8.2E+02	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	**0.08**	0.081 U	**0.23**	0.081 U	0.072 U	0.075 U
Fluoranthene	mg/kg		3.0E+03	**1.40**	**0.0015 J**	**0.11**	0.0081 U	**0.08**	0.0077 U	**0.064 J**	**0.005 J**	**0.032 J**	0.0082 U	**0.05**	**0.15**
Fluorene	mg/kg		3.0E+03	**0.022 J**	0.0082 U	**0.0021 J**	0.0081 U	0.074 U	0.0077 U	0.077 U	**0.0016 J**	0.078 U	0.0082 U	0.0072 U	**0.08**
Indeno[1,2,3-c,d]pyrene	mg/kg	2.9E+00		**0.38**	0.0082 U	**0.04**	0.0081 U	**0.025 J**	0.0077 U	**0.012 J**	0.0081 U	0.078 U	0.0082 U	**0.0061 J**	**0.03**
Isophorone	mg/kg	2.4E+03	1.6E+04	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	**0.025 J**
Naphthalene	mg/kg	1.7E+01	5.9E+01	**0.09**	0.0082 U	**0.02**	0.0081 U	0.074 U	0.0077 U	0.077 U	**0.10**	0.078 U	0.0082 U	**0.004 J**	**3.80**
N-Nitroso-di-n-propylamine	mg/kg	3.3E-01		0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	**0.062 J**	0.081 U	**0.055 J**	0.081 U	0.072 U	0.075 U
Pentachlorophenol	mg/kg	4.0E+00	2.8E+02	0.2 U	0.2 U	0.21 U	0.2 U	0.18 U	0.19 U	**0.052 J**	0.2 U	**0.052 J**	0.2 U	0.18 U	0.19 U
Phenanthrene	mg/kg			**0.85**	**0.0012 J**	**0.06**	0.0081 U	**0.025 J**	0.0077 U	**0.05 J**	**0.01**	**0.033 J**	0.0082 U	**0.03**	**1.40**
Phenol	mg/kg		2.5E+04	0.081 U	0.08 U	0.084 U	0.079 U	0.073 U	0.076 U	0.077 U	0.081 U	0.08 U	0.081 U	0.072 U	0.075 U
Pyrene	mg/kg		2.3E+03	**1.30**	**0.0012 J**	**0.09**	0.0081 U	**0.064 J**	0.0077 U	**0.055 J**	**0.0036 J**	**0.024 J**	0.0082 U	**0.03**	**0.20**
PCBs															
Aroclor 1262	mg/kg			**0.12**	N/A	0.0627 U	N/A	0.0662 U	N/A	0.0538 U	N/A	0.0557 U	N/A	0.0538 U	N/A
PCBs (total)	mg/kg	9.4E-01		**0.12**	N/A	0.0627 U	N/A	0.0662 U	N/A	0.0538 U	N/A	0.0557 U	N/A	0.0538 U	N/A
TPH/Oil and Grease															
Diesel Range Organics	mg/kg		6.2E+03	**80.1**	**3.2 J**	**15.6**	**3.4 J**	**16.9**	7.6 U	**109**	**6.7 J**	**82.7**	**9.30**	**7.1 J**	**270**
Gasoline Range Organics	mg/kg		6.2E+03	12.6 U	11.4 U	13.4 U	10.5 U	10.4 U	11.2 U	14.1 U	9.8 U	12.9 U	10.2 U	9.4 U	**77.4**
Oil and Grease	mg/kg		6.2E+03	**1,740**	**154**	**657**	**151**	**1,330**	**435**	**1,800**	**677**	**1,130**	**49 J**	**375**	**812**

Detections in bold
Values in purple indicate an exceedance of the carcinogenic screening level
Values in orange indicate an exceedance of the non-carcinogenic screening level
Values in red indicate an exceedance of both the C/NC screening levels

COPC = Constituent of Potential Concern
C = Carcinogenic Screening Level
NC = Non-Carcinogenic Screening Level
*PAH compounds were analyzed via SIM
[¥]The more conservative NC screening level for 3-methylphenol was used

Data Flags:
U: This analyte was not detected in the sample. The numeric value represents the sample quantitation/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
N/A: This parameter was not analyzed for this sample.

Table 1
Summary of Organics Detected in Soil
Parcel B22 - Road and Utility Investigation Area
Tradepoint Atlantic
Sparrows Point, Maryland

Parameter	Units	COPC Screening Level (C)	COPC Screening Level (NC)	R1-007-SB-1	R1-007-SB-5	R1-008-SB-1.5	R1-008-SB-4.5	R1-009-SB-1	R1-009-SB-4.5	R1-010-SB-1	R1-010-SB-5
Volatile Inorganic Compounds											
Acetone	mg/kg		6.7E+04	N/A	**0.0058 J**	N/A	N/A	N/A	**0.0075 J**	N/A	N/A
Semi-Volatile Organic Compounds*											
1,1-Biphenyl	mg/kg	4.1E+02	2.0E+01	0.078 U	0.082 U	0.073 U	0.078 U	**0.026 J**	0.083 U	0.073 U	0.08 U
2,4-Dimethylphenol	mg/kg		1.6E+03	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
2,4-Dinitrotoluene	mg/kg	7.4E+00	1.6E+02	0.078 U	0.082 U	**0.08**	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
2,6-Dinitrotoluene	mg/kg	1.5E+00	2.5E+01	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
2-Chloronaphthalene	mg/kg		6.0E+03	0.078 U	0.082 U	**0.73**	0.078 U	**0.32**	0.083 U	0.073 U	0.08 U
2-Methylnaphthalene	mg/kg		3.0E+02	0.078 U	**0.0075 J**	0.073 U	0.0078 U	**0.03**	**0.0073 J**	0.073 U	0.0083 U
2-Methylphenol	mg/kg		4.1E+03	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
3&4-Methylphenol(m&p Cresol)[x]	mg/kg		4.1E+03	0.16 U	0.16 U	0.15 U	0.16 U	**0.049 J**	0.17 U	0.15 U	0.16 U
3,3'-Dichlorobenzidine	mg/kg	5.1E+00		0.078 U	0.082 U	**0.016 J**	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Acenaphthene	mg/kg		4.5E+03	0.078 U	**0.00079 J**	**0.0066 J**	0.0078 U	**0.005 J**	**0.0047 J**	0.073 U	0.0083 U
Acenaphthylene	mg/kg			**0.10**	**0.0015 J**	0.073 U	0.0078 U	**0.05**	**0.03**	0.073 U	0.0083 U
Acetophenone	mg/kg		1.2E+04	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Anthracene	mg/kg		2.3E+04	**0.047 J**	**0.0026 J**	**0.018 J**	0.0078 U	**0.04**	**0.06**	0.073 U	0.0083 U
Benzaldehyde	mg/kg	8.2E+02	1.2E+04	0.078 U	0.082 U	0.073 U	0.078 U	**0.19**	0.083 U	0.073 U	0.08 U
Benzo[a]anthracene	mg/kg	2.9E+00		**0.48**	**0.01**	**0.08**	**0.0034 J**	**0.13**	**0.21**	**0.02 J**	0.0083 U
Benzo[a]pyrene	mg/kg	2.9E-01		**0.43**	**0.01**	**0.08**	**0.0022 J**	**0.14**	**0.19**	**0.018 J**	0.0083 U
Benzo[b]fluoranthene	mg/kg	2.9E+00		**0.90**	**0.02**	**0.20**	**0.0039 J**	**0.30**	**0.26**	**0.049 J**	0.0083 U
Benzo[g,h,i]perylene	mg/kg			**0.20**	**0.0075 J**	**0.043 J**	**0.0021 J**	**0.08**	**0.08**	0.073 U	0.0083 U
Benzo[k]fluoranthene	mg/kg	2.9E+01		**0.30**	**0.0063 J**	**0.16**	**0.0029 J**	**0.09**	**0.10**	**0.039 J**	0.0083 U
bis(2-Ethylhexyl)phthalate	mg/kg	1.6E+02	1.6E+03	0.078 U	0.082 U	**0.19**	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Carbazole	mg/kg			0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Chrysene	mg/kg	2.9E+02		**0.52**	**0.01**	**0.10**	**0.0042 J**	**0.18**	**0.19**	**0.036 J**	0.0083 U
Dibenz[a,h]anthracene	mg/kg	2.9E-01		**0.09**	**0.0021 J**	0.073 U	**0.0011 J**	**0.03**	**0.03**	0.073 U	0.0083 U
Di-n-butylphthalate	mg/kg		8.2E+03	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Di-n-ocytlphthalate	mg/kg		8.2E+02	0.078 U	0.082 U	**0.36**	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Fluoranthene	mg/kg		3.0E+03	**0.68**	**0.02**	**0.12**	**0.0042 J**	**0.23**	**0.44**	**0.033 J**	**0.00057 J**
Fluorene	mg/kg		3.0E+03	0.078 U	**0.0012 J**	0.073 U	0.0078 U	**0.005 J**	**0.01**	0.073 U	0.0083 U
Indeno[1,2,3-c,d]pyrene	mg/kg	2.9E+00		**0.20**	**0.0067 J**	**0.03 J**	**0.0018 J**	**0.08**	**0.09**	0.073 U	0.0083 U
Isophorone	mg/kg	2.4E+03	1.6E+04	0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Naphthalene	mg/kg	1.7E+01	5.9E+01	**0.056 J**	**0.01**	0.073 U	0.0078 U	**0.07**	**0.03**	0.073 U	0.0083 U
N-Nitroso-di-n-propylamine	mg/kg	3.3E-01		0.078 U	0.082 U	0.073 U	0.078 U	0.077 U	0.083 U	0.073 U	0.08 U
Pentachlorophenol	mg/kg	4.0E+00	2.8E+02	0.2 U	0.21 U	**0.047 J**	0.2 U	**0.053 J**	0.21 U	0.18 U	0.2 U
Phenanthrene	mg/kg			**0.16**	**0.01**	**0.069 J**	**0.0011 J**	**0.09**	**0.19**	**0.019 J**	0.0083 U
Phenol	mg/kg		2.5E+04	0.078 U	0.082 U	0.073 U	0.078 U	**0.026 J**	0.083 U	0.073 U	0.08 U
Pyrene	mg/kg		2.3E+03	**0.57**	**0.02**	**0.11**	**0.0038 J**	**0.21**	**0.33**	**0.027 J**	0.0083 U
PCBs											
Aroclor 1262	mg/kg			0.0572 U	N/A	0.0541 U	N/A	0.0643 U	N/A	0.0528 U	N/A
PCBs (total)	mg/kg	9.4E-01		0.0572 U	N/A	0.0541 U	N/A	0.0643 U	N/A	0.0528 U	N/A
TPH/Oil and Grease											
Diesel Range Organics	mg/kg		6.2E+03	**161**	**10.7**	**124**	**4.6 J**	**34.6**	**47.9**	**91.4**	**3.3 J**
Gasoline Range Organics	mg/kg		6.2E+03	12.9 U	10 U	13.2 U	22.7 U	10.7 U	10.5 U	12.7 U	11.6 U
Oil and Grease	mg/kg		6.2E+03	**14,600**	**906**	**12,300**	**517**	**836**	**680**	**11,900**	**296**

Detections in bold
Values in purple indicate an exceedance of the carcinogenic screening level
Values in orange indicate an exceedance of the non-carcinogenic screening level
Values in red indicate an exceedance of both the C/NC screening levels

COPC = Constituent of Potential Concern
C = Carcinogenic Screening Level
NC = Non-Carcinogenic Screening Level
*PAH compounds were analyzed via SIM
[y]The more conservative NC screening level for 3-methylphenol was used

Data Flags:
U: This analyte was not detected in the sample. The numeric value represents the sample quantitation/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
N/A: This parameter was not analyzed for this sample.

Table 2
Summary of Inorganics Detected in Soil
Parcel B22 - Road and Utility Investigation Area
Tradepoint Atlantic
Sparrows Point, Maryland

Parameter	Units	COPC Screening Level (C)	COPC Screening Level (NC)	R1-001-SB-1	R1-001-SB-5	R1-002-SB-1	R1-002-SB-5	R1-003-SB-1	R1-003-SB-5	R1-004-SB-1.5	R1-004-SB-5	R1-005-SB-1.5	R1-005-SB-5
Metal													
Aluminum	mg/kg		1.1E+05	**14,200**	**29,300**	**12,400**	**15,300**	**41,200**	**5,420**	**26,300**	**15,300**	**39,700**	**10,800**
Arsenic	mg/kg	3.0E+00	4.8E+01	**6.80**	**5.80**	**6.40**	**5.70**	**1.8 J**	1.9 U	**8.00**	**3.80**	**2.50**	2.6 U
Barium	mg/kg		2.2E+04	**205**	**86.3**	**99.6**	**116**	**432**	**23.0**	**311**	**45.6**	**462**	**30.8**
Beryllium	mg/kg	7.0E+03	2.3E+02	**1.10**	**0.75 J**	**0.69 J**	**0.63 J**	**7.60**	**0.41 J**	**3.00**	**0.51 J**	**5.50**	**0.32 J**
Cadmium	mg/kg	9.3E+03	9.8E+01	**1.1 J**	1.5 U	**1.2 J**	1.3 U	**0.26 J**	1.2 U	**0.92 J**	1.4 U	**0.29 J**	1.5 U
Chromium	mg/kg			**120**	**31.9**	**41.4**	**24.6**	**24.1**	**6.50**	**110**	**25.4**	**17.6**	**11.2**
Chromium VI	mg/kg	6.3E+00	3.5E+02	**0.49 JB**	**1.2 JB**	**0.56 JB**	**0.9 JB**	**0.5 JB**	**0.75 JB**	**0.35 JB**	**0.79 JB**	**0.42 JB**	**0.37 JB**
Cobalt	mg/kg	1.9E+03	3.5E+01	**7.70**	**3.5 J**	**8.60**	**4.60**	**0.49 J**	**0.95 J**	**18.6**	**3 J**	**0.58 J**	**1.7 J**
Copper	mg/kg		4.7E+03	**48.3**	**7.20**	**32.7**	**5.90**	**1.4 J**	**3.2 J**	**53.8**	**8.20**	4.4 U	**2 J**
Iron	mg/kg		8.2E+04	**27,600**	**16,900**	**24,600**	**15,300**	**13,200**	**4,310**	**84,700**	**22,000**	**40,200**	**7,930**
Lead	mg/kg		8.0E+01	**145**	**18.8**	**123**	**12.3**	**8.00**	**4.40**	**57.3**	**9.70**	**7.90**	**8.50**
Manganese	mg/kg		2.6E+03	**4,380**	**30.0**	**847**	**59.6**	**2,890**	**16.3**	**5,970**	**72.0**	**2,470**	**15.0**
Mercury	mg/kg		4.6E+00	**0.044 J**	**0.034 J**	**0.13**	0.12 U	0.11 U	0.11 U	0.11 U	0.12 U	0.12 U	**0.007 J**
Nickel	mg/kg	6.4E+04	2.2E+03	**26.6**	**11.0**	**16.2**	**14.0**	**4.1 J**	**3 J**	**19.7**	**10.5**	**3 J**	**5.3 J**
Selenium	mg/kg		5.8E+02	3.6 U	4 U	3.8 U	3.4 U	3.1 U	3.1 U	**2.9 J**	3.6 U	**3.60**	4.1 U
Thallium	mg/kg		1.2E+00	**4.3 J**	10 U	9.5 U	8.5 U	7.9 U	7.7 U	**5.5 J**	9.1 U	8.8 U	10.3 U
Vanadium	mg/kg		5.8E+02	**257**	**37.5**	**69.0**	**30.1**	**17.4**	**8.90**	**254**	**34.4**	**23.8**	**15.1**
Zinc	mg/kg		3.5E+04	**381**	**21.8**	**438**	**36.5**	**12.1**	**10.8**	**176**	**25.8**	**9.60**	**14.4**
Other													
Cyanide	mg/kg		1.5E+01	**0.92 J**	1.2 U	**0.25 J**	1.2 U	**0.55 J**	1.2 U	**1.00**	1.1 U	**2.80**	1.2 U

COPC = Constituent of Potential Concern
C = Carcinogenic Screening Level
NC = Non-Carcinogenic Screening Level

Detections in bold
Values in purple indicate an exceedance of the carcinogenic screening level
Values in orange indicate an exceedance of the non-carcinogenic screening level
Values in red indicate an exceedance of both the C/NC screening levels

Data Flags:
U: This analyte was not detected in the sample. The numeric value represents the sample quantitation/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.

Table 2
Summary of Inorganics Detected in Soil
Parcel B22 - Road and Utility Investigation Area
Tradepoint Atlantic
Sparrows Point, Maryland

Parameter	Units	COPC Screening Level (C)	COPC Screening Level (NC)	R1-006-SB-1	R1-006-SB-5	R1-007-SB-1	R1-007-SB-5	R1-008-SB-1.5	R1-008-SB-4.5	R1-009-SB-1	R1-009-SB-4.5	R1-010-SB-1	R1-010-SB-5
Metal													
Aluminum	mg/kg		1.1E+05	**11,300**	**1,280**	**33,900**	**13,500**	**36,700**	**53,300**	**15,400**	**15,900**	**30,100**	**15,500**
Arsenic	mg/kg	3.0E+00	4.8E+01	2.2 U	**8.20**	2.4 U	**5.50**	**2.10**	2.4 U	**2.90**	**9.20**	**3.10**	**8.30**
Barium	mg/kg		2.2E+04	**86.0**	**34.8**	**345**	**65.9**	**504**	**666**	**144**	**180**	**722**	**165**
Beryllium	mg/kg	7.0E+03	2.3E+02	**0.93**	**0.59 J**	**2.40**	**0.68 J**	**3.40**	**3.80**	**1.90**	**0.94 J**	**2.40**	**1.30**
Cadmium	mg/kg	9.3E+03	9.8E+01	**0.42 J**	**0.28 J**	**1.1 J**	**0.15 J**	**0.58 J**	**0.34 J**	**0.48 J**	**2.10**	**0.5 J**	1.5 U
Chromium	mg/kg			**1,420**	**393**	**604**	**50.5**	**35.4**	**21.2**	**225**	**137**	**592**	**29.5**
Chromium VI	mg/kg	6.3E+00	3.5E+02	**8.40**	**1.4 B**	**0.7 JB**	**0.49 JB**	**0.5 JB**	**0.48 JB**	**0.41 JB**	**0.68 JB**	**0.71 JB**	**0.92 JB**
Cobalt	mg/kg	1.9E+03	3.5E+01	4.3 U	**13.6**	**0.9 J**	**4.2 J**	**1.2 J**	**0.48 J**	**5.10**	**9.80**	**4.70**	**5.30**
Copper	mg/kg		4.7E+03	**10.0**	**11.1**	**21.4**	**13.7**	**13.0**	**3.9 J**	**20.3**	**42.1**	**14.0**	**12.2**
Iron	mg/kg		8.2E+04	**169,000**	**36,800**	**83,500**	**37,600**	**14,600**	**16,200**	**51,800**	**31,800**	**56,200**	**36,000**
Lead	mg/kg		8.0E+01	2.2 U	**21.9**	**143**	**17.5**	**29.3**	**8.30**	**23.3**	**98.9**	**18.6**	**11.6**
Manganese	mg/kg		2.6E+03	**28,800**	**852**	**21,400**	**1,510**	**5,980**	**6,950**	**5,040**	**3,610**	**25,300**	**85.2**
Mercury	mg/kg		4.6E+00	0.1 U	**0.034 J**	0.11 U	**0.021 J**	0.1 U	0.11 U	**0.014 J**	**0.043 J**	0.11 U	0.12 U
Nickel	mg/kg	6.4E+04	2.2E+03	**17.8**	**65.0**	**10.8**	**12.5**	**7 J**	**1.3 J**	**15.4**	**24.6**	**10.6**	**13.6**
Selenium	mg/kg		5.8E+02	3.5 U	3.9 U	**3.1 J**	3.3 U	**2.4 J**	**2.5 J**	3.5 U	3.9 U	**3 J**	4 U
Thallium	mg/kg		1.2E+00	**14.7**	9.7 U	**22.6**	8.4 U	**4.1 J**	9.6 U	8.7 U	**8.7 J**	**35.2**	10 U
Vanadium	mg/kg		5.8E+02	**629**	**56.0**	**1,550**	**116**	**150**	**131**	**156**	**696**	**3,110**	**46.2**
Zinc	mg/kg		3.5E+04	**15.7**	**47.7**	**213**	**49.2**	**68.9**	**3.2 J**	**138**	**494**	**57.7**	**41.9**
Other													
Cyanide	mg/kg		1.5E+01	**0.29 J**	**0.19 J**	**1.20**	1.2 U	**0.68 J**	**0.84 J**	**0.26 J**	**0.96 J**	**0.46 J**	1.2 U

COPC = Constituent of Potential Concern
C = Carcinogenic Screening Level
NC = Non-Carcinogenic Screening Level

Detections in bold
Values in purple indicate an exceedance of the carcinogenic screening level
Values in orange indicate an exceedance of the non-carcinogenic screening level
Values in red indicate an exceedance of both the C/NC screening levels

Data Flags:
U: This analyte was not detected in the sample. The numeric value represents the sample quantitation/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.

Table 3 - Parcel B22
Road and Utility Investigation Area EPCs - Pooled Soils

Parameter	Cancer COPC Screening Level (mg/kg)	Non-Cancer COPC Screening Level (mg/kg)	EPC Type Site-Wide Exposure Unit	EPC Site-Wide Exposure Unit (mg/kg)
Arsenic	3.0E+00	4.8E+01	95% KM (t) UCL	5.51
Chromium VI	6.3E+00	3.5E+02	95% Chebyshev (Mean, Sd) UCL	2.76
Cyanide		1.5E+01	95% KM (t) UCL	0.97
Iron		8.2E+04	95% Adjusted Gamma UCL	57,150
Manganese		2.6E+03	95% Adjusted Gamma UCL	12,844
Thallium		1.2E+00	95% KM (Percentile Bootstrap) UCL	11.3
Vanadium		5.8E+02	95% Chebyshev (Mean, Sd) UCL	1,092
Benzo[a]pyrene	2.9E-01		95% GROS Adjusted Gamma UCL	0.31

COPC = Constituent of Potential Concern

Table 4 - Parcel B22
Road and Utility Investigation Area Pooled Soils
Construction Worker Risk Ratios

115 Day		Site-Wide Exposure Unit (19.3 ac.)				
			Construction Worker			
			SSLs (mg/kg)		Risk Ratios	
Parameter	Target Organs	EPC mg/kg	Cancer	Non-Cancer	Risk	HQ
Arsenic	Cardiovasular; Dermal	5.51	32.9	208.8	1.7E-07	0.03
Chromium VI	Respiratory	2.76	46.2	1739	6.0E-08	0.002
Cyanide	None Specified	0.97		32		0.03
Iron	None Specified	57,150		522,916		0.1
Manganese	Nervous	12,844		8,700		1
Thallium	None Specified	11.3		29.9		0.4
Vanadium	Dermal	1,092		3,448		0.3
Benzo(a)pyrene		0.31	5.30		5.8E-08	
					3E-07	↓

SSLs calculated using equations in the EPA Supplemental Guidance dated 2002

Guidance Equation Input Assumptions:

5 cars/day (2 tons/car)
5 trucks/day (20 tons/truck)
3 meter source depth thickness

Total HI	Cardioascular	0
	Dermal	0
	Respiratory	0
	Nervous	1
	None Specified	1

APPENDIX A

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-001-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 40s, partly cloudy
Northing (US ft)	: 568157.044
Easting (US ft)	: 1462655.856

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0						
		-	R1-001-SB-1	(0-0.9') SILT with GRAVEL and ORGANICS, well graded, loose, dark brown, dry, no plasticity, no cohesion	ML/GW	
1				(2-3.5') SILT and CLAY, stiff, yellow-red and gray, dry, low plasticity, low cohesion		
		0.1				
2					ML/CL	
	78	0.0				
3						
		0.0		(3.5-5') CLAY, hard, yellow-red/ light brown, dry, high plasticity, high cohesion		
4					CH	
		0.0	R1-001-SB-5			
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-002-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 40s, sunny
Northing (US ft)	: 567548.661
Easting (US ft)	: 1462644.967

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0						
		0.1	R1-002-SB-1	(0-1') SILT, well graded, soft, dark brown, dry, no plasticity, low cohesion	ML	
1				(1.1-5') SILT/CLAY, soft, reddish yellow/ light brown, dry, low plasticity, low cohesion	ML/CL	
		0.2		(1.5-4') CLAY, soft to medium, light brown/ reddish yellow, dry, high plasticity, high cohesion		
2						
	100	2.9			CH	
3						
		2.1				
4				(4-5') same as above, stiff		
		1.5	R1-002-SB-5		CH	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-003-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567434.131
Easting (US ft)	: 1461819.723

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0						
		1.7	R1-003-SB-1	(0-1.6') SILT with fine grained SAND, well graded, soft, loose, dark brown, moist, no plasticity, no cohesion	SW/ML	
1						
		2.2		(1.6-4.7') CLAY, stiff, light brown to gray, moist, high plasticity, high cohesion		
2						
	96	0.7				
3					CH	
		1.1				
4						
		0.0	R1-003-SB-5			
				(4.7-5') SAND, fine grained, very soft, light gray, moist, no plasticity, no cohesion	SP	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-004-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567438.995
Easting (US ft)	: 1461375.195

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.5') CONCRETE	SW/ML	
		1.9				
			R1-004-SB-1.5	(0.5-1.5') SAND, coarse, with little SILT and GRAVEL, Well Graded, loose, dark brown/ gray, dry, no plasticity, no cohesion	SW	
1						
		1.1		(1.5-3') SLAG, large, loose, gray /brown, moist, no plasticity, no cohesion	GW	
2						
	86	0.6				
3				(3-5') CLAY, stiff, gray to orange, dry, high plasticity, high cohesion		
		0.0				
4					CH	
		0.0	R1-004-SB-5			
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-005-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567392.240
Easting (US ft)	: 1460997.142

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.5') ASPHALT		
		-		(0.5-4.5') SLAG, coarse-grained SAND and GRAVEL, Well Graded, loose, light gray, moist, no plasticity, no cohesion		
1			R1-005-SB-1.5			
		3.3				
2						
	84	23.3			GW	
3						
		11.7				
4						
		5.9	R1-005-SB-5			
				(4.5-5') CLAY with some fine-grained SAND, medium stiffness, dark brown to black, moist, high plasticity, high cohesion	CH	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-006-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567559.500
Easting (US ft)	: 1460728.417

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0						
		-	R1-006-SB-1	(0-4') SAND, well graded, medium grained, with little SILT, loose, dark brown, dry (except 0-0.5' moist), no plasticity, no cohesion		
1						
		0.8				
2					SW	
	84	0.7				
3						
		0.7				
4				(4-4.5') same as above with small gravel	GW/SW	
		1.8	R1-006-SB-5	(4.5-5') SILT with some SAND, poorly graded, trace COAL, black, dry, no plasticity, no cohesion	ML	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-007-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567733.809
Easting (US ft)	: 1460675.323

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.2') SILT and fine grained SAND with ORGANICS, poorly graded, hard, brown, moist, no plasticity, no cohesion	SP/ML	
		0.9	R1-007-SB-1	(0.2-3') SLAG with well graded GRAVEL, loose, brown/ pale white, dry, no plasticity, no cohesion, oxidation throughout		
1						
		1.4			GW	
2						
	98	4.8				
3				(3-4') SLAG, large chunks, well graded, loose, gray to black, dry		
		24.9			GW	
4				(4-4.5') SILT with CLAY, well graded, medium stiffness, brown, moist	CL/ML	
		12.4	R1-007-SB-5	(4.5-5') CLAY with chunks of white CONCRETE, poorly graded, hard, light gray, dry, high plasticity, cohesive	CH	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-008-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 568150.8
Easting (US ft)	: 1460636.056

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.5') ASPHALT		
		-		(0.5-4.5') coarse grained SAND and GRAVEL with large SLAG chunks, well graded, loose, dark brown to gray, moist, no plasticity, no cohesion		
1			R1-008-SB-1.5			
		1.2				
2						
	88	4.0			GW/SW	Oxidation from 2.2-2.9'
3						
		5.9				
4			R1-008-SB-4.5			
		0.6		(4.5-5') SLAG, large chunks, very coarse, well graded, loose, dark brown, no plasticity, no cohesion	GW/SW	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-009-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567956.066
Easting (US ft)	: 1460412.127

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.2') SILT with ORGANICS, well graded, soft, brown, dry, no plasticity, no cohesion	ML	
		2.5	R1-009-SB-1	(0.2-2') SLAG and GRAVEL, well graded, coarse grained, loose, dark brown to black, dry, no plasticity, no cohesion	GW	Metal pieces (0.2-2.0')
1						
		2.1				
2				(2-3.5') SLAG with some GRAVEL, well graded, coarse grained/large chunks, loose, gray to brown, no plasticity, no cohesion	GW	
	90	23.8				
3						
		15.7				
			R1-009-SB-4.5	(3.5-4.5') CLAY, poorly graded, medium consistency, gray to tan, moist, high plasticity, cohesive	CH	
4						
		0.4				
				(4.5-5') SLAG, well graded, very coarse/ chunks, loose, black, wet, no plasticity, no cohesion	GW	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

ARM Group Inc.
Earth Resource Engineers and Consultants

Boring ID: R1-010-SB

(page 1 of 1)

Client	: EnviroAnalytics Group
ARM Project No.	: 160443M-5-6
Project Description	: Sparrows Point - Parcel B22
	: Road and Utility Investigation
Site Location	: Sparrows Point, MD
ARM Representative	: L. Glumac
Checked by	: W. Mader P.G., CPSS
Drilling Company	: Green Services, Inc
Driller	: K.P.
Drilling Equipment	: Geoprobe 7822DT

Date	: 12/5/2016
Weather	: 50s, sunny
Northing (US ft)	: 567578.990
Easting (US ft)	: 1462451.016

Depth (ft.)	% Recovery	PID Reading (PPM)	Sample ID/Interval	DESCRIPTION	USCS	REMARKS
0				(0-0.2') CONCRETE		
		0.1	R1-010-SB-1	(0.2-1') SAND with some GRAVEL, well graded, loose, dark brown, dry, no plasticity, no cohesion	SW	
1		1.1		(1-2') SLAG and GRAVEL, well graded, loose, gray, moist, no plasticity, no cohesion	GW	
2	100	0.8		(2-3.5') CLAY, soft to medium, reddish yellow/ light brown, dry, high plasticity, high cohesion	CH	
3		0.0		(3.5-5') CLAY, stiff, reddish yellow/ light brown, dry, high plasticity, low cohesion		
4		0.0	R1-010-SB-5		CH	
5						

Total Borehole Depth: 5' bgs.
Boring terminated at target depth.

APPENDIX B

Construction Worker Soil Screening Levels
115 Work Day Exposure
Calculation Spreadsheet - Road and Utiltiy Investigation (B22)

Description	Variable	Value
Days worked per week	DW	5
Exposure duration (yr)	ED	1
Hours worked per day	ET	8
A/constant (unitless) - particulate emission factor	Aconst	12.9351
B/constant (unitless) - particulate emission factor	Bconst	5.7383
C/constant (unitless) - particulate emission factor	Cconst	71.7711
Dispersion correction factor (unitless)	FD	0.185
Days per year with at least .01" precipitation	P	130
Target hazard quotient (unitless)	THQ	1
Body weight (kg)	BW	80
Averaging time - noncancer (yr)	ATnc	1
Soil ingestion rate (mg/d)	IR	330
Skin-soil adherence factor (mg/cm2)	AF	0.3
Skin surface exposed (cm2)	SA	3300
Event frequency (ev/day)	EV	1
Target cancer risk (unitless)	TR	01E-06
Averaging time - cancer (yr)	ATc	70
A/constant (unitless) - volatilization	Aconstv	2.4538
B/constant (unitless) - volatilization	Bconstv	17.566
C/constant (unitless) - volatilization	Cconstv	189.0426
Dry soil bulk density (kg/L)	Pb	1.5
Average source depth (m)	ds	3
Soil particle density (g/cm3)	Ps	2.65
Total soil porosity	Lpore/Lsoil	0.43
Air-filled soil porosity	Lair/Lsoil	0.28

Construction Worker Soil Screening Levels
115 Work Day Exposure
Calculation Spreadsheet - Road and Utiltiy Investigation (B22)

Area of site (ac)	Ac	19.3
Overall duration of construction (wk/yr)	EW	23
Exposure frequency (day/yr)	EF	**115**
Cars per day	Ca	5
Tons per car	CaT	2
Trucks per day	Tru	5
Tons per truck	TrT	20
Mean vehicle weight (tons)	w	**11**
Derivation of dispersion factor - particulate emission factor (g/m2-s per kg/m3)	Q/Csr	**14.4**
Overall duration of construction (hr)	tc	**3,864**
Overall duration of traffic (s)	Tt	**3,312,000**
Surface area (m2)	AR	**78,104**
Length (km)	LR	**279**
Distance traveled (km)	ΣVKT	**321**
Particulate emission factor (m3/kg)	PEFsc	**104,105,718**
Derivation of dispersion factor - volatilization (g/m2-s per kg/m3)	Q/Csa	**7.58**
Total time of construction (s)	Tcv	**13,910,400**

Input
Calculation

Chemical	^Ingestion SF $(mg/kg\text{-}day)^{-1}$	^Inhalation Unit Risk $(ug/m^3)^{-1}$	^Subchronic RfD (mg/kg-day)	^Subchronic RfC (mg/m^3)	^GIABS	Dermally Adjusted RfD (mg/kg-day)	^ABS	^RBA	*Dia	*Diw	*Henry's Law Constant $(atm\text{-}m^3/mol)$	*Kd	*Koc	DA	Volatilization Factor - Unlimited Reservoir (m^3/kg)	Carcinogenic Ingestion/ Dermal SL (SLing/der)	Carcinogenic Inhalation SL (SLinh)	Carcinogenic SL (mg/kg)	Non-Carcinogenic Ingestion/ Dermal SL (SLing/der)	Non-Carcinogenic Inhalation SL (SLinh)	Non-Carcinogenic SL (mg/kg)
Arsenic, Inorganic	1.50E+00	4.30E-03	3.00E-04	1.50E-05	1	3.00E-04	0.03	0.6			-	2.90E+01				32.9	16,137	32.9	212	14,869	208.8
Chromium(VI)	5.00E-01	8.40E-02	5.00E-03	3.00E-04	0.025	1.25E-04	**0.01**	1			-	1.90E+01				49.0	826	46.2	1,749	297,380	1,738
Cyanide (CN-)	-	-	2.00E-02	8.00E-04	1	2.00E-02	**0.01**	1	2.10E-01	2.50E-05	4.15E-03	9.90E+00		4.68E-06	4.18E+3				14,940	32	31.7
Iron	-	-	7.00E-01	-	1	7.00E-01	**0.01**	1			-	2.50E+01							522,916		522,916
Manganese (Non-diet)	-	-	2.40E-02	5.00E-05	0.04	9.60E-04	**0.01**	1			-	6.50E+01							10,552	49,563	8,700
Thallium (Soluble Salts)	-	-	4.00E-05	-	1	4.00E-05	**0.01**	1			-	7.10E+01							30		29.9
Vanadium and Compounds	-	-	1.00E-02	1.00E-04	0.026	2.60E-04	**0.01**	1			-	1.00E+03							3,572	99,127	3,448
Benzo[a]pyrene	7.30E+00	1.10E-03	-	-	1		0.13	1	4.80E-02	5.60E-06	1.87E-05	3.54E+03	5.90E+05	2.37E-11	1.86E+6	5.3	1,105	5.3			

*chemical specific parameters found in Chemical Specific Parameters Spreadsheet at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016
^chemical specific parameters found in Unpaved Road Traffic calculator at https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

APPENDIX C

Utility Excavation NAPL Contingency Plan

Revision 0 – January 10, 2017

Introduction:

Proposed underground utilities and excavations necessary for the redevelopment of the Tradepoint Atlantic property may encounter areas of petroleum (TPH) and/or Oil & Grease contamination in soil. The assessment of TPH-DRO/GRO and Oil & Grease completed as part of each Phase II Investigation includes the following:

- TPH-DRO/GRO and Oil & Grease data are assessed with their respective location to subsurface utilities, stormwater conveyances and surface waters.
- Each soil boring with evidence of non-aqueous phase liquid (NAPL) in the soil cores, whether located near utilities or not, is investigated via the installation of a piezometer to assess mobility to groundwater.
- Locations that exhibit elevated detections of TPH/Oil & Grease or evidence of NAPL, that are within reasonable proximity (i.e. 25 feet) to subsurface utilities or stormwater conveyances and within reasonable proximity (i.e. 100 feet) to surface waters, will be identified for further delineation.

Any NAPL identified in soil borings or piezometers during the Phase II Investigation would be noted on relevant logs and identified in Response and Development Work Plans for construction planning purposes. Despite these planning efforts, unidentified pockets of contamination (including NAPL) may still be encountered during construction. This contingency plan provides the procedures to be utilized during construction work to properly address response and construction techniques if any materials impacted with NAPL are encountered.

Objectives:

The purpose of this plan is to describe procedures to be followed in the event that NAPL is encountered in utility trenches or other excavations during development of the Tradepoint Atlantic property. The specific objectives of this plan and the procedures outlined herein are:

1. To ensure identification and proper management of Oil & Grease and petroleum-contaminated soils.
2. To ensure proper worker protection for working in areas of Oil & Grease and petroleum contamination.
3. To ensure that the installation of new utilities does not create new preferential flow paths for the migration of free-phase hydrocarbons (Oil & Grease, TPH-DRO/GRO, etc.) or soil vapors.

Identification of Oil & Grease and Petroleum Contaminated Soil:

An Environmental Professional (EP) will be on-site to determine if soils show evidence of the presence of Oil & Grease or TPH present as NAPL. Oil & Grease or petroleum-contaminated soil can be identified by the presence of free oil, oil staining, a petroleum odor, or any combination of these conditions. Free oil (NAPL) is liquid oil which could potentially be drained or otherwise extracted from the soil. The appearance of oil staining is not always consistent, but varies depending on the nature of the oil, the soil type, and the age of the release. Staining associated with old petroleum contamination often has a greenish hue, but may also be brown or black. The olfactory sense is the most sensitive instrument for identifying petroleum contamination in the field. Therefore, a petroleum odor may be noted although there is no visible sign of oil or staining. In some instances, decaying organic matter can produce an odor similar to petroleum, but this is rare.

If NAPL is encountered in the utility trench, the extent of impacts shall be delineated by excavating trenches or installing borings perpendicular to the utility alignment to examine the soil for physical evidence of NAPL. Perpendicular transects will be investigated every 50 feet along through the section of the utility alignment where there is physical evidence of NAPL in the trench. Each transect will extend to a distance of 10 feet from the centerline of the utility.

Soil samples will be collected from the perpendicular borings or trenches to test for extractable Oil & Grease or petroleum-contaminated soil using the Oil Sticks™ test kit. This test kit provides a determination of whether hydrocarbons are present in soil and extractable (i.e. could mobilize as a NAPL). Oil Sticks™ change from a pale blue to a deep blue color when they come in contact with free product. This instantaneous change in color occurs even when miniscule amounts of product come in contact with the strip. The sensitivity of Oil Sticks™ is estimated to be about 1,000 to 2,000 mg/kg (for a presence/absence test) for soil testing. The field test is performed by placing approximately 3 tablespoons of soil in a clean sample cup and adding enough water to cover the sample. After stirring the sample and waiting ~1 minute, the Oil Sticks™ test strip should be swished through the water, making sure to tough the strip to the sides of the cup where product may collect at the interface (meniscus) between the cup, water, and air. If the strip turns deep blue, or deep blue spots appear, oil or hydrocarbon is present.

If extractable hydrocarbons are identified in Site soils, disposal requirements will be determined using the quantitative PetroFLAG™ hydrocarbon analysis system (see following section). The PetroFLAG™ hydrocarbon analysis system is a broad spectrum field test kit suitable for TPH contamination regardless of the source or state of degradation (Dexsil Corporation). PetroFLAG™ field test kits do not distinguish between aromatic and aliphatic hydrocarbons, but quantify all fuels, oils, and greases as TPH. Dilutions can be used to determine concentrations of TPH/Oil & Grease above the normal calibration range. Dexsil notes that positive results for TPH may occur if naturally occurring waxes and oils, such as vegetable oils, are present in the sample. Additional detail regarding the procedure for the PetroFLAG™ kit is given in **Attachment 1**.

Soil Excavation, Staging, Sampling and Disposal:

The EP will monitor all utility trenching activities for signs of potential contamination. In particular, soils will be monitored with a hand-held photoionization detector (PID) for potential VOCs, and will also be visually inspected for the presence of staining, petroleum waste materials, or other indications of contamination that may be different than what was already characterized. Excavated material that is visibly stained or that exhibits a sustained PID reading of greater than 10 ppm will be segregated and containerized or placed in a stockpile on polyethylene or impervious surface until the material can be analyzed for TPH/Oil & Grease using the PetroFLAG™ kit to characterize the material for appropriate disposal. If excavated and stockpiled, such materials will be covered with a plastic tarp so that the entire stockpile is encapsulated, and anchored to prevent the elements from affecting the integrity of the containment. The MDE will be notified if such materials are encountered during utility work.

Soil exhibiting physical evidence of NAPL contamination or elevated TPH/Oil & Grease locations with detections in the low percentage range will be excavated and segregated for disposal at the on-site nonhazardous landfill (Greys Landfill). The extent of the excavation will be determined in the field following screening with the Oil Sticks™ test kit, but disposal requirements will be determined via analysis with the PetroFLAG™ test kit (because the Oil Sticks™ method is not quantitative). Any recovered NAPL will be collected for off-site disposal. As required by the appropriate and MDE approved facility, samples impacted by NAPL will be collected for profiling/waste characterization and submitted to a fixed laboratory for the following analyses: metals, VOCs, TPH-DRO/GRO, and any additional analysis required by the selected disposal facility. Upon receipt of any additional characterization analytical results, the MDE Voluntary Cleanup Program (VCP) will be notified of the proposed disposal facility. Non-impacted material without evidence of NAPL (i.e. soils that may contain measureable concentrations of TPH/Oil & Grease but below percentage levels) may be placed on the Site in areas to be paved or capped.

Reporting:

If evidence of NAPL in soil or groundwater is encountered during excavation, it will be reported to the MDE (VCP Project Manager) within two hours. Information regarding the location and characteristics of any NAPL contaminated soil will be documented as follows:

- location (exact stationing)
- extent of contamination (horizontally and vertically – prepare a sketch including dimensions)
- relative degree of contamination (i.e. free oil with strong odor vs. slight staining)
- visual documentation (take photographs and complete a photograph log)

Utility Installations in Impacted Areas:

Underground piping or conduits installed through areas of Oil & Grease or petroleum contamination shall be leak proof and water tight. All joints will be adequately sealed or gasketed, and pipes or conduits will be properly bedded and placed to prevent leakage. All trench backfill will meet the MDE definition of Clean Fill. Pipe bedding will be installed to minimize the potential for accumulation of water and concentrated infiltration. This can be achieved by using a relatively small amount of low-permeability pipe bedding; open-graded stone will be avoided or only used in thicknesses of 6 inches or less. Bedding must be properly placed and compacted below the haunches of the pipe. Clay, flowable fill, or concrete plugs will be placed every 100 feet across any open-graded pipe bedding to minimize the preferential flow and concentration of water along the bedding of such utilities.

If required, each trench plug will be constructed with a 2-foot-thick clay plug or 1-foot-thick flowable fill or concrete plug, perpendicular to the pipe, which extends at least 1 foot in all directions beyond the permeable pipe bedding. The plug acts as an anti-seep collar, although it doesn't necessarily need to extend above the top of the pipe or even above the spring line of the pipe depending on observed conditions. Installation of each trench plug will follow the completion of the trench excavation, installation of granular pipe bedding (because dense-graded aggregate or soil or other pipe bedding is difficult to properly compact below the haunches of the pipe), and seating of the pipe. The trench plug will then be installed by digging out a 1-foot trench below and around the pipe corridor, and placing clay or flowable fill to construct the plug. A specification drawing for installation of the trench plug has been provided as **Figure 1**.

Attachment 1 - PetroFLAG™ Procedure

PetroFLAG™ field test kits use a proprietary turbidimetric reaction to determine the TPH concentration of solvent extracted samples (USEPA). Calibration standards provided with the unit are used to perform a two-point calibration for the PetroFLAG™. A blank and a 1,000 ppm standard are run by the analyzer unit to create an internal calibration curve.

Analysis of a soil sample is performed using three simple steps: extraction, filtration, and analysis. The PetroFLAG™ analysis is performed as follows:

- Place a 10 gram soil sample in a test tube.
- Add extraction solvent to the tube.
- Shake the tube intermittently for four minutes.
- Filter the extract into a vial that contains development solution
- Allow the solution to react for 10 minutes.

The filtration step is important because the PetroFLAG™ analyzer measures the turbidity or "optical density" of the final solution. Approximately 25 samples can be analyzed per hour. The vial of developed solution is placed in the meter, and the instrument produces a quantitative reading that reveals the concentration of hydrocarbons in the soil sample. The PetroFLAG™ method quantifies all fuels, oils, and greases as TPH between 15 and 2000 ppm (Dexsil Corporation). A 10x dilution of the filtered extraction solvent will be completed to allow for quantification of soil concentrations in excess of 10,000 ppm. The specially designed PetroFLAG™ analyzer allows the user to select, in the field, the response factor that is appropriate for the suspected contaminant at each site. Vegetable-based oils have been shown to exhibit a response factor of 18% (EPA Method 9074). Using the selected response factor, the analyzer compensates for the relative response of each analyte and displays the correct concentration in parts per million (ppm).

References:

U.S. Environmental Protection Agency (EPA). Contaminated Site Clean-up Information (Clu-IN): Test Kits. Office of Superfund Remediation and Technology Innovation. http://www.clu-in.net/characterization/technologies/color.cfm

Dexsil Corporation. 2016. PetroFLAG Analyzer System (PF-MTR-01). http://www.dexsil.com/products/detail.php?product_id=23

EPA SW-846 Method Number 9074 - Turbidimetric Screening Procedure for Total Recoverable Hydrocarbons in Soil

GENERAL NOTES:

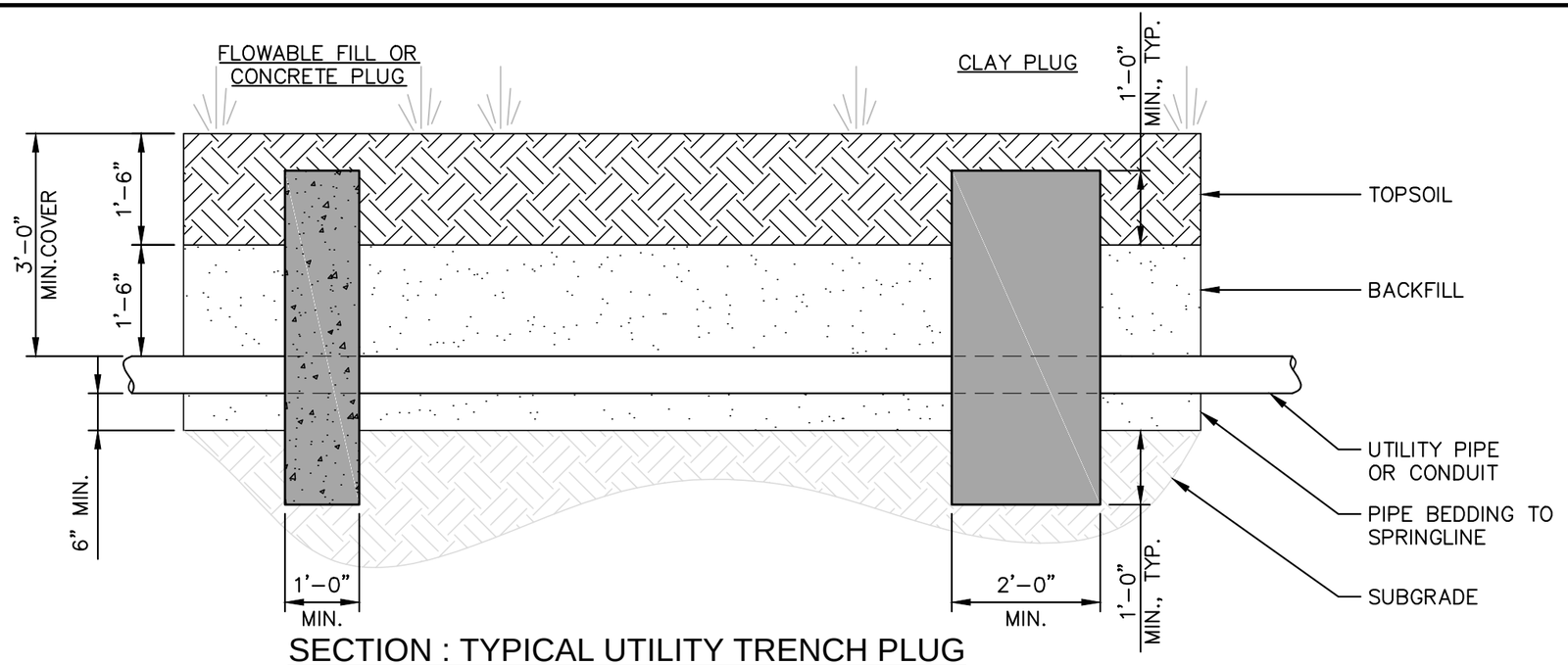
1. ALL PIPES OR CONDUIT PASSING THROUGH AREAS OF PETROLEUM CONTAMINATION SHALL BE LEAK–PROOF AND WATERTIGHT. ALL JOINTS SHALL BE SEALED OR GASKETED.

2. ALL PIPES SHALL BE PROPERLY PLACED AND BEDDED TO PREVENT MISALIGNMENT OR LEAKAGE. PIPE BEDDING SHALL BE INSTALLED IN SUCH A MANNER AS TO MINIMIZE THE POTENTIAL FOR ACCUMULATION OF WATER AND CONCENTRATED INFILTRATION.

3. ALL TRENCH BACKFILL SHALL MEET THE MDE DEFINITION OF CLEAN FILL.

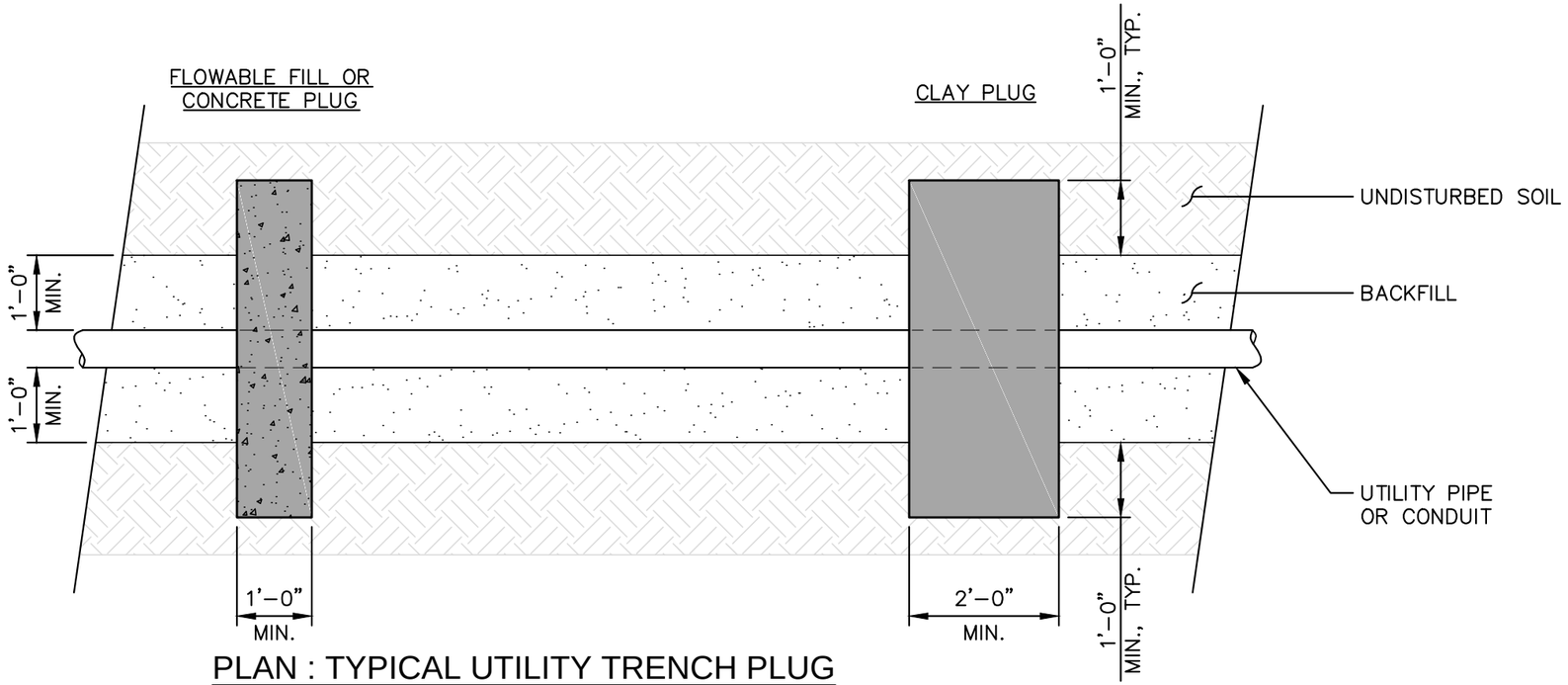
4. TRENCH PLUGS PLUG SHALL EXTEND A MINIMUM OF ONE (1) FOOT BEYOND PERMEABLE BEDDING OR BACKFILL IN ALL DIRECTIONS.

5. ANTI–SEEP COLLARS FROM THE PIPE MANUFACTURER, THAT ARE PRODUCED SPECIFICALLY FOR THE PURPOSE OF PREVENTING SEEPAGE AROUND THE PIPE, ARE ACCEPTABLE IF INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, AND ONLY WITH PRIOR APPROVAL BY EAG.



SECTION : TYPICAL UTILITY TRENCH PLUG

SCALE: 1/2" = 1'–0"



PLAN : TYPICAL UTILITY TRENCH PLUG

SCALE: 1/2" = 1'–0"

ARM Group Inc.
Earth Resource Engineers and Consultants
www.armgroup.net

UTILITY TRENCH PLUG
Sparrows Point Site
EnvirAnalytics Group, LLC

January 2017
NONE
160443M

Figure 1