Phase II Investigation
Work Plan

Area B Groundwater Investigation
Sparrows Point Terminal, LLC
Sparrows Point, Maryland

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ARM Project 150300M

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1.0 INTRODUCTION

1.1 Introduction

ARM Group Inc. (ARM), on behalf of EnviroAnalytics Group (EAG), has prepared the following Work Plan to complete a comprehensive Groundwater Investigation on a central portion of the Sparrows Point Terminal, LLC property as shown in **Figure 1**. The portion to be investigated is comprised of approximately 1,140 acres of the approximately 3,100-acre former plant property located within the area of the property designated as Area B (the Site). The boundaries of Area A and B are shown in **Figure 1.**

The objectives of this investigation are to:

1. Determine the presence or absence of impacts to groundwater in the central portion of Area B,
2. Identify potential continuing sources of groundwater contamination, and
3. Characterize the quality of groundwater at the perimeter of the Site that potentially is discharging to surface water.

Investigation of the Site groundwater will be performed in compliance with requirements pursuant to the following:

- Administrative Consent Order (ACO) between 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 Sparrows Point Terminal, LLC and the United States Environmental Protection Agency (effective November 25, 2014).

The entire property was accepted into the Maryland Department of the Environment's (MDE's) Voluntary Cleanup Program (VCP) on September 11, 2014. The Site's current and anticipated future use is Tier 3 (Industrial), and plans for the Site include demolition and redevelopment over the next several years.

The Site is part of the acreage that was removed (Carveout Area) from inclusion in the Multimedia Consent Decree (Civil Action JFM-97-558) between Bethlehem Steel Corporation, the United States Environmental Protection Agency (EPA), and the Maryland Department of the Environment (MDE) effective October 8, 1997 (Consent Decree) as documented in correspondence received from EPA on September 12, 2014. Based on this agreement, EPA has determined that no further investigation or corrective measures will be required under the terms

of the Consent Decree for the Carveout Area. However, the SA reflects that the property within the Carveout Area will remain subject to the EPA's RCRA Corrective Action authorities.

1.2 Site Background

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 steelmaking operations at the Facility ceased in fall 2012.

The Site was formerly occupied by iron and steel processes generally identified in the Description of Current Conditions Report (Rust 1998) as the Open Hearth Furnace Area, Primary Rolling Mills Area, and Blast Furnace Area. Other former operations include a power generation building and associated oil storage facilities, a vehicle maintenance area and areas occupied by a former employee town. By 2013, most buildings in these areas had been demolished with concrete slabs, if present, remaining on grade.

1.3 Previous Investigations

A number of groundwater investigations have been completed as part of a Site-Wide Investigation (SWI) program required by the Consent Decree. Major submittals completed to date as part of the SWI include:

- Description of Current Conditions (Rust 1998)
- Site-Wide Investigation Work Plan- Groundwater Study (CH2M Hill 2000)
- Site-Wide Investigation Groundwater Study Report (SWI), July 2001 (CH2M Hill 2001)
- Site-Wide Investigation Release Site Characterization Study (RCS), June 2002 (CH2M Hill 2002)
- Site-Wide Investigation: Report of Nature & Extent of Releases to Groundwater from the Special Study Areas (SSAs) (URS 2005), revised 2007.

While Area B was not the primary focus of some of these investigations, data on groundwater conditions within Area B was gathered that is helpful in the scoping of this proposed groundwater investigation.

Table 1 shows well construction details for the existing wells. Some of the piezometers around Area B were installed as part of the investigations of adjacent SSAs. Piezometer names beginning with “TM” are in the Tin Mill Area. Piezometer names beginning with “FM” are in

the Finishing Mill Area. A number of the existing piezometers are labels "SW" for Site-Wide. These were installed as part of the Site-Wide Investigation Groundwater Study completed in 2001. A few of the existing piezometers are labeled "TS", indicating that they were installed for a tidal study effort completed as part of the Site-Wide Investigation Groundwater Study. One of the existing piezometers (SG07-PZM007) is labeled "SG"; which indicates that it was installed as part of a surface water-groundwater study. This piezometer was also used in the Site-Wide Investigation Groundwater Study Report (SWI) (CH2M-Hill, 2001).

Available boring and well construction logs for the existing site-wide wells being used for this investigation are included as **Appendix A**.

The results from previous investigations have provided an indication of the constituents that might be expected in the study area wells. The existing wells located within the study area for which past sample data are available include FM01-PZM003, FM01-PZM041, FM05-PZM004, FM05PZM024, TM05-PZM005, TM05-PZM040, TM05-PZM069, SW10-PZM012, SW13-PZM003, SW13-PZM025, SW13-PZM111, SW13-PZM025, SW14-PZM004 and SW14-PZM099. **Table 2** provides available data on general water chemistry, inorganics, and metals identified in the groundwater samples collected from the existing wells. Some wells were analyzed for TCL volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs); which have been provided on **Table 3**. Historic concentrations that exceed the Project Action Limits (PALs) provided in the Quality Assurance Project Plan (QAPP) Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits have been highlighted in yellow in **Table 2** and **Table 3**. As indicated on **Table 2**, no metals or inorganics were found consistently above the PALs; however, iron was detected at levels above the PALs in several of the intermediate zone wells. Isolated exceedances of the PALs were observed for arsenic, lead, thallium, and vanadium. **Table 3** indicates that no detections of organic constituents were identified in the site-wide (SW) wells, but some isolated detections of generally low levels of organic constituents were present in the existing wells in the Tin Mill (TM) and Finishing Mill (FM) areas.

1.4 Conceptual Site Model

1.4.1 Topography/Surface Drainage

The Sparrows Point property is located on a peninsula bounded to the east by Old Road Bay and Jones Creek; to the south by the Patapsco River; and to the west by Bear Creek.

The current ground surface is relatively flat. All major topographic features, such as buildings, landfills, and material stockpiles, are manmade. Throughout most of the peninsula, the elevation of the ground surface is between 10 and 20 feet above mean sea level (amsl) (USGS, 1969). The

average elevation is about 15 feet amsl. Several manmade landforms (raw and byproduct material stockpiles) exceed 20 feet amsl in elevation, but in general are maintained in maximum pile heights of approximately 40 to 75 feet.

Land reclamation and fill placement have occurred at the Sparrows Point property since the early 1900s. In general, fill placement occurred in three modes: (1) stream channels and estuaries that originally extended into the Sparrows Point peninsula were filled; (2) the entire southern shoreline of the peninsula was expanded southward into the Patapsco River; and (3) fill was placed throughout the property to level grades. The extent of fill placement is shown on **Figure 2** (Approximate Shoreline in 1916). The fill deposits are thickest (up to 40 feet) in the historic stream channels and estuaries, particularly Humphreys Creek, Greys Creek, Jones Creek, and Old Road Bay.

Fill deposits primarily related to land reclamation associated with the expansion and development of the Sparrows Point property occurred roughly from the early 1900s till the 1970s. No land reclamation activities have occurred since. The fill deposits consist primarily of iron- and steel-making slag that was placed as both "hot-poured" and "cold-poured" materials. Fill within the Site consists of surficial layers of slag that have been placed as grade-leveling material.

Surface water runoff is diverted and collected by a network of culverts, underground pipes, and drainage ditches, and discharged through the permitted storm water outfalls shown on **Figure 1**. Storm water from the majority of the study area (Parcels B2, B3, B7, B10 and most of B5) is directed east and then discharged to Jones Creek and Old Road Bay via permitted Outfalls 001, 017, and 068. The small portion of Parcel B5 that is immediately adjacent to the Turning Basin is directed south to permitted Outfalls 055 and 056; which discharge to the Turning Basin. Storm water from Parcel B4 and the southern portion of Parcel B1 is directed to the west, and discharged to the Patapsco River via Outfalls 012 and 013. The northern portion of Parcel B1 is directed north to the Tin Mill Canal and Humphreys Creek Wastewater Treatment Plant (shown on **Figure 1)** and is discharged to Bear Creek through Outfall 014. The storm water discharges are covered under existing National Pollutant Discharge Elimination System (NPDES) discharge permits MD 0001201 & MD0068462. A detailed discussion of the existing NPDES discharge locations is presented in the June 2002, RCS report.

1.4.2 Site Hydrogeology

Three near-surface hydrogeologic, or groundwater, zones were identified from previous site investigations. According to the Site-Wide Investigation Report of Nature & Extent of Releases to Groundwater from the Special Study Areas (SSAs) (URS 2005), revised 2007, these zones were designated shallow, intermediate, and lower. The shallow hydrogeologic zone includes the

unconfined water table at the site. Piezometers designated as “shallow” piezometers are typically screened in the fill material or unconsolidated materials comprised of recently deposited sediments. The shallow piezometer bottom-of-screen elevations generally range from +5 to -20 feet amsl. The “intermediate” hydrogeologic zone includes the unconfined to partially confined groundwater in the Pleistocene Upper Talbot unit. The “intermediate” piezometer bottom-of-screen elevations generally range from -20 to -50 feet amsl. The “lower” hydrogeologic zone includes the confined groundwater in the Lower Talbot or Upper Patapsco Sand unit. The “lower” piezometer bottom-of-screen elevations generally range from -50 to -141 feet amsl. The hydrogeologic boundary elevations vary by several feet across the Sparrows Point facility. Hydrogeologic zones at greater depth are known to exist based on a review of the regional geology; however, these deeper units are isolated from these upper three units and impacts have not been identified from former iron and steel operations.

1.4.2.1 Shallow Hydrogeologic Zone

The shallow water table below the Site occurs within recent sedimentary deposits or slag fill material. In some areas of the Site, the slag fill is directly underlain by and connected to the coarser grained beds or lenses within the Talbot Formation that comprise the Upper Talbot Channel Unit. In these areas, the slag fill and Upper Talbot Channel Units form a single groundwater flow system. In much of the investigation area, the slag fill material is underlain by finer-grained silts and clays that comprise the Talbot Clay Aquitard. In these areas, shallow groundwater flow may be separated from groundwater in any underlying coarse-grained beds or lenses. The piezometers designated as shallow piezometers are screened within this shallow, unconfined unit.

As shown in **Figure 4**, a radial flow pattern has been observed in the shallow hydrogeologic zone within the Area B groundwater investigation area. Shallow groundwater appears to flow from a mound located in the central portion of the Site northwestward towards Tin Mill Canal, westward toward Bear Creek/Patapsco River, eastward toward Jones Creek and Old Road Bay and southward toward the Patapsco River. The water table slope decreases sharply as it encounters the original shoreline of Sparrows Point. Within the Site area, the Pennwood Intake/Discharge Canal (shown on **Figure 1)** receives groundwater discharge and provides near-shore recharge to the shallow subsurface based on the water-level data assessment for station group SG07. The locations of discharge and recharge vary along the canal, with recharge occurring toward the eastern part of the station, and discharge occurring to the west. The water level in the canal is typically higher than in the proximal piezometer (SG07-PPM08), indicating flow from the canal into the groundwater system in this area. However, the water level in the canal is always lower than the groundwater levels in both the distal piezometer and in piezometer SG07-PZM007 further to the west, indicating groundwater flow toward the canal. This suggests

the overall groundwater flow is toward the canal despite localized areas where canal recharges the shallow subsurface.

- ***Hydraulic Conductivity***

Four piezometers were tested to determine hydraulic conductivity in the shallow zone. These tests included a single test on piezometer SW05-PZM004 (CH2M Hill, 2002a) and rising and falling head slug tests on piezometers CO27-PZM012, CO32-PZM041, and SW71- PZM007 (by URS in 2004). The results were highly variable and ranged over three orders of magnitude (4.1×10^{-5} to 1.7×10^{-2} cm/sec). This range is consistent with what would be anticipated from the uncontrolled placement of fill material. A geometric mean of 5.9×10^{-4} was calculated from the slug test results; however, this value should be used with caution in any calculations since the hydraulic conductivity is highly variable in this material.

- ***Tidal Influence***

Data from the tidal study component of the Site-Wide Groundwater Study Report (SWI) (CH2M Hill, 2001) was evaluated to determine the extent and magnitude of tidal influence within the Site area. Ten tidal monitoring stations were installed at the facility. Each station consisted of a pair of shallow piezometers, one near shore (proximal) and one further inland (distal), and a surface-water monitoring point in the estuary. The distances between the piezometers and the shoreline ranged from 25 feet to 175 feet for the proximal piezometers and 120 feet to 285 feet for the distal piezometers. Water-level variations at all three points were measured and recorded at 10-minute intervals using In-Situ, Inc. Trolls® (integrated pressure transducers and data loggers) over a full lunar cycle of approximately 30 days.

Two of the stations, TS09 and TS10, were located along Old Road Bay in the eastern portion of the Site area (**Figure 4**). The SWI noted that the influence of the tides on the shallow zone from these stations was either delayed or not present, depending on the piezometer being observed. The average tidal fluctuation observed at the surface monitoring points was 1.64 feet at station TS09 and 0.96 feet at TS10. The corresponding average tidal fluctuation at the inland piezometers was 0.05 feet at a distance of 165 feet inland from the shoreline at TS09 and 0.06 feet at a distance of 255 feet inland at TS10. Since the water levels in the shallow zone occur at elevations of 4 to 8 feet above mean sea level, and the water table slope increases sharply near the shorelines, tidal influence in this zone is not expected to extend significantly inward in the investigation area. The SWI estimated the inland extent of tidal influence greater than 0.01 feet at stations TS09 and TS10 to be 220 feet and 320 feet, respectively. Therefore, the tidal influence would only affect monitoring wells placed within about 300 feet of the shoreline within the groundwater study area, and no significant effect would be expected in the inland areas.

1.4.2.2 Intermediate Hydrogeologic Zone

Intermediate groundwater flow is generally consistent with flow patterns observed in the overlying shallow unit, indicating that the shallow and intermediate zones are hydraulically connected. There is a mound in the intermediate zone observed in the south-central portion of the Sparrows Point Peninsula. Groundwater flows radially from this mounded area to the surrounding water bodies. The presence of clay and silt layers within the intermediate hydrogeologic zone likely retard the vertical recharge of groundwater from the upper fill material.

- ***Hydraulic Conductivity***

The hydraulic conductivity of the intermediate hydrogeologic zone was evaluated at five piezometers. These piezometers include SW17-PZM025, SW05-039, SW20-PZM041 and SW13-PZM025, where a single slug test was conducted (CH2M Hill, 2001b), and CO27-PZM046 and SW17-PZM038, where a rising and falling slug test were conducted at each piezometer. The results ranged over three orders of magnitude (5×10^{-6} to 7.6×10^{-3} cm/sec). A geometric mean of 4.7×10^{-4} was calculated from the slug test results.

- ***Tidal Influence***

The influence of the tides on the intermediate zone was relatively instantaneous with high and low tides producing corresponding high and low groundwater levels with approximately ¼ the amplitude of the tidal fluctuations. This pattern indicates the intermediate zone is partially confined and is hydraulically connected to, or outcrops within, the surface water of the Chesapeake Bay area.

1.4.2.3 Lower Hydrogeologic Zone

The groundwater flow in the lower hydrogeologic zone is primarily to the southwest with little hydraulic influence from the shallow or intermediate zones. The vertical gradient is downward over much of Sparrows Point; however, the vertical gradient is near zero or slightly upward in the southeast portion of the peninsula and along Tin Mill Canal under current flow conditions.

- ***Hydraulic Conductivity***

The hydraulic conductivity of the lower hydrogeologic zone was evaluated by conducting rising and falling head slug tests at nine piezometers by URS in December 2003. The results were variable and ranged over two orders of magnitude (3.6×10^{-5} to 6.1×10^{-3} cm/sec). A geometric mean of 1.0×10^{-3} cm/sec was calculated from the slug test results. The hydraulic conductivity

values calculated for this zone are typical of silty sand to fine sand. Of the three hydrogeologic zones evaluated through slug testing, the lower zone was the most uniform.

- ***Tidal Influence***

The influence of the tides on the lower zone was similar to that observed in the intermediate zone. This pattern indicates the lower zone is partially confined and is hydraulically connected to, or outcrops within, surface water of the Chesapeake Bay area.

1.5 Potential Source Identification

Several areas in and around the buildings and facilities within the Site boundaries may have been historical sources of groundwater contamination. These areas were identified as potential sources of groundwater contamination through a review of historical documents. The first potential sources to be identified were Recognized Environmental Conditions (RECs) located within the Site boundaries, as shown on the REC Location Map provided in the Phase I Environmental Site Assessment (ESA) prepared by Weaver Boos Consultants dated May 19, 2014. Following the identification and evaluation of all RECs at the Site, Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) were identified from the DCC report.

Four (4) sets of historical site drawings were reviewed to identify additional potential sources of groundwater contamination following the identification of all SWMUs and AOCs. 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. **Table 4** provides a list of the available historical drawings for the Site, the original date of the drawing, and the date of the most recent revision of each drawing.

1.6 Monitoring System Design

The objectives of this investigation are to:

1. Assess the presence or absence of impacts to groundwater in the central portion of Area B,
2. Identify potential continuing sources of groundwater contamination, and
3. Characterize the quality of groundwater at the perimeter of the Site that potentially is discharging to surface water.

To satisfy these objectives, groundwater monitoring will be completed to recover samples from the shallow hydrogeologic zone in wells within the interior of the study area located close to

targets, or clusters of targets, (near-field wells), and from perimeter wells in both the shallow and the intermediate zones. Further assessment will be completed based on the results of this investigation to determine if additional sampling of the intermediate or lower zones is required based on the results and characteristics of the groundwater quality.

A biased approach was developed and utilized to locate groundwater monitoring wells within the Site. The goal of this approach is to place wells in locations that intersect the estimated plume areas from potential sources of groundwater contamination. Estimated plume areas for potential sources were delineated hydrogeologically downgradient of their locations using the historical groundwater contour map of the Site adapted from Figure 3-11: Shallow Hydrogeologic Zone Groundwater Flow Contours June 2004 from the Site Wide Investigation Report of Nature & Extent of Releases to Groundwater from the Special Study Areas prepared by URS, dated January 2005. The report also presented a contour map based on December 2003 groundwater elevations showing a similar groundwater flow pattern. Using the June 2004 contours, each estimated plume area was initially delineated as an isosceles triangle having a 3:1 height-to-width ratio. The top vertex of the triangle coincides with the location of the potential source, and the width of the triangle increases with distance from the source location. This concept of a plume is based on an elongated plume model described in *An Analytical Model for Multidimensional Transport of a Decaying Contaminant Species* (Domenico, P.A. 1992). Representation of plume areas were then geographically identified using GIS software (ArcMap Version 10.2.2) as shown in **Figure 3.** Plumes from potential non-point sources were approximated as originating from a central point of origin to provide the minimum estimated plume width since plume migration between wells was the primary concern.

The groundwater monitoring system design incorporates collecting groundwater samples from newly installed, and several existing, groundwater monitoring wells. Locations for proposed groundwater monitoring wells to be sampled were then identified around the perimeter of the Site (‘perimeter wells’) in intervals designed to intersect the calculated plume areas to detect contamination potentially present downgradient of the identified potential sources. At each perimeter location, existing or newly installed wells will monitor the shallow, unconfined hydrogeologic zone. Select locations will also have new wells installed in the intermediate hydrogeologic zone. These locations will fill in gaps between existing wells installed in the intermediate hydrogeologic zone along the eastern boundary of the Site.

In addition to the perimeter wells, source specific groundwater monitoring wells have also been located in the interior of the Site (‘near-field wells’) to further target areas with a high concentration of potential sources, and to fill in any large spatial gaps. All near-field groundwater monitoring wells will be sampled to monitor groundwater in the shallow, unconfined zone. These proposed groundwater monitoring well locations, along with potential source locations and their estimated plume areas, are also provided on **Figure 3.**

Existing and proposed well locations within each hydrogeologic zone that will be sampled for this investigation are shown on **Figure 4 through 6.**

Existing site-wide groundwater monitoring wells that will be sampled for this investigation were inspected to assess the suitability of the wells for sampling. ARM personnel used a handheld GPS unit to locate the wells based on their geographical coordinates. Each well was photographed and inspected to determine whether or not it is in sufficient condition for sampling. Inspections include the well pad (observing whether it is loose, cracked, or otherwise damaged), protective outer casing, and the inner casing. The depth to bottom was measured in each well and compared to the recorded original drilled depth. The well inspection observations for each well are recorded on Well Inspection Forms that have been provided in **Appendix B**.

Wells will not be sampled if they have been damaged to the extent that surface water may have leaked into the well, or to the point that it is not possible to obtain a groundwater sample from the well. Should the wells not be suitable for sampling, or are no longer present, new groundwater monitoring wells will be installed in these locations. The unsuitable existing wells will then be properly abandoned in accordance with COMAR 26.04.04.34 through 36.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Project Personnel

The investigation of Area B groundwater will be conducted by ARM under a contract with EAG. ARM will provide project planning, field sampling and reporting support. The required drilling and laboratory services will be contracted directly by EAG. The management, field, and laboratory responsibilities of key project personnel are defined in this section.

The ARM Task Manager, Mr. Eric Magdar is responsible for ensuring that all activities are conducted in accordance with this Work Plan and the approved QAPP for the Site. Mr. Magdar will provide technical coordination with the MDE, EPA and EAG. The ARM Task Manager is responsible for managing all operations conducted for this project including:

- Ensure all personnel assigned to this project review the technical project plans before initiation of all tasks associated with the project.
- Review of project plans in a timely manner.
- Ensure proper methods and procedures are implemented to collect representative samples.
- Monitor the project budget and schedule and ensure the availability of necessary personnel, equipment, subcontractors, and other necessary services.

The lead ARM Geologist, Mr. Stewart Kabis, will be responsible for coordinating field activities including the collection, preservation, documentation and shipment of samples. Mr. Kabis will directly communicate with the ARM Task Manager and Laboratory Task Manager on issues pertaining to sample shipments, schedules, container requirements, and other necessary issues. Mr. Kabis is also responsible for ensuring the accuracy of sample documentation including the completion of the chain-of-custody (CoC) forms.

Pace Analytical Services, Inc. (PACE) of Greensburg, Pennsylvania will provide the analytical services for this project. The address for the laboratory is as follows:

Pace Analytical
1638 Roseytown Road
Greensburg, PA 15601

During the field activities, the Laboratory Task Manager will coordinate directly with the ARM Task Manager on issues regarding sample shipments, schedules, container requirements, and other field-laboratory logistics. The Laboratory Task Manager will monitor the daily activities of the laboratory, coordinate all production activities, and ensure that work is being conducted as

specified in this document. Samantha Bayura will be the Laboratory Task Manager for PACE on this project.

All communication, roles and responsibilities will be carried out in accordance with the QAPP Worksheet 3 & 5—Project Organization and QAPP Distribution and Worksheet 6—Communication Pathways.

2.2 Health and Safety Issues

The investigation will be conducted under a site-specific Health and Safety Plan, included as **Appendix C,** to protect investigation workers from possible exposure to contaminated groundwater. Based on historical site information, the planned site activities will be conducted under modified Level D personal protection. The requirements of the modified Level D protection are defined in ARM's site specific Health and Safety Plan. All field personnel assigned for work at the Site have been trained in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response standard (29 CFR 1910.120) and other applicable OSHA training standards. All field staff will be experienced in hazardous waste site work, use of personal protective equipment (PPE), and emergency response procedures.

3.0 FIELD ACTIVITIES AND PROCEDURES

This Work Plan presents the methods and protocols to be used to complete the groundwater investigation. 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, investigation-derived waste (IDW) management methods, reporting requirements are described in detail in the QAPP that has been developed to support the investigation and remediation of the Sparrows Point Terminal Site (Sparrows Point Terminal Quality Assurance Project Plan, ARM Group Inc. Revision 02, September 2015).

The proposed schedule of this investigation is contained in this work plan. All site characterization activities will be conducted under the site-specific health and safety plan (HASP), which is provided as **Appendix C**.

3.1 Utility Clearance

Appropriate precautions to avoid subsurface utilities and structures will be taken during the site investigation. Prior to initiating any subsurface investigations, the location of utilities in the project area will be identified using the Miss Utility system. In addition to the Miss Utility system, each proposed monitoring well location will be reviewed and approved with utility personnel currently working on the property. To facilitate this, all proposed boring locations will be located and marked using GPS instruments. Additionally, prior to well installation, ARM will secure the required well construction permits from Baltimore County Groundwater Management Section.

3.2 Existing Well Inspection and Redevelopment

ARM personnel made an attempt to find each of the existing wells planned for sampling, but a number of the existing wells still have not been located. For these wells, ARM will make a second attempt to locate the well in the field. If the second attempt is unsuccessful, and the missing well monitors the shallow or intermediate hydrogeologic zone, a new groundwater well will be installed at the historically recorded geographic location and screened in the same hydrogeologic zone as the original well. Regarding existing wells screened in the lower hydrogeologic zone, those that are found in good condition will be sampled, but wells that are not found or are not in sufficient condition for sampling will not be replaced. The conditions of all existing wells, as determined by the initial field inspections, are included in **Table 1.**

Because it has been years since the existing wells have been sampled, each well that will be sampled will be redeveloped according to procedures referenced in Worksheet 21—Field

Standard Operating Procedures (SOPs) of the QAPP, SOP No. 018 Well Development. After redevelopment, ARM will record the depth to bottom in each well again to compare to the recorded original drilled depth. Similarly, any newly installed wells will be developed according to procedures referenced in Worksheet 21—Field Standard Operating Procedures (SOPs) of the QAPP, SOP No. 018 Well Development.

3.3 Well Installation

Proposed new shallow groundwater monitoring wells indicated on **Figure 4** will be installed in the shallow hydrogeologic zone using hollow-stem augers, and will extend to a depth of seven (7) feet below the apparent water table. The screen interval for the proposed shallow-zone wells will be from the bottom of the borehole to three (3) feet above the water table.

The proposed groundwater monitoring wells installed near the Pennwood Canal (SW-040-MW and SW-041-MW) will extend to five (5) feet below the bottom depth of the canal, and the screen interval will be from five (5) feet below the bottom depth of the canal to above the elevation of the water surface in the canal. However, the top of the screen interval will be no less than 3 feet bgs, so that a minimum of one foot of sand filter pack plus a two-foot bentonite seal may still be installed above the top of the screen interval.

Three proposed wells will be installed to monitor the intermediate hydrogeologic zone: SW-043-MWI, SW-045-MWI, and SW-074-MWI (see **Figure 5**). These wells will each be a total depth of approximately 50 feet bgs, although the exact depth and screen interval will be determined in the field in order to adequately capture the intermediate hydrogeologic zone. These wells were incorporated into this work plan to fill in gaps between existing wells installed in the intermediate hydrogeologic zone. The new wells will help investigate groundwater migrating towards the eastern boundary of the Site.

For all groundwater monitoring wells installed under this Work Plan, the depth to water (i.e. the water table) will be identified in the field through the collection of continuous split-spoon samples. As each borehole is advanced, the drilling subcontractor and/or ARM personnel will record the number of blow counts required to advance the split-spoon sampler for each discrete 6-inch interval, i.e., SPT testing. ARM personnel will then visually inspect and screen each split-spoon sample with a hand-held Photo Ionization Detector (PID), prior to logging the soil type. Once the final depth of the well has been reached, the two-inch diameter flush-threaded polyvinyl chloride (PVC) screen and riser will be installed. All well screens will have 0.02-inch factory-slots.

A well filter pack (sand) will fill the annulus to no less than 1 foot nor more than 2 feet above the well screen, and will be washed into place (as necessary) through a tremie pipe with water from a

potable source to avoid allowing the sand to free fall through the water column. A 0.5-foot thick layer of very fine sand (sand blotter) will then be placed at the top of the filter pack. A bentonite seal will then be placed in the well above the filter pack and sand blotter.

For the wells installed into the intermediate hydrogeologic zone, the bentonite seal will extend from the top of the sand blotter to the water table surface and will have a minimum thickness of 3 feet. Bentonite pellets or chips may be used if they do not have to free fall through more than approximately 15 feet of water. Where the bentonite is installed through more than 15 feet of water, the bentonite should be hydrated and emplaced as a slurry under pressure through a tremie pipe. A second 0.5-foot thick sand blotter will then be placed on top of the bentonite seal. The annular space above the bentonite seal will then be filled to within 5 feet of the surface with a cement/bentonite grout that will be tremied into place.

As the well screen will extend above the water table for the wells installed in the shallow hydrogeologic zone, a cement/bentonite grout will be used as the annulus seal directly above the filter pack and the sand blotter, and will extend to within 5 feet of the ground surface.

The upper five feet of the annulus, or the remaining available annular space, will be filled with concrete to the surface, and each new well will be completed with either a “flush-mount” or “stick-up” steel protective casing. All wells will have two foot by two foot, sloping concrete aprons, and caps to secure and protect the newly installed wells.

The new wells will be installed and developed according to procedures referenced in the QAPP Worksheet 21—Field SOPs, SOP No. 018 Well Development and SOP No. 014 Monitoring Well Construction.

3.4 Water Level Measurement

All proposed groundwater monitoring wells will be surveyed to obtain top of casing elevation data. Following installation and development of the proposed wells, and redevelopment of the existing wells that are to be resampled, a synoptic round of groundwater measurements will be collected from the new and existing wells that are proposed as part of the monitoring network. The groundwater elevation data from these monitoring wells will be used to create a groundwater contour map indicating groundwater flow direction. ARM will also check each monitoring well for the presence of LPH using an oil-water interface probe. Water level measurements and oil-water interface measurements will be collected according to procedures referenced in the QAPP Worksheet 21—Field SOPs, SOP No. 019 Depth to Groundwater and NAPL Measurements.

3.5 Well Sampling

One round of groundwater samples will be collected. The groundwater samples will be collected using peristaltic pump when the depth to groundwater is less than 20 feet below grade. In instances where the depth to groundwater exceeds 20 feet below grade, a submersible pump will be used. Many of the existing wells were found to have ½-inch casing and screen. These wells will be sampled using a peristaltic pump. The previous groundwater contour maps indicate that depth to water in the existing wells is typically less than 20 feet. All samples will be collected in accordance with the procedures referenced in the QAPP Worksheet 21—Field SOPs, SOP No. 007 Low Flow Groundwater Sampling.

All down-hole groundwater sampling equipment will be decontaminated according to procedures referenced in the QAPP Worksheet 21—Field SOPs, SOP No. 016 Equipment Decontamination.

All groundwater samples will be analyzed for TCL-VOCs, TCL-SVOCs, TAL-Metals (total and dissolved), Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide. Samples from the perimeter wells will also be analyzed for PCBS using USEPA Method 680. 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.

3.6 Sample Documentation

3.6.1 Sample Numbering

Samples will be numbered in accordance with the QAPP Appendix C—Data Management Plan. Groundwater samples collected from the new groundwater monitoring wells will be given the prefix “SW” for “Site-wide”. The station designation numbers for new groundwater monitoring wells begin with SW-021, resuming consecutive numbering following the highest number currently-existing site-wide well with designation “SW020”. Samples will be given the suffix “-MWS” or “MWI” to indicate the sample is from a monitoring well installed in the shallow hydrogeologic zone (“MWS”) or the intermediate hydrogeologic zone (“MWI”).

3.6.2 Sample Labels & Chain-of-Custody Forms

Samples will be labeled and recorded on the Chain-of-Custody form in accordance with methods referenced in the QAPP Worksheet 26 & 27—Sample Handling, Custody and Disposal.

3.7 Laboratory Analysis

EAG has contracted PACE of Greensburg, Pennsylvania to perform the laboratory analysis for this project. The groundwater samples will be submitted for analysis with a standard turnaround time (approximately 10 work days). The specific list of compounds and analytes that the groundwater samples will be analyzed for, as well as the quantitation limits and project action limits, are provided in Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

All groundwater samples will be collected using dedicated equipment including new polyethylene tubing. 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 to support the data validation:

- Blind Field Duplicate – at a rate of one duplicate per twenty samples
  - VOC, SVOC, Metals, Oil & Grease, DRO, GRO, PCBs
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
  - VOC, SVOC, Metals, Oil & Grease, DRO, GRO, PCBs
- Field Blank – at a rate of one per twenty samples (substitute Equipment Blank when sampling with non-dedicated or submersible pumps)
  - VOC, SVOC, Metals, Oil & Grease, DRO, GRO
- Trip Blank – at a rate of one per day
  - VOC

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

5.0 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 .

6.0 DATA VALIDATION

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

7.0 REPORTING

Following the receipt of all sampling results from Area B, ARM will prepare an Area B Groundwater Study Report that will document the sample collection procedures and supporting rationale. ARM will present and interpret the results in terms of the objectives of the investigation, specifically by addressing to what extent the analytical data:

1. Indicates the presence or absence of impacts to groundwater in the central portion of Area B,
2. Indicates there are potential continuing sources of groundwater contamination, and
3. Indicates the quality of groundwater at the perimeter of the Site that is potentially discharging to surface water.

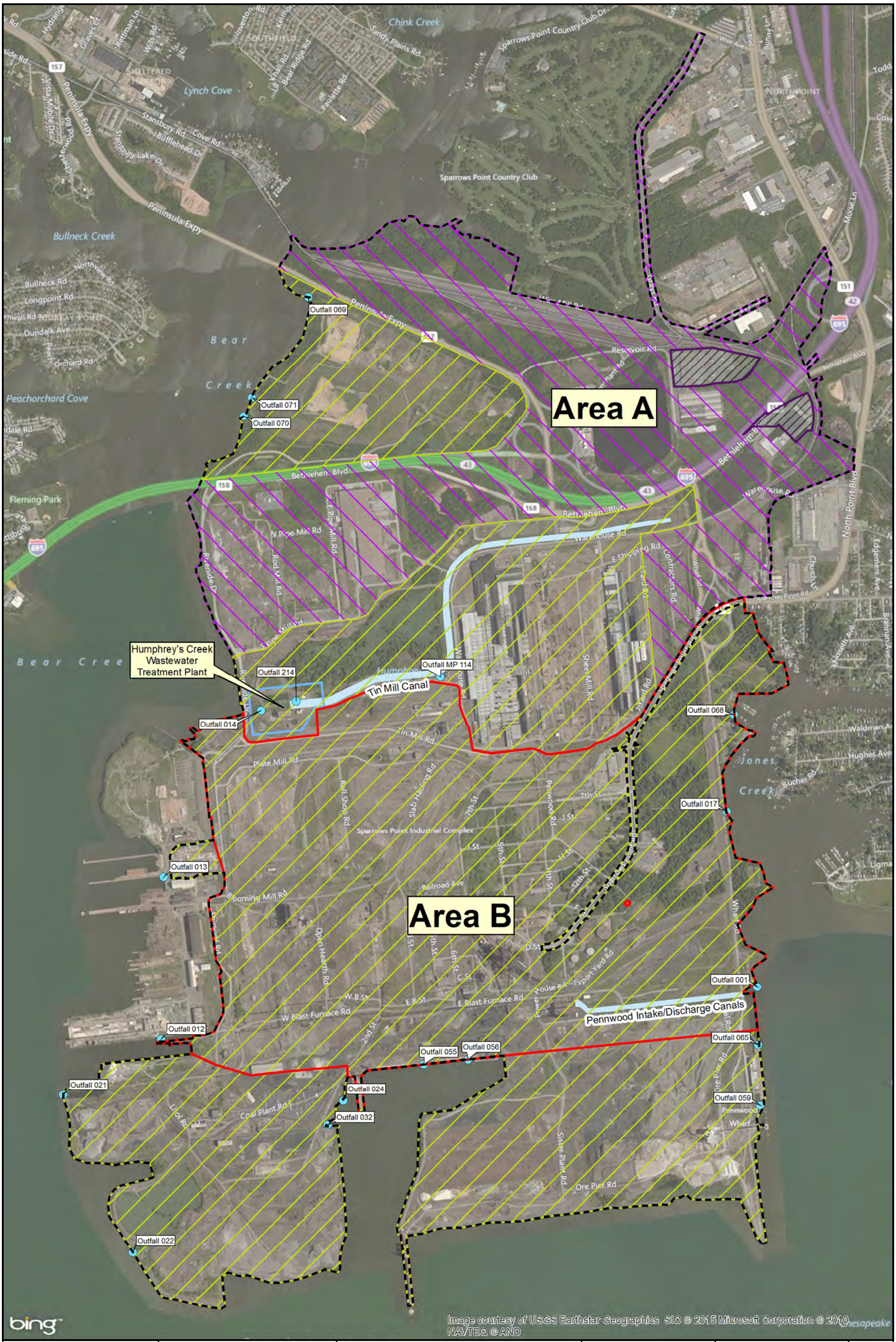
All results will be presented in tabular and graphical formats as appropriate to best summarize the data for future use. The sample results will also be compared against the Project Action Limits (PALs) presented in Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits. ARM will also present recommendations for any additional site investigation activities if warranted.

8.0 SCHEDULE

The activities below are planned so that they may be completed within six months of agency approval of this Work Plan. In addition, the investigation report will be submitted to the regulatory authorities within two months of completion of the field investigation in accordance with these approximate timeframes:

- Well inspection and redevelopment activities have already begun and will take approximately four (4) weeks to complete;
- Well installation activities will take approximately eight (8) weeks to complete once approval of the work plan is received;
- Well sampling will take approximately six (6) weeks to complete, with each well sampled at least 48 hours after its completed installation;
- Well depth-to-water measurements will take approximately three (3) days to complete, and will be started 24-hours after the last well has been sampled;
- Groundwater sample analysis, data validation and review is expected to require an additional six (6) weeks to complete; and
- Preparation of the investigation report, including an internal Quality Assurance Review cycle, will require another four (4) weeks.

FIGURES



ARM Group Inc.
Earth Resource Engineers and Consultants

0 375 750 1,500 Feet

Stormwater Outfalls
Area A
Area B
Groundwater Study Area
Site Boundary

Area B Groundwater Investigation Study Area

September 1, 2015

EnviroAnalytics Group	Sparrows Point Terminal
Area B: Project 150300M	Baltimore County, MD

Figure 1

ARM Group Inc.
Earth Resource Engineers and Consultants

0 375 750 1,500 Feet

1916 Shoreline
- Land
- Marsh
- Water

- Area A
- Area B
- Groundwater Study Area
- Site Boundary

Approximate Shoreline in 1916

September 1, 2015

Adapted from Figure 2-5 of the Description of Current Conditions Report prepared by Rust Environmental and Infrastructure, dated January 1998

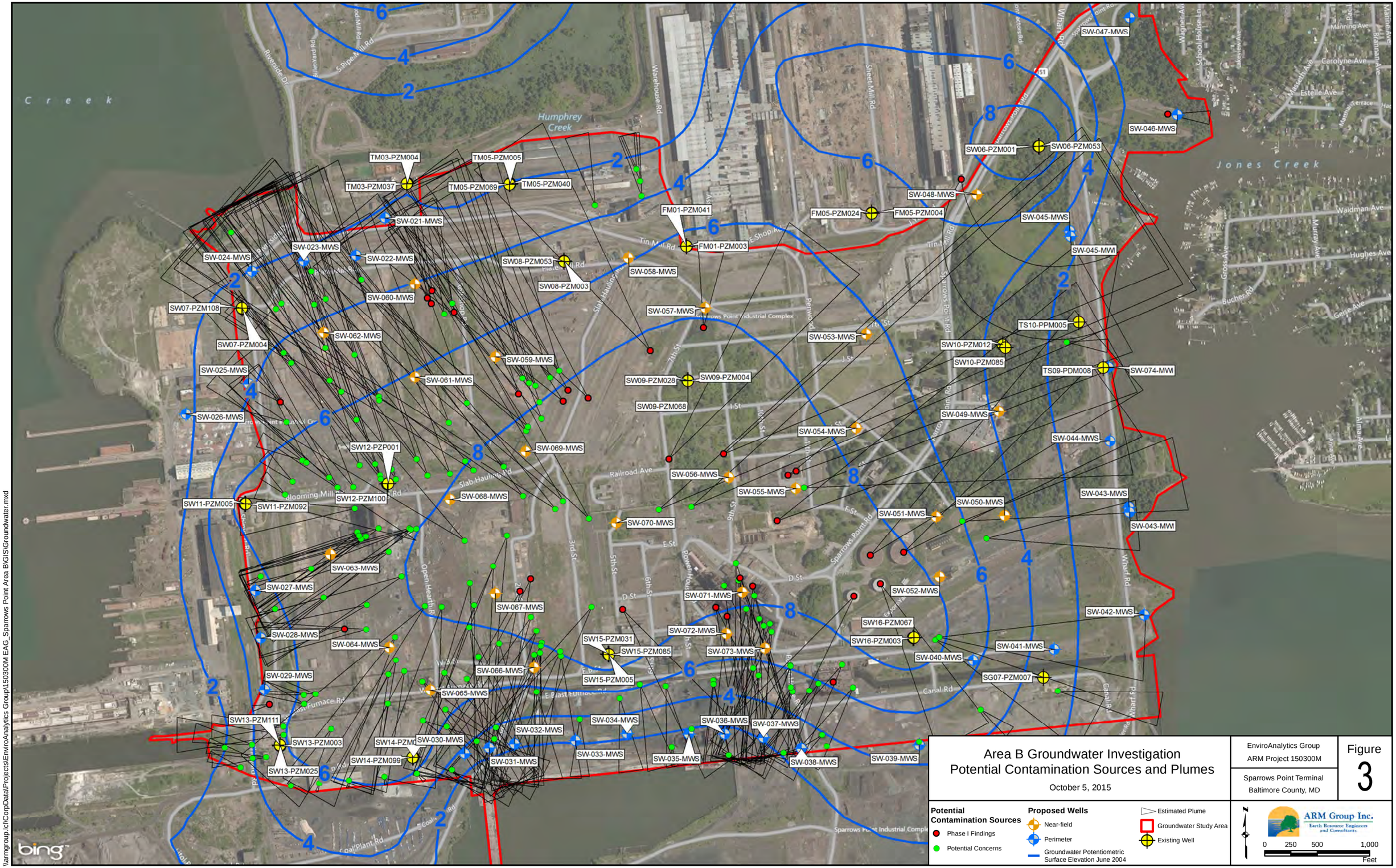
EnviroAnalytics Group

Area B: Project 150300M

Sparrows Point Terminal

Baltimore County, MD

Figure 2



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Area B Groundwater Investigation
Potential Contamination Sources and Plumes

October 5, 2015

EnviroAnalytics Group
ARM Project 150300M

Sparrows Point Terminal
Baltimore County, MD

Figure
3

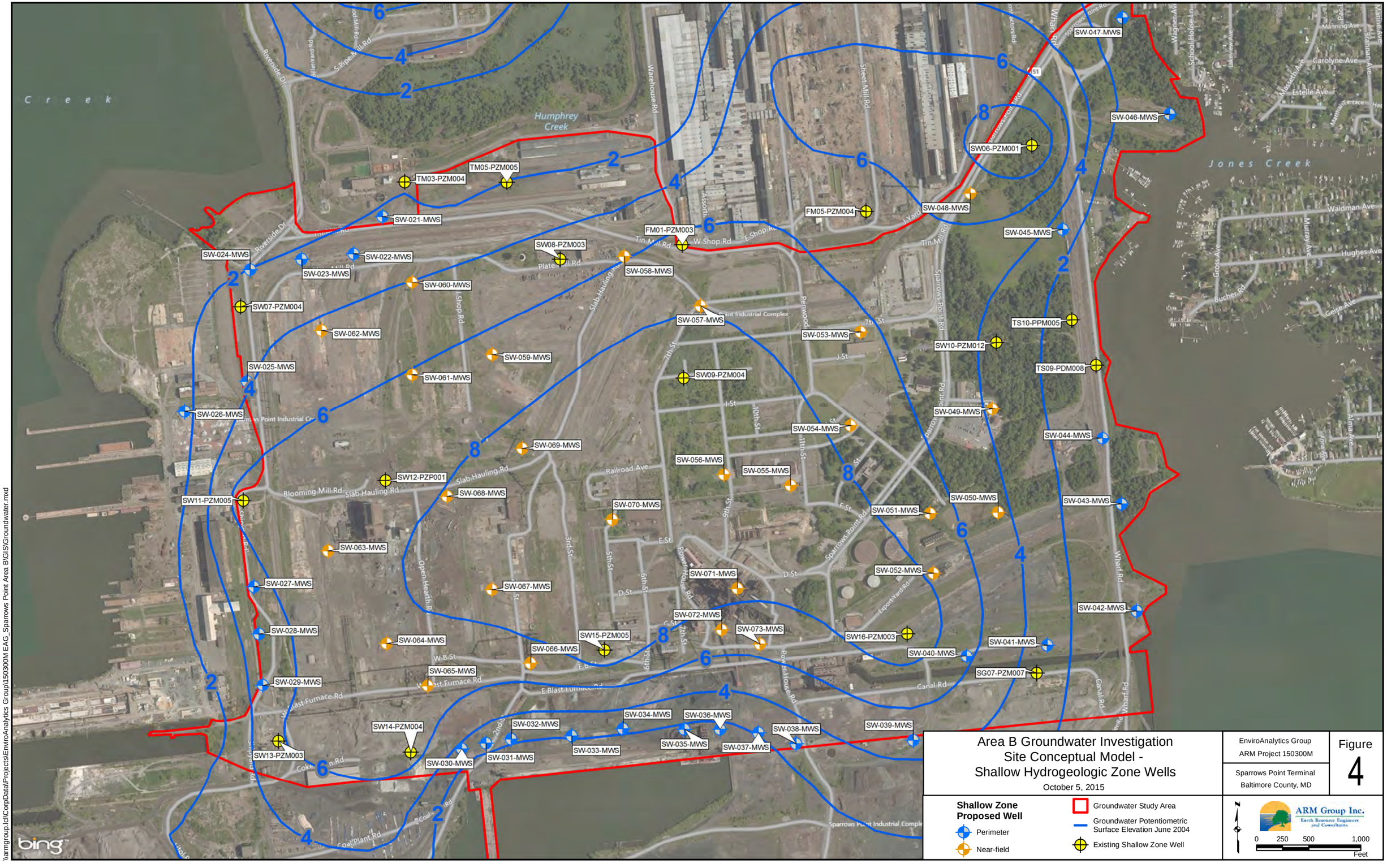
Potential Contamination Sources
- Phase I Findings
- Potential Concerns

Proposed Wells
- Near-field
- Perimeter
- Groundwater Potentiometric Surface Elevation June 2004

- Estimated Plume
- Groundwater Study Area
- Existing Well

ARM Group Inc.
Earth Resource Engineers and Consultants

0 250 500 1,000
Feet



Area B Groundwater Investigation
Site Conceptual Model -
Shallow Hydrogeologic Zone Wells
October 5, 2015

EnviroAnalytics Group
ARM Project 150300M

Sparrows Point Terminal
Baltimore County, MD

Figure 4

Shallow Zone Proposed Well
- Perimeter
- Near-field

- Groundwater Study Area
- Groundwater Potentiometric Surface Elevation June 2004
- Existing Shallow Zone Well

ARM Group Inc.
Earth Resource Engineers and Consultants

N

0 250 500 1,000 Feet

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Area B Groundwater Investigation
Site Conceptual Model -
Intermediate Hydrogeologic Zone Wells

October 5, 2015

EnviroAnalytics Group
ARM Project 150300M

Sparrows Point Terminal
Baltimore County, MD

Figure
5

Intermediate Zone Proposed Wells

- Perimeter
- Groundwater Study Area
- Intermediate Zone Existing Well

ARM Group Inc.
Earth Resource Engineers and Consultants

0 250 500 1,000
Feet

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Area B Groundwater Investigation
Site Conceptual Model - Lower Hydrogeologic Zone Wells

October 5, 2015

Groundwater Study Area

Lower Zone Existing Well

EnviroAnalytics Group
ARM Project 150300M

Sparrows Point Terminal
Baltimore County, MD

Figure 6

ARM Group Inc.
Earth Resource Engineers and Consultants

0 250 500 1,000
Feet

TABLES

Table 1
Existing Site-wide Well Construction Information

Well	TOC Elevation (ft AMSL)	Intallation Method	Date Installed	Protection	Depth to Water (ft TOC)	Total Depth (ft)	Riser Length (ft)	Screen Length (ft)	Top of Screen Elevation (ft AMSL)	Bottom of Screen Elevation (ft AMSL)	Filter Pack Interval (ft)	Seal Interval (ft)	Grout Interval (ft)	Diameter (in)	Condition
Shallow Hydrogeologic Zone Wells															
FM01-PZM003	10.11	Hollow Stem Auger	9/21/2001	Flush mount	3.94	13.5	3.5	10	6.61	-3.39	2-13.5	0.5-2	0-0.5	2	Will be Sampled
FM05-PZM004	9.3	Hollow Stem Auger	9/21/2001	Flush mount		14	4	10	5.3	-4.7	3-14	2-3	0-2		Not found [1]
SG07-PZM007	14.7	Hollow Stem Auger	8/10/2000	Steel Riser	17.44	19	9	10	2.7	-7.3	7-19	1.5 - 7	0 - 1.5	2	Will be Sampled
SW06-PZM001	17.51	Hollow Stem Auger	10/5/2000	Steel Riser		15	5	10	9.51	-0.49	3-15	2-3	0 - 2		Not found [1]
SW07-PZM004	14.58	Hollow Stem Auger	10/5/2000	Steel Riser	12.23	16	6	10	5.58	-4.42	4-16	3-4	0 - 3	2	Will be Sampled
SW08-PZM003	8.49	Hollow Stem Auger	9/20/2000	Flush Mount		12	2	10	6.49	-3.51	1.5 - 12	1 - 1.5	0.5 - 1	2	[2]
SW09-PZM004	13.21	Hollow Stem Auger	10/5/2000	Steel Riser	5.93	14	4	10	6.21	-3.79	3-14	2-3	0 - 2	2	Will be Sampled
SW10-PZM012	7.82	Hollow Stem Auger	10/4/2000	Steel Riser	9.6	17	7	10	-2.18	-12.18	5-17	4-5	0 - 4	2	Will be Sampled
SW11-PZM005	10.79	Hollow Stem Auger	10/6/2000	Flush Mount		16	6	10	4.79	-5.21	4-16	3-4	0.5 - 3		Not found [1]
SW12-PZP001	18.34	Hollow Stem Auger	10/6/2000	Steel Riser		14	4	10	11.34	1.34	3-14	2-3	0 - 2		Not found [1]
SW13-PZM003	15.75	Hollow Stem Auger	10/10/2000	Steel Riser*		17	7	10	11.75	1.75	5-17	4-5	0.5 - 4	2	Damaged [3]
SW14-PZM004	13.87	Hollow Stem Auger	10/10/2000	Steel Riser		15	5	10	5.87	-4.13	3-15	2-3	0 - 2		Not found [1]
SW15-PZM005	14.84	Hollow Stem Auger	10/16/2000	Steel Riser	4.87	17	7	10	4.84	-5.16	5-17	4-5	0 - 4	2	Will be Sampled
SW16-PZM003	15.08	Hollow Stem Auger	10/17/2000	Steel Riser	8.2	15	5	10	7.08	-2.92	3-15	2-3	0 - 2	2	Will be Sampled
TM03-PZM004	12.86	Hollow Stem Auger	9/19/2001	Steel Riser		15.3	5.3	10	4.56	-5.44	3.5 - 15.3	2 - 3.5	0-2	2	Damaged [3]
TM05-PZM005	13.44	Hollow Stem Auger	9/20/2000	Steel Riser	11.86	15	5	10	5.44	-4.56	3 - 15	1 - 3	0 - 1	2	Damaged [3]
TS10-PPM005	8.68	Hollow Stem Auger	8/7/2000	Steel Riser	5.97	14	4	10	1.68	-8.32	3-14	2-3	0 - 2	2	Will be Sampled
TS09-PDM008	8.68	Hollow Stem Auger	8/4/2000	Flush Mount		17	7	10	1.68	-8.32	5-17	1.5 - 5	0 - 1.5		Not found [1]
Intermediate Hydrogeologic Zone Wells															
FM01-PZM041	9.97	Direct Push	9/19/2001	Flush mount		51	41	10	-31.03	-41.03	41-51	40-41	0-40	0.5	[4]
FM05-PZM024	9.53	Direct Push	9/19/2001	Flush mount		32	22	10	-12.47	-22.47	22-32	21-22	0-21		Not found [1]
SW06-PZM053	17.44	Direct Push	10/23/2000	Steel Riser		67	64	3	-49.56	-52.56	64 - 67	63 - 64	0 - 63		Not found [1]
SW08-PZM053	8.7	Direct Push	10/18/2000	Flush Mount		62	59	3	-50.3	-53.3	59 - 62	58 - 59	0.5 - 58		[2]
SW09-PZM028	13.14	Direct Push	10/4/2000	Steel Riser		38	35	3	-24.86	-27.86	35 - 38	34 - 35	0 - 34	0.5	[4]
SW13-PZM025	15.59	Direct Push	10/10/2000	Flush Mount		39	36	3	-20.41	-23.41	36 - 39	35 - 36	0.5-35	0.5	[4]
SW15-PZM031	15.03	Direct Push	10/20/2000	Steel Riser		43	40	3	-27.97	-30.97	40 - 43	39 - 40	0-39	0.5	[4]
TM03-PZM037	12.835	Direct Push	9/25/2001	Steel Riser		48	38	10	-28.165	-38.165	38-48	37-38	0-37	0.5	[4]
TM05-PZM040	13.96	Direct Push	10/12/2000	Steel Riser		50.5	47.5	3	-36.54	-39.54	47.5 - 50.5	46.5 - 47.5	0 - 46.5		[5]
Lower Hydrogeologic Zone Wells															
SW07-PZM108	14.75	Hollow Stem Auger	12/13 - 12/14/2000	Steel Riser	15.96	120	115	5	-103.25	-108.25	111 - 120	3 - 111	0 - 3	2	Will be Sampled
SW09-PZM068	13.36	Direct Push	10/23/2000	Steel Riser		78	75	3	-64.64	-67.64	75 - 78	74 - 75	0 - 74	0.5	[6]
SW10-PZM085	7.69	Direct Push	10/19/2000	Steel Riser		90	87	3	-82.31	-85.31	87 - 90	86 - 87	0 - 86	0.5	[6]
SW11-PZM092	10.71	Hollow Stem Auger	12/11/2000	Flush Mount		104	99	5	-88.29	-93.29	95 - 104	3-95	0.5 - 3		Not found
SW12-PZM100	17.9	Hollow Stem Auger	12/06 - 12/07/2000	Steel Riser		115	110	5	-95.1	-100.1	106 - 115	3 - 106	0 - 3		Not found
SW13-PZM111	15.33	Hollow Stem Auger	11/28/2000	Flush Mount	16.25	125	120	5	-104.67	-109.67	116 - 125	2 - 116	0.5 - 2	2	Will be Sampled
SW14-PZM099	13.69	Hollow Stem Auger	12/11/2000	Steel Riser		110	105	5	-94.31	-99.31	101 - 110	3 - 101	0 - 3		Not found
SW15-PZM085	14.33	Hollow Stem Auger	10/31/2000	Steel Riser	15.12	97	92	5	-80.67	-85.67	90 - 97	3-90	0 - 3	2	Will be Sampled
SW16-PZM067	15.42	Direct Push	10/24/2000	Steel Riser		79	76	3	-63.58	-66.58	76 - 79	75 - 76	0 - 75	0.5	[6]
TM05-PZM069	13.99	Direct Push	10/12/2000	Steel Riser		79.5	76.5	3	-65.51	-68.51	76.5 - 79.5	75 .5 - 76.5	0 - 75.5		[5][6]

Existing groundwater wells were classified as shallow, intermediate, or lower based on contour maps of these hydrogeologic zones in the Site-Wide Investigation Groundwater Study • Site-Wide Investigation: Report of Nature & Extent of Releases to Groundwater from the Special Study Areas (SSAs) (URS 2005), revised 2007.

Depth to water from September 2015

* Well SW13-PZM003: Listed as flush mount, but determined to be stick-up during assessment

Well Condition Footnotes:

[1] For existing wells that were not initially found, a second attempt may be made to locate the well in the field. If the second attempt is unsuccessful, a new groundwater well will be installed at the same location.

[2] Location SW08: one well was observed and the other could not be found. The 2" well that was observed was a flush mount (sewer clean-out cover), was blocked at 2.85' TOC. Both wells will be replaced.

[3] Damaged well that will be replaced.

[4] Small diameter piezometer needs further inspection. If it cannot be located or sampled, it will be replaced.

[5] TM05: one well was observed and the other could not be found. The 1/2" well that was observed to have been knocked over and bent past 45 degrees will be inspected. TM05-PZM040 will be replaced as needed.

[6] Small diameter piezometer needs further inspection. It will be sampled if it is in usable condition.

Table 2
Detected Metals and Inorganics in Existing Wells

Analyte	CAS	Units	Project Action Limit	FM01-PZM003	FM01-PZM041	FM01-PZM041 DUP	FM05-PZM004	FM05-PZM024	SW10-PZM012	SW13-PZM003	SW13-PZM025	SW13-PZM111
Alkalinity	ALKT	UG/L	No PAL							120000	160000	210000
Amenable cyanide	AMENABLECN	UG/L	200	4 B	28 J	30 J	3300 J	190 J	1.6	120	4.1	75
Antimony	7440-36-0	UG/L	6	5.6 B	4.1 U	4.1 U	4.1 U	4.1 U	2 U	2 U	3.1 U	2 U
Antimony, dissolved	7440-36-0	UG/L	6						2 U	2 U	2.7 U	2 U
Arsenic	7440-38-2	UG/L	10	4.2 J	26.6	26.4	12.1	3.2 J	5 U	5 J	8.5	4 J
Arsenic, dissolved	7440-38-2	UG/L	10						5 U	5 U	10	3 J
Barium	7440-39-3	UG/L	2000	19.8 J	608	608	24.8 J	95.4 J	30	80	110	65
Barium, dissolved	7440-39-3	UG/L	2000						30	60	100	61
Beryllium	7440-41-7	UG/L	4	2.1 B	2.3 B	2.1 B	3 B	0.86 B	0.9 L	1 U	1 U	1 U
Beryllium, dissolved	7440-41-7	UG/L	4						0.8 L	1 U	1 U	1 U
Cadmium	7440-43-9	UG/L	5	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U				
Chloride	16877-00-6	UG/L	No PAL							20000	980000	280000
Chromium	7440-47-3	UG/L	100	21.7	1.3 J	1.4 J	3.1 J	1.9 J				
Cobalt	7440-48-4	UG/L	50	1.1 J	0.86 U	0.86 U	0.86 U	1.7 J	37	1 U	5.7	0.6 J
Cobalt, dissolved	7440-48-4	UG/L	50						34	1 U	5.6	1 U
Copper	7440-50-8	UG/L	1300	20.6 J	0.77 U	0.77 U	8.9 B	0.77 U	2 U	6.8	4.2 J	7.7
Copper, dissolved	7440-50-8	UG/L	1300						2 K	2 J	3.5	2 U
Iron, total	7439-89-6	UG/L	14000							2200	45000	1600
Lead	7439-92-1	UG/L	15	50.5	1.8 U	1.8 U	3 B	1.9 J	1 U	7.2 U	1 UJ	8.7
Mercury	7439-97-6	UG/L	2	0.054 U	0.054 U	0.054 B	0.054 U	0.054 U				
Nickel	7440-02-0	UG/L	390	2.5 J	2.4 U	2.4 U	3.9 J	2.4 U	58	3.2 U	12 U	8.1 U
Nickel, dissolved	7440-02-0	UG/L	390						54	2.2 U	11 U	7.8 U
Nitrate, as N	14797-55-8	UG/L	No PAL							1000	50 U	50 U
Nitrite, as N	14797-65-0	UG/L	No PAL							20	5 U	5 U
Selenium	7782-49-2	UG/L	50	3.2 U	3.2 U	3.2 U	3.2 U	4 J	5 U	5 U	9	5 J
Selenium, dissolved	7782-49-2	UG/L	50						5 U	5 U	8.3	4 J
Silver	7440-22-4	UG/L	94	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U				
Sulfate	18785-72-3	UG/L	No PAL							99000	94000	18000
Sulfide	18496-25-8	UG/L	No PAL	1000 U	1000 U	1000 U	1000 U	1000 U	1000 UL	1000 UJ	1000 UL	1000 UL
Thallium	7440-28-0	UG/L	2	5.7 U	5.7 U	6.7 J	5.7 U	5.7 U	1 U	1 U	1 U	1 U
Tin	7440-31-5	UG/L	12000	28.8 U	33.5 J	28.8 U	28.8 U	28.8 U	35 J	220	530	450
Tin, dissolved	7440-31-5	UG/L	12000						39 J	170	560	430
Vanadium	7440-62-2	UG/L	86	368	1.5 U	1.5 U	20 J	9.7 J	5 U	30	5 U	17
Vanadium, dissolved	7440-62-2	UG/L	86						5.8 U	20	5 U	11 U
Zinc	7440-66-6	UG/L	6000	121	1.9 B	1.5 U	14.8 J	2.6 B	100 K	50	10 UJ	54
Zinc, dissolved	7440-66-6	UG/L	6000						94 K	10	10 U	10

Yellow highlight indicates Project Action Limit Exceedance

Qualifier	Definition
U	The analyte was analyzed for, but was not detected. Also used when the analyte was detected, but not substantially above the level reported in laboratory or field blanks. The associated number indicates the reporting limit.
J	Unreliable result. Analyte may or may not be present in the sample.
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L	Analyte present. Reported value may be biased high. Actual value is expected to be higher.
UJ	Not detected, quantitation limit may be inaccurate or imprecise.
UL	Not detected, quantitation limit is probably higher.
D	Result reported from a secondary dilution.

Table 2
Detected Metals and Inorganics in Existing Wells

Analyte	CAS	Units	Project Action Limit	SW14-PZM004	SW14-PZM004 DUP	SW14-PZM099	TM03-PZM004	TM03-PZM037	TM05-PZM005	TM05-PZM040	TM05-PZM069
Alkalinity	ALKT	UG/L	No PAL								
Amenable cyanide	AMENABLECN	UG/L	200	30	29	1 U	2300 J	14 K	9 K	43 K	
Antimony	7440-36-0	UG/L	6	2.9 U	2	2 U	4.2 B	4.1 U	4.7 J	4.2 B	
Antimony, dissolved	7440-36-0	UG/L	6	2 U	2 U	2.9 U					
Arsenic	7440-38-2	UG/L	10	5 U	5 U	5 U	7.4 J	30.5	4.1 J	3.6 J	
Arsenic, dissolved	7440-38-2	UG/L	10	5 U	5 U	5 U					
Barium	7440-39-3	UG/L	2000	51	52	150 J	30.5 B	158 J	18.3 J	240	
Barium, dissolved	7440-39-3	UG/L	2000	51	51	140 J					
Beryllium	7440-41-7	UG/L	4	0.7 U	0.7 U	1 U	1.6 B	2.3 B	3.7 B	2.6 B	
Beryllium, dissolved	7440-41-7	UG/L	4	0.9 J	1 J	1 U					
Cadmium	7440-43-9	UG/L	5				4.1 J	0.63 U	0.63 U	0.63 U	
Chloride	16877-00-6	UG/L	No PAL				83400	1130000			
Chromium	7440-47-3	UG/L	100				30.5	5.1	1.2 J	2.7 J	
Cobalt	7440-48-4	UG/L	50	30	30	0.6 J	1.6 J	0.86 U	0.86 U	0.86 U	
Cobalt, dissolved	7440-48-4	UG/L	50	30	30	1 U					
Copper	7440-50-8	UG/L	1300	2.6	2.8	2 U	28	0.77 U	0.77 U	0.77 U	
Copper, dissolved	7440-50-8	UG/L	1300	3.1	2.9	2					
Iron, total	7439-89-6	UG/L	14000	4000	4000	26000	13400	75700	200	22000	130000
Lead	7439-92-1	UG/L	15	1 U	1 U	1 J	232	1.8 U	2.3 J	1.8 U	
Mercury	7439-97-6	UG/L	2				0.23 B	0.054 U	0.054 U	0.061 B	
Nickel	7440-02-0	UG/L	390	40	40	2.8 U	5.4 J	2.4 U	2.4 U	2.4 U	
Nickel, dissolved	7440-02-0	UG/L	390	40	40	2 U					
Nitrate, as N	14797-55-8	UG/L	No PAL								
Nitrite, as N	14797-65-0	UG/L	No PAL								
Selenium	7782-49-2	UG/L	50	5 U	5 U	5 U	3.2 U	3.2 U	3.2 U	3.8 J	
Selenium, dissolved	7782-49-2	UG/L	50	5 U	5 U	5 U					
Silver	7440-22-4	UG/L	94				0.75 J	1.1 J	0.75 U	0.75 U	
Sulfate	18785-72-3	UG/L	No PAL				60200	186000	110000	2600	33000
Sulfide	18496-25-8	UG/L	No PAL	1000 UJ	1000 UJ	1000 UL	1000 U	1000 U	2000	1000 U	
Thallium	7440-28-0	UG/L	2	1 U	1 U	0.7 J	5.7 U	5.7 U	5.7 U	5.7 U	
Tin	7440-31-5	UG/L	12000	210	240	140 K	28.8 U	39.4 J	28.9 J	28.8 U	
Tin, dissolved	7440-31-5	UG/L	12000	230	250	140 K					
Vanadium	7440-62-2	UG/L	86	5 U	5 U	5 U	63.4	2.9 J	1110	8.7 J	
Vanadium, dissolved	7440-62-2	UG/L	86	5 U	5 U	5 U					
Zinc	7440-66-6	UG/L	6000	130	140	10 U	293	4.3 B	1.5 B	2.6 B	
Zinc, dissolved	7440-66-6	UG/L	6000	140	150	5 J					

Yellow highlight indicates Project Action Limit Exceedance

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J	Unreliable result. Analyte may or may not be present in the sample.
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L	Analyte present. Reported value may be biased high. Actual value is expected to be higher.
UJ	Not detected, quantitation limit may be inaccurate or imprecise.
UL	Not detected, quantitation limit is probably higher.
D	Result reported from a secondary dilution.

Table 3
Detected Organic Compounds in Existing Wells

Analyte	CAS	Units	Project Action Limit	FM01-PZM003	FM01-PZM041	FM01-PZM041 DUP	FM05-PZM004	FM05-PZM024	SW10-PZM012
2-Methylnaphthalene	91-57-6	UG/L	36	10 U	10 U	10 U	3.6 J	10 U	10 U
Acenaphthene	83-32-9	UG/L	530	10 U	10 U	10 U	0.95 J	10 U	10 U
Anthracene	120-12-7	UG/L	1800	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	71-43-2	UG/L	5	1 U	1 U	1 U	1.7	1 U	1 U
Benzo(a)anthracene	56-55-3	UG/L	0.012	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	50-32-8	UG/L	0.2	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	205-99-2	UG/L	0.034	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	191-24-2	UG/L	-	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	207-08-9	UG/L	0.34	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	117-81-7	UG/L	6	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	67-66-3	UG/L	0.22	31	1 U	1 U	1 U	1 U	1 U
Chrysene	218-01-9	UG/L	3.4	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	132-64-9	UG/L	-	10 U	10 U	10 U	1.3 J	10 U	10 U
Ethylbenzene	100-41-4	UG/L	700	1 U	1 U	1 U	1 U	1 U	1 U
Fluoranthene	206-44-0	UG/L	800	0.73 J	10 U	10 U	1.5 J	10 U	10 U
Fluorene	86-73-7	UG/L	290	10 U	10 U	10 U	1.8 J	10 U	10 U
Indeno(1,2,3-cd)pyrene	193-39-5	UG/L	0.034	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	91-20-3	UG/L	0.17	0.59 J	10 U	10 U	320	4.5 J	10 U
Phenanthrene	85-01-8	UG/L	-	0.98 J	10 U	10 U	3.6 J	10 U	10 U
Phenol	108-95-2	UG/L	5800	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	129-00-0	UG/L	120	10 U	10 U	10 U	1 J	10 U	10 U
Toluene	108-88-3	UG/L	1000	1 U	1 U	1 U	0.62 J	1 U	1 U
Xylene, total	1330-20-7	UG/L	10000	3 U	3 U	3 U	0.75 J	3 U	1 U

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D	Result reported from a secondary dilution.

Table 3
Detected Organic Compounds in Existing Wells

Analyte	CAS	Units	Project Action Limit	SW13-PZM003	SW13-PZM025	SW13-PZM111	SW14-PZM004	SW14-PZM004 DUP	SW14-PZM099
2-Methylnaphthalene	91-57-6	UG/L	36	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthene	83-32-9	UG/L	530	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	120-12-7	UG/L	1800	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	71-43-2	UG/L	5	1 U	1 U	5 U	1 U	1 U	5 U
Benzo(a)anthracene	56-55-3	UG/L	0.012	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	50-32-8	UG/L	0.2	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	205-99-2	UG/L	0.034	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	191-24-2	UG/L	-	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	207-08-9	UG/L	0.34	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	117-81-7	UG/L	6	13	5.9 J	10 U	10 U	10 U	10 U
Chloroform	67-66-3	UG/L	0.22	1.5		5 U	1 U	1 U	5 U
Chrysene	218-01-9	UG/L	3.4	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	132-64-9	UG/L	-	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	100-41-4	UG/L	700	1 U	1 U	5 U	1 U	1 U	5 U
Fluoranthene	206-44-0	UG/L	800	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	86-73-7	UG/L	290	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	193-39-5	UG/L	0.034	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	91-20-3	UG/L	0.17	10 U	1 U	10 U	10 U	10 U	10 U
Phenanthrene	85-01-8	UG/L	-	10 U	10 U	10 U	10 U	10 U	10 U
Phenol	108-95-2	UG/L	5800	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	129-00-0	UG/L	120	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	108-88-3	UG/L	1000	0.9 J	1 U	5 U	1 U	1 U	5 U
Xylene, total	1330-20-7	UG/L	10000	2 J	2 UJ	5 U	2 U	2 U	5 U

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U	The analyte was analyzed for, but was not detected. Also used when the analyte was detected, but not substantially above the level reported in laboratory or field blanks. The associated number indicates the reporting limit.
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D	Result reported from a secondary dilution.

Table 3
Detected Organic Compounds in Existing Wells

Analyte	CAS	Units	Project Action Limit	TM03-PZM004	TM03-PZM037	TM05-PZM005	TM05-PZM040	TM05-PZM069
2-Methylnaphthalene	91-57-6	UG/L	36	38	10 U	3.4 J	10 U	10 U
Acenaphthene	83-32-9	UG/L	530	7.1 J	10 U	1.7 J	3 J	10 U
Anthracene	120-12-7	UG/L	1800	12	10 U	10 U	10 U	10 U
Benzene	71-43-2	UG/L	5	1 U	0.31 J	2	1 U	5 U
Benzo(a)anthracene	56-55-3	UG/L	0.012	10	10 U	10 U	10 U	10 U
Benzo(a)pyrene	50-32-8	UG/L	0.2	7.5 J	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	205-99-2	UG/L	0.034	7.8 J	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	191-24-2	UG/L	-	6.7 J	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	207-08-9	UG/L	0.34	6.8 J	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	117-81-7	UG/L	6	10 U	10 U	10 U	10 U	10 U
Chloroform	67-66-3	UG/L	0.22	30	1 U	1 U	1 U	5 U
Chrysene	218-01-9	UG/L	3.4	11	10 U	10 U	10 U	10 U
Dibenzofuran	132-64-9	UG/L	-	36	10 U	1.7 J	10 U	10 U
Ethylbenzene	100-41-4	UG/L	700	1 U	1 U	0.25 J	1 U	5 U
Fluoranthene	206-44-0	UG/L	800	34	1.1 J	1 J	10 U	10 U
Fluorene	86-73-7	UG/L	290	34	0.62 J	2.5 J	10 U	10 U
Indeno(1,2,3-cd)pyrene	193-39-5	UG/L	0.034	6.5 J	10 U	10 U	10 U	10 U
Naphthalene	91-20-3	UG/L	0.17	240	2.7 J	48	7.1 J	
Phenanthrene	85-01-8	UG/L	-	75	2.5 J	5.3 J	2.2 J	10 U
Phenol	108-95-2	UG/L	5800	6.9 J	10 U	10 U	10 U	10 U
Pyrene	129-00-0	UG/L	120	27	10 U	10 U	10 U	10 U
Toluene	108-88-3	UG/L	1000	1 U	1 U	0.71 J	1 U	5 U
Xylene, total	1330-20-7	UG/L	10000	3 U	3 U	1.5 J	3 U	10 U
Yellow highlight indicates Project Action Limit Exceedance								

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Table 4
Available Historical Drawings

Set Name	Drawing Number	Original Date Drawn	Latest Revision Date
Plant Arrangement	5009	6/25/1958	3/12/1982
Plant Arrangement	5013	10/22/1958	3/12/1982
Plant Arrangement	5014	10/1/1959	3/12/1982
Plant Arrangement	5015	6/14/1957	3/12/1982
Plant Arrangement	5016	5/28/1958	3/12/1982
Plant Arrangement	5017	7/7/1958	3/12/1982
Plant Arrangement	5018	7/7/1958	3/12/1982
Plant Arrangement	5020	unknown	3/9/1982
Plant Arrangement	5021	10/1/1958	3/11/1982
Plant Arrangement	5022	5/5/1958	3/11/1982
Plant Arrangement	5023	9/8/1958	3/11/1982
Plant Arrangement	5024	9/1/1958	3/11/1982
Plant Arrangement	5026	6/24/1958	3/11/1982
Plant Arrangement	5027	6/24/1959	3/11/1982
Plant Arrangement	5028	6/24/1959	3/11/1982
Plant Arrangement	5029	8/25/1959	3/11/1982
Plant Arrangement	5030	8/2/1958	3/11/1982
Plant Arrangement	5032	9/1/1958	3/11/1982
Plant Arrangement	5033	6/23/1958	3/11/1982
Plant Arrangement	5034	6/23/1958	3/19/1982
Plant Arrangement	5035	9/1/1958	3/19/1982
Plant Arrangement	5036	unknown	3/11/1982
Plant Arrangement	5038	9/1/1958	3/11/1982
Plant Arrangement	5039	9/1/1958	3/11/1982
Plant Arrangement	5040	6/15/1958	3/19/1982
Plant Arrangement	5041	6/15/1958	3/19/1982
Plant Arrangement	5042	unknown	3/11/1982
Plant Arrangement	5047	1/17/1966	3/11/1958

Table 4
Available Historical Drawings

Set Name	Drawing Number	Original Date Drawn	Latest Revision Date
Plant Index	5109	unknown	3/10/2008
Plant Index	5113	unknown	3/12/2008
Plant Index	5114	unknown	8/14/2008
Plant Index	5115	unknown	9/4/2008
Plant Index	5116	unknown	8/14/2008
Plant Index	5117	unknown	8/14/2008
Plant Index	5118	unknown	8/14/2008
Plant Index	5120	unknown	6/26/2008
Plant Index	5120A	unknown	3/28/2008
Plant Index	5120B	unknown	9/28/2010
Plant Index	5120C	unknown	9/28/2010
Plant Index	5120D	unknown	8/13/2008
Plant Index	5120E	unknown	8/11/2008
Plant Index	5121	unknown	11/7/2008
Plant Index	5122	unknown	11/7/2008
Plant Index	5123	unknown	11/7/2008
Plant Index	5124	unknown	5/3/2007
Plant Index	5126	unknown	9/27/2010
Plant Index	5127	unknown	8/14/2008
Plant Index	5128	unknown	12/14/2007
Plant Index	5129	unknown	9/10/2009
Plant Index	5130	unknown	6/26/2008
Plant Index	5132	unknown	8/15/2008
Plant Index	5133	unknown	7/9/2008
Plant Index	5134	unknown	1/8/2008
Plant Index	5135	unknown	7/11/2008
Plant Index	5136	unknown	1/9/2008
Plant Index	5138	unknown	1/10/2008
Plant Index	5139	unknown	1/16/2008
Plant Index	5140	unknown	8/15/2008
Plant Index	5141	unknown	9/27/2010
Plant Index	5142	unknown	11/10/2008
Plant Index	5147	unknown	11/10/2008

Table 4
Available Historical Drawings

Set Name	Drawing Number	Original Date Drawn	Latest Revision Date
Plant Sewer Lines	5509	9/11/1959	3/18/1982
Plant Sewer Lines	5513	8/26/1959	1/22/1982
Plant Sewer Lines	5514	unknown	1/22/1982
Plant Sewer Lines	5515	Oct-58	9/11/2008
Plant Sewer Lines	5516	9/1/1958	9/12/2008
Plant Sewer Lines	5517	8/21/1959	2/9/1982
Plant Sewer Lines	5518	1/21/1957	2/10/1982
Plant Sewer Lines	5520	unknown	3/19/1992
Plant Sewer Lines	5521	9/30/1959	9/10/2008
Plant Sewer Lines	5522	unknown	9/10/2008
Plant Sewer Lines	5523	unknown	2/24/1982
Plant Sewer Lines	5524	unknown	2/24/1982
Plant Sewer Lines	5526	8/24/1959	3/19/1992
Plant Sewer Lines	5527	unknown	9/10/2008
Plant Sewer Lines	5528	unknown	9/10/2008
Plant Sewer Lines	5529	8/26/1959	7/14/1992
Plant Sewer Lines	5530	8/15/1959	3/29/1976
Plant Sewer Lines	5532	unknown	6/1/1976
Plant Sewer Lines	5533	8/25/1959	6/8/1976
Plant Sewer Lines	5534	8/28/1959	3/19/1976
Plant Sewer Lines	5535	unknown	5/28/1976
Plant Sewer Lines	5536	3/24/1976	3/24/1976
Plant Sewer Lines	5538	unknown	2/10/1975
Plant Sewer Lines	5539	8/28/1959	2/21/1975
Plant Sewer Lines	5540	6/15/1958	7/14/1991
Plant Sewer Lines	5541	9/6/1959	10/6/1993
Plant Sewer Lines	5542	9/11/1959	3/18/1976
Plant Sewer Lines	5547	9/16/1959	3/15/1976

Table 5
Summary of Proposed Groundwater Monitoring Wells

Well ID	Ground Surface Elevation* (feet AMSL)	Groundwater Elevation* (feet AMSL)	Depth to Water (feet bgs)	Bottom of casing elevation (feet AMSL)	PVC Screen Length (feet)	PVC Riser Length (feet)	Total Depth (bgs)	Diameter	Hydrogeologic Zone	New or Replacement	Notes
SW-021-MWS	9.6	3	6.6	-4	10	12	17	2 inch	Shallow	New	Perimeter
SW-022-MWS	11.4	3	8.4	-4	10	13	18	2 inch	Shallow	New	Perimeter
SW-023-MWS	11.9	3	8.9	-4	10	14	19	2 inch	Shallow	New	Perimeter
SW-024-MWS	10.7	3	7.7	-4	10	13	18	2 inch	Shallow	New	Perimeter
SW-025-MWS	10.0	3	7.0	-4	10	12	17	2 inch	Shallow	New	Perimeter
SW-026-MWS	8.7	2	6.7	-5	10	12	17	2 inch	Shallow	New	Perimeter
SW-027-MWS	13.7	5	8.7	-2	10	14	19	2 inch	Shallow	New	Perimeter
SW-028-MWS	12.2	5	7.2	-2	10	12	17	2 inch	Shallow	New	Perimeter
SW-029-MWS	11.2	5	6.2	-2	10	11	16	2 inch	Shallow	New	Perimeter
SW-030-MWS	11.2	3	8.2	-4	10	13	18	2 inch	Shallow	New	Perimeter
SW-031-MWS	9.8	3	6.8	-4	10	12	17	2 inch	Shallow	New	Perimeter
SW-032-MWS	7.7	3	4.7	-4	7	13	15	2 inch	Shallow	New	Perimeter
SW-033-MWS	9.7	3	6.7	-4	10	12	17	2 inch	Shallow	New	Perimeter
SW-034-MWS	8.8	3	5.8	-4	10	11	16	2 inch	Shallow	New	Perimeter
SW-035-MWS	11.7	2	9.7	-5	10	15	20	2 inch	Shallow	New	Perimeter
SW-036-MWS	11.4	2	9.4	-5	10	14	19	2 inch	Shallow	New	Perimeter
SW-037-MWS	9.7	3	6.7	-4	10	12	17	2 inch	Shallow	New	Perimeter
SW-038-MWS	12.2	3	9.2	-4	10	14	19	2 inch	Shallow	New	Perimeter
SW-039-MWS	17.1	5	12.1	-2	10	17	22	2 inch	Shallow	New	Perimeter
SW-040-MWS	10.6	7	3.6	0	7	12	14	2 inch	Shallow	New	Perimeter
SW-041-MWS	11.3	3	8.3	-4	10	13	18	2 inch	Shallow	New	Perimeter
SW-042-MWS	7.5	2	5.5	-5	10	10	15	2 inch	Shallow	New	Perimeter
SW-043-MWI	7.5	2	5.5	-42	10	45	50	2 inch	Intermediate	New	Perimeter
SW-043-MWS	7.5	2	5.5	-5	10	11	16	2 inch	Shallow	New	Perimeter
SW-044-MWS	8.9	2	6.9	-5	10	12	17	2 inch	Shallow	New	Perimeter
SW-045-MWI	11.6	2	9.6	-38	10	45	50	2 inch	Intermediate	New	Perimeter
SW-045-MWS	11.6	2	9.6	-5	10	15	20	2 inch	Shallow	New	Perimeter
SW-046-MWS	9.4	2	7.4	-5	10	12	17	2 inch	Shallow	New	Perimeter
SW-047-MWS	17.3	2	15.3	-5	10	20	25	2 inch	Shallow	New	Perimeter
SW-048-MWS	14.4	2	12.4	-5	10	17	22	2 inch	Shallow	New	Near Field
SW-049-MWS	10.7	3	7.7	-4	10	13	18	2 inch	Shallow	New	Near Field
SW-050-MWS	5.8	5	0.8	-2	7	9	11	2 inch	Shallow	New	Near Field
SW-051-MWS	10.1	7	3.1	0	7	11	13	2 inch	Shallow	New	Near Field
SW-052-MWS	12.7	7	5.7	0	10	11	16	2 inch	Shallow	New	Near Field
SW-053-MWS	13.2	7	6.2	0	10	11	16	2 inch	Shallow	New	Near Field
SW-054-MWS	10.4	7	3.4	0	7	11	13	2 inch	Shallow	New	Near Field
SW-055-MWS	8.7	8	0.7	1	7	9	11	2 inch	Shallow	New	Near Field
SW-056-MWS	8.8	8	0.8	1	7	9	11	2 inch	Shallow	New	Near Field
SW-057-MWS	12.2	7	5.2	0	10	10	15	2 inch	Shallow	New	Near Field
SW-058-MWS	11.4	6	5.4	-1	10	10	15	2 inch	Shallow	New	Near Field
SW-059-MWS	13.1	7	6.1	0	10	11	16	2 inch	Shallow	New	Near Field
SW-060-MWS	11.2	5	6.2	-2	10	11	16	2 inch	Shallow	New	Near Field
SW-061-MWS	11.8	7	4.8	0	7	13	15	2 inch	Shallow	New	Near Field
SW-062-MWS	13.6	5	8.6	-2	10	14	19	2 inch	Shallow	New	Near Field
SW-063-MWS	18.1	7	11.1	0	10	16	21	2 inch	Shallow	New	Near Field
SW-064-MWS	14.6	7	7.6	0	10	13	18	2 inch	Shallow	New	Near Field
SW-065-MWS	11.7	7	4.7	0	7	13	15	2 inch	Shallow	New	Near Field
SW-066-MWS	10.2	7	3.2	0	7	11	13	2 inch	Shallow	New	Near Field
SW-067-MWS	12.4	8	4.4	1	7	12	14	2 inch	Shallow	New	Near Field
SW-068-MWS	14.2	8	6.2	1	10	11	16	2 inch	Shallow	New	Near Field
SW-069-MWS	13.5	8	5.5	1	10	10	15	2 inch	Shallow	New	Near Field
SW-070-MWS	8.2	8	0.2	1	7	8	10	2 inch	Shallow	New	Near Field
SW-071-MWS	12.1	8	4.1	1	7	12	14	2 inch	Shallow	New	Near Field
SW-072-MWS	12.0	7	5.0	0	7	13	15	2 inch	Shallow	New	Near Field
SW-073-MWS	11.4	7	4.4	0	7	12	14	2 inch	Shallow	New	Near Field
SW -074-MWI	8.3	1	7.3	-41.7	10	45	50	2 inch	Intermediate	New	Perimeter

Table 5
Summary of Proposed Groundwater Monitoring Wells

Well ID	Ground Surface Elevation* (feet AMSL)	Groundwater Elevation* (feet AMSL)	Depth to Water (feet bgs)	Bottom of casing elevation (feet AMSL)	PVC Screen Length (feet)	PVC Riser Length (feet)	Total Depth (bgs)	Diameter	Hydrogeologic Zone	New or Replacement	Notes
FM05-PZM004	9.1	6	3.1	-1	7	11	13	2 inch	Shallow	Replacement	[1]
SW06-PZM001	13.4	9	4.4	2	7	12	14	2 inch	Shallow	Replacement	[1]
SW08-PZM003	9.2	5	4.2	-2	7	12	14	2 inch	Shallow	Replacement	[2]
SW11-PZM005	10.4	6	4.3	-1	7	12	14	2 inch	Shallow	Replacement	[1]
SW12-PZP001	14.6	7	7.4	0	10	12	17	2 inch	Shallow	Replacement	[1]
SW13-PZM003	12.9	6	7.4	-2	10	12	17	2 inch	Shallow	Replacement	[2]
SW14-PZM004	10.7	6	4.5	-1	7	12	14	2 inch	Shallow	Replacement	[1]
TM03-PZM004	9.0	2	7.5	-6	10	12	17	2 inch	Shallow	Replacement	[2]
TM05-PZM005	9.9	2	7.9	-5	10	13	18	2 inch	Shallow	Replacement	[2]
TS09-PDM008	8.6	1	8.1	-7	10	13	18	2 inch	Shallow	Replacement	[1]
FM01-PZM041	9.7	6	3.5	-40	7	48	50	2 inch	Intermediate	Replacement	[1][3]
FM05-PZM024	9.1	6	3.1	-41	7	48	50	2 inch	Intermediate	Replacement	[1][3]
SW06-PZM053	13.2	9	4.2	-37	7	48	50	2 inch	Intermediate	Replacement	[1][3]
SW08-PZM053	8.4	5	3.4	-42	7	48	50	2 inch	Intermediate	Replacement	[2][3]
SW09-PZM028	9.9	9	1.4	-40	7	48	50	2 inch	Intermediate	Replacement	[1][3]
SW13-PZM025	12.9	6	7.4	-37	10	45	50	2 inch	Intermediate	Replacement	[1][3]
SW15-PZM031	11.7	9	3.2	-38	7	48	50	2 inch	Intermediate	Replacement	[1][3]
TM03-PZM037	9.1	2	7.6	-41	10	45	50	2 inch	Intermediate	Replacement	[1][3]
TM05-PZM040	10.1	2	8.1	-40	10	45	50	2 inch	Intermediate	Replacement	[1][3]

*Values in these columns were estimated utilizing ArcGIS.
[1] Well needs further inspection, will be replaced if unusable.
[2] Well is damaged and will be replaced
[3] These wells will have a total depth of approximately 50 feet bgs, although the exact depth and screen interval will be determined in the field in order to adequately capture the intermediate hydrogeologic zone.

Total Additional Shallow Zone Wells: 63
Total Additional Intermediate Zone Wells: 12

Appendix A

CH2MHILL

PROJECT NUMBE 164586.01.HT.DR

BORING NUMBER FM01-PZM003

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Bethlehem Steel

LOCATION : Sparrows Point, MD

ELEVATION :

DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Auger with 2' split-spoon

WATER LEVELS : START : 9/21/2001 END:09/21/2001 LOGGER : Linda Lotto

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
0					SLAG FILL, granular silty slag fill	
5						Water Table ♦
	5-6.9	0.9	1	7-4-21-100/5 (25)	(SM) Wet Silt-Sand with Gravel Very Dark Grey Munsell= 10YR 3/Y	
10	10-12	2	2	4-1-1-1 (2)	(CL) Wet Very Soft Silty Clay Penetrometer=0 Dark Greenish Grey Munsell = GLey1 4/1	Clay organic in nature, fibrous material embedded in the clay. Fibrous material from a plant (possibly a phragmites). Bottom of boring
15						
20						
25						
30						

PROJECT NUMBE 148003.23	BORING NUMBER SW-07-UP
	SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel — LOCATION : Sparrows Point, MD

ELEVATION : 14.71 ft (TOC) — DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 16.54 ft bls (1/25/2001) — START : 12/13/2000 END: 12/13/2000 — LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
0					SLAG FILL, black slag fragments, with some silt	Met drillers on site at 7:00 am. Steam-cleaned augers and equipment.	
						Moved drill rig to SW-07 at 8:30 am.	
						Began drilling at 8:45 am.	
5						Drilled to 25' prior to collecting first spoo sample. Lithology to 25 feet is taken from the CPT sounding.	SLAG FILL
10					SILTY CLAY to clay		
15					CLAYEY SILT to silty clay		CLAY 1
20							
25	25 – 27	0.8	1	3 - 3 - 3 - 3 (6)	SILTY SAND, (SM), sand 85%, silt 15%, wet, loose, fine grained quartz, light gray		SAND 1

PROJECT NUMBE 148003.23	BORING NUMBER SW-07-UP
	SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 14.71 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVEL: 16.54 ft bls (1/25/2001) START : 12/13/2000 END: 12/13/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone above Hole	
	30 32	1.8	2	2 - 2 - 3 - 3 (5)	SILTY CLAY, (CL/ML), soft, moist, with some fine grained sand, dark gray and black mottled, medium plasticity		
35							CLAY 2
	35 37	1.8	3	2 - 2 - 18 - 30 (20)			
					SILTY SAND, (SM), wet, sand 80%, silt 20%, medium grained quartz, with some gravel, well rounded		
40	40 42	1.4	4	7 - 17 - 17 - 12 (34)			
					SILTY SAND, (SM), wet, sand 60%, silt 40%, medium grained quartz with well rounded gravel, gray, with shell fragments		SAND 2
45	45 47	1.2	5	2 - 4 - 4 - 8 (8)			
50	50 52	2	6	WOH/6" 1 - 2 - 2 (3)			
					SILTY CLAY, (CL/ML), moist, firm, medium plasticity, with some fine grained sand and shell fragments		
55	55 57	2	7	4 - 4 - 4 - 5 (8)			CLAY 3

PROJECT NUMBER 148003.23	BORING NUMBER SW-07-UP
	SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel — LOCATION : Sparrows Point, MD

ELEVATION : 14.71 ft (TOC) — DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 16.54 ft bls (1/25/2001) — START : 12/13/2000 END: 12/13/2000 — LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	60	2	8	3 - 2 - 3 - 4 (5)			CLAY 3
	62				SANDY SILT, (ML), silt 60%, sand 40%, gray color with shell fragments		
					SANDY SILT, (ML), silt 85%, sand 15%, gray with shell fragments, firm, wet, w/wood fragments and fine grained sand, medium plasticity		
65							
	65	2	9	3 - 3 - 4 - 6 (7)			SAND 3
	67						
70							
	70	2	10	4 - 3 - 4 - 5 (7)			
	72						
					SILTY CLAY, (CL/ML), moist, firm, medium plasticity, dark gray with fine grained sand		
75							
	75	2	11	3 - 4 - 5 - 5 (9)			
	77						
80							CLAY 4
	80	1.9	12	6 - 5 - 9 - 8 (14)			
	82						
85							
	85	2	13	4 - 5 - 7 - 8 (12)			
	87						
					SILTY CLAY, (CL/ML), slightly moist, medium to low plasticity, very firm, dark gray with black mottling and layering, trace fine grained sand, with trace shell fragments and gravel in 100' sample		

PROJECT NUMBER 148003.23	BORING NUMBER SW-07-UP
	SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 14.71 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 16.54 ft bls (1/25/2001) START : 12/13/2000 END: 12/13/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	90 92	2	14	5 - 6 - 7 - 9 (13)	SILTY CLAY, (CL/ML), slightly moist, medium to low plasticity, very firm, dark gray with black mottling and layering, trace fine grained sand, with trace shell fragments and gravel in 100' sample		
95	95 97	1.9	15	4 - 6 - 7 - 9 (13)			CLAY 4
100	100 102	1.6	16	3 - 6 - 6 -8 (12)			
105	105 107	1.8	17	4 - 5 - 7 - 11 (12)	SANDY CLAY, (CL), firm, moist, low plasticity, clay 70%, sand 30%, grayish brown with black mottling		
110	110 112	1	18	WOH/24" (0)	SILTY SAND, (SM), sand 80%, silt 20%, fine grained, yellowish brown, soupy		
115	115 117	1	19	6 - 12 - 28 - 33 (40)	SILTY SAND, (SM), sand 80%, silt 20%, fine grained, brown GRAVELLY SAND, (SW), coarse grained sand, well rounded gravel, wet, multi-color		SAND 4

PROJECT NUMBER 148003.23	BORING NUMBER SW-07-UP
	SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 14.71 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 16.54 ft bls (1/25/2001) START : 12/13/2000 END: 12/13/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
120	120	0.4	20	9 - 20 - 22 - 30 (42)	GRAVELLY SAND, (SW), coarse grained sand, well rounded gravel, wet, multi-color		SAND 4
122	122				End of Boring		
125							
130							
135							
140							
145							

PROJECT NUMBE 148003.23	BORING NUMBER SW-12-UP
	SHEET 1 OF 4

SOIL BORING LOG

PROJECT :	Bethlehem Steel	LOCATION :	Sparrows Point, MD
ELEVATION :	17.94 ft (TOC)	DRILLING CONTRACTOR :	E2SI
DRILLING METHOD AND EQUIPMENT USED :	Mobile B-61, Hollow Stem Augers, 4.25 ID		
WATER LEVELS	19.60 ft bls (1/25/2001)	START : 12/06/2000	END: 12/07/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
					SLAG FILL, black slag fragments, with some silt	Met drillers on site at 8:00 am. Steam-cleaned augers and equipment.	
						Moved drill rig to SW-12 at 9:30 am.	
						Began drilling at 10:00 am.	
5						Drilled to 50' prior to collecting first spoo sample. Lithology to 50 feet is taken from the CPT sounding.	
							SLAG FILL
10							
15					SANDY SILT, to clayey silt		
					CLAYEY SILT, to silty clay		
					SANDY SILT, to clayey silt		
20					CLAYEY SILT, to silty clay		CLAY 1
					SANDY SILT, to clayey silt		
					CLAYEY SILT, to silty clay		
					SANDY SILT, to clayey silt		
25					Sensitive fine grained material		
							CLAY 2

PROJECT NUMBE 148003.23	BORING NUMBER SW-12-UP
	SHEET 2 OF 4

SOIL BORING LOG

PROJECT :	Bethlehem Steel	LOCATION :	Sparrows Point, MD
ELEVATION :	17.94 ft (TOC)	DRILLING CONTRACTOR :	E2SI
DRILLING METHOD AND EQUIPMENT USED :	Mobile B-61, Hollow Stem Augers, 4.25 ID		
WATER LEVEL:	19.60 ft bls (1/25/2001)	START : 12/06/2000	END: 12/07/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone above Hole	
					Sensitive fine grained material		
35					SANDY SILT to clayey silt		CLAY 2
40					SILTY SAND to sandy silt		SAND 2
					SANDY SILT to clayey silt		
45							
50							CLAY 3
	50 52	2	1	4 - 2 - 4 - 4 (6)	CLAYEY SILT, (ML/CL), wet, soft, dark gray with black organic matter at 50', trace gravel at 55', gravel and shells at 60', large shells at 65' and 70' samples		
55							
	55 57	1.7	2	4 - 3 - 4 - 5 (7)			

PROJECT NUMBER 148003.23	BORING NUMBER SW-12-UP
	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Bethlehem Steel — LOCATION : Sparrows Point, MD

ELEVATION : 17.94 ft (TOC) — DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 19.60 ft bls (1/25/2001) — START : 12/06/2000 END: 12/07/2000 — LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	60				CLAYEY SILT, (ML/CL), wet, soft, dark gray with black organic matter at 50', trace gravel at 55', gravel and shells at 60', large shells at 65' and 70' samples		
	62	2	3	4 - 3 - 4 - 4 (7)			
65							
	65						CLAY 3
	67	2	4	4 - 4 - 5 - 5 (9)			
70							
	70						
	72	2	5	3 - 3 - 4 - 6 (7)			
					SILTY CLAY, (CL/ML), firm, moist, and dark gray to 90' with gray coloring and layering to 95' and gray with black mottling to 102'		
75							
	75						
	77	1	6	3 - 3 - 4 - 4 (7)			
80							
	80						CLAY 4
	82	1.7	7	4 - 4 - 4 - 6 (8)			
85							
	85						
	87	2	8	3 - 4 - 5 - 6 (9)			

PROJECT NUMBER 148003.23	BORING NUMBER SW-12-UP
	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 17.94 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 19.60 ft bls (1/25/2001) START : 12/06/2000 END: 12/07/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	90 92	2	9	5 - 6 - 6 - 7 (12)	SILTY CLAY, (CL/ML), firm, moist, and dark gray to 90' with gray coloring and layering to 95' and gray with black mottling to 102'		
95	95 97	1.5	10	5 - 6 - 8 - 8 (14)			
100	100 102	1.4	11	4 - 4 - 6 - 8 (10)			CLAY 4
105	105 107	2	12	4 - 4 - 5 - 6 (9)	SILTY CLAY, (CL/ML), firm, moist, dark yellowish brown with black		
110	110 112	2	13	6 - 25 - 24 - 32 (49)	SILTY SAND, (SM), sand 90%, loose, silt 20%, dark yellowish brown turning to gray, turning to very pale brown color, wet, fine to medium grained quartz		SAND 4
115	115 117	0.9	14	19 - 22 - 19 - 24 (41)			
					End of Boring		

PROJECT NUMBE 148003.23	BORING NUMBER SW-13-UP
	SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel — LOCATION : Sparrows Point, MD

ELEVATION : 13.31 ft (TOC) — DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 14.58 ft bls (12/12/2000) — START : 11/28/2000 END: 11/29/2000 — LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
0					SLAG FILL, black slag fragments, with some silt	Met drillers on site at 7:15 am. Steam-cleaned augers and equipment.	
						Moved drill rig to SW-13 at 8:30 am.	
						Began drilling at 9:00 am.	
5						Drilled to 20' prior to collecting first spoo sample. Slag fill to approx. 20 ft.	
							SLAG FILL
10							
15							
20	20 22	0.2	1	8 - 8 - 7 - 6 (15)	SILTY CLAY, (CL/ML), light gray with some slag fragments		
					SILTY CLAY, (CL/ML), mottled yellowish red silt and light gray with some slag fragments		**CLAY 1**
25	25 27	1.8	2	8 - 6 - 7 - 9 (13)	SILTY SAND (SM), sand 60%, silt 40%, yellowish red fine grained quartz		**SAND 1**

PROJECT NUMBE 148003.23	BORING NUMBER SW-13-UP
	SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 13.31 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVEL: 14.58 ft bls (12/12/2000) START : 11/28/2000 END: 11/29/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone above Hole	
	30	1.6	3	3 - 3 - 4 - 3 (7)	SILTY CLAY, (CL/ML), clay 80%, silt 20% with some fine grained sand, dark gray		
	32						CLAY 2
35							
	35	1.3	4	3 - 7 - 6 - 9 (13)	SILTY SAND, (SM), sand 60%, silt 40%, some shell fragment in 35 - 37 foot sample, mottled gray and olive brown turning to light olive brown, fine grained quartz		
	37						
40							
	40	1.2	5	7 - 10 - 15 - 16 (25)			
	42						
45							
	45	1	6	15 - 8 - 10 - 11 (18)	SAND, (SW), fine to medium grained quartz, light gray pale brown		
	47				CLAYEY SILT, (ML/CL), moist, firm, with wood fragments very dark gray		SAND 2
					SILTY SAND, (SM), wet, sand 60%, silt 40%, fine grained quartz, very dark gray		
50							
	50	1.5	7	14 - 10 - 10 - 5 (20)	SILTY SAND, (SM), wet, sand 60%, silt 40%, fine to medium grained quartz, light gray and yellowish brown mottled, with some small white gravel in the 55 to 57 feet sample		
	52						
55							
	55	1	8	5 - 9 - 9 - 4 (18)			
	57						

PROJECT NUMBER 148003.23	BORING NUMBER SW-13-UP
	SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel — LOCATION : Sparrows Point, MD

ELEVATION : 13.31 ft (TOC) — DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 14.58 ft bls (12/12/2000) — START : 11/28/2000 END: 11/29/2000 — LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	60				SILTY SAND, (SM), wet, sand 60%, silt 40%, fine grained quartz, light gray, yellowish brown, and dusky red mottled, with some small white gravel		
	62	0.9	9	6 - 11 - 12 - 14 (23)			
							SAND 2
65							
	65				SILTY SAND, (SM), wet, sand 60%, silt 40%, fine grained quartz, light gray		
	67	1.8	10	36 - 13 - 2 - 2 (15)	SANDY SILT, (ML), moist, firm, silt 70%, sand 30%, light gray color, fine grained quartz, with some small gravel and wood fragments		
70							
	70				SANDY CLAY, (CL), moist, fine grained quartz, gray		
		1.7	11	18 - 41 - 38 - 35 (79)	CLAYEY SAND, (SC), sand 60%, clay 40%, fine grained quartz, gray		
	72				SILTY CLAY, (CL/ML), moist, firm, clay 80%, silt 20%, with some fine grained quartz, gray		
75							
	75				SILTY CLAY, (CL/ML), moist, firm, clay 80%, silt 20%, gray and reddish brown mottling with some organic matter		CLAY 3
	77	1.8	12	10 - 17 - 35 - 41 (52)			
80							
	80				SILTY CLAY, (CL/ML), moist, firm, clay 80%, silt 20%, gray and reddish brown mottling with some fine grained sand		
	82	1.8	13	17 - 23 - 34 - 51 (57)			
85							
	85				SILTY CLAY, (CL/ML), moist, dense, clay 80%, silt 20%, reddish brown with some fine grained sand		
	87	1.6	14	17 - 49 - 50/4" (99)	SILTY SAND, (SM), wet, dense, sand 80%, silt 20%, fine to medium grained quartz, gray		SAND 3

PROJECT NUMBER 148003.23	BORING NUMBER SW-13-UP
	SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 13.31 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 14.58 ft bls (12/12/2000) START : 11/28/2000 END: 11/29/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	90 92	1.1	15	19 - 46 - 50/4" (96)	SILTY SAND, (SM), wet, dense, sand 80%, silt 20%, fine to medium grained quartz, gray		SAND 3
					SANDY SILT, (SM), silt 60%, sand 40%, fine grained quartz sand, gray		
95	95 97	1.5	16	12 - 26 - 40 - 47 (66)	SILTY CLAY, (CL/ML), clay 80%, silt 20%, mottled with various colors including red, gray, weak red, reddish brown, light olive brown and dark red, very dense, brittle when compressed		
100	100 102	1.4	17	12 - 29 - 43- 50 (72)			CLAY 4
105	105 107	1.7	18	19 - 36 - 49 - 50/4" (85)			
110	110 112	1	19	33 - 50/4" (83)			
115	115 117	1.4	20	15 - 44 - 50/5" (94)			

PROJECT NUMBER 148003.23	BORING NUMBER SW-13-UP
	SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bethlehem Steel LOCATION : Sparrows Point, MD

ELEVATION : 13.31 ft (TOC) DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Mobile B-61, Hollow Stem Augers, 4.25 ID

WATER LEVELS 14.58 ft bls (12/12/2000) START : 11/28/2000 END: 11/29/2000 LOGGER : Lisa Carter

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole	
	120	0.85	21	42 - 50/4" (92)			
	122				SILTY SAND, (SM), wet, dense, sand 60%, silt 40%, fine to very fine grained quartz, light gray		
					SANDY CLAY, (CL), moist, dense, clay 60%, sand 40%, fine grained quartz, light gray and red		**CLAY 4**
125							
	125	0.25	22	50/3" (50)			
	127						
					End of Boring		
130							
135							
140							
145							

CH2MHILL

PROJECT NUMBE 164586.01.HT.DR | **BORING NUMBER** TM03-PZM004

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Bethlehem Steel | LOCATION : Sparrows Point, MD

ELEVATION : | DRILLING CONTRACTOR : E2SI

DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Auger with 2' split-spoon

WATER LEVELS 9.5 BGS | START : 9/19/2001 END: 09/19/2001 | LOGGER : Linda Lotto

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
0					SLAG FILL, granular silty slag fill	
	3-5	1.5	1	3-9-6-19 (15)	(GM) Dry Silty Gravel Slag. Black Munsell=5Y2.5/1	
5						
	8-10	1	2	10-16-18-59 (34)	(GM) Dry Silty Gravel Slag. Black Munsell=5Y2.5/1	Water Table ♦
10						
	13-15	1.2	3	9-9-8-7 (17)	(GM) Wet Silty Gravel Slag. Very dark Brown Munsell=7.5YR 2.5/3	
15						Bottom of boring
20						
25						
30						

Appendix B

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: W. Shop Road: Next to RR tracks

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: FM01-PZM003 Well Permit No.: _____

Coordinates:

Latitude/Northing 568252.054 Longitude/Easting 1460279.365

Condition of Well Pad: Fair Flush Mount or Stick-Up? Flush

Well ID Marked? No If yes, where? _____

Locking cap? No Lock? No Diameter of Well: 2 in.

Structural integrity of well: Good; has broken cap (fell in well); good cover

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	3.94 TOC; 4.13 BGS	
Depth to Bottom (feet BGS/TOC)	11.31 TOC; 11.51 BGS	13.5' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Well cap broke while replacing and a piece fell into well. Placed nitrile glove under cap to seal.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Open gravel area

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: FM05-PZM004 Well Permit No.: _____

Coordinates:

Latitude/Northing 568569.755 Longitude/Easting 1462039.327

Condition of Well Pad: NA Flush Mount or Stick-Up? Stick-up

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: Could not locate well

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		14' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Off side of Canal Rd.; near mound

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SG07-PZM007 Well Permit No.: _____

Coordinates:

Latitude/Northing 564148.494 Longitude/Easting 1463674.708

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? Yes If yes, where? Right side of outer casing

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	17.44 TOC; 14.77 BGS	
Depth to Bottom (feet BGS/TOC)	25.41 TOC; 22.74 BGS	19' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Could not locate well

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW06-PZM001 Well Permit No.: _____

Coordinates:

Latitude/Northing 569204.398 Longitude/Easting 1463626.61

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA (Could not locate well)

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		15' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well; only broken PVC found.

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: After RR, before fence

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW07-PZM004 Well Permit No.: _____

Coordinates:

Latitude/Northing 567658.832 Longitude/Easting 1456050.022

Condition of Well Pad: Good Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	12.23 TOC; 9.78 BGS	
Depth to Bottom (feet BGS/TOC)	18.15 TOC; 15.70 BGS	16' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Black outer casing

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In marsh closer to hill

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW08-PZM003 or SW08-PZM053 Well Permit No.: _____

Coordinates:

Latitude/Northing 568112.127/568107.673 Longitude/Easting 1459112.156/1459113.28

Condition of Well Pad: Under Water Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? No Lock? No Diameter of Well: 2 in.

Structural integrity of well: Likely blocked/ could not identify water.

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	NA (blocked?)	
Depth to Bottom (feet BGS/TOC)	2.85 TOC; 2.55 BGS	

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Well located in ditch surrounded by water

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Off 7th St.: Access Road

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW09-PZM004 Well Permit No.: _____

Coordinates:

Latitude/Northing 566975.141 Longitude/Easting 1460293.513

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? Yes If yes, where? Middle outer casing

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	5.93 TOC; 3.14 BGS	
Depth to Bottom (feet BGS/TOC)	16.98 TOC; 13.19 BGS	14' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Access road next to fire station

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW10-PZM012 Well Permit No.: _____

Coordinates:

Latitude/Northing 567312.891 Longitude/Easting 1463288.221

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? Yes If yes, where? Front side of outside casing

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	9.6 TOC; 6.56 BGS	
Depth to Bottom (feet BGS/TOC)	20.3 TOC; 17.26 BGS	17' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW11-PZM005 Well Permit No.: _____

Coordinates:

Latitude/Northing 565800.944 Longitude/Easting 1456075.911

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Cleared some vegetation and dug soil slightly; could not locate. Records indicate "Flush Mount".

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate well

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW12-PZP001 Well Permit No.: _____

Coordinates:

Latitude/Northing 565991.29 Longitude/Easting 14157437.268

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well; GPS shows location in middle of clear field with gravel

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Patch of grass; white voltage boxes

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW13-PZM003 Well Permit No.: _____

Coordinates:

Latitude/Northing 563496.415 Longitude/Easting 1456410.803

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? Yes If yes, where? Top riser cap

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Poor; tilted 30 degrees; Possible Blockage

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)	Dry/Blocked	

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Well lid partially broken

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW14-PZM004 Well Permit No.: _____

Coordinates:

Latitude/Northing 563388.178 Longitude/Easting 1457679.013

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		15' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate; area appears to have been demolished; possibly under rubble pile

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Near overhead pipe; Next to tree

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW15-PZM005 Well Permit No.: _____

Coordinates:

Latitude/Northing 564367.598 Longitude/Easting 1459534.073

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	4.87 TOC; 2.28 BGS	
Depth to Bottom (feet BGS/TOC)	20.31 TOC; 17.72 BGS	17' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Near RR in patch of bushes; in road

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW16-PZM003 Well Permit No.: _____

Coordinates:

Latitude/Northing 564524.689 Longitude/Easting 1462434.666

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	8.20 TOC; 6.08 BGS	
Depth to Bottom (feet BGS/TOC)	17.60 TOC; 15.48 BGS	15' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In small patch of grass near tower

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: TM03-PZM004 Well Permit No.: _____

Coordinates:

Latitude/Northing 568855.1685 Longitude/Easting 1457622.3

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Bad; well and casing bent completely flush with ground surface

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		15' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to bend

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In trees near bundle of RR ties

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: TM05-PZM005 Well Permit No.: _____

Coordinates:

Latitude/Northing 568852.343 Longitude/Easting 1458598.173

Condition of Well Pad: Broken Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Well bent past 45 degrees (straightened upright)

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	11.86 TOC; 8.10 BGS	
Depth to Bottom (feet BGS/TOC)	16.67 TOC; 12.91 BGS	15'BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Pulled well upright and took well measurements. PVC possibly broken or disconnected.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: In woods next to RR tracks

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: TS10-PPM005 Well Permit No.: _____

Coordinates:

Latitude/Northing 567530.198 Longitude/Easting 1464010.165

Condition of well pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? No Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	5.97' TOC; 3.29' BGS	-
Depth to Bottom (feet BGS/TOC)	13.19' TOC; 10.51' BGS	14' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: W. Shop Road; Next to RR tracks

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: FM01-PZM041 Well Permit No.: _____

Coordinates:

Latitude/Northing 568251.833 Longitude/Easting 1460275.595

Condition of Well Pad: Clear; soil area Flush Mount or Stick-Up? Flush

Well ID Marked? No If yes, where? _____

Locking cap? No Lock? No Diameter of Well: ½ in.

Structural integrity of well: Corroded seal

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		51' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Dug soil to uncover; could not measure. Well Cap painted fluorescent orange.

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Could not locate well

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: FM05-PZM024 Well Permit No.: _____

Coordinates:

Latitude/Northing 568561.617 Longitude/Easting 1462039.291

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA (Could not locate well)

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		32' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Could not locate well

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW06-PZM053 Well Permit No.: _____

Coordinates:

Latitude/Northing 569204.261 Longitude/Easting 1643631.605

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		67' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Only found broken pvc in soil

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Could not locate

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW08-PZM003/SW08-PZM053 Well Permit No.:

Coordinates:

Latitude/Northing 568112.127/568107.673 Longitude/Easting 1459112.156/1459113.28

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where?

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: Could not locate well

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Off 7th St: Access road

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW09-PZM028 Well Permit No.: _____

Coordinates:

Latitude/Northing 566975.977 Longitude/Easting 1460287.924

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? Partially If yes, where? Middle outside exterior casing

Locking cap? Yes Lock? Yes Diameter of Well: ½ in

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Diameter too small to measure

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Patch of bushes; white voltage boxes

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW13-PZM025 Well Permit No.: _____

Coordinates:

Latitude/Northing 563498.818 Longitude/Easting 1456410.606

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? No Diameter of Well: ½ in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		39' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to diameter.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Near overhead pipe

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW15-PZM031 Well Permit No.: _____

Coordinates:

Latitude/Northing 564372.669 Longitude/Easting 1459531.619

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		43' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to diameter

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In small patch of grass near tower

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: TM03-PZM037 Well Permit No.: _____

Coordinates:

Latitude/Northing 568850.5805 Longitude/Easting 1457616.781

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in.

Structural integrity of well: Well bent

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		48' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to diameter and bend

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Could not locate

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: TM05-PZM040 orTM05-PZM069 Well Permit No.: _____

Coordinates:

Latitude/Northing 568847.867 or 568845.666 Longitude/Easting 1458598.509 or 1458593.769

Condition of well pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: Could not locate

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		80’ or 50’ BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate well

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: TS09-PDM008 Well Permit No.: _____

Coordinates:

Latitude/Northing 567097.148 Longitude/Easting 1464242.2

Condition of well pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		17' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Well location adjacent to railroad tracks; which is being dug up. GPS puts the well under a pile of asphalt.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: After RR, before fence

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW07-PZM108 Well Permit No.: _____

Coordinates:

Latitude/Northing 567665.21 Longitude/Easting 1456049.01

Condition of Well Pad: Good Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good; inner casing slightly tilted; no well cap

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	15.96 TOC; 12.33 BGS	
Depth to Bottom (feet BGS/TOC)	124.45 TOC; 120.82	120' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Off 7th St: Access road

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: SW09-PZM068 Well Permit No.: _____

Coordinates:

Latitude/Northing 566970.991 Longitude/Easting 1460290.85

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		78' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Diameter too small to measure

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Access road next to fire station

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW10-PZM085 Well Permit No.: _____

Coordinates:

Latitude/Northing 567286.887 Longitude/Easting 1463311.377

Condition of Well Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		90' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to diameter.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW11-PZM092 Well Permit No.: _____

Coordinates:

Latitude/Northing 565801.436 Longitude/Easting 1456083.477

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Cleared some vegetation and dug around the area; could not locate. Records indicate "Flush Mount".

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate well

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW12-PZM100 Well Permit No.: _____

Coordinates:

Latitude/Northing 565989.874 Longitude/Easting 1457431.31

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where? _____

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate; GPS shows location in middle of clear field with Gravel.

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Patch of bushes; white elect. boxes

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW13-PZM111 Well Permit No.: _____

Coordinates:

Latitude/Northing 563502.98 Longitude/Easting 1456409.706

Condition of Well Pad: Good Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? No Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	16.25 TOC; 14.72 BGS	
Depth to Bottom (feet BGS/TOC)	127.33 TOC; 125.80 BGS	125' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Monitoring wells Location of Well: Could not locate

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW14-PZM099 Well Permit No.:

Coordinates:

Latitude/Northing 563386.52 Longitude/Easting 1457671.2

Condition of Well Pad: NA Flush Mount or Stick-Up? NA

Well ID Marked? NA If yes, where?

Locking cap? NA Lock? NA Diameter of Well: NA

Structural integrity of well: NA (could not locate)

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		110' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not locate well. GPS shows should be under pile of rubble

Possible piece of well casing observed.

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: Near overhead pipe

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW15-PZM085 Well Permit No.: _____

Coordinates:

Latitude/Northing 564367.461 Longitude/Easting 1459539.351

Condition of Well Pad: Good Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: 2 in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	15.12 TOC; 13.15 BGS	
Depth to Bottom (feet BGS/TOC)	102.2 TOC; 100.23 BGS	97' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: _____

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In small patch of bushes near RR tracks

Project Number: 150300M Date: 9/15/2015

WELL INFORMATION

Well ID: SW16-PZM067 Well Permit No.: _____

Coordinates:

Latitude/Northing 564528.79 Longitude/Easting 1462441.872

Condition of Wall Pad: Fair Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in.

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		79' BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure due to diameter

PICTURE OF WELL DURING INSPECTION

ARM Group Inc.

WELL INSPECTION FORM

Site: Sparrows Point: Area B Location of Well: In trees near bundle of RR ties

Project Number: 150300M Date: 9/14/2015

WELL INFORMATION

Well ID: TM05-PZM040 or TM05-PZM069 Well Permit No.: _____

Coordinates:

Latitude/Northing 568847.867/568845.666 Longitude/Easting 1458598.609/1458593.769

Condition of well pad: Buried Flush Mount or Stick-Up? Stick-up

Well ID Marked? No If yes, where? _____

Locking cap? Yes Lock? Yes Diameter of Well: ½ in.

Structural integrity of well: Well bent past 45 degrees (did not straighten)

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)		
Depth to Bottom (feet BGS/TOC)		80’ or 50’ BGS

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: Could not measure well due to diameter and tilt.

PICTURE OF WELL DURING INSPECTION

Appendix C

Health and Safety Plan

Area B Groundwater Investigation
Sparrows Point Terminal, LLC
Sparrows Point, Maryland

Prepared for:
EnviroAnalytics Group
1650 Des Peres Road
Suite 230
Saint Louis, Missouri 63131

Prepared by:
ARM Group Inc.
9175 Guilford Road
Suite 310
Columbia, MD 21046

September 2015

ARM Project 150300M

Respectfully submitted,

Eric S. Magdar
Senior Geologist

T. Neil Peters
Vice President

TABLE OF CONTENTS

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared for employees of ARM Group Inc. (ARM) to address personnel health and safety requirements for employees of ARM and its subcontractors to complete a Phase II investigation on a portion of the Sparrows Point Terminal, LLC property that has been designated as Area B. The on-site activities shall include the following: collection of soil samples, installation and purging of permanent monitoring wells, and the collection of groundwater samples. ARM will comply with industry-standard health and safety protocol and Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 to prevent human exposure to volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), petroleum hydrocarbons, polychlorinated biphenyls (PCB) and metals present in site soil and groundwater.

2.0 GENERAL INFORMATION

2.1 Site Description

Area B, which is comprised of 1,140 acres of the approximately 3,100-acre former plant property, is located off of Sparrows Point Boulevard in Sparrows Point, Maryland. Area B is an area that composes of 10 parcels within the Sparrows Point facility. Area B and its parcels are shown on **Figure 1.**

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

2.2 Site Hazards

The following is a general description of the potential site hazards.

Chemical Hazards:

- VOCs, SVOCs, PCBs and petroleum hydrocarbons potentially present in soil and groundwater.

Explosive Hazards:

- VOC and petroleum hydrocarbon vapors in boreholes and collection containers.

Physical Hazards:

- Slipping/tripping in work area
- Stress/fatigue from heat or cold temperatures
- Traffic
- Driving on steep slopes in off-road conditions
- Insect and animal bites
- Hand tools

Mechanical/Electrical Hazards:

- Underground utilities
- Heavy equipment (Hollow-stem Auger Rig)
- Noise from heavy equipment operations
- Power tools

2.3 Utilities

Prior to initiating any subsurface investigations, all underground utilities will be cleared using the Miss Utility system. Additionally, EnviroAnalytics Group (EAG) will clear each proposed

boring with utility personnel currently working on the property. The ARM staff will be responsible for avoiding any above ground utilities while operating vehicles on the site.

2.4 Waste Management

Investigation derived waste material will be generated as a result of the planned site work. These wastes will include the following: soil cuttings, decontamination water, and groundwater. Specific procedures for investigation derived waste (IDW) have been established in SOP 005, attached in Appendix A of the EPA approved Quality Assurance Project Plan (QAPP), in order to properly handle IDW wastes from drilling and/or sampling activities.

2.5 Site Controls and Security

It is the responsibility of ARM staff to keep unauthorized personnel away from the work areas during site work. All equipment used at the site must be secured or taken off-site. Subsurface intrusions should be covered to reduce any hazard that may be posed. Traffic cones, caution tape, physical barriers, or other such means as necessary shall be used to ensure that no unauthorized work area entry occurs.

3.0 OPERATING PROCEDURES

3.1 Air Monitoring

Due to the nature of the site activities and materials potentially present at the site, no vapor hazards are expected. If discernable odors are noted, then work will be temporarily suspended and air monitoring will be initiated using a PID or explosive gas indicator. If sustained vapor concentrations are measured at or above action levels in the breathing zone, work will immediately cease until such time as appropriate action is established. This action may require the upgrade of PPE or reevaluation of the need to proceed.

3.2 Personnel Protection

Personnel health and safety protection shall follow the guidelines provided by this HASP. Modifications to the HASP may be made by the field supervisor with the approval of the ARM Project Manager on a day-to-day basis as conditions change, based on existing conditions. Any necessary revisions must be fully documented by the field supervisor to include the specifics and rationalizations for the change.

It is anticipated that a modified Level D will be appropriate for the anticipated site activities. PPE associated with this designated level of protection (Level D), as established by the USEPA, is listed in a later section. Equipment listed for this level should be available to all personnel.

PPE will be stored in a clean, dry environment prior to it usage. Disposable equipment shall remain, in as much as possible, its original manufacturer's packaging to ensure its integrity. PPE that is assigned to a specific end user is subject to inspection by the supervisor at any time.

3.2.1 Determination of Level of Protection Requirements

The appropriate level of personnel protection must be established on the basis of ambient air monitoring responses. Air monitoring action levels should be consistent with the primary compounds of concern as listed in Table 3-1 (below). Appropriate action should be taken if total organic vapor air concentrations are sustained at a concentration equal to or greater than the PEL listed on Table 3-1.

Substance	CAS #	OSHA PEL (ppm)	IDLH (ppm)
Benzene	71-43-2	10	500
Toluene	108-88-3	200	500
Ethyl benzene	100-41-4	100	800
Xylenes	1330-20-7	100	900
Naphthalene	91-20-3	10	250
Tetrachloroethylene	127-18-4	100	150
Trichloroethylene	79-01-6	100	1,000

Notes: ppm = parts per million, PEL = Permissible Exposure Limit,
STEL = Short Term Exposure Limit, IDLH = Immediately Dangerous to Life or Health

This criterion will be applicable to all activities unless specific protection requirement for a certain task are addressed separately. As previously stated, it is anticipated that a modified Level D will be appropriate for the anticipated site activities; which requires a regular worker uniform, steel-toed safety shoes, hardhat, safety glasses and long paints. Level D will be considered the minimum protection level for all work on-site.

Respiratory protection against dust must also be considered during site work, particularly on windy days. The usage of dust respirators (high efficiency particulate air [HEPA] filters) will be determined by site conditions and judgment of the field supervisor. Sprinklers may be used to control dust during work activities.

3.2.2 Dermal Protection

In general, dermal protection levels will correspond with the respiratory protection level in use during an activity as described in other sections. For most activities on the site, Level D dermal protection will be adequate. When work tasks are such that a higher level of personal protection is required, dermal protection may be upgraded to coated Tyvek (Saranex) or chemical-resistant rain suit or Tyvek. This determination will be made by the ARM Field Supervisor as required.

Chemical and abrasion-resistant outer gloves and inner chemical-resistant disposable gloves would be required in the work zone to provide adequate protection of hands and assist in preventing transfer of contaminants. As much of the investigation may require handling of possibly contaminated equipment, groundwater, or soil, chemical-resistant gloves should be required for all on-site work with these materials. Various operations, which require dexterity and do not necessitate the abrasion-resistant feature of outer gloves, could be performed with the inner gloves only, at the direction of the ARM Field Supervisor.

3.2.3 Eye Protection

Since many volatile contaminants are capable of penetrating skin tissues, the eyes provide a potential route of entry into the body. Typically, volatile organic vapors will be detected in the air-monitoring program. Dust and air-borne particulates will be monitored visually and nuisance dust standards will be applied. If exceeded, dust masks will be donned. Eye protection requirements must correspond to the respiratory protection level.

3.3 Task-Related Personnel Protection

At a minimum, all workers are required to wear long pants, steel toed shoes and a sleeved shirt at all times. Additional PPE will be required on a task-specific basis.

3.3.1 Soil Logging and Soil Sampling Activities

All personnel should wear the following:

- Long pants and sleeved shirt/vest (high visibility)
- Steel toe safety boots
- Safety glasses with side shields
- Hearing protection
- Hardhat
- Chemical resistant gloves

3.3.2 Well Installation Activities

All personnel should wear the following PPE during well installation activities:

- Long pants and sleeved shirt
- Steel toe safety boots
- Safety glasses with side shields
- Hearing protection
- Hardhat
- Chemical resistant gloves

3.3.3 Groundwater Sampling

All personnel should wear the following PPE during groundwater sampling activities:

- Long pants and sleeved shirt
- Steel toe safety boots
- Safety glasses with side shields
- Chemical resistant gloves

3.4 Explosion Prevention

Due to the potential presence of flammable materials at the site, the following safety guidelines must be followed to prevent the possibility of explosion:

a. All monitoring equipment will be intrinsically safe or explosion-proof, if used in areas of possible explosive atmospheres.

b. A fire extinguisher, first-aid kit, and an eye wash station will be located at the site within a short distance of site work.

c. Any compressed gas cylinders or bottles will be stored safely as required by the OSHA regulations. In addition, metal barriers must be provided and installed between oxygen and acetylene bottles, extending above the height of the regulators. At the end of each work shift, regulators shall be removed and replaced with protective caps.

d. No explosives, whatsoever, shall be used or stored on the premises.

e. All cleaning fluids or solvents must be stored and transported in OSHA-approved safety containers.

f. Propane, butane, or other heavier-than-air gases shall not be transported onto or used on-site unless prior approval is obtained in writing from the Project Manager and the Facility Operator.

4.0 DECONTAMINATION PROCEDURES

Decontamination procedures will be used on some field tasks, but not all, completed at the site. All decontamination operations will be performed at the sampling location unless the level of PPE is upgraded. If the level of PPE is upgraded, all decontamination operations will be performed in a central decontamination area and supervised by the ARM Field Supervisor. If necessary, a decontamination corridor will be set up adjacent to the area and equipped with brushes and drum storage. Disposable outerwear and contaminated disposable equipment will be placed directly into a 55-gallon steel drum for future disposal. Please refer to SOP 005 for additional guidance regarding IDW. The ARM Field Supervisor would be required to inspect PPE and clothing to determine if decontamination procedures were sufficient to allow passage into the staging area.

The following decontamination facilities, as a minimum, will be provided in the staging area:

a. Hand washing facilities

b. First-aid kit

c. Eye wash station

d. Fire extinguisher

Proper on-site decontamination procedures, the use of disposable outer clothing, and field wash of hands and face as soon as possible after leaving the decontamination corridor could effectively minimize the opportunity for skin contact with contaminants.

4.1 Personnel Decontamination Procedures

Decontamination procedures should be as follows:

Level D decontamination will consist of:

1. Potable water wash and potable water rinse of boots and outer gloves (if worn).

2. Drum all visibly impacted disposable clothing.

3. Field wash of hands and face.

4.2 Equipment Decontamination

Specific procedures for decontamination of field equipment have been established in SOP 016, attached in Appendix A of the EPA approved QAPP, in order to prevent cross contamination by the drilling or sampling equipment.

Level D personnel protection is required during equipment decontamination.

5.0 EMERGENCY CONTINGENCY INFORMATION

Pertinent emergency telephone numbers are listed in Table 5-1. This information must be reviewed by and provided to all personnel prior to site entry.

Table 5-1
Emergency Telephone Numbers

Facility/Title	Telephone Number
Fire and Police	911
Ambulance	911
James Calenda, EnviroAnalytics Group	(314) 620-3056
Eric Magdar, ARM Manager	Office: (410) 290-7775 Cell: (301) 529-7140
Hospital – Johns Hopkins Bayview	(410) 550-0350

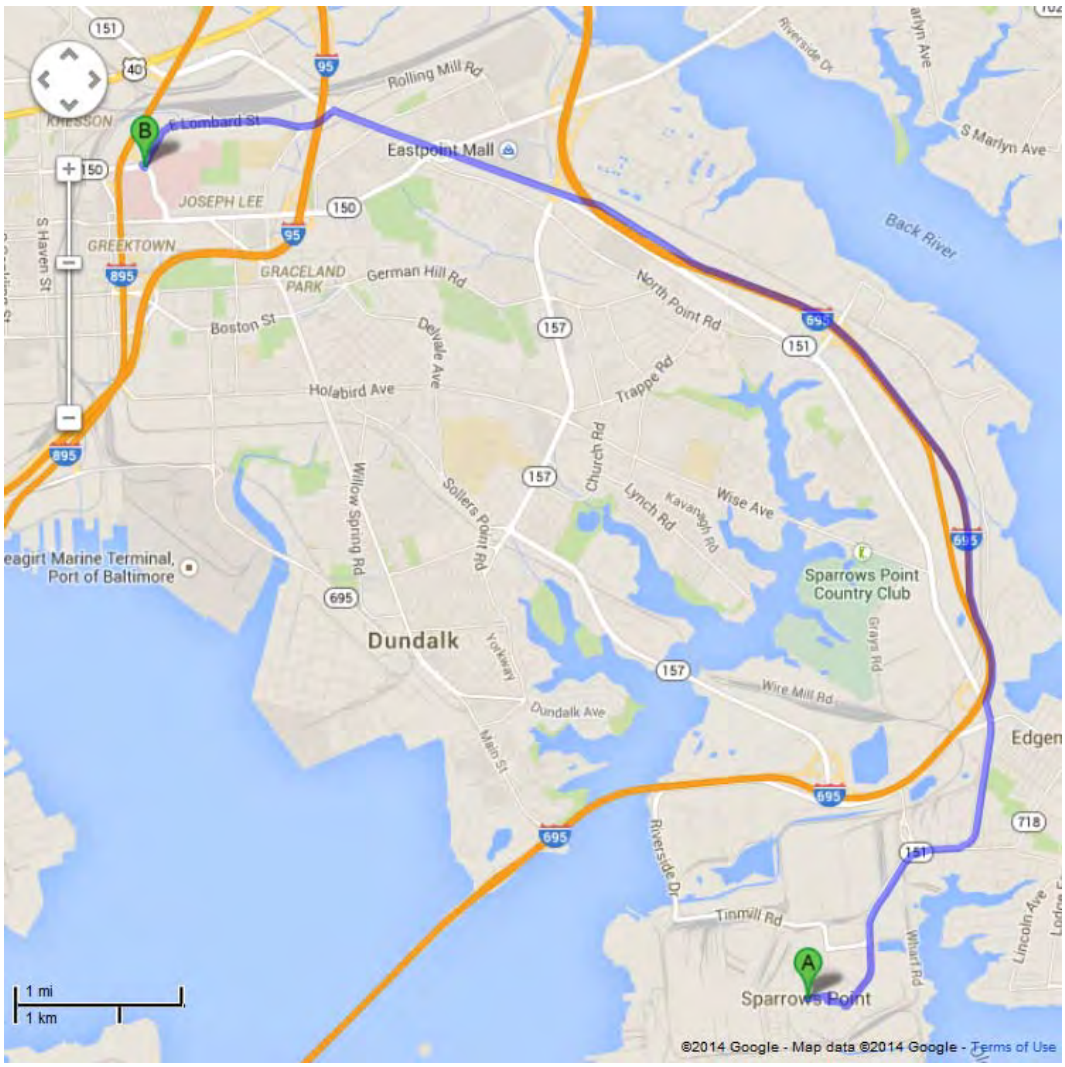
In the event of a fire or explosion, the site will be evacuated immediately and the appropriate emergency response groups notified. In the event of an environmental incident caused by spill or spread of contamination, personnel will attempt to contain the spread of contamination, if possible.

In the event of a personnel injury, emergency first aid would be applied on site by ARM as deemed necessary. The victim should be transported to the local medical facility if needed. The map to the hospital is provided below.

Hospital Route From Sparrows Point Terminal

Johns Hopkins Bayview
4940 Eastern Avenue
Baltimore, MD
(410) 550-0350

1. Start out going East on 7th Street.
2. Turn LEFT onto Sparrow Point Road.
3. Travel 1.4 miles and continue onto North Point Boulevard.
4. Travel 0.9 miles and turn slight right to merge onto I-695 North/Baltimore Beltway toward Essex.
5. Travel 3.4 miles and take EXIT 40 for MD-151/N. Pt. Blvd. N toward MD-150/East. Blvd W/Baltimore.
6. Travel 0.5 miles and merge onto MD-151 N/North Point Blvd.
7. Travel 2.0 miles and turn LEFT onto Kane Street.
8. Travel 0.2 miles and turn slight right onto E. Lombard Street.
9. Travel 1.2 miles and turn left onto Bayview Blvd.
10. Make a left at the emergency room of the hospital



6.0 ACKNOWLEDGEMENT OF PLAN

All site personnel are required to read and comply with the HASP. The following safety compliance affidavit should be signed and dated by each person directed to work on-site.

I have read this HASP and agree to conduct all on-site work in conformity with the requirements of the HASP. I acknowledge that failure to comply with the designated procedures in the HASP may lead to my removal from the site, and appropriate disciplinary actions by my employer.

Title and Company	Name	Signature	Date