FORMER COKE OVEN AREA (COA)
INTERIM MEASURES
SUPPLEMENTAL INVESTIGATION REPORT

Revision 1 – April 15, 2020

TRADEPOINT ATLANTIC
SPARROWS POINT, MARYLAND

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EXECUTIVE SUMMARY

On behalf of EnviroAnalytics Group (EAG), ARM Group Inc. (ARM) prepared this Interim Measures (IM) Supplemental Investigation Report for a portion of the Tradepoint Atlantic Property that has been designated as the Former Coke Oven Area (COA). This evaluation was based on the findings and recommendations from the Coke Oven Interim Measures 2019 Progress Report, Revision 0, dated January 31, 2020, and the United States Environmental Protection Agency (USEPA) comment letter dated December 3, 2018.[1] The results described herein better define the nature and extent of constituents of concern in the COA and will be used in a Corrective Measures Study (CMS) to optimize the corrective action and enhance, modify and or develop alternatives to existing interim measures, as needed. The information provided in the report will be used in the CMS to optimize the corrective action.

The objectives of the supplemental investigation included: i) evaluate groundwater and offshore data to assess whether current conditions could be adversely impacting the offshore environment; ii) delineate the areas of the COA where elevated concentrations of constituents of concern in groundwater could be causing surface water or pore water impacts; iii) further delineate the extent of constituents of concern in groundwater to further characterize potential source areas; iv) evaluate the efficacy of currently implemented interim measures; and v) evaluate the potential to optimize the interim measures to better achieve corrective action objectives. Each objective was attained as detailed in the report and summarized below.

. General characteristics typical of the COA include:

- The COA is entirely made land from historical slag fill placement that expanded the areal extent of the Sparrows Point peninsula, which is important in considering corrective actions. The slag was placed to create land and slag along shorelines provides poor habitat for benthic organisms.

- Beneath the surficial slag fill layer lie alternating layers of native fine-grained sediments (clays and silts) and coarse-grained sediments (sands).

- Groundwater occurrence was segregated into the shallow zone and the intermediate zone. The shallow zone contains groundwater in the surficial slag unit. The intermediate zone contains groundwater found in the deeper native materials.

[1] EPA comments were in response to the report Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area (ARM, 2018).The activities described were conducted in accordance with the Former COA Interim Measures (IM) Supplemental Investigation Work Plan, Revision 1 (dated March 7, 2019) and the Offshore Investigation Work Plan, Revision 1 (dated February 27, 2019). All methods and protocols for this investigation followed the procedures included in the Quality Assurance Project Plan (QAPP) dated April 5, 2016, which was approved by the agencies to support the investigation and remediation of the Tradepoint Atlantic property.

- Groundwater exhibits very little elevation difference in the shallow zone. Flow is impacted by this flat gradient and is generally radial from the center of the northern boundary of the peninsula outward toward the east, south and western shores of the peninsula. It is locally affected along the shoreline by tide.

- Groundwater flow in the intermediate zone is variable and is typically controlled locally by the operation of remedial extraction wells and pumping at the proximate shipyard graving dock. Vertical gradient between wells in the shallow and intermediate zones is generally downward and is affected by groundwater extraction.

A conceptual site model (CSM), based on the above, was used to evaluate potential exposure risks and to refine the understanding of the nature and extent of constituents of concern. The CSM was developed based on the following considerations: i) the potential sources and release mechanisms for constituents with elevated concentrations; ii) the fate and transport of the constituents; iii) the media of concern; iv) potential pathways for human and ecological receptors, if any; and v) potential human populations and wildlife receptors that could be exposed to constituents of concern.

The Site is currently developed for industrial use. The area is supplied by municipal potable water and a groundwater use restriction will be imposed. Therefore, an industrial worker would not be exposed to groundwater. Exposure through volatilization into indoor air would be a potential future exposure pathway if buildings were to be constructed within impacted areas. The shallow and intermediate groundwater concentrations exceed vapor intrusion screening levels across much of the COA.

The exposures of concern are potential recreational exposure and aquatic life exposure to surface water and sediment pore water impacted by nearshore groundwater discharges. Benthic organisms in bottom substrates and fish and water column invertebrates are the primary aquatic receptors in the nearshore areas. This supplemental investigation included the collection of sediment pore water and surface water samples to assess potential exposures in these receptors. Additionally, people could be exposed to chemicals in surface water directly or via consumption of fish that have accumulated chemicals. However, because all of the constituents of concern are rapidly eliminated in aquatic organisms, fish consumption pathways are not considered to be an important exposure pathway. The supplemental investigation focused on three subareas within the COA designated as Cell 2, Cell 3, and Cell 5, the fundamental and distinguishing characteristics of which are described subsequently. In the areas investigated, the nature and extent of groundwater impacts have been adequately defined to support a CMS to optimize the corrective action. A summary of area-specific salient information includes:

- **Cell 2** - Located in the former Benzol Processing area. It includes an air sparge/soil vapor extraction (AS/SVE) system for the shallow groundwater zone and a groundwater pump and treat (GWPT) system for the intermediate groundwater zone. The primary focus of the interim

measures is to address the presence of elevated concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene in the intermediate groundwater zone. The existing GWPT system appears to be effectively removing hydrocarbons from the subsurface and should continue to be operated and monitored in accordance with current practices. The AS/SVE system was deactivated in 2018 because components of the SVE trench were submerged by shallow groundwater elevations caused by historically high rainfall.

Constituent concentrations in shallow and intermediate groundwater exceed potential sitewide cleanup levels for vapor intrusion or potable groundwater use. Surface water is not impacted. Pore water constituent concentrations at some locations exceed criteria for human consumption of organisms and protection of benthic aquatic life. Data presented herein demonstrate that the current discharges of groundwater are not exacerbating the previously identified offshore impacts from historical direct releases. No unacceptable concentrations were identified in surface water. The offshore sediment impacts can be attributed to historical releases of non-aqueous phase liquids (NAPL) offshore. There is no direct connection between the constituent of concern data observed within pore water and current discharges of groundwater.

- **Cell 3** - Located south of the former Benzol Processing area and north of a cove on the western shore. No specific former steel mill operations have been identified in this area. The interim measure consists of an AS/SVE system for the shallow groundwater zone. The primary focus of the interim measure is to address the presence of elevated concentrations of BTEX and naphthalene in the shallow groundwater zone. The existing AS/SVE system performance was below expectations and will be further evaluated in the CMS. Constituent concentrations in shallow groundwater exceed potential sitewide cleanup levels for vapor intrusion or potable groundwater use. Constituent concentrations in surface water exceed water quality criteria for human consumption of organisms close to shore in a confined, small manmade cove area, but in-stream water quality criteria are met within a reasonable mixing zone distance. The sporadic distribution of benzene in surface water will not result in accumulation in fish. Pore water samples were obtained from slag fill. The concentrations of naphthalene at some pore sample locations exceeded criteria for protection of benthic aquatic life. Data presented herein demonstrate that the current discharges of groundwater are not exacerbating the previously identified offshore impacts from historical direct releases., The offshore sediment impacts can be attributed to historical releases of non-aqueous phase liquids (NAPL) to the cove or offshore prior to the shoreline being extended with slag fill. Given that historical releases is the source of elevated naphthalene levels in this area, it can be concluded that groundwater is not contributing significantly to chemical concentration. Regardless of source, however, the overall ecological impacts to the benthic community from naphthalene are considered minimal given that the degraded benthic habitat conditions limit

the quality and quantity of the benthic community in the slag dominated nearshore areas.

- **Cell 5** - Located in the former Coal Tar Storage area, west of the Turning Basin. It includes a Dual Phase Extraction (DPE) system and a Dense Non-Aqueous Phase Liquid (DNAPL) recovery system for the shallow groundwater zone. The primary focus of the interim measure is to address naphthalene in the shallow groundwater zone. The DPE system will be further evaluated in the CMS. The DNAPL system was operating effectively and should continue to operate. Constituent concentrations in shallow groundwater exceed potential sitewide cleanup levels for vapor intrusion and potable groundwater use. Surface water is not impacted.

  The pore water investigation generally showed no significant impacts along the associated shoreline. The pore water at the northernmost shoreline sample locations contained elevated naphthalene concentrations, however the data indicates that the impacts are attributed to direct historical discharges or placement of slag when the land was created rather than current groundwater discharges. Pore water constituent concentrations at some locations collected from slag fill matrix rather than aquatic habitat exceeded criteria for protection of benthic aquatic life.. The current discharge of groundwater does not exacerbate the impacts already observed in the pore water and given the source of the pore water constituents, the interim measure cannot affect pore water quality. Regardless of source, the overall ecological impacts to the benthic community from naphthalene are minimal given the slag-dominated nearshore areas.

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1.0 INTRODUCTION

ARM Group LLC (ARM), on behalf of EnviroAnalytics Group (EAG), has prepared this Interim Measures (IM) Supplemental Investigation Report for a portion of the Tradepoint Atlantic Property that has been designated as the Former Coke Oven Area (COA). This report summarizes the findings of investigation activities at the COA conducted in accordance with the Former COA Interim Measures (IM) Supplemental Investigation Work Plan, Revision 1 (dated March 7, 2019) and the Offshore Investigation Work Plan, Revision 1 (dated February 27, 2019).

The activities summarized in this report were proposed based on the findings and recommendations from the Coke Oven Interim Measures 2019 Progress Report, Revision 0, dated January 31, 2020, and the United States Environmental Protection Agency (USEPA) letter, dated December 3, 2018, submitted in response to the report Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area (ARM, 2018).

1.1 Tradepoint Atlantic – Site Background

The Tradepoint Atlantic property is located in Baltimore County, Maryland at the southeastern corner of the Baltimore metropolitan area, approximately nine miles from the downtown area. The property encompasses approximately 3,100 acres located on a peninsula situated on the Patapsco River near its confluence with the Chesapeake Bay, physically positioned in the mouth of the heavily industrialized and urbanized Baltimore Harbor / Patapsco River region. A land connection to the northeast links the peninsula with the adjacent community of Edgemere.

From the late 1800s until 2012, the 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, 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, and current plans for the Site include demolition and redevelopment over the next several years. Some portions of the site have already undergone remediation and/or redevelopment.

1.2 Coke Oven Area – General Information

The COA is located on a peninsula in the southwestern portion of the Tradepoint Atlantic Property, shown on **Figure 1**. It is bordered by the Patapsco River to the west and south, and the Turning Basin to the east. This peninsula comprises approximately 308 acres of the approximately 3,100-acre former plant property, includes the former COA and the Coke Point Landfill.

Within the COA, this Supplemental Investigation focused on three distinct smaller areas designated as Cell 2, Cell 3, and Cell 5. **Figure 2** shows the location and boundaries of the COA and the Cells.

Below is a list of the cells, the name of the area they cover, and their current IM system(s):

- Cell 2 (former Coal Basin Area): Air-sparging/soil-vapor extraction (AS/SVE) system in the shallow groundwater zone and groundwater pump and treat (GWPT) system in the intermediate groundwater zone;
- Cell 3 (Cove Area): AS/SVE system in the shallow zone; and
- Cell 5 (Turning Basin side of COA): Dual Phase Extraction (DPE) system and Dense Non-Aqueous Phase Liquid (DNAPL) recovery system for the shallow zone.

An overview, including system performance and recommendations from the CO IM 2019 Progress Report (ARM, 2020), of these three IM systems is discussed below. Relevant findings of the Pre-Design Investigation (PDI) Summary Report (Key Environmental, 2015) are also discussed.

1.3 Cell 2 Description and Background

Cell 2 is located in the former Benzol Processing area. **Figure 3** shows the historic plant drawings indicating the past operations in this area and the locations of all wells within the area. Cell 2 includes an AS/SVE system for the shallow groundwater zone and a GWPT system for the intermediate groundwater zone in the former Coal Basin Area of the site. The primary focus of the IMs for this area is to address the presence of elevated concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene in the intermediate groundwater zone.

The PDI Summary Report (Key, 2015) focused on potential light non-aqueous phase liquid (LNAPL) communication between Cell 2 and Cell 6 in the area southeast of Cell 2. Minimal impacts were observed east and southeast of Cell 2.

The findings in the CO IM 2019 Progress Report (ARM, 2020) indicated the existing GWPT system appeared to be effectively removing hydrocarbons from the subsurface and should continue to be operated and monitored in accordance with current practices. The AS/SVE system was not providing effective removal (i.e., less than 0.1 pounds of hydrocarbons removed in 2018) and did not operate in 2019 as a result.

1.4 Cell 3 Description and Background

Cell 3 is located south of the former Benzol Processing area and north of a cove on the western shore of the COA. **Figure 4** shows Cell 3 features overlain on historic plant drawings indicating the past operations in this area and the locations of all wells within the area. No specific plant operations are identified in this area. The Cell 3 IM consists of an AS/SVE system for the shallow groundwater zone. The primary focus of the IM for this area is to address the presence of elevated concentrations of BTEX and naphthalene in the shallow groundwater zone (between approximately 20 and 27 feet below grade, near the base of the fill materials located above the native underlying clay and silt layers).

The findings of the PDI Summary Report (Key, 2015) revealed minimal impacts at monitoring wells CO32-PZM004 and TS06-PPM008 located east of the cove that lies to the south of Cell 3. Therefore, groundwater discharge from east of the cove is not believed to be a source of the surface water impacts observed in the cove during the investigation outlined in the Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area. (ARM, 2018). In addition, minimal impacts were observed in iso-flow groundwater samples collected at location CO130-SB036, located northeast of the Cell 3, and at location CO126-SB036, along the western portion of the remedial trench. These borings suggested that the eastern and western horizontal extents of impacted groundwater in this area were delineated.

The findings in the CO IM 2019 Progress Report (ARM, 2020) indicated that the existing AS/SVE system performance was below expectations and recommended that consideration be given to modifying the system or utilizing alternate approaches.

1.5 Cell 5 Description and Background

Cell 5 is located in the former Coal Tar Storage area, just west of the Turning Basin. **Figure 5** shows the historic plant drawings indicating the past operations in this area and the locations of all wells within the area. Cell 5 includes a DPE system and a DNAPL recovery system for the shallow groundwater zone on the Turning Basin side of the former COA. The primary focus of the IMs for this area is to address naphthalene in the shallow groundwater zone.

The PDI Summary Report (Key, 2015) focused on the horizontal and vertical delineation of DNAPL in an area located west of Cell 5, but no additional soil borings and/or monitoring wells were installed within the vicinity of Cell 5.

The findings in the CO IM 2019 Progress Report (ARM, 2020) indicated that the DPE system was not effectively removing hydrocarbons and recommended that consideration be given to modifying the current system. The DNAPL system seemed to be operating effectively and should continue to be operated and monitored in accordance with current practices.

2.0 SITE INVESTIGATION ACTIVITIES

Information regarding the project organization, field activities (including installation, development and sampling), field equipment, sample handling and management procedures, the selected laboratory and analytical methods, quality control and quality assurance procedures, investigation-derived waste (IDW) management methods, and reporting requirements are described in detail in the approved Former COA Interim Measures (IM) Supplemental Investigation Work Plan, Revision 1 (dated March 7, 2019). All methods and protocols for this investigation followed the procedures included in the Quality Assurance Project Plan (QAPP) dated April 5, 2016, which was approved by the agencies to support the investigation and remediation of the Tradepoint Atlantic property.

2.1 Cell 2

2.1.1 Groundwater Investigation

Shallow monitoring wells were installed in Cell 2 to investigate the extent of shallow impacts near the western shoreline. Shallow wells were also installed between the sparge wells and the northern shoreline to determine whether the treatment system has reduced concentrations within the expected zone of influence. In addition, shallow wells were installed in spatial gaps between existing monitoring wells in Cell 2 and Cell 1. Although some of the new wells were installed within or very close to Cell 1, they are referred to as Cell 2 wells for the sake of this investigation. Intermediate monitoring wells were installed to improve horizontal delineation of contamination to the south and west of the Cell 2 AS/SVE system.

A total of 12 shallow and nine intermediate groundwater monitoring wells were installed in accordance with the procedures referenced in the QAPP Worksheet 21 – Field Standard Operating Procedures (SOPs), SOP No. 13 – Drilling and SOP No. 14 –Monitoring Well Construction. The new monitoring wells were constructed with a stick-up steel protective casing. Locations of the new monitoring wells in Cell 2 are shown on **Figure 6.**

The new monitoring wells were installed using an 8140LS Geoprobe® Sonic drill rig. During installation, each soil core was visually inspected and screened with a hand-held photoionization detector (PID) prior to logging soil types, which were recorded by a geologist in accordance with QAPP Worksheet 21 – Field SOPs, SOP No. 12 – Geologic Logging. Unless otherwise indicated, all Unified Soil Classification System (USCS) group symbols provided on the attached boring logs are from visual observations. Well construction and boring logs are provided in **Appendix A**.

During the completion of field work, it was necessary to shift some groundwater points from the proposed locations shown in the Work Plan, primarily due to utility and accessibility conflicts. Field shifts were completed during the installation of proposed monitoring wells COK-MWS, COK-MWI,

CON-MWS, CON-MWI, COO-MWS, COO-MWI, and COU-MWS. The necessary field location shifts were completed due to the following:

- COK-MWS and COK-MWI due to the location of a berm surrounding the perimeter of Cell 2
- CON-MWS, CON-MWI, COO-MWS, and COO-MWI due to dredge material located along the western edge of Cell 2 located inside of the berm area
- COU-MWS due to utilities

During monitoring well installation, several screen intervals were adjusted due to site conditions. The adjustments listed below were made to the proposed monitoring well construction specifications.

- COR-MWI: screen interval was shifted to 22-37 feet bgs to capture product (NAPL) observed in the soil core 26-30 feet bgs.
- COS-MWS and COT-MWS: screen intervals were shifted to 5-20 feet bgs to match the bottom screen level depths of other shallow monitoring wells in Cell 1 at similar grade.
- COU-MWS, COW-MWS, and COY-MWS: screen intervals were shifted to 5-20 feet bgs to bridge the water level observed in the soil cores.
- COX-MWS and COZ-MWS: screen intervals were shifted to 10-20 feet bgs to more closely match the screen intervals of existing nearby shallow monitoring wells.

The newly installed monitoring wells were developed in accordance with QAPP Worksheet 21 – Field SOPs, SOP No. 15 – Well Development. After development, the depth to bottom in each well was recorded to compare to the original drilled depth. Well Development Forms for the newly installed monitoring wells have been included in **Appendix B**.

The new monitoring wells installed during this investigation were surveyed by a Maryland-licensed surveyor to obtain top of casing (TOC) elevation data. Supporting documentation from the surveys is included as **Appendix C**. A synoptic round of groundwater measurements was collected from the monitoring wells included in the monitoring network. Surveyed TOC elevations for all applicable locations can be found in **Table 1**, along with the depth to water (DTW) measurements from this date, and the calculated groundwater elevation.

Groundwater samples were collected from the new monitoring wells in accordance with the procedures referenced in Worksheet 21 – Field SOPs, SOP No. 007 – Low Flow Groundwater Sampling provided in Appendix A of the QAPP. Groundwater samples were collected using laboratory supplied sample containers and preservatives, a peristaltic pump, dedicated polyethylene tubing, a YSI water quality meter with a flow-through cell. The purge logs have been included in **Appendix D**. Calibration of the YSI meter was performed before the start of each day of the sampling event. Documentation of the YSI meter calibration has also been included in **Appendix D**.

All groundwater samples were analyzed for BTEX, naphthalene, total petroleum hydrocarbons diesel range organics (TPH-DRO), and TPH gasoline range organics (GRO).

2.1.2 Pore Water Investigation

Pore water sampling was conducted in the offshore areas of Cell 2 to investigate possible effects of groundwater discharge to surface water at each of the proposed pore water sampling locations shown on **Figure 7**. Sampling was attempted at each of the proposed pore water sampling locations shown on **Figure 7.** At each location, attempts were made to drive separate push-point samplers to depths of nine inches and three feet below the bottom-water interface. Pore water sampling was not successful at many of the proposed locations because of refusal of the sampler on hard (rocky) substrate including slag and debris fill, or the presence of low permeability fine-grain deposits at the proposed sample interval which clogged the screen of the sampler. In some cases, the sample was collected from a depth of two feet below the bottom-water interface when a sample could not be collected from a depth of three feet. **Figure 7** notes the proposed locations and relative depths where sampling was unsuccessful, as well as the reason that the pore water sample could not be collected from the proposed sample interval. **Table 2** provides a summary of pore water sampling locations. **Appendix E** provides a photographic summary of common sampling issues that prevented pore water sample collection at various locations.

Where successful, separate push-point samplers were advanced to a depth of nine inches and three feet below the bottom-water interface. Each push-point sampler was equipped with a spiked sampling flange to secure the instrument to the sediment floor, gauge the proper depth of the sampler below the sediment surface, and to serve as a surface seal to prevent intrusion of surface water into the sampler. All pore water samples were collected using disposable tubing.

Pore water samples were collected at a total of 20 locations. Pore water samples were collected in accordance with the procedures referenced in SOP No. 29 – Pore Water Sampling, which is a new SOP proposed for addition to the QAPP, and SOP No. 006 – Groundwater Sampling in the approved QAPP (Revision 3). Prior to filling sampling containers with pore water from the push-point sampler, water quality parameters (temperature, pH, dissolved oxygen, conductivity, oxidation-reduction potential) of surface water and of pore water were monitored to assess to verify the push-point sampler was sealed and isolated from the surface water. The pore water samples placed directly into laboratory-supplied preserved sample bottles and placed on ice in coolers to be transported to the laboratory under a completed Chain of Custody.

All pore water samples were analyzed for BTEX, naphthalene, TPH-DRO and TPH-GRO. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

2.1.3 Surface Water Investigation

Following receipt of the analytical laboratory data for the pore water samples, the preliminary results were shared with the MDE and the USEPA at a meeting on June 6th, 2019. The agencies subsequently requested the collection of supplemental surface water samples from the offshore areas of the COA. A supplemental work plan for the collection of surface water samples was approved in an email dated July 9, 2019.

Six surface water samples were collected offshore of Cell 2 at locations that corresponded with pore water sampling locations with elevated analytical data. Surface water samples were collected at a depth of two feet below the water surface. At three of the sampling locations, the depth of the water was greater than six feet. At these locations a second surface water sample was collected at a depth that was two feet above the sediment-water interface. All surface water samples were collected in accordance with the procedures referenced in SOP No. 4 – Surface Water Sampling. Samples were analyzed for benzene and naphthalene.

2.2 Cell 3

2.2.1 Groundwater Investigation

In Cell 3, monitoring wells were installed to investigate groundwater from deeper zones. It was observed that monitoring wells CO101-PZM, CO102-PZM, CO103-PZM, and CO104-PZM were installed to an approximate depth of 20 feet bgs, while the most contaminated monitoring well at Cell 3, CO30-PZM015, was installed to a depth of 27.5 feet bgs. Therefore, the target depths for screen intervals in the new monitoring wells at Cell 3 was 20-35 feet bgs, as described below.

In Cell 3, Vertical Aquifer Profiling (VAP) was performed to define the vertical extent of groundwater impact. VAP was performed during drilling of the borehole for monitoring well COD-MWS, located in the central portion of Cell 3. Groundwater samples were collected from seven different five-foot intervals. The VAP samples were collected and analyzed for BTEX. The VAP was performed in accordance with the QAPP, Worksheet 21 – Field SOPs, SOP No. 30 Vertical Aquifer Profiling – Sonic Drilling. The results of the VAP (discussed in Section 3.0) determined the screen intervals of the new monitoring wells installed at Cell 3.

A total of 10 shallow zone monitoring wells were installed in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 13 – Drilling and SOP No. 14 – Monitoring Well Construction. The new monitoring wells were constructed with a stick-up steel protective casing. Locations of the new monitoring wells in Cell 3 are shown on **Figure 8.**

The new monitoring wells were installed using an 8140LS Geoprobe® Sonic drill rig. During installation, each soil core was visually inspected and screened with a hand-held PID prior to logging soil types, which were recorded by a geologist in accordance with QAPP Worksheet 21 – Field SOPs,

SOP No. 12 – Geologic Logging. All USCS group symbols provided on the attached boring logs are from visual observations. Well construction and boring logs are provided in **Appendix A**.

During the completion of field work, it was necessary to shift some groundwater points from the proposed locations shown in the Work Plan, primarily due to accessibility conflicts. Field shifts were completed during the installation of proposed monitoring wells COA-MWS and COB-MWS. The necessary field location shifts were completed due to the following:

- COA-MWS due to a large stockpile
- COB-MWS due to a trench

During monitoring well installation, several screen intervals were adjusted due to site conditions. The following adjustments were made to the proposed monitoring well construction specifications:

- COB-MWS, COE-MWS, and COJ-MWS screen intervals were shifted to 10-25 feet bgs due to the presence of clay from 25 to 35 bgs.
- COD-MWS screen interval was shifted to 12-28 feet bgs to bridge the water level observed in the soil core.

The new monitoring wells installed during this investigation were surveyed by a Maryland-licensed surveyor to obtain TOC elevation data. Supporting documentation from the surveys is included as **Appendix C**. A synoptic round of groundwater measurements was collected from the monitoring wells included in the monitoring network. Surveyed TOC for all applicable locations can be found in **Table 3**, along with the DTW measurements and the calculated groundwater elevation.

All groundwater samples were analyzed for BTEX and the remaining (non-VAP groundwater samples) were additionally analyzed for naphthalene.

2.2.2 Pore Water Investigation

Pore water sampling was conducted in the offshore areas of Cell 3 to investigate possible effects of groundwater discharge to surface water in the manner described for Cell 2. Sampling was attempted at each of the proposed pore water sampling locations shown on **Figure 9.** In some cases, the sample was collected from a depth of two feet below the sediment-water interface when a sample could not be collected from a depth of three feet. **Figure 9** notes the proposed locations and relative depths where sampling was unsuccessful, as well as the reason that the pore water sample could not be collected from the proposed sample interval. **Table 4** provides a summary of pore water sampling locations.

All pore water samples obtained from Cell 3 were analyzed for BTEX and naphthalene. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

2.2.3 Surface Water Investigation

Surface water samples were collected offshore of Cell 3 at 20 locations. Surface water samples were collected directly offshore at distances of 30 feet, 60 feet, 90 feet, 120 feet, and 150 feet from the shoreline. Surface water samples were collected at a depth of two feet below the water surface. At some of the sampling locations, the depth of the water was greater than six feet. At these locations a second surface water sample was collected at a depth that was two feet above the bottom-water interface. All surface water samples were collected in accordance with the procedures referenced in SOP No. 4 – Surface Water Sampling. Samples were analyzed for BTEX and naphthalene.

2.2.4 Offshore Bathymetry Mapping

A boat and a Furuno FCV 667 Depth Sounder Fish Finder were used to measure the depth to the bottom at 65 locations to develop a contour of the bottom of the cove south of Cell 3. A Trimble Geo7X handheld GPS was used to obtain coordinates for each of these locations, 26 of which were former surface and/or pore water sampling locations. The additional 39 locations were added to provide bathymetry for the full Cell 3 cove. The bathymetric map developed from the data is discussed in Section 5 of this report.

2.3 Cell 5

2.3.1 Groundwater Investigation

During this supplemental investigation, a total of six shallow zone groundwater monitoring wells were installed in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 13 – Drilling and SOP No. 14 –Monitoring Well Construction. The new monitoring wells were constructed with a stick-up or a flush mount steel protective casing. Locations of new monitoring wells in Cell 5 are shown on **Figure 10.**

During the completion of field work, it was necessary to shift some groundwater points from the proposed locations shown in the Work Plan, primarily due to utility and accessibility conflicts. Field shifts were not completed during the installation of proposed monitoring well COEE-MWS due to a large stockpile. As a result, a monitoring well was not installed at this location.

All new monitoring wells in Cell 5 were installed with well screen intervals of 5-25 feet bgs due to the groundwater table observed in the soil cores.

The new monitoring wells installed during this investigation were surveyed by a Maryland-licensed surveyor to obtain TOC elevation data. Supporting documentation from the surveys is included as **Appendix C**. A synoptic round of groundwater measurements was collected from the monitoring wells included in the monitoring network. Surveyed TOC for all applicable locations can be found in **Table 5**, along with the DTW measurements and the calculated groundwater elevation.

All groundwater samples were analyzed for naphthalene.

2.3.2 Pore Water Investigation

Pore water sampling was conducted in the offshore areas of Cell 5 to investigate possible effects of groundwater discharge to surface water in the same manner as described above. Sampling was attempted at each of the proposed pore water sampling locations shown on **Figure 11.** In some cases, the sample was collected from a depth of two feet below the bottom-water interface when a sample could not be collected from a depth of three feet. **Figure 11** notes the proposed locations and relative depths where sampling was unsuccessful, as well as the reason that the pore water sample could not be collected from the proposed sample interval. **Table 6** provides a summary of pore water sampling locations. **Appendix E** provides a photographic summary of common sampling issues that prevented pore water sample collection at various locations.

All pore water samples were analyzed for naphthalene. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

2.3.3 Surface Water Investigation

Surface water samples were collected offshore of Cell 5 at 11 locations that corresponded with pore water sampling locations with elevated analytical data. Surface water samples were collected at a depth of two feet below the water surface. At some of the sampling locations, the depth of the water was greater than six feet. At these locations a second surface water sample was collected at a depth that was two feet above the bottom-water interface. All surface water samples were collected in accordance with the procedures referenced in SOP No. 4 – Surface Water Sampling. Samples were analyzed for naphthalene.

2.4 Laboratory Analysis

Samples were sent by courier to PACE. of Greensburg, Pennsylvania to perform the laboratory analysis. 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. Quantitation limits and project action limits for all analytes are provided in QAPP Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits. All laboratory reports are included as an electronic attachment.

2.5 Quality Assurance (QA) and Quality Control (QC) Samples

QC samples for the entire field effort 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, duplicates, etc.).

The following QC samples were submitted for analysis to support the data validation:

- Trip Blank
- Blind Field Duplicate – at a rate of one duplicate per twenty samples
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
- Field Blank – at a rate of one per twenty samples

The QC samples were collected and analyzed in accordance with the QAPP Worksheet 12 – Measurement Performance Criteria, QAPP Worksheet 20 – Field Quality Control and QAPP Worksheet 28 – Analytical Quality Control and Corrective Action. A summary of QA/QC samples collected is included in **Appendix F**.

3.0 ANALYTICAL RESULTS

3.1 Cell 2

3.1.1 Shallow Groundwater

Groundwater data for shallow zone wells are summarized in **Table 7.** Benzene was detected in every shallow well sampled during this investigation, with values ranging from a minimum of 1.1 micrograms per liter (µg/L) in CO42-PZM004 to maximum of 514,000 µg/L in COU-MWS. **Figure 12** shows the distribution of benzene concentrations in the shallow zone in the vicinity of Cell 2. As indicated, the highest concentration in the immediate vicinity of the Cell 2 shallow AS/SVE system is 16,100 µg/L in COL-MWS. Concentrations to the west of Cell 2 toward the Patapsco River were approximately twice the highest level in Cell 2. The shallow zone benzene concentrations decrease to the east and southeast from Cell 2, with low concentrations that seem to separate Cell 2 from the Cell 1 area to the southeast. The highest concentrations of benzene were found farther to the southeast in the Cell 1 area and in the area west of Cell 1. Benzene concentrations in this area were above 100,000 µg/L.

Ethylbenzene was detected in 16 shallow zone groundwater wells in Cell 2. The highest detection of ethylbenzene was measured at 1,020 µg/L at COT-MWS. Three historical groundwater monitoring wells (CO40-PZM008, CO41-PZM001, and CO42-PZM004) had undetectable levels of ethylbenzene in the groundwater. Toluene was detected in all shallow zone groundwater monitoring wells in Cell 2. The maximum concentration of toluene was 122,000 µg/L and was detected at COT-MWS; the lowest concentration was detected at CO41-PZM001 at a concentration of 0.6 J µg/L. Xylenes were detected in all shallow zone groundwater monitoring wells in Cell 2, excluding historical well CO41-PZM001. For xylenes, the highest detection of 24,400 µg/L was measured in COT-MWS.

Naphthalene was detected in every shallow zone groundwater monitoring well in Cell 2, excluding two historical groundwater wells (CO41-PZM001 and CO42-PZM004). The distribution of naphthalene (**Figure 13**) is very different from benzene. Naphthalene concentrations were much lower than benzene concentrations, and the maximum concentrations were found along the shoreline within Cell 2 and to the west of Cell 2. Naphthalene concentrations farther inland and to the east and southeast are generally less than 1,000 µg/L.

DRO and GRO were both detected in all newly installed shallow zone groundwater monitoring wells. Historical groundwater monitoring wells throughout Cell 2 were not sampled for DRO and GRO. The highest concentration of DRO was measured at 10,300 µg/L at COM-MWS, whereas the lowest concentration of DRO was measured at 1,010 µg/L at COK-MWS. GRO was measured between 16,500 µg/L at COK-MWS and 871,000 µg/L (at COW-MWS).

3.1.2 Intermediate Groundwater

All groundwater data for intermediate zone monitoring wells are summarized in **Table 8.** Benzene was detected in every intermediate zone groundwater well in Cell 2. Detections ranged from 0.4 J µg/L in well CO38-PZM043 to 361,000 µg/L in COV-MWI. **Figure 14** shows the distribution of benzene in the intermediate zone. The maximum benzene concentration at COV-MWI is south of Cell 2. From there, the benzene plume extends to the west toward the Patapsco River and in a narrow swath to the north to well CO27-PZM046 near the pump and treat system. Directly to the north, the concentration of benzene in COL-MWI is an order of magnitude lower than that of CO27-PZM046.

Ethylbenzene was detected in all intermediate groundwater monitoring wells, excluding CO38-PZM043. The highest concentration of ethylbenzene was measured at 918 µg/L at COV-MWI. Toluene was detected in all intermediate groundwater wells, excluding CO38-PZM043. The highest detection of toluene was 71,800 µg/L at CO41-PZM036. Similar to ethylbenzene and toluene, xylenes were detected in all intermediate groundwater wells, excluding CO38-PZM043. The highest concentration of xylenes was measured at 58,500 µg/L at COV-MWI.

Naphthalene was detected in all intermediate zone groundwater locations monitored, excluding CO38-PZM043. The highest detection was measured at 43,500 µg/L at COR-MWI. **Figure 15** shows the highest naphthalene concentrations are to the west and southwest of Cell 2 toward the Patapsco River. In addition, naphthalene is slightly elevated along the northern shore near the pump and treat system in well CO27-PZM046. However, similar to concentrations of benzene, the concentration of naphthalene in COL-MWI (directly to the north) is an order of magnitude lower than that of CO27-PZM046.

DRO and GRO were both detected in all newly installed intermediate zone groundwater wells. Historical groundwater wells throughout Cell 2 were not sampled for DRO and GRO. The highest measured concentration of DRO was measured at 24,200 µg/L at COR-MWI, whereas the lowest concentration of DRO was measured at 348 µg/L at COK-MWI. GRO was measured between 6,620 µg/L at COK-MWI and 600,000 µg/L at COR-MWI.

3.1.3 Pore Water

Table 9 presents the results of the pore water investigation at Cell 2. As indicated, samples were not obtained at several of the proposed locations due to the presence of either a hard bottom or low permeability sediments. The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Figure 16 shows the locations of pore water sample results for benzene. Benzene was not detected at significant concentrations in the pore water north of Cell 2 in the coal basin. Benzene was only detected in four samples in this area, with the highest concentration detected being 3.4 µg/L. Benzene was detected in six of the eight pore water samples collected off the western shore near Cell 2. Concentrations in this area ranged up to 19,100 µg/L. Concentrations of benzene in five of the eight pore water samples collected off the western shore exceeded the human health ambient water quality criteria (AWQC) for consumption of organism only (noncarcinogenic) of 90 µg/L.

Ethylbenzene was detected in five samples, all near the western shore, with a maximum concentration of 127 µg/L in CO-070-PW-1. None of the concentrations of ethylbenzene exceeded the applicable AWQC. Toluene was detected in five samples, all also near the western shore, with a maximum concentration of 1,910 µg/L in sample CO-070-PW-1. Two concentrations of toluene exceeded the applicable AWQC. Xylenes were detected in the same five western shore samples, with a maximum concentration of 511 µg/L in CO-070-PW-1. There is no applicable AWQC for xylenes.

Figure 17 presents the results for naphthalene in the pore water samples. Naphthalene was detected in 16 samples in the coal basin area. The highest concentration detected was relatively low at 63.9 µg/L. Naphthalene was detected in all of the samples from the western shore, with the maximum concentration being 72,000 µg/L. The results varied substantially with both location and depth. The naphthalene concentrations exceeded the narcosis secondary chronic value (SCV) in five of the 32 samples.

DRO was detected in all pore water samples offshore of Cell 2, while GRO was detected in only six of the 25 samples. The maximum concentrations for both DRO and GRO were measured in sample CO-049-PW-3 (off the western shore) at concentrations of 26,400 µg/L and 47,400 µg/L, respectively.

3.1.4 Surface Water

The results for the surface water samples at Cell 2 are presented in **Table 10.** The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Benzene was detected in five of 10 samples, with a maximum concentration of 2.8 µg/L. There were also trace detections of toluene and naphthalene. Ethylbenzene and xylenes were not detected.

Figure 18 shows the locations of the surface water results. While there were trace detections of benzene and naphthalene in the surface water west of Cell 2, there were no exceedances of surface water quality criteria.

3.2 Cell 3

3.2.1 VAP Results

VAP analyses indicate that BTEX concentrations were highest in the 20-25-foot depth sample, while the naphthalene was highest in the 25-30-foot depth sample. Based on these observations, all remaining proposed wells in Cell 3 of the COA were installed with a screen interval of 20-35 feet bgs to capture the majority of the impacted groundwater. The table below presents the results of the vertical profile samples.

COD-MWS VAP Sample Results						
Depth (bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Total
15-20	9,660	742	20.6	236	553	11,211.60
20-25	14,600	1150	31.8	346	4,860	20,987.80
25-30	6,250	554	13.4	128	67,300	74,245.40
30-35	1,460	22.5	21.4	53.1	20,700	22,257
35-40	25	2.3	0.5	2.5	1,340	1,370.30
40-45	12.6	1.3	0.3	1.1	438	453.3
45-50	2.6	0.4	0.3	0.8	89.3	93.4

3.2.2 Shallow Groundwater

All groundwater data for shallow zone wells in Cell 3 are summarized in **Table 11.**

Benzene was detected in every shallow zone groundwater well in Cell 3. The maximum concentration of benzene (51,000 µg/L) was detected at well CO30-PZM015. **Figure 19** shows the distribution of benzene concentrations in the shallow zone of Cell 3. The maximum benzene concentrations are located within a narrow north-south swath in the center of the Cell 3 area.

Ethylbenzene was detected in all shallow groundwater samples, excluding CO101-PZM and CO104-PZM. The highest concentration of ethylbenzene was measured at 90.9 µg/L at COG-MWI. Toluene was detected in all shallow groundwater samples, excluding CO101-PZM and CO104-PZM. The highest detection of toluene was 4,140 µg/L at COC-MWS. Xylenes were detected in all shallow groundwater samples, excluding CO101-PZM and CO104-PZM. The highest concentration of xylenes was measured at 1,440 µg/L at COG-MWS.

Naphthalene was detected in all shallow zone groundwater locations, excluding CO101-PZM. The highest concentration was measured at 10,600 µg/L at COG-MWS. **Figure 20** shows the naphthalene distribution in the shallow zone in Cell 3. The naphthalene plume generally coincides with the benzene plume.

3.2.3 Pore Water

Figure 21 shows the results for the five pore water samples that were successfully collected. The results are also summarized in **Table 12**. The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Although a sample was collected from location CO-016-PW-1, furthest to the east, no analytes were detected. Benzene was detected in each of the other four cove samples (CO-020-PW-1, CO-040-PW-1, CO-040-PW-3, and CO-025-PW-1). The maximum detection of benzene was 1,900 µg/L in sample CO-020-PW-1. Concentrations of benzene in CO-020-PW-1 and CO-040-PW-3 exceeded the applicable AWQC.

Ethylbenzene was detected in all samples (except CO-016-PW-1) with a maximum concentration of 14.4 µg/L in sample CO-040-PW-3. Toluene was detected in the four western samples, with a maximum concentration of 141 µg/L in sample CO-020-PW-1. There were no exceedances of AWQC for ethylbenzene or toluene. Xylenes were also detected in the four western samples with the maximum concentration of 332 µg/L in sample CO-040-PW-3.

Naphthalene was detected in the four western samples. The maximum detection of naphthalene was 18,700 µg/L in sample CO-025-PW-1. In addition to CO-025-PW-1, concentrations of naphthalene in CO-040-PW-1 and CO-040-PW-3 exceeded the narcosis SCV.

3.2.4 Surface Water

Figure 22 shows the locations and results for all 31 surface water samples that were collected. The results are also summarized in **Table 13**. The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Benzene was detected in every sample except SW-23-8.5 and exceeded the AWQC in seven samples (SW-14-2, SW-15-2, SW-16-2, SW-18-2, SW-26-1, SW-27-1, and SW-29-2). The maximum detection of benzene was 736 µg/L in sample SW-29-2.

Ethylbenzene was detected in two samples (SW-26-1 and SW-27-1), with a maximum concentration of 1.5 µg/L at location SW-21-1. Toluene was detected in 25 of the 31 samples, with a maximum concentration of 67.2 µg/L in sample SW-27-1. There were no exceedances of AWQC for ethylbenzene or toluene. Xylenes were detected in 13 of the 31 samples, with a maximum

concentration of 21.4 µg/L in sample SW-27-1.

Naphthalene was detected in 30 of the 31 samples, with a maximum concentration of 18.5 µg/L at location SW-27-1. None of the concentrations of naphthalene exceeded the narcosis SCV.

3.3 Cell 5

3.3.1 Shallow Groundwater

Figure 23 maps the distribution of naphthalene concentrations in the shallow zone of Cell 5. All groundwater data for shallow zone wells are summarized in **Table 14.**

Naphthalene was detected in all shallow zone groundwater locations, excluding CO57-PZP002 and CO59-PZP002. The maximum concentration was detected in well CODD-MWS at 14,800 µg/L.

3.3.2 Pore Water

Figure 24 shows the locations and results for the nine pore water samples that were successfully collected. The results are summarized in **Table 15.** The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Naphthalene was detected in all pore water samples. The minimum concentration was 0.33 J µg/L detected in sample CO-086-PW-1, while the maximum concentration was 9,230 µg/L detected in sample CO-074-PW-1. Concentrations in five samples exceeded the narcosis SCV.

3.3.3 Surface Water

Figure 25 shows the locations and results for the 16 surface water samples that were collected. The results are summarized in **Table 16**. The table also indicates whether sample concentrations exceeded surface water quality criteria to provide a preliminary screening against these available ecological criteria to identify issues for further evaluation. The relevance and significance of any exceedances of these criteria will be considered in the conceptual site model development and problem formulation and assessed in the CMS.

Naphthalene was detected in all samples except CO-079-SW-2 and CO-098-SW-2. The maximum concentration was 1.1 µg/L in sample CO-073-SW-5. None of the concentrations exceeded the narcosis SCV.

4.0 DATA USABILITY ASSESSMENT

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

Quality assurance and quality control (QA/QC) samples were collected during field studies to evaluate field/laboratory variability. A summary of QA/QC samples associated with this investigation has been included as **Appendix F**. The following QC samples were submitted for analysis to support the data validation:

- Blind Field Duplicate – at a rate of one duplicate per twenty samples
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
- Field Blank – at a rate of one per twenty samples

Each of these QA/QC samples was analyzed for the appropriate analytes corresponding to the analyses run for samples from each Cell. The QC samples were collected and analyzed in accordance with the QAPP Worksheet 12 – Measurement Performance Criteria, QAPP Worksheet 20 – Field Quality Control and QAPP Worksheet 28 – Analytical Quality Control and Corrective Action.

4.1 Data Verification

A verification review was performed on documentation generated during sample collection and analysis. The verification included a review of field log books, field data sheets, and chain-of-custody (COC) forms to ensure that all planned samples were collected, and to ensure consistency with the field methods and decontamination procedures specified in the QAPP Worksheet 21 – Field SOPs and Appendix A of the QAPP. In addition, calibration logs were reviewed to ensure that field equipment was calibrated and/or checked once per day. The logs have been provided in Appendix D.

The laboratory deliverables were reviewed to ensure that all records specified in the QAPP as well as necessary signatures and dates are present. Sample receipt records were reviewed to ensure that the sample condition upon receipt was noted, and any missing/broken sample containers (if any) were noted and reported according to plan. The data packages were compared to the COCs to verify that results were provided for all collected samples. The data package case narratives were reviewed to ensure that all exceptions (if any) are described.

4.2 Data Validation

The complete analytical dataset underwent USEPA Stage 2B data validation for the environmental sample analyses performed by PACE and supporting Level IV Data Package information by Environmental Data Quality Inc. (EDQI). The full Data Validation Reports (DVRs) provided by

EDQI have been included as an electronic attachment.

Sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. The Stage 2B review was performed as outlined in "Guide for Labeling Externally Validated Laboratory Analytical Data for Superfund Use", EPA-540-R-08-005. Results were validated or qualified according to general guidance provided in "USEPA National Functional Guidelines for Inorganic Superfund Data Review (ISM02.1)", USEPA October 2013. Region III references this guidance for validation requirements. This document specifies procedures for validating data generated for Contract Laboratory Program (CLP) analyses. The approved QAPP dated April 5, 2016 and the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data.

4.3 Data Usability

The data were evaluated with respect to the quality control elements of precision, bias, representativeness, comparability, completeness and sensitivity relative to data quality indicators and performance measurement criteria outlined in QAPP Worksheet 12 – Measurement Performance Criteria. The following discussion details deviation from the performance measurement criteria, and the impact on data quality and usability.

The measurement performance criteria of precision and bias were evaluated in the data validation process as described in the DVRs. Where appropriate, potential limitations in the results have been indicated through final data flags. These flags indicate whether particular data points were quantitative estimates, biased high/low, associated with blank contamination, etc. Individual data flags are provided with the results in the detection summary tables and on exceedance figures. A qualifier code glossary is included with each data validation report provided by EDQI. Particular results may have been marked with the "R" flag if the result was deemed to be unreliable and was not included in any further data evaluation. None of the results were flagged with an "R" qualifier during data validation. A discussion of data completeness (the proportion of valid data) is included below.

Representativeness is a measure of how accurately and precisely the data describe the Site conditions. Representativeness of the samples submitted for analysis was ensured by adherence to standard sampling techniques and protocols, as well as appropriate sample preservation prior to analysis. Sampling was conducted in accordance with the QAPP Worksheet 21 – Field SOPs and Appendix A of the QAPP. Specific Field SOPs applicable to the assessment of representativeness include Field SOP Numbers 004, 006, 007, 009, 010, 011, 012, 013, 014, 016, 017, 018, 019, 020, 024, 027, 029, and 030. Review of the field notes and laboratory sample receipt records indicated that collection of groundwater, pore water, and surface water at the Site was representative, with no significant deviations from the SOPs.

Comparability describes the degree of confidence in comparing two sets of data. Comparability is maintained across multiple datasets by the use of consistent sampling and analytical methods across multiple project phases. Comparability of sample results was ensured through the use of approved standard sampling and analysis methods outlined in the QAPP. QA/QC protocols help to maintain the comparability of datasets, and in this case were assessed via blind duplicates, blank samples, and spiked samples, where applicable. No deviations from the QAPP were noted in the data set.

Sensitivity is a determination of whether the analytical methods and quantitation limits will satisfy the requirements of the project. The laboratory reports were reviewed to verify that reporting limits met the quantitation limits for specific analytes provided in QAPP Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits. In general, the laboratory reporting limits met the detection and quantitation limits specified in the QAPP.

Completeness is expressed as a ratio of the number of valid data points to the total number of analytical data results. Non-usable ("R" flagged) data results were determined through the data validation process. The approved QAPP specifies that the completeness of data is assessed by professional judgement but should be greater than or equal to 90%. Data completeness for each compound is summarized in **Appendix G.** All analytes evaluated had a computed completeness ratio of 100%. Based on the completeness evaluation, there were no significant data gaps.

5.0 CONCEPTUAL SITE MODEL

5.1 COA Geology

The Description of Current Conditions (DCC) report (Rust Environment & Infrastructure, 1998) describes how historical slag fill placement along shorelines expanded the Sparrows Point peninsula in size. In 1916, the Coke Point peninsula did not exist. It was created over the years as slag was placed along the shoreline, creating land in the southwestern area of the Site outward from the original shoreline. **Appendix H** shows the outward progression of the Coke Point peninsula shoreline over time as compiled from various historical aerial photographs. As a result, the entire present-day Coke Point peninsula is covered with a surficial layer of slag. Likewise, much of the near-shore, submerged bottom is comprised of slag. The surficial slag unit is 20 or more feet thick across most of the Site. Off-shore borings (EA, 2009) show the slag fill to extend at least 100 to 200 ft out into the river from the shoreline.

Beneath the surficial slag fill layer lie alternating layers of native fine-grained sediments (clays and silts) and coarse-grained sediments (sands).

Cross-sections were developed from the site boring logs to illustrate the site-specific lithologies. **Figure 26** shows the locations of the cross-sections. Cross-sections A-A' (**Figure 27)** and B-B' (**Figure 28)** depict the subsurface through Cell 2 from west to east and north to south, respectively. Cross-section C-C' (**Figure 29**) depicts the subsurface from the western side of Cell 2 in the north to Cell 3 in the south. Cross-section D-D' (**Figure 30**) shows the subsurface of Cell 3 from west to east. Cross-sections E-E' (**Figure 31)** and F-F' (**Figure 32)** depict the subsurface through Cell 5 from north to south and west to east, respectively.

5.2 COA Hydrogeology

Groundwater occurrence in the COA has been segregated into the shallow zone and the intermediate zone. The shallow zone is considered to be the groundwater found in the surficial slag unit. Wells in this zone typically have screened intervals between 5 and 25 feet bgs.

In most areas of the COA, a native sand layer lies directly underneath the surficial slag unit, separated from the slag layer in some places by a silt/clay layer. The intermediate zone is considered to be the groundwater found in the native sand layer. Wells in the intermediate zone screened in this sand layer. Wells in this zone typically have screened intervals between 30 and 50 feet bgs.

The cross-sections indicate the screened intervals of the wells or well pairs in the shallow and intermediate flow zones. The water levels in the shallow and intermediate zones are also indicated on the cross-sections.

5.2.1 Shallow Zone Groundwater Flow

Figure 33 shows the groundwater elevations in the shallow zone in wells across the Coke Point Peninsula. In general, with the exception of localized mounding, the shallow groundwater flows radially from an elevation of approximately 2 ft AMSL in the center of the northern boundary of the peninsula outward toward the east, south and western shores of the peninsula where the water level is approximately 0.5 ft AMSL or lower.

Groundwater flow in the shallow zone is not affected appreciably by pumping at the Graving Dock located at the former shipyard to the north of the COA. The seawall at the coal dock that extends through the full thickness of the shallow zone at the COA and the surface water in the coal basin both serve as hydraulic barriers to isolate the shallow zone in the COA from the Graving Dock.

Shallow groundwater in the Cell 2 area generally flows from east to west toward the Patapsco River. Localized mounding is evident near the reinjection wells in the southeast corner of Cell 2. The presence of the seawall along the northern shore restricts flow to the north and directs it to the west. To the south the gradient appears to crown in the at approximately 1 ft AMSL in the area west of Cell 1, with southerly flow further south in the peninsula.

The groundwater elevations for Cell 3 show shallow groundwater to be at approximately 0.4 to 0.5 ft AMSL, with less than two tenths of a foot of difference between all the wells and no consistent gradient. The water table is essentially flat within this area. Overall groundwater flow direction is toward the cove south of Cell 3, but the flow direction is likely to be affected by tidal fluctuations

The groundwater elevations for Cell 5 show very little gradient over this relatively large area. The apparent general groundwater flow direction is from northwest to southeast, with some evidence of mounding around the Cell 5 reinjections wells, but the flat gradient and the potential effect of tidal fluctuations make it complicate further definition of the local flow direction although net flow is toward the Turning Basin.

5.2.2 Intermediate Zone Groundwater Flow

The intermediate groundwater contour map (**Figure 34**) is shown for the northwestern portion of the peninsula (around the Cell 2 IM). A more extensive groundwater contour map for the intermediate zone is not feasible due to limited groundwater elevation measurements available outside this area. Additional wells are being installed to facilitate the generation of a groundwater contour map for the intermediate zone across the entire peninsula as outlined in the Coke Point Area Corrective Measures Study Work Plan (Rev. 0, October 18, 2019).

Within the Cell 2 area, the contour map shows a fairly consistent gradient to the north toward the extraction wells. Vertical gradients between wells in the shallow and intermediate zones in the Cell 2 area are consistently downward with exception of the CO028 well pair on the western

shoreline. The effect of the groundwater extraction is evident in the negative elevations and the depression around the extraction wells. In fact, a localized capture area has been documented in the intermediate zone, indicated by water levels in the intermediate zone measured one to two feet lower in the vicinity of the Cell 2 IM pumping system than in nearby intermediate zone wells. This provides evidence that the Cell 2 pump and treat system is providing hydraulic control along the northern border of Cell 2.

Groundwater flow in the intermediate zone is affected to some extent by pumping at the Graving Dock located at the former shipyard to the north of the COA. This is evident by the presence of benzene at relatively low concentrations (750 µg/L) in the water pumped at the Graving Dock. The Graving Dock pumps continuously at a rate of approximately 750 gpm from an underdrain system that controls the water level within the dock area below the surrounding river level. The Graving Dock comprises an area of 184 ft wide by approximately 1400 ft long (6.4 acres) projecting to the west out into the river. The dock is constructed with slag berms surrounding the north and south walls. The southern berm forms the northern bank of the coal basin adjacent to Cell 2, approximately 300 ft north of the coal pier seawall. The drainage system extends from the surface to an elevation of approximately -38 ft below the mean high-water level. The Graving Dock is surrounded by open water on three sides that serves as a source of recharge and the pumping is spread over the entire 6.4-acre area of the Graving Dock. Thus, the drainage system intercepts primarily river water infiltrating through the slag berms as well as some groundwater upwelling from the intermediate zone. The concentration of benzene in the Graving Dock water (average of 733.4 µg/L in 2019) is almost 500 times lower than the maximum benzene concentration in the intermediate ground water in the COA (320,000 µg/L in COV-MWI), indicating that flow from the COA makes up a fraction of the water pumped at the Graving Dock.

5.3 Contaminant Sources

Figure 35 shows the sitewide distribution of benzene concentrations in the shallow groundwater zone wells across the whole Coke Point Peninsula (CPP). The figure shows the area of LNAPL recovery at Cell 6. The highest shallow groundwater benzene concentrations are located around Cell 1 immediately west of the Cell 6 LNAPL zone. The Cell 6 area is located in the area of the former Benzol Processing area, which was the original source of the LNAPL and benzene contamination. The Cell 6 LNAPL area is likely the source area for the elevated benzene concentrations observed in the shallow zone groundwater in Cell 1, which then migrates to Cell 2 and possibly Cell 3, where concentrations are at least an order of magnitude lower.

In the eastern half of the CPP, there are three separate and distinct areas where benzene concentrations are elevated above the surrounding concentrations. These likely represent impacts from separate isolated sources near wells CP08-PZM008, CO112-PZM and CO08-PZM005. However, the benzene concentrations at each of these three locations are all an order of magnitude lower than the levels observed in the Cell 1 area. Well CP08-PZM008 is located in the Coke Point

Landfill so the impact here is likely formerly associated with the landfill. This portion of the landfill has now been excavated and removed. Well CO112-PZM is located within the known DNAPL source area in Cell 5, which is the source of the benzene impact. DNAPL recovery is ongoing in this area. Well CO08-PZM005 appears to be an isolated impact associated with an unidentified local source.

Figure 36 shows the distribution of naphthalene in the shallow groundwater across the CPP. The highest concentration is associated with the known DNAPL source in the Cell 5 area. The Cell 6 NAPL area also appears to be serving as a source of naphthalene in the shallow zone at well CO93-PZM. There appear to be separate minor sources in the vicinity of CO05-PZM006, COG-MWS in the Cell 3 area, and CO28-PZM010. As noted, the 1964 and 1966 aerials show discharges occurring very close to the current location of well CO28-PZM010.

Figure 37 shows the benzene distribution in the intermediate zone. This figure shows the primary impact to be located in Cell 2 and to the south and to the west of Cell 2. The LNAPL in the Cell 6 area may also represent a possible source for benzene observed in the intermediate zone at COV-MWI and CO41-PZM036, potentially migrating through the shallow zone within the Cell 1 area and drawn to the intermediate zone by pumping at the Graving Dock. The elevated benzene concentrations in the intermediate groundwater extend to the west around well CO28-PZM048. Historical aerial photographs (**Appendix H**) show the past operations and expansion of the shoreline over time, as well as the locations of visible historical discharges to the river. The photographs show that as fill was added to make land and expand the peninsula, outfalls were relocated to the west toward the area of well CO28-PZM048, with the 1964 and 1966 aerials showing discharges occurring right in the area of well CO28-PZM048. These former direct discharge locations, and contamination that settled out at the discharge locations, have been buried by the fill and new discharge locations have been created along the new shorelines. This is the likely source of the elevated benzene concentrations in the intermediate groundwater in well CO28-PZM048 and the NAPL observed as sheen or staining in some borings for intermediate zone wells. Like CO08-PZM005 in the shallow zone, well CO08-PZM036 appears to show an isolated impact in the intermediate zone associated with an unidentified local source.

Figure 38 shows the naphthalene distribution in the intermediate zone groundwater. The maximum concentration of naphthalene in the intermediate zone is located at COR-MWI. Concentrations in the shallow zone within this area are much lower than observed in the intermediate zone. As discussed above, the historical aerial photographs in **Appendix H** show visible historical discharge points within this area. The source of the elevated naphthalene concentrations in the intermediate zone groundwater, as well as NAPL observed in soil borings, near well COR-MWI, is likely contamination deposited in historical river bottom sediments by direct discharges and then later buried by slag fill.

Lesser concentrations of naphthalene are present in the Cell 2 wells CO39-PZM042 and COM-MWI but are separated from the impacts centered on COR-MWI. The concentrations in the intermediate zone at these Cell 2 locations are higher than in the levels observed in the paired shallow zone wells. Therefore, it is likely that the source of the impact in this area was also historical direct discharges later covered by slag fill. As with benzene, well CO08-PZM036 appears to show an isolated impact for naphthalene in the intermediate zone associated with an unidentified local source.

The benzene and naphthalene plumes in the shallow groundwater in Cell 3 originate north of new well COA-MWS, north of the large slag pile at Cell 3. The benzene isoconcentration map for the CPP (**Figure 35**) indicates that the benzene plume may connect to the plume to the west of Cell 1 and may have originated from the Cell 1 area. However, the current benzene concentration in well COA-MWS is slightly lower than the levels currently observed in well CO30-PZM015 and in COG-MWS, indicating that the maximum concentrations in the source of the plume may have attenuated. **Figure 36** shows that the naphthalene concentrations are highest close to the shoreline at Cell 3, indicating that they could potentially be associated with sediments impacted by historical direct discharges later buried by slag fill.

An area of NAPL has been identified in previous investigations as the apparent source of the dissolved naphthalene plume at Cell 5. This supplemental investigation indicated the highest naphthalene concentration in the new wells to be just east of the NAPL area, supporting the previous conclusions of the NAPL area as the source of the dissolved plume.

5.4 Migration Pathways and Extent

5.4.1 Shallow Zone

Figures 35 and 36 show the benzene and naphthalene distributions, respectively, in the shallow groundwater zone across the CPP. As indicated in **Figure 35**, the highest benzene concentrations in the shallow groundwater are associated with the former Benzol Processing area in the Cell 6 LNAPL zone and the Cell 1 area. Benzene has migrated from this source area to the to the northwest toward the coal basin at Cell 2. The extent of the groundwater plume is limited by the coal dock seawall to the north where the migration appears to have continued to the west along the seawall to the river. Similarly, benzene in the shallow groundwater appears to have migrated to the southwest from Cell 1 toward the cove at Cell 3. The benzene concentrations in the shallow groundwater in Cell 2 and 3 are an order of magnitude lower relative to the concentrations within and immediately to the west of Cell 1.

The new wells installed during this supplemental investigation further refined the identified plume of benzene and naphthalene within the shallow groundwater at Cell 3. The plume continues to be centered within the existing Cell 3 system, and the new well COA-MWS confirms that the benzene plume originates farther north than the limits of the existing wells. The benzene and naphthalene

plumes in shallow groundwater terminate to the south at the local discharge within the cove area. The extents of the benzene and naphthalene plumes have been defined to the east and west.

The vertical profiling at the location of well COD-MWS indicated that the benzene plume is located primarily in the interval from 15 ft to 25 ft bgs, which extends below the depth of the air sparge wells in the existing Cell 3 system. In addition, the vertical profiling identified elevated naphthalene concentrations primarily in the interval from 25 to 35 ft bgs.

The naphthalene distribution in the shallow zone does not show clear migration pathways within the western half of the COA. With the exception of one elevated naphthalene concentration at CO93-PZM, the naphthalene concentrations in the shallow zone are highest along the shorelines with relatively low levels inland, again indicating that they could potentially be associated with sediments impacted by historical direct discharges later buried by slag fill.

The benzene impact associated with the isolated source associated with CP08-PZM008 in the former coke point landfill appears to be fully delineated and does not appear to be migrating to the shoreline within the shallow groundwater zone. The elevated naphthalene concentrations associated with this source area are similarly fully defined and do not indicate migration of naphthalene in the shallow groundwater to the shoreline.

In the eastern half of the COA, the benzene and naphthalene associated with the DNAPL zone in Cell 5 would be expected to migrate to the southeast based on the shallow groundwater contours. Migration in this direction may be controlled by the existing IM. The supplemental wells COAA-MWS, COBB-MWS, and COCC-MWS identified higher concentrations of benzene and naphthalene than previously documented. As a result, and as shown on **Figure 23**, the naphthalene plume extends north of the existing Cell 5 IM system but is bounded to the north by existing wells CO20-PZM004 and CO10-PZM006. The plume is bounded to the east by the shoreline of the Turning Basin, a surface water feature constructed from slag fill with the highest perimeter concentrations for both benzene and naphthalene located at wells COAA-MWS and COCC-MWS. The elevated benzene drops off at well CO35-PZM013 to the south.

5.4.2 Intermediate Zone

Benzene and naphthalene distribution in the intermediate groundwater zone are shown on **Figure 37** and **Figure 38**, respectively. The highest benzene concentrations in the intermediate zone are located in the area to the west and northwest of the former Benzol Processing area. Benzene in the intermediate zone migrated downward from the shallow zone impacts associated with the LNAPL source zone in Cell 6 and the higher concentration shallow groundwater observed in and to the west of Cell 1. The downward and northward migration within this area was enhanced by historical pumping from the intermediate zone at the Graving Dock to the north. However, it is likely that the pumping at the Graving Dock is having less of an effect and pumping at the Cell 2 intermediate zone

IM is now having a greater influence on migration in the intermediate zone.

The intermediate wells placed between the recovery wells and the seawall (COK-MWI, COL-MWI and COM-MWI) show that the concentration of benzene downgradient from the recovery wells is lower than the concentrations upgradient. The benzene concentration drops from 318,000 µg/L in COP-MWI upgradient of the recovery wells to 40,800 µg/L in COL-MWI further north and downgradient of the recovery wells. The groundwater contours also show the water level in the intermediate zone to be 1 to 2 ft lower near the pumping wells relative to the surrounding wells. These results indicate that the pump and treat system is effectively controlling the migration of contaminants in the intermediate zone to the north from Cell 2. Using the Graving Dock withdrawal rate of 1,080,000 gallons per day (750 gpm) and the average influent benzene concentration of 733.4 µg/L results in 2,412 pounds of benzene removed in 2019 by the Graving Dock pumping. By comparison, the Cell 2 system removed 5,800 pounds of hydrocarbons (mostly benzene) in 2019 pumping at less than 10 gpm.

The new intermediate well COR-MWI placed between existing wells CO41-PZM036 and CO28-PZM048 confirms that the elevated benzene concentration in CO28-PZM048 is likely resulting from migration of benzene in the intermediate zone to the west toward the Patapsco River. Well COV-MWI indicates that the known north-south plume originates further south than CO41-PZM036.

The naphthalene distribution indicated on **Figure 38** does not correspond to the benzene distribution, suggesting different predominant sources and migration pathways. As discussed above, the highest concentrations of naphthalene in the intermediate zone align with the historical location of outfalls. Therefore, it is likely that the naphthalene was deposited in sediments proximate to the outfalls that were then buried by slag fill as the peninsula was expanded. As noted with the shallow groundwater, the elevated level of benzene, and to a lesser extent naphthalene, at well CO08-PZM036 may be associated with an isolated local source.

There were no significant impacts in the intermediate zone outside of the two areas discussed above. The impacts within these areas are limited to the shallow zone. **Figures 29** and **30** show the vertical distribution of benzene and naphthalene in the Cell 3 area. In general, the boring logs in this area show a silt/clay layer or layers between the shallow slag fill and the underlying intermediate zone sand. Intermediate well CO30-PZM060 has only low concentrations, indicating little migration from the shallow zone to the intermediate zone within the Cell 3 area. **Figures 31** and **32** show the vertical distribution of naphthalene concentrations in the Cell 5 area. Some borings show a clay layer separating the shallow zone slag fill layer from the intermediate zone sand layer. Other borings do not show the clay layer and indicate a potential hydraulic connection between the slag fill and the underlying sand layer. However, data from intermediate zone well CO26-PZM032 shows a very low concentration of naphthalene in the intermediate zone, indicating little migration from the shallow zone to the intermediate zone.

5.5 Potential Receptors and Exposure Pathways

The Site is currently developed for industrial use. The area is supplied by municipal potable water and a groundwater use restriction will be imposed. Therefore, an industrial worker would not be exposed to groundwater. Exposure through volatilization into indoor air would be a potential future exposure pathway if buildings were to be constructed within impacted areas. The shallow and intermediate groundwater concentrations exceed vapor intrusion screening levels across much of the COA.

The groundwater ultimately discharges to surface water bodies including the coal basin at Cell 2, manmade cove at Cell 3, and the Turning Basin at Cell 5, but also directly to the Patapsco River west of Cell 2. Therefore, the exposures of concern are potential recreational exposure and aquatic life exposure to surface water and sediment. Benthic organisms in bottom substrates and fish and water column invertebrates are the primary aquatic receptors in the nearshore areas. This supplemental investigation included the collection of sediment pore water and surface water samples to assess potential exposures in these receptors.

Pore water is a potential exposure medium for benthic organisms. Benthic organisms can be exposed to chemicals in groundwater that discharges to sediments and is present in the pore water of nearshore areas. Overall, ecological impact of this type of exposure is expected to be low, however, largely because the benthic communities in the nearshore area will be limited in both diversity and number due to the presence of slag fill, which dominates the nearshore areas. Slag provides poor habitat for benthic organisms. This is due in part to a relatively homogenous distribution of large-sized particles and an absence of organic matter that is a necessary food source for some organisms. The benthic environment created by slag is significantly different from the natural conditions of the surrounding natural waters and creates conditions in which few organisms can adapt. Additionally, elevated pH associated with slag not only creates an additional stressor that would limit benthic communities, but also creates a geochemical conditions that favor calcite precipitation which could smother benthic organisms that are present and create very dense, fine grained particles that also provide poor benthic habitat. As noted earlier, pore water samples could not be collected in many near shore areas due to presence of hard bottom or low permeability sediments.

The slag fill does provide a medium through which chemicals transported via groundwater into the pore water could reach the surface water column above the fill. Surface water is potential exposure medium for fish and other aquatic organisms that inhabit the area. Fish and invertebrates could be exposed to dissolved phase chemicals in surface water largely via uptake over the gills.

People could be exposed to chemicals in surface water via direct contact and incidental ingestion while recreating in the waters and via consumption of fish that have accumulated chemicals. The surface water criteria for human health are developed to protect for these exposures and the AWQC developed for benzene is for the protection of consumption of fish by people. Because benzene as

well as all of the chemicals detected in the surface water are rapidly eliminated in aquatic organisms, it will not accumulate in fish unless the exposure to the fish is constant. If benzene is present in surface water in some areas in which a fish roams but not in others, it will not accumulate in the fish. As a result, distribution of benzene in surface water, even if above the AWQC, will not result in accumulation in fish unless it is elevated across the majority of the area within the fish's home range. Pore water concentrations of benzene are not representative of water column concentrations to which fish are exposed.

5.6 Preliminary Risk Evaluation

The discharge of groundwater from the Cell 2 area is not causing significant impacts to the coal basin to the north of Cell 2. No unacceptable concentrations were identified offshore to the north of Cell 2. The pore water and surface water data show only trace impacts offshore in this inlet, with the exception of some DRO detections, which are likely associated with historical direct discharges to the coal basin as noted by the reported presence of NAPL sheen at Location 1 in the previous off-shore investigation report (EA, 2009). The concentrations in the shallow groundwater along this northern shore are relatively low and discharge from the shallow zone to the pore water and surface water appears to be cut off by the seawall along the northern shoreline, as shown on **Figure 28** (Cross -section B-B').

Pore water samples from the Patapsco River bottom sediments to the west of the Cell 2 area indicate that benzene and naphthalene are present. The finding of these constituents in pore water off the western shore is consistent with the findings of previous sediment investigations (EA, 2009) that reported evidence of NAPL in the sediment off the western shore. Positive dye tests, PID readings, and petroleum odor were reported at EA's Location 2 off the western shore (see Figure 4-4 and Table 4-9 in **Appendix H**). Therefore, the presence of benzene and naphthalene in these offshore areas appears to be due to historical releases of NAPL directly to the Patapsco, and not the result of ongoing groundwater transport to this shoreline area.

In fact, the groundwater and pore water results indicate that there is no direct connection between the observed pore water impacts and current discharges of groundwater. The concentrations of naphthalene in the offshore pore water samples CO-070-PW-2 and CO-049-PW-3 are 63,200 µg/L and 72,000 µg/L, respectively. Both the shallow and intermediate wells along the shoreline had lower total naphthalene concentrations (maximum of 8,570 µg/L in COO-MWI) than observed in the pore water samples. In addition, the pore water impacts are predominantly naphthalene, with naphthalene concentrations being roughly 3 to 5 times the concentration of benzene. The shallow and intermediate groundwater in the shoreline wells consistently has higher benzene than naphthalene concentrations, with benzene being 8 to 33 times higher than naphthalene in the shallow groundwater and 8 to 47 times higher in the intermediate zone groundwater.

At Cell 3, groundwater discharges to a shallow cove (approximately 700 feet long by 300 feet wide) constructed of slag fill, as indicated in the historical aerial photographs. As shown on **Figure 39,** the bottom of the cove was measured to be approximately 8 to 10 feet deep at center. The VAP sampling indicated the highest concentration of benzene was found approximately -8.37 to – 13.37 feet above mean sea level (amsl) (20-25 feet bgs), which is generally consistent with bottom elevations at the center of the cove.

Surface water concentrations exceeded the current Maryland surface water quality standard for benzene at one location immediately offshore within the manmade cove south of Cell 3. The surface water benzene concentrations exceed the AWQC for human consumption of organisms at a few additional locations within this cove. However, benzene concentrations are below these potentially applicable surface water quality criteria in all samples in the western transect. Thus, the surface water meets in-stream water quality criteria within a reasonable mixing zone and the sporadic distribution of benzene in surface water within the confined space of the cove will not result in accumulation in fish, since fish will roam in areas where benzene concentrations are lower or not detected.

The pore water samples offshore at Cell 3 showed naphthalene is present in the bottom deposits in the cove. These results are consistent with the previous offshore investigation (EA, 2009) which reported an odor and sheen in the sediment boring at EA's Location 5 in the cove (see Figure 4-4 and Table 4-9 in **Appendix I**). These observations indicate that pore water concentrations of naphthalene can be attributed to historical direct NAPL discharges to the cove or to residual NAPL present in the offshore sediments prior to the shoreline being extended.

Naphthalene concentrations in pore water exceed the SCV in some locations, but groundwater discharges will not exacerbate the pore water issue. Contaminants found in pore water in the submerged slag were entrained in the slag when it was placed within the water column during the creation of land and are not a result of contaminants migrating in groundwater. Pore water sampling was unsuccessful at most locations around the COA due a hard slag bottom encountered that prevented sampler penetration into the top foot. The previous EA offshore investigation (EA, 2009) noted the presence of NAPL in cores of the bottom sediments within each of the area where significant pore water concentrations were observed. The NAPL found in bottom cores could not have occurred through accumulation related to any groundwater flow mechanism. LNAPL has only been identified inland at the Cell 6 location and LNAPL would not flow from on-shore to a submerged off-shore location - it would instead float and discharge at the water's edge; DNAPL is only present inland at the Cell 5 area and has not been identified in perimeter wells. The NAPL was directly discharged off-shore, or was present as contamination in the slag placed during the creation of the peninsula, and has been hydraulically trapped (due to surface tension and permeability) in the pore spaces of the slag beneath the bottom-water interface.

In the Turning Basin east of the peninsula, the surface water sampling indicated no exceedances of surface water criteria. The pore water investigation showed no significant impacts in the southern portion of the shoreline downgradient of the existing Cell 5 system, much lower than concentrations in shoreline wells COFF-MWS and COGG-MWS. However, the pore water sampling identified relatively high pore water naphthalene concentrations at the three northernmost sample locations (CO-073-PW, CO-074-PW and CO-079-PW). These results are consistent with the findings of the previous offshore investigation (EA, 2009) which indicated a sheen and odor in sediment at their Locations 13A and 13C (see Figure 4-4 and Table 4-9 in **Appendix I**), such that these impacts can be attributed to direct historical discharges or placement of slag when the land was created rather than current groundwater discharges. As such, it is not habitat. Given that historic releases is the source of elevated naphthalene levels in this area, it can be concluded that groundwater is not contributing significantly to chemical concentration. Regardless of source, however, the overall ecological impacts to the benthic community from naphthalene are considered minimal given that the degraded benthic habitat conditions limit the quality and quantity of the benthic community in the slag dominated nearshore areas.

6.0 FINDINGS

The results of this supplemental investigation were reviewed and evaluated to fulfill the objectives listed below.

1. Evaluate the groundwater and offshore data to assess whether current conditions could be adversely impacting the offshore environment;
2. Delineate the areas of the COA where elevated concentrations of constituents of concern in groundwater could be causing surface water or pore water impacts;
3. Further delineate the extent of constituents of concern in groundwater in selected locations to further characterize potential source areas;
4. Assess whether the currently implemented remedies require modifications in order to address potential impact from constituents of concern to sediment pore water or surface water;
5. Assess improvements and/or alternatives to the currently implemented remedies in order to meet groundwater remedial objectives.

The findings of the investigation of each IM area are discussed in the sections below.

6.1 Cell 2

The nature and extent of groundwater impacts in and around Cell 2 have been adequately defined in both the shallow and intermediate zones to support a Corrective Measures Study (CMS) to determine a final remedy. The shallow and intermediate groundwater in the Cell 2 area exceeds potential sitewide cleanup levels for vapor intrusion or potable groundwater use. Surface water is not impacted in the Cell 2 area. Pore water concentrations at some locations west of Cell 2 exceed criteria for human consumption of organisms and protection of benthic aquatic life. However, the current discharges of groundwater are not exacerbating the previously identified offshore impacts from historical direct releases.

6.2 Cell 3

The nature and extent of groundwater impacts in and around Cell 3 have been adequately defined to support a CMS to determine a final remedy. The shallow groundwater in the Cell 3 area exceeds potential sitewide cleanup levels for vapor intrusion or potable groundwater use. Surface water exceeds water quality criteria for human consumption of organisms close to shore in the manmade cove area. However, the impact is highly localized and in-stream water quality criteria are met within a reasonable mixing zone distance. Pore water concentrations at some locations west of Cell 3 exceed criteria for human consumption of organisms and protection of benthic aquatic life. As noted, the pore water samples were collected from a slag fill matrix rather than a natural aquatic habitat. The current discharges of groundwater may be causing localized surface water quality exceedances,

but not exacerbating the previously identified pore water impacts from historical direct releases.

The results of this investigation indicate that the existing Cell 3 IM may not prevent groundwater discharge to surface water or pore water above potentially relevant criteria. The contaminant distribution indicates the system extends far enough to the east and west, but that the existing sparge wells are not deep enough to fully intercept the plume. The groundwater elevation map shows an essentially flat gradient, likely fluctuating with tidal influence. This flat gradient and the resulting low groundwater velocity further inhibits the effectiveness of the Cell 3 system, which is designed to treat groundwater as it migrates through the system.

The current IM could be modified to address the identified benzene plume to prevent the discharge of benzene in shallow groundwater to the cove. However, it should be noted that the observed surface water benzene impacts could be resulting from direct groundwater discharge or from desorption and upwelling from the historical sediment impacts, or both. Therefore, eliminating the discharge of contaminants in groundwater may not reduce the surface water concentrations to the AWQC level.

6.3 Cell 5

The nature and extent of groundwater impacts in and around Cell 5 have been adequately defined to support a CMS to determine a final remedy. The shallow groundwater in the Cell 5 area exceeds potential sitewide cleanup levels for vapor intrusion or potable groundwater use. Surface water is not impacted in the Cell 5 area. Pore water concentrations at some locations east of Cell 5 exceed criteria for protection of benthic aquatic life. As noted, the pore water samples were collected from a slag fill matrix rather than a natural aquatic habitat.

Well CODD-MWS indicates that the highest concentration portion of the naphthalene plume is located within the area upgradient of the existing Cell 5 DPE treatment system. However, the additional shallow wells COAA-MWS, COBB-MWS and COCC-MWS indicate a naphthalene plume extending to the shoreline north of the existing Cell 5 system. These wells are located adjacent to the three pore water sample locations that exhibit elevated naphthalene concentrations, indicating that the current IM may not be preventing the discharge of naphthalene in groundwater at concentrations exceeding potentially relevant criteria. However, as noted above, previous investigations have indicated that these impacts may have resulted from historical direct discharges due the indication of NAPL impacts in the sediment. The naphthalene concentrations in the wells are of the same magnitude as the concentrations already present in the pore water. Therefore, the current discharge of groundwater would not exacerbate the impacts already observed in the sediment. The CMS will assess corrective action objectives relative to groundwater discharges to pore water east of Cell 5 and remedies evaluated in the CMS will include potential modifications to the current IM or alternative remedies with the objective of mitigation of naphthalene above relevant criteria.

7.0 REFERENCES

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FIGURES

Property Boundary

Coke Oven Area

Coke
Oven Area

Tradepoint Atlantic
Coke Oven Area Location Map

June 18, 2019

Figure
1

N

ARM Group Inc.
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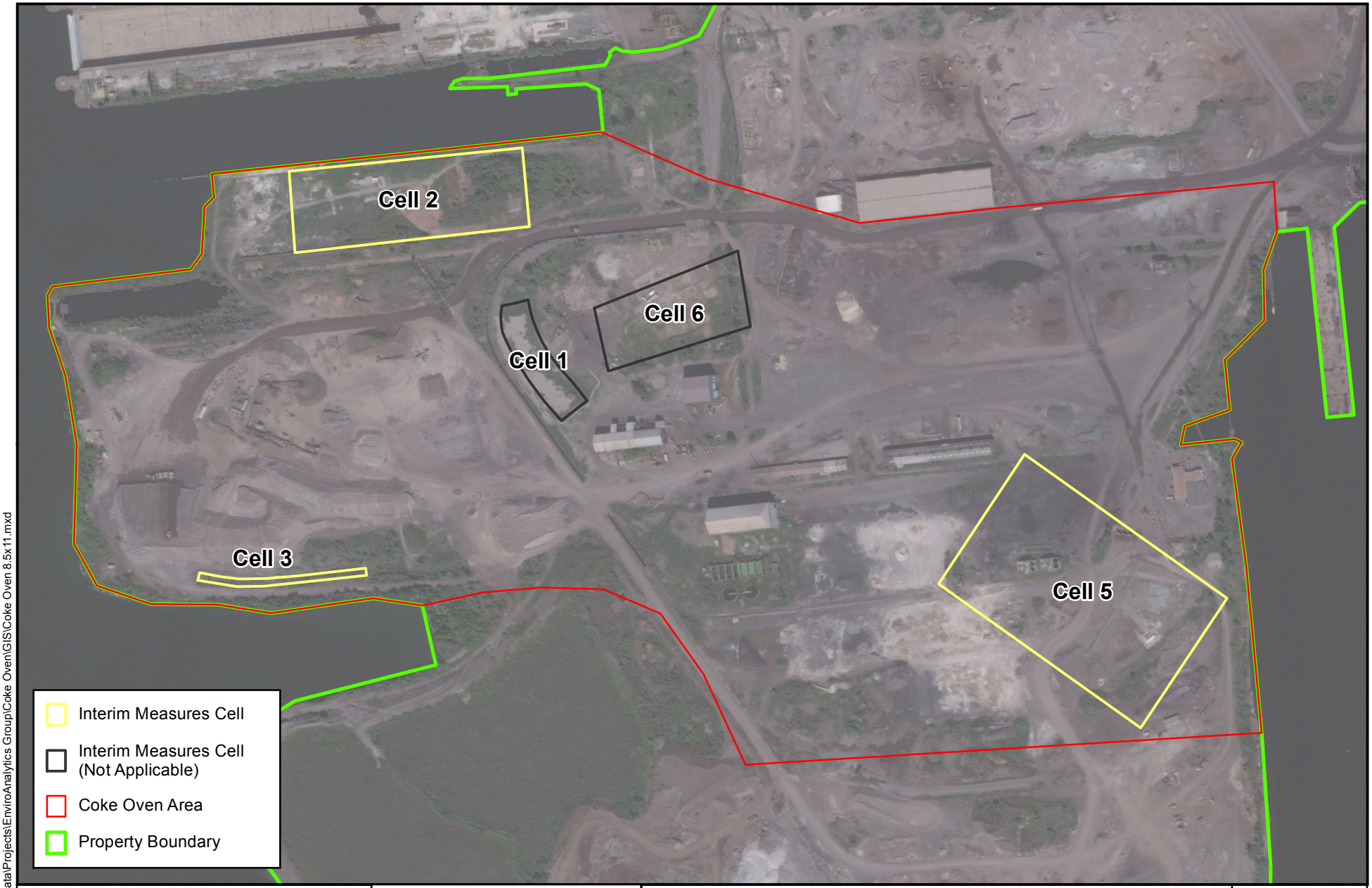
0 500 1,000 2,000
Feet

Tradepoint Atlantic

Baltimore County, MD

EnviroAnalytics Group

ARM Project No. 190288M
& No. 190342M



N

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1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Interim Measures Cell Locations

Figure 2

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END OF HISTORICAL DRAWING SET

PATAPSCO RIVER

CON-MWS/I
COO-MWS/I
COP-MWI
COQ-MWI
COR-MWI
COS-MWS
COT-MWS
COU-MWS
COV-MWI
COW-MWS
COX-MWS
COY-MWS
COZ-MWS
COK-MWS/I
COL-MWS/I
COM-MWS/I

CO36-PZM008/043
CO43-PZM048
CO44-PZM048
CO45-PZM047
CO46-PZM047
CO47-PZM046
CO48-PZM044
CO27-PZM012/046
CO37-PZM003/038
CO38-PZM006/043
CO39-PZM007/042
CO40-PZM008
CO41-PZM001/036
CO42-PZM004
CO28-PZM010/048
CO121
CO122
CO54-PZM
CO53-PZM
CO51-PZM
CO49-PZM
CO52-PZM
CO50-PZM
CO03-PZM005
CO15-PZM005
CO18-PZM006
CO02-PZM006/041
CO88-PZM
CO16-PZM006
CO100-PZM
CO93-PZM
CO17-PZM005
TS05-PPM007
TS05-PDM004

SV-1
AS-1
AS-2
AS-3
AS-4
AS-5
AS-6
AS-7
AS-8

- Supplemental Shallow Well
- Supplemental Intermediate Well
- Supplemental Shallow/Intermediate Well
- Existing Shallow Well
- Existing Intermediate Well
- Re-Injection Well
- Extraction Well
- SVE Trench (SV) Riser
- Air Sparge (AS) Well
- SVE Extraction Trench (Under-Ground)

N

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1 inch = 120 feet

0 60 120
Feet

Cell 2
Historical Plant Map

Figure 3

N

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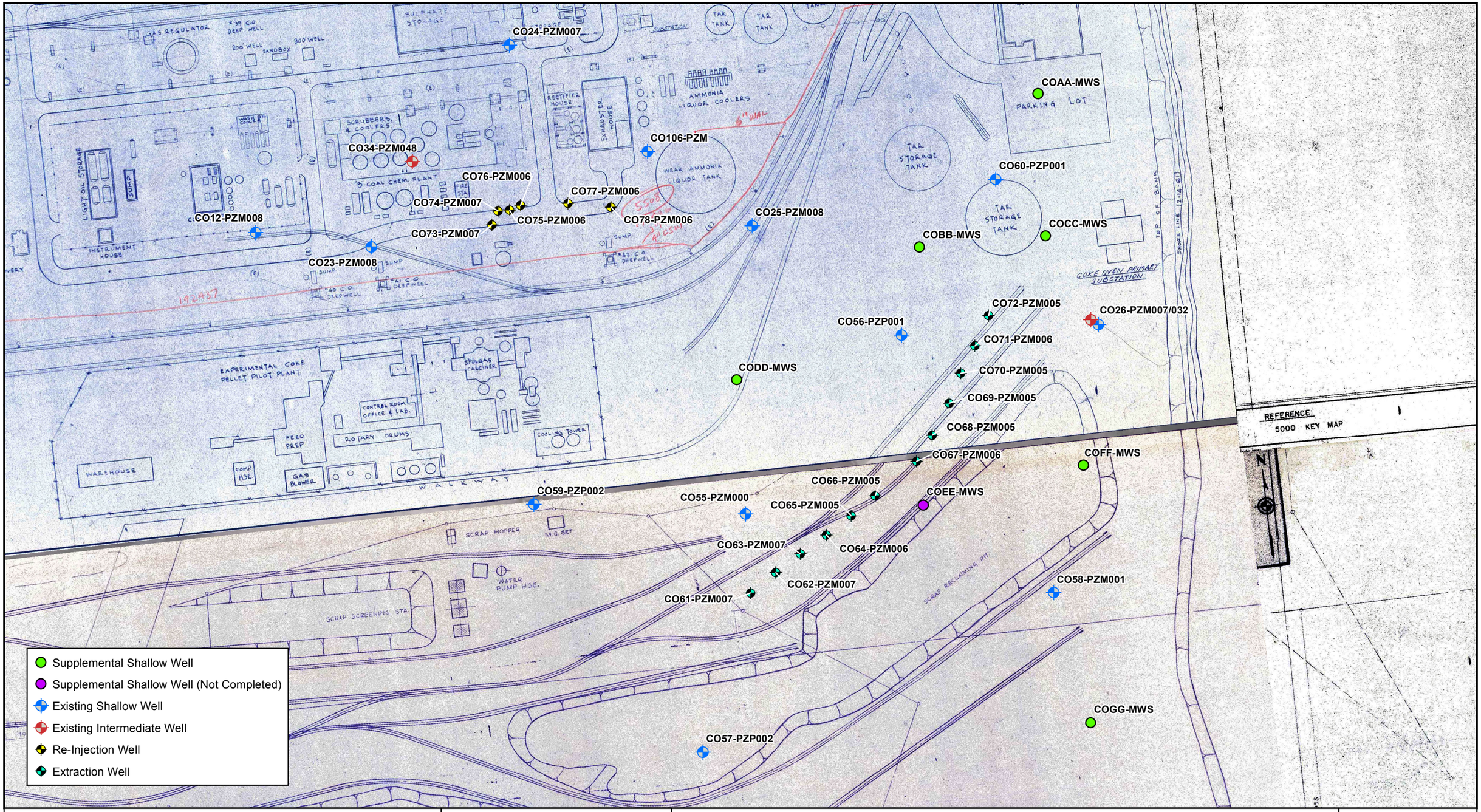
1 inch = 80 feet

0 40 80
Feet

Cell 3
Historical Plant Map

Figure 4



N

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1 inch = 120 feet

Cell 5
Historical Plant Map

Figure 5

N

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1 inch = 120 feet

0 60 120
Feet

Former Coke Oven Area - Cell 2
Well Locations
Aerial View

Figure 6

N

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1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Pore Water Sample Locations
Aerial View

Figure 7

N

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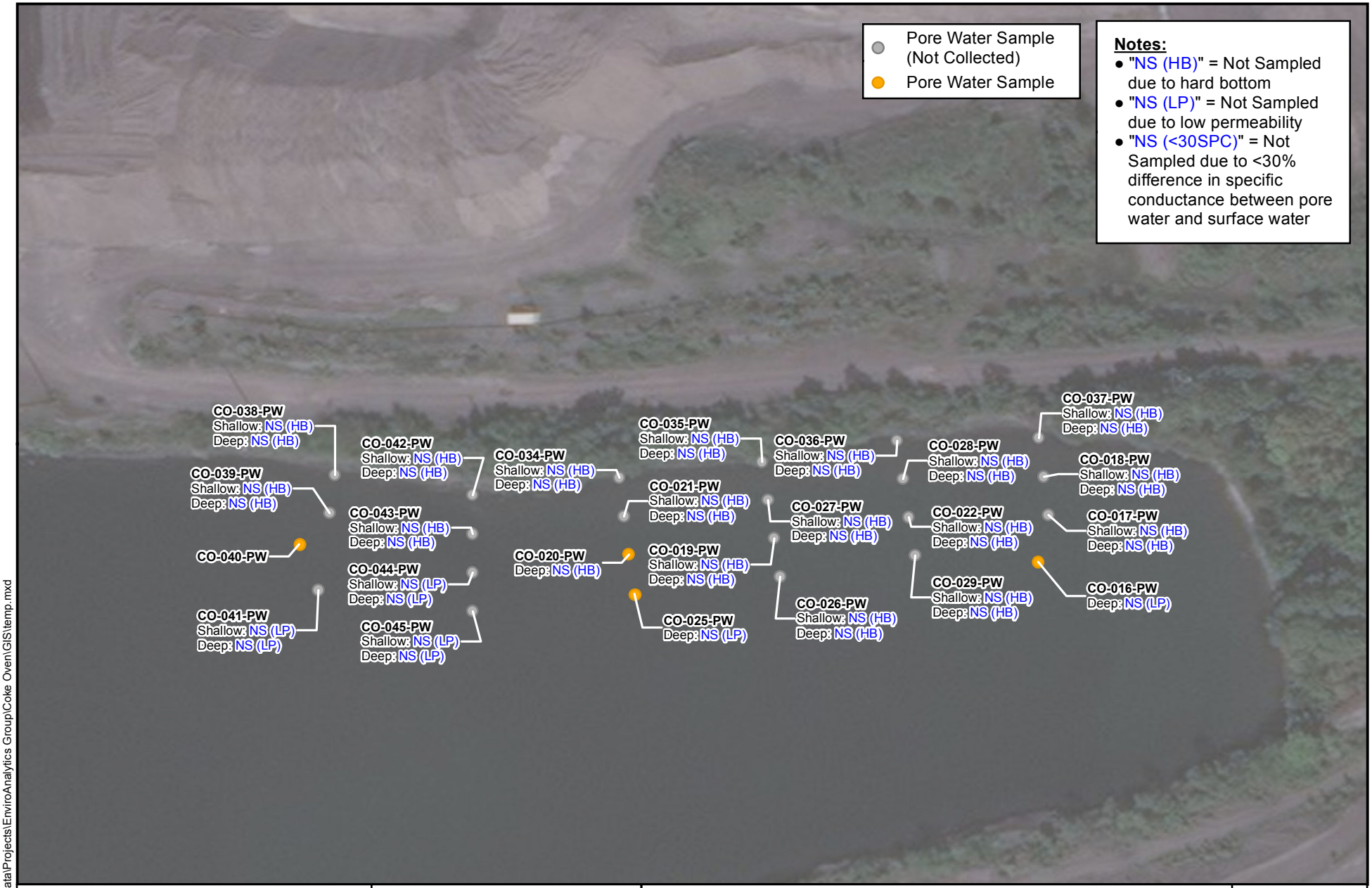
1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 3
Well Locations
Aerial View

Figure 8



N

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1 inch = 100 feet

0 50 100 Feet

Former Coke Oven Area - Cell 3
Pore Water Sample Locations
Aerial View

Figure 9

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N

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1 inch = 120 feet

0 60 120
Feet

Former Coke Oven Area - Cell 5
Well Locations
Aerial View

Figure 10

N

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1 inch = 170 feet

0 85 170
Feet

Former Coke Oven Area - Cell 3
Pore Water Sample Locations
Aerial View

Figure 11

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Notes:

- COA Wells Collected March 25-March 26, 2019
  - *Most Recent Sample 2014-2016
  - ^Most Recent Sample 2001-2004
- Supplemental Wells Collected May 1-May 14, 2019
- Concentrations are in µg/L
- "ND" = Not Detected
- "NS" = Not Sampled

Supplemental Shallow Well

Supplemental Shallow Well (NAPL Observed in Boring)

COA Shallow Well

Interim Measures Cell

Benzene Distribution (µg/L)

ND - 10

>10 - 100

>100 - 1,000

>1,000 - 10,000

>10,000 - 100,000

>100,000

CON-MWS 33,400

CO36-PZM008 5,380

COK-MWS 7,420

COL-MWS 16,100

CO27-PZM012 3,630

COM-MWS 2,390

CO37-PZM003* 22,100

CO121-PZM* 1,970

TS05-PPM007^ 360

TS05-PDM004 NS

CO122-PZM NS

CO42-PZM004 1.1

CO39-PZM007 282

Cell 2

CO38-PZM006 4,660

CO40-PZM008 40.5

COO-MWS 38,400

CO03-PZM005* ND

COT-MWS 337,000

CO28-PZM010* 20,900

CO41-PZM001 1.7

COU-MWS 514,000

CO15-PZM005* 169,000

CO18-PZM006 338,000

COS-MWS 11,100

COW-MWS 210,000

COX-MWS 148,000

CO100-PZM NS

Cell 6

CO02-PZM006 127,000

CO93-PZM 162,000

CO19-PZM004* 409

Cell 1

COZ-MWS 57,700

CO88-PZM* 166,000

COY-MWS 117,000

CO17-PZM005^ 28,000

CO16-PZM006* 119,000

N

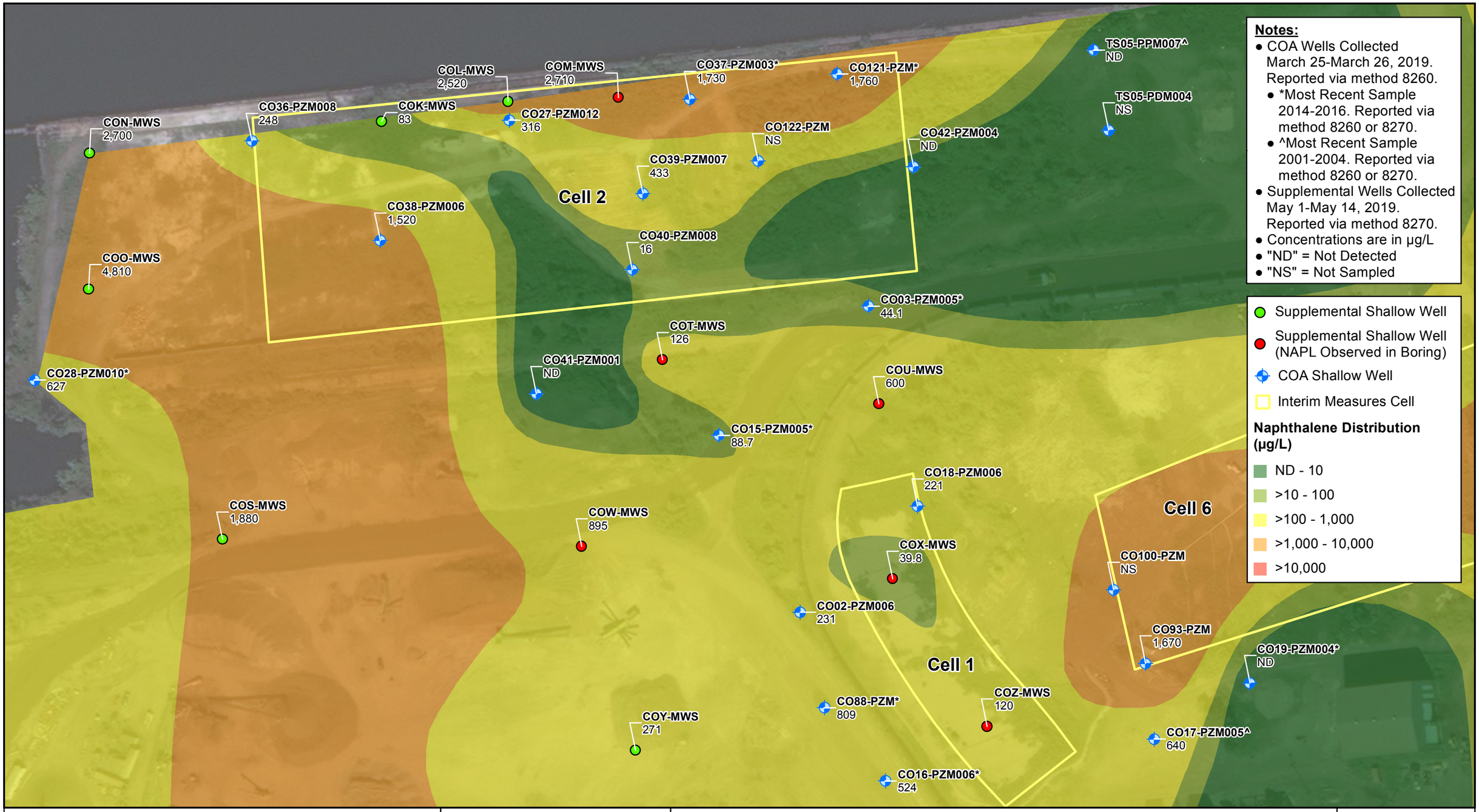
ARM Group Inc.
Engineers and Scientists

1 inch = 120 feet

0 60 120 Feet

Cell 2
Groundwater Benzene Distribution
Shallow Zone

Figure 12



N

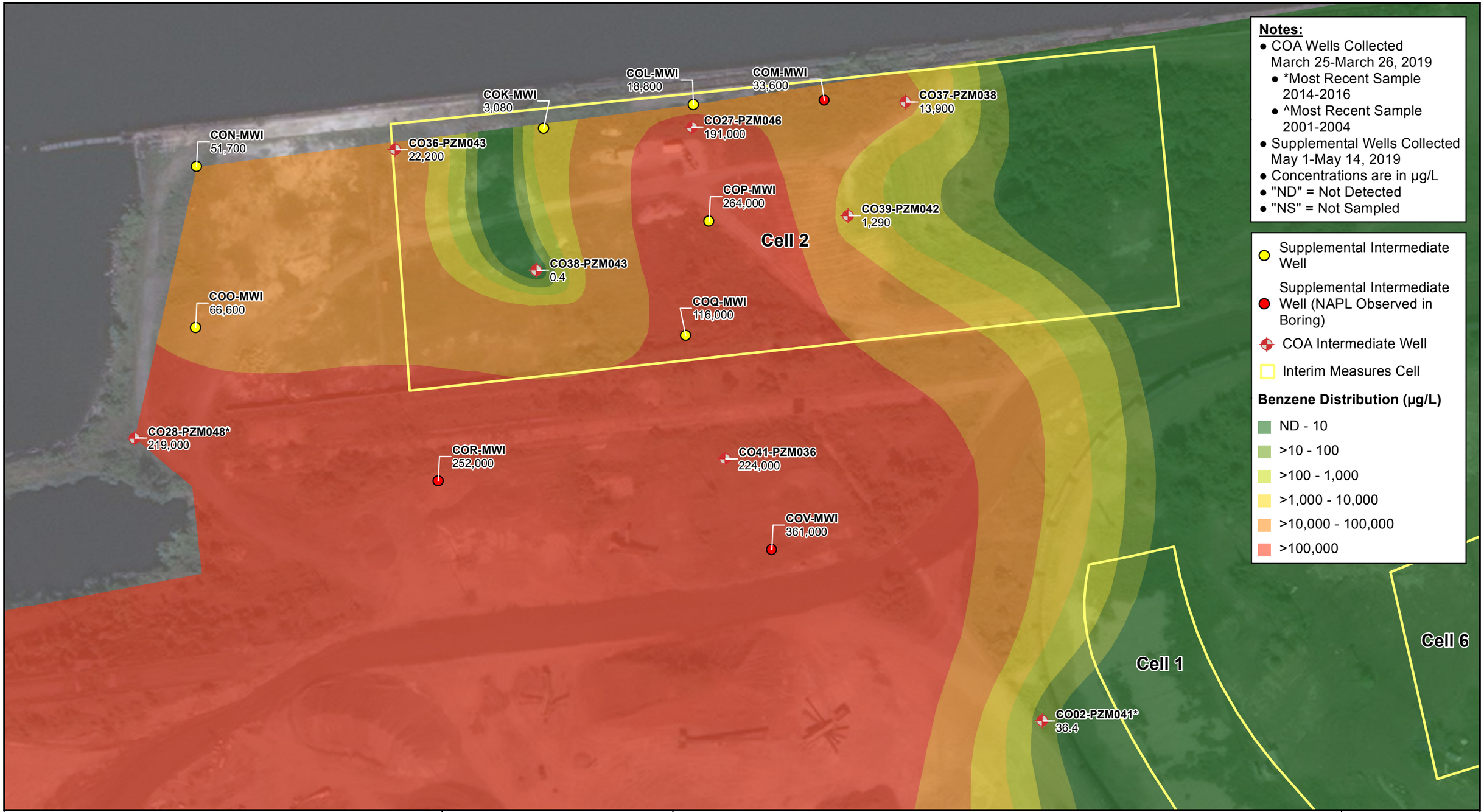
ARM Group Inc.
Engineers and Scientists

1 inch = 120 feet

0 60 120
Feet

Cell 2
Groundwater Naphthalene Distribution
Shallow Zone

Figure 13



N

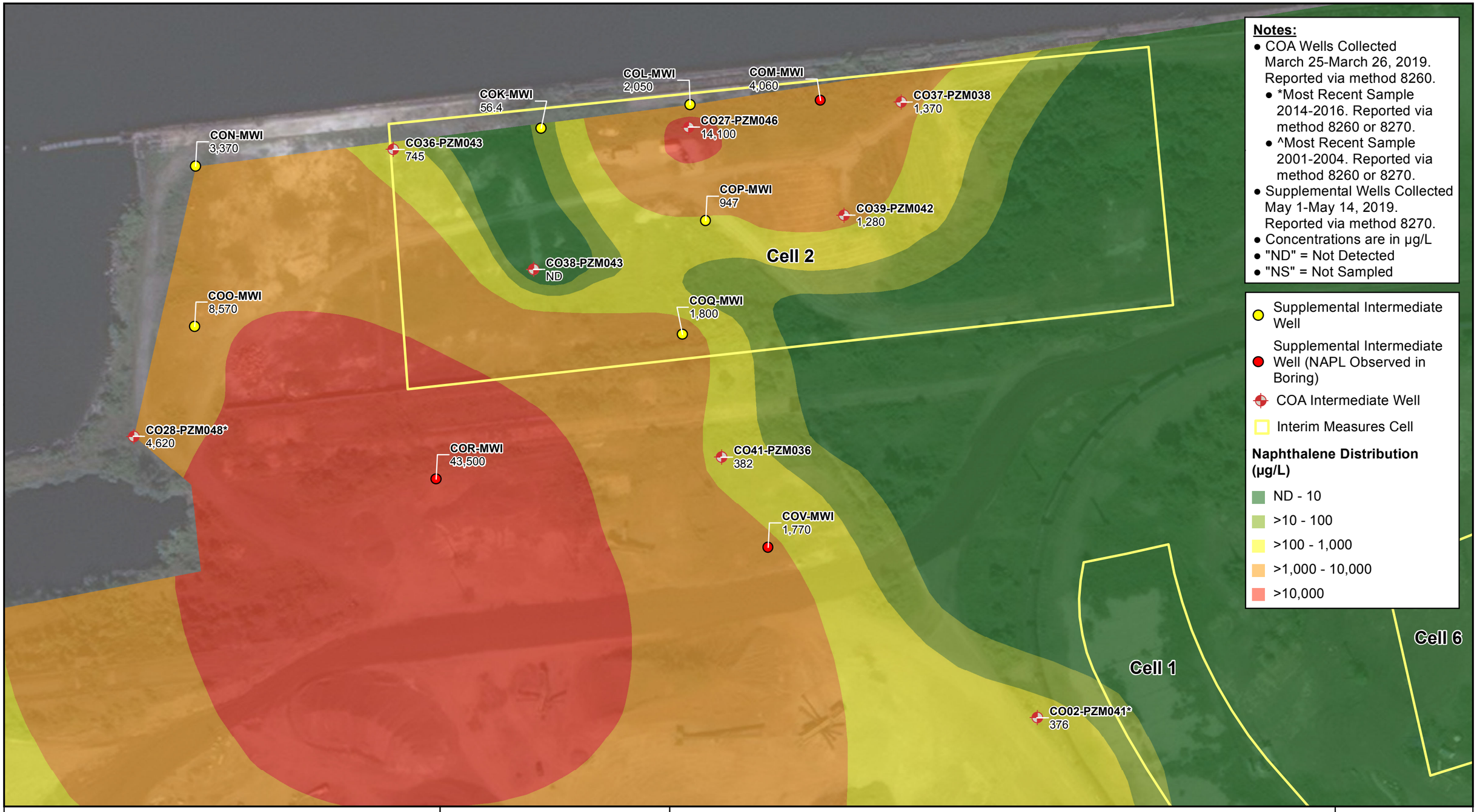
ARM Group Inc.
Engineers and Scientists

1 inch = 100 feet

0 50 100
Feet

Cell 2
Groundwater Benzene Distribution
Intermediate Zone

Figure 14



N

ARM Group Inc.
Engineers and Scientists

1 inch = 100 feet

0 50 100 Feet

Cell 2
Groundwater Naphthalene Distribution
Intermediate Zone

Figure 15

N

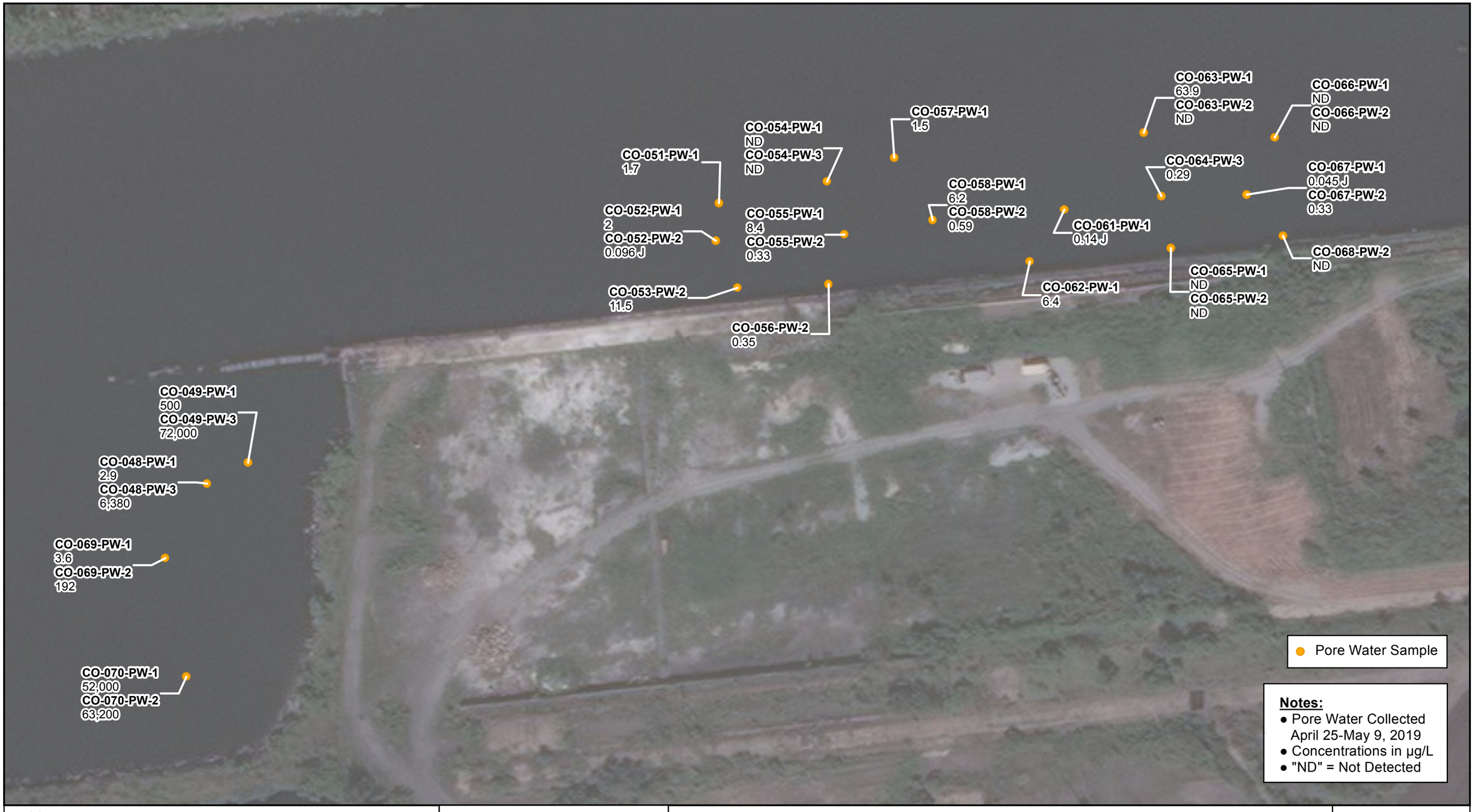
ARM Group Inc.
Engineers and Scientists

1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Pore Water Sample Locations
Benzene Results

Figure 16



N

ARM Group Inc.
Engineers and Scientists

1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Pore Water Sample Locations
Naphthalene Results

Figure 17

N

ARM Group Inc.
Engineers and Scientists

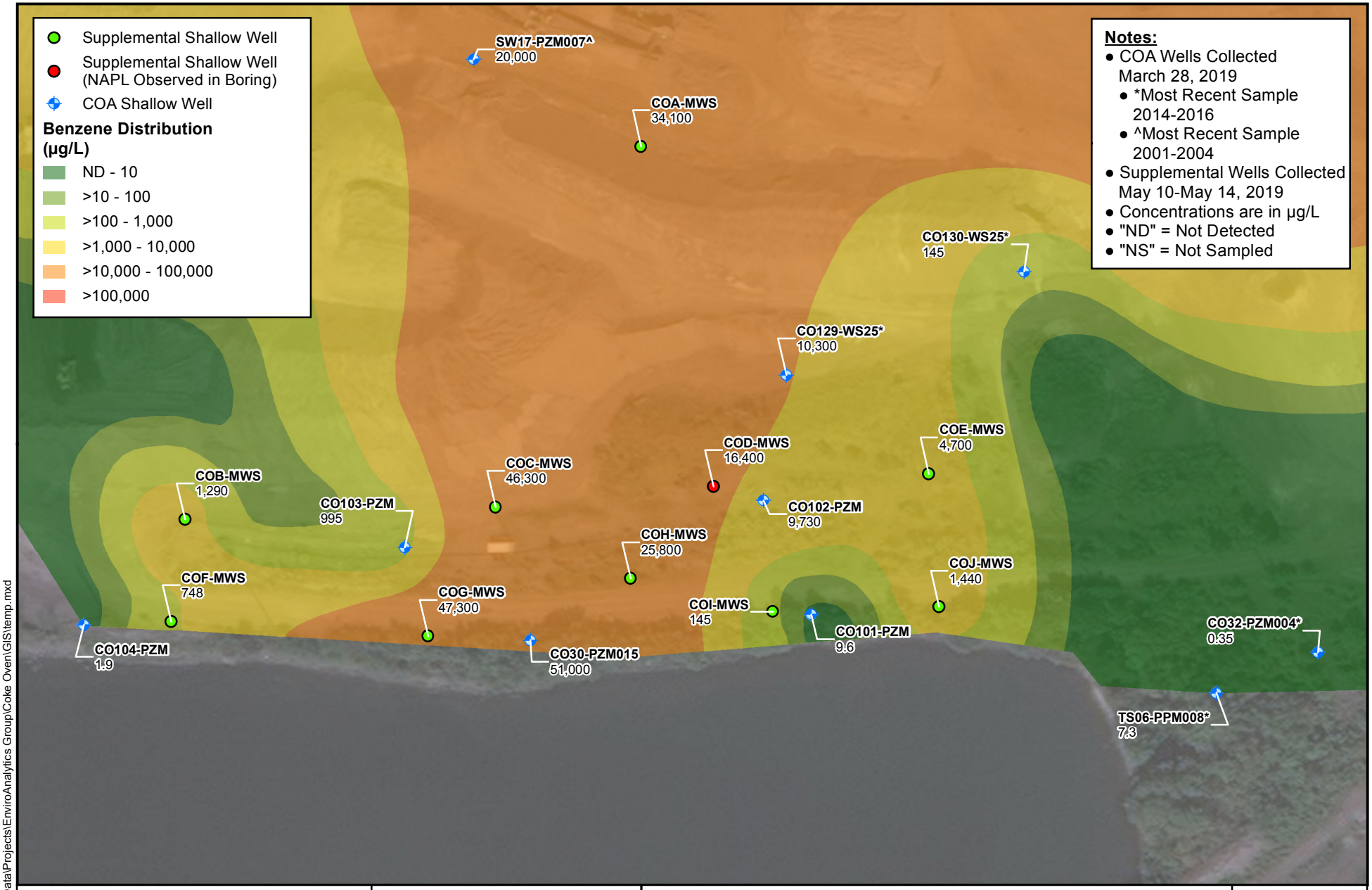
1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Surface Water Sample Locations
Benzene and Naphthalene Results

Figure 18

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



N

ARM Group Inc.
Engineers and Scientists

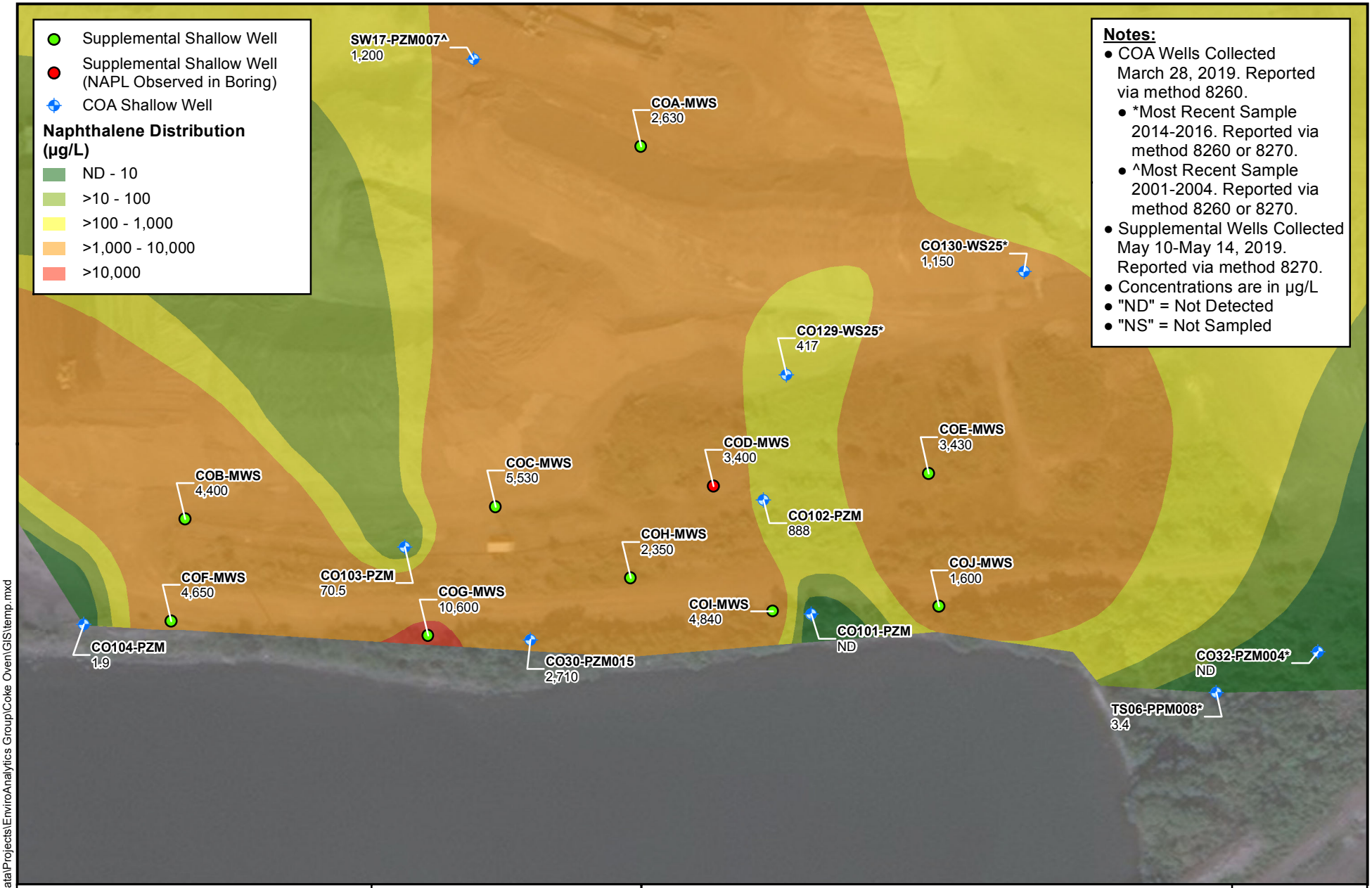
1 inch = 120 feet

0 60 120 Feet

Cell 3
Groundwater Benzene Distribution
Shallow Zone

Figure 19

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



N

ARM Group Inc.
Engineers and Scientists

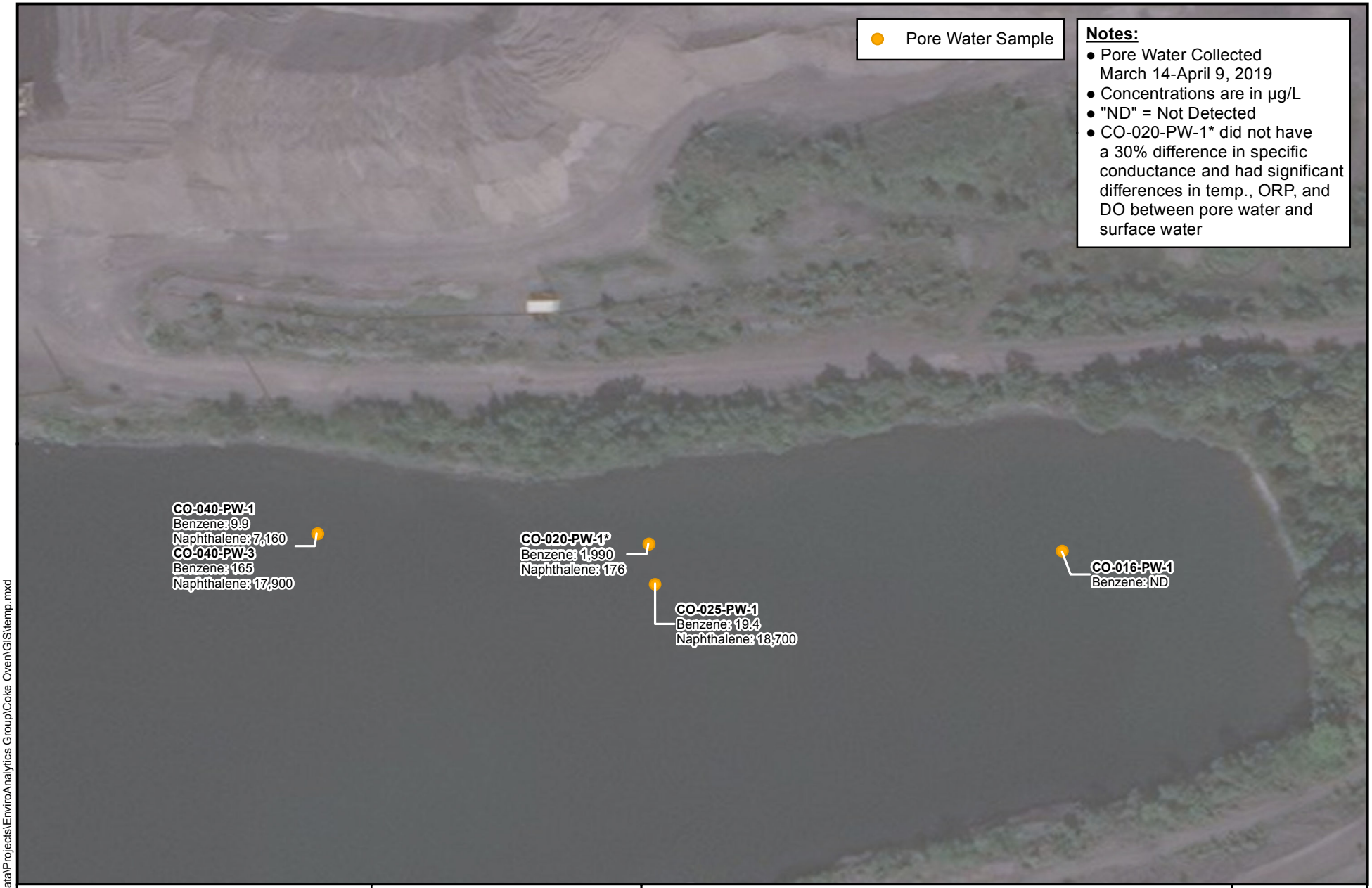
1 inch = 120 feet

0 60 120 Feet

Cell 3
Groundwater Naphthalene Distribution
Shallow Zone

Figure 20

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



N

ARM Group Inc.
Engineers and Scientists

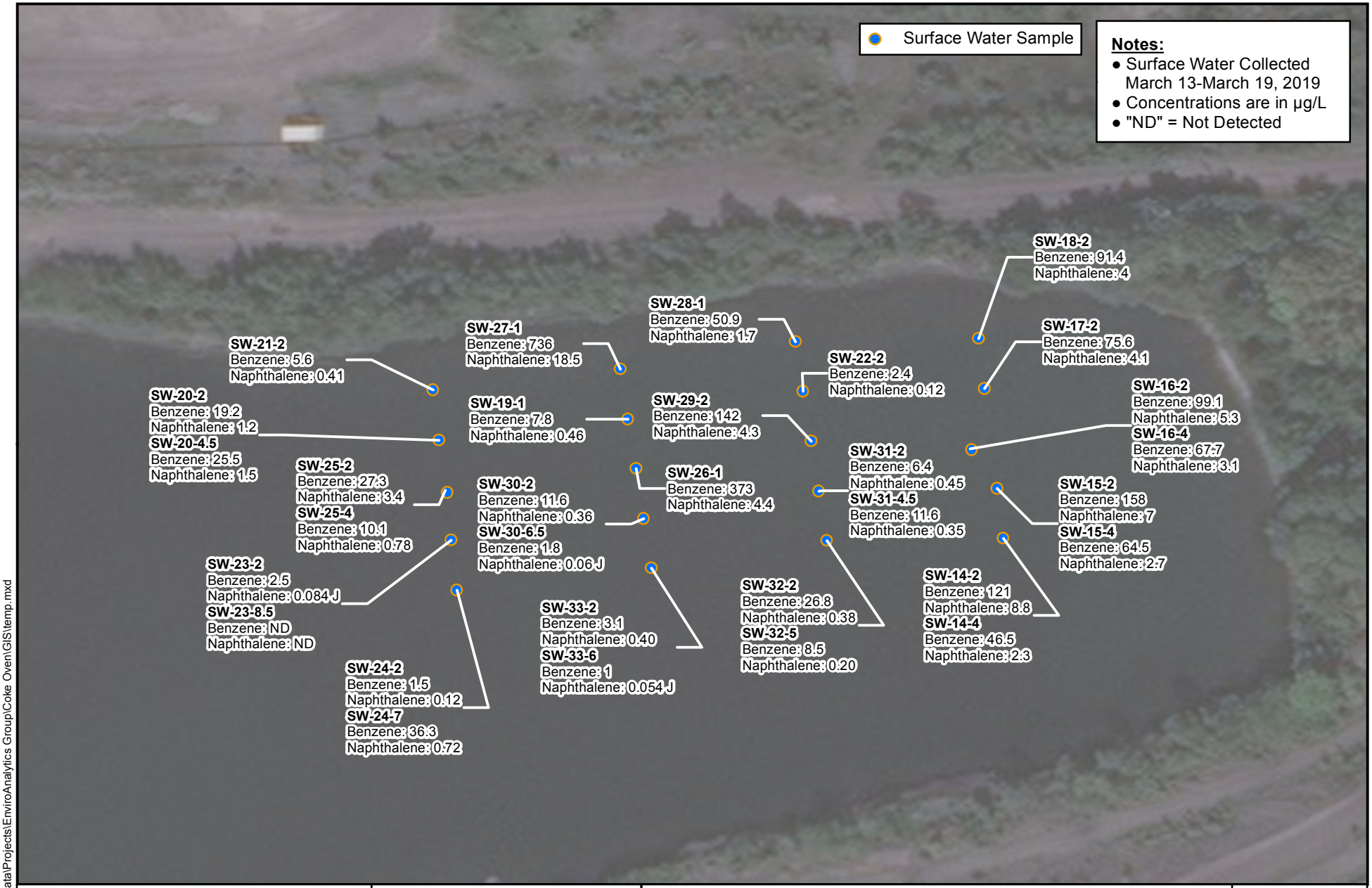
1 inch = 100 feet

0 50 100 Feet

Former Coke Oven Area - Cell 3
Pore Water Sample Locations
Benzene and Naphthalene Results

Figure 21

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



N

ARM Group Inc.
Engineers and Scientists

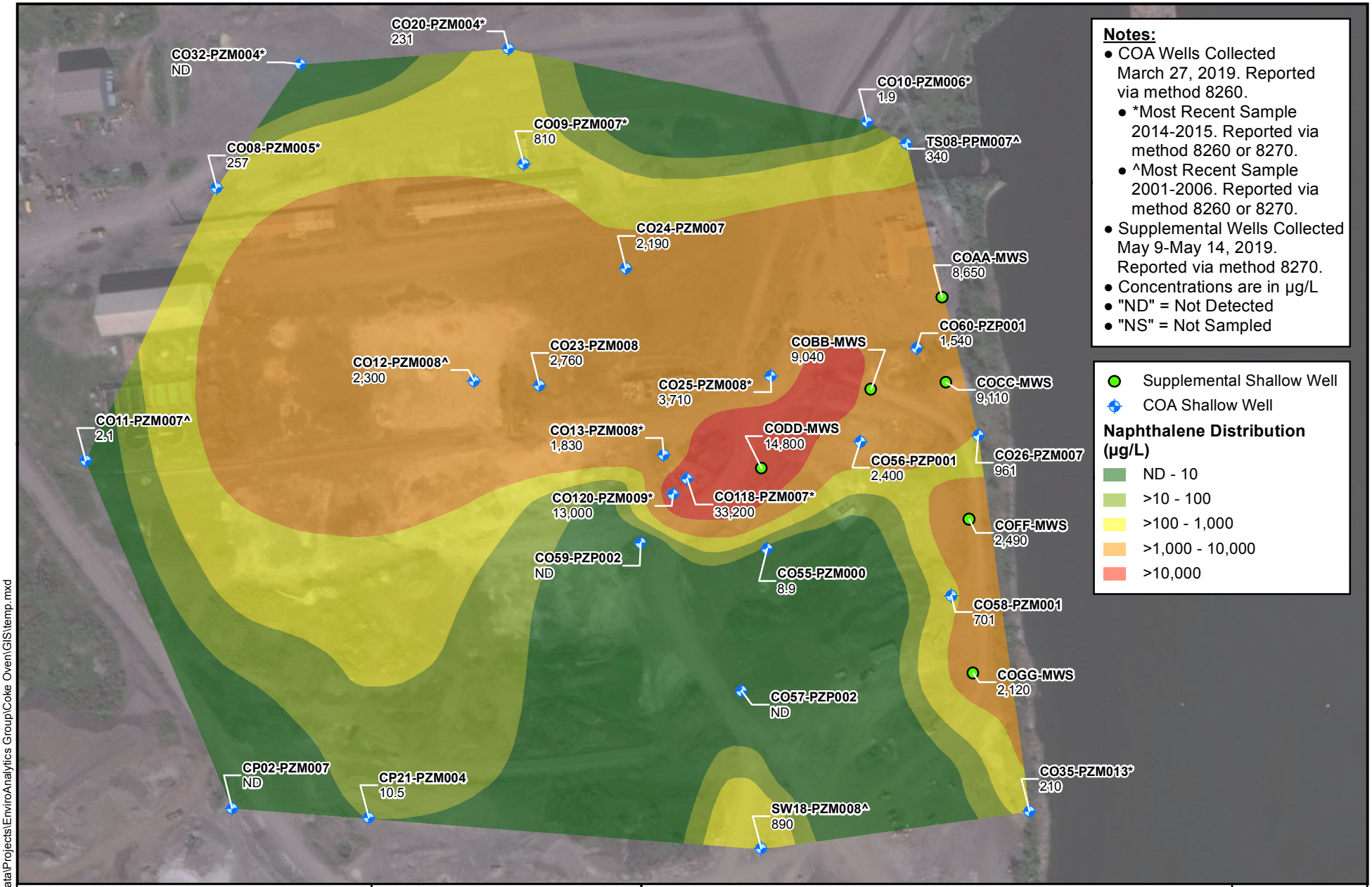
1 inch = 80 feet

0 40 80 Feet

Former Coke Oven Area - Cell 3
Surface Water Sample Locations
Benzene and Naphthalene Results

Figure 22

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



Notes:

- COA Wells Collected March 27, 2019. Reported via method 8260.
  - *Most Recent Sample 2014-2015. Reported via method 8260 or 8270.
  - ^Most Recent Sample 2001-2006. Reported via method 8260 or 8270.
- Supplemental Wells Collected May 9-May 14, 2019. Reported via method 8270.
- Concentrations are in µg/L
- "ND" = Not Detected
- "NS" = Not Sampled

Supplemental Shallow Well

COA Shallow Well

Naphthalene Distribution (µg/L)

- ND - 10
- >10 - 100
- >100 - 1,000
- >1,000 - 10,000
- >10,000

N

ARM Group Inc.
Engineers and Scientists

1 inch = 300 feet

0 150 300 Feet

Cell 5
Groundwater Naphthalene Distribution
Shallow Zone

Figure 23

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd

N

ARM Group Inc.
Engineers and Scientists

1 inch = 170 feet

0 85 170
Feet

Former Coke Oven Area - Cell 5
Pore Water Sample Locations
Naphthalene Results

Figure 24

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd

Notes:
- Surface Water Collected July 9-16, 2019
- Concentrations are in µg/L
- "ND" = Not Detected

N

ARM Group Inc.
Engineers and Scientists

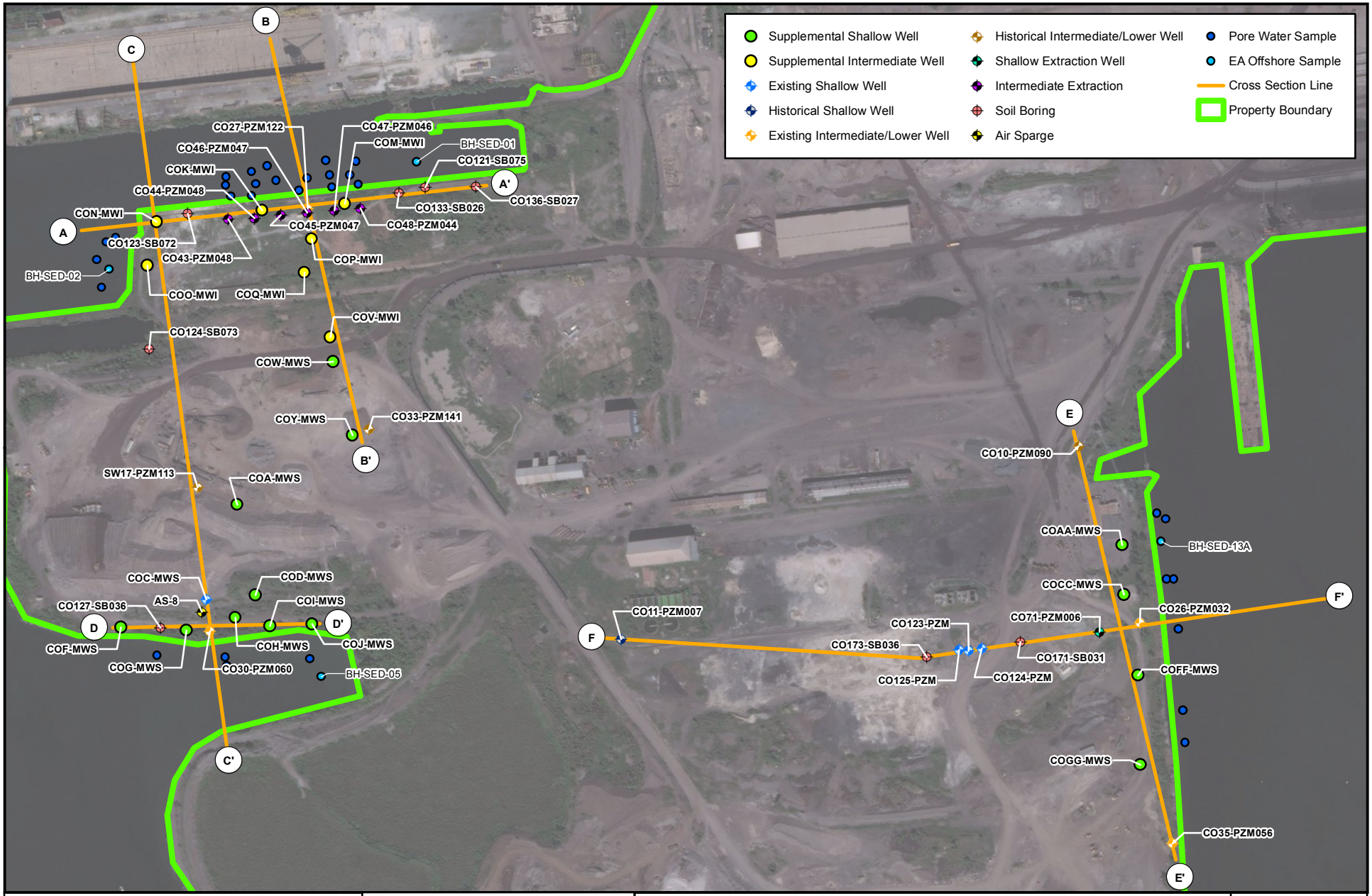
1 inch = 170 feet

0 85 170 Feet

Former Coke Oven Area - Cell 5
Surface Water Sample Locations
Naphthalene Results

Figure 25

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\temp.mxd



N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Cross Section Overview
Sample Locations

Figure 26

P:\EnviroAnalytics Group\Coke Oven\GIS\Coke Oven 8.5x11.mxd

A (west)

A' (east)

ELEVATION (feet)

Seawall

BH-SED-02

CON-MWS/I

CO123-SB072

COK-MWS/I

CO27-PZM well cluster:
-012 (shallow)
-046 (interm.)
-122 (deep)

COM-MWS/I

CO133-SB026

CO121-SB075

CO136-SB027

CO43-PZM048
(extraction well)

CO44-PZM047
(extraction well)

CO45-PZM047
(extraction well)

CO47-PZM046
(extraction well)

CO48-PZM044
(extraction well)

B: 33,400
N: 2,700

B: 51,700
N: 3,370

B: 2,350
N: 12.2

B: 1 U
N: 2.7

B: 7,420
N: 83

B: 3,080
N: 56.4

B: 609
N: 13.5

B: 3,630
N: 316

B: 191,000
N: 14,100

B: 15,900
N: 959

B: 2,390
N: 2,710

B: 33,600
N: 4,060

B: 15,200
N: 1,470

B: 3.2
N: 10 U

DISTANCE (feet)

LEGEND

- Slag
- Sand
- Silt/Clay
- Pore Water Sampling Location
- NAPL Observation (offshore sample from Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point; EA, 2009)
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation
- Groundwater Flow Direction

NOTES:

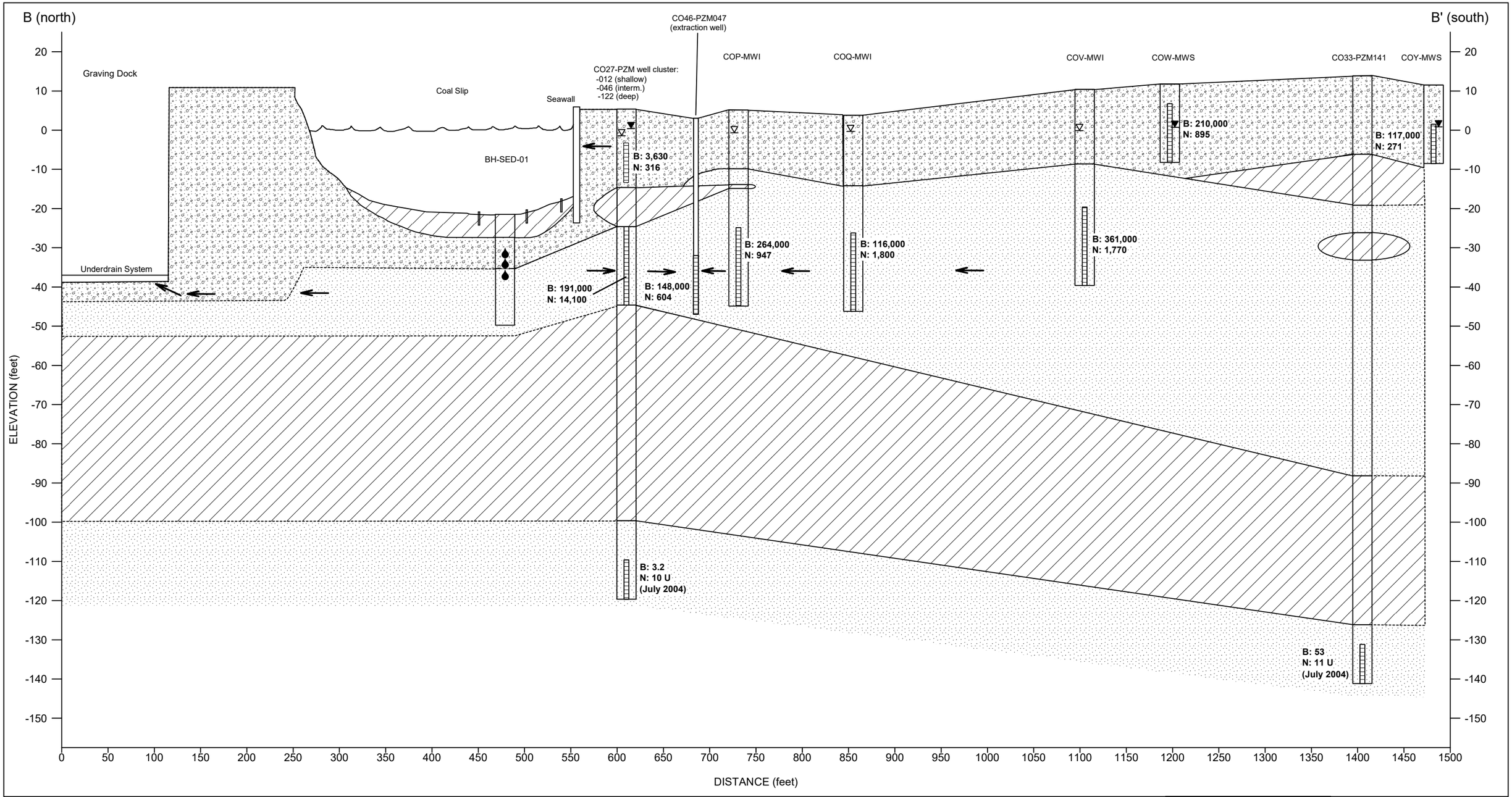
- Cross-section is vertically exaggerated.
- Groundwater levels measured July 15-16, 2019.
- B: Benzene concentration in micrograms per liter
- N: Naphthalene concentration in micrograms per liter. Sample collection date is March/May 2019 unless otherwise noted.
- U=Non-detect qualifier

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group Inc.
Engineers and Scientists

Figure 27

Cross-Section A-A'
(Revision 1)



LEGEND

- Slag
- Sand
- Silt/Clay
- Pore Water Sampling Location (~30 ft spacing)
- NAPL Observation (offshore sample from Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point; EA, 2009)
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation
- Groundwater Flow Direction

NOTES:

- Cross-section is vertically exaggerated.
- Groundwater levels measured July 15-16, 2019.
- B: Benzene concentration in micrograms per liter
- N: Naphthalene concentration in micrograms per liter. Sample collection date is March/May 2019 unless otherwise noted.
- U=Non-detect qualifier

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group Inc.
Engineers and Scientists

Figure 28

Cross-Section B-B'
(Revision 1)

11-05-2019 P:\EnviroAnalytics Group\190342M COA Onshore Supplemental Investigation\Documents\COA Cross Sections\XSection Bor Logs\QuickCross\B-B' Rev 1.cro

C (north)

C' (south)

Graving Dock

Coal Slip

Sea Wall

CON-MWS/I

COO-MWS/I

CO124-SB073

SW17-PZM well cluster:
-007 (shallow)
-038 (interm.)
-113 (deep)

COA-MWS

COC-MWS

AS-8 Sparge Well

CO30-PZM well pair:
-015 (shallow)
-060 (interm.)

Cove

Pore water sampling locations

BH-SED-05

Underdrain System

B: 33,400
N: 2,700

B: 38,400
N: 2,700

B: 51,700
N: 3,370

B: 66,600
N: 8,570

B: 20,000
N: 1,200
(July 2004)

B: 54,000
N: 30
(July 2004)

B: 34,100
N: 2,630

B: 46,300
N: 5,530

B: 51,000
N: 2,710

B: 49.8
N: 2 U
(Dec. 2019)

B: 2.6
N: 10 U
(July 2004)

ELEVATION (feet)

DISTANCE (feet)

LEGEND

- Slag
- Sand
- Silt/Clay
- Pore Water Sampling Location (~30 ft spacing)
- NAPL Observation (offshore sample from Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point; EA, 2009)
- Shallow Well Groundwater Elevation
- Intermediate Well Groundwater Elevation
- Groundwater Flow Direction

NOTES:

- Cross-section is vertically exaggerated.
- Groundwater levels measured July 15-17, 2019.
- B: Benzene concentration in micrograms per liter
- N: Naphthalene concentration in micrograms per liter. Sample collection date is March/May 2019 unless otherwise noted.
- U=Non-detect qualifier

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group Inc.
Engineers and Scientists

Figure 29

Cross-Section C-C'
(Revision 1)

D (west)

D' (east)

COF-MWS

CO127-SB036

COG-MWS

CO30-PZM well pair:
-015 (shallow)
-060 (interm.)

COH-MWS

COI-MWS

COJ-MWS

B: 748
N: 4,650

B: 47,300
N: 10,600

B: 51,000
N: 2,710

B: 49.8
N: 2 U
(Dec. 2019)

B: 25,800
N: 2,350

B: 145
N: 4,840

B: 1,440
N: 1,600

ELEVATION (feet)

20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

DISTANCE (feet)

LEGEND

- Slag
- Sand
- Silt/Clay
- ▼ Shallow Well Groundwater Elevation
- ▽ Intermediate Well Groundwater Elevation
- Sparge Zone

NOTES:

- Cross-section is vertically exaggerated.
- Groundwater levels measured 7/17/2019.
- B: Benzene concentration in micrograms per liter
- N: Naphthalene concentration in micrograms per liter.
  Sample collection date is March/May 2019 unless otherwise noted.
- U=Non-detect qualifier

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group LLC
Engineers and Scientists

Figure 30

Cross-Section D-D'
(Revision 1)

E (north)

E' (south)

CO10-PZM well cluster:
-006 (shallow)
-029 (interm.)
-090 (deep)

COAA-MWS

COCC-MWS

CO26-PZM well pair:
-007 (shallow)
-032 (interm.)

COFF-MWS

COGG-MWS

CO35-PZM well pair:
-013 (shallow)
-056 (interm.)

N: 19 (June 2015)

N: 8,650

N: 9,110

N: 961

N: 2,490

N: 2,120

N: 481 (Oct. 2019)

N: 280 (July 2004)

N: 48.6 (Dec. 2019)

N: 6.6 (June 2015)

N: 11 U (July 2004)

ELEVATION (feet)

20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300

DISTANCE (feet)

LEGEND

- Slag
- Sand
- Silt/Clay
- ▼ Shallow Well Groundwater Elevation

NOTES:

- Cross-section is vertically exaggerated.
- Groundwater levels measured 7/17/2019.
- N: Naphthalene concentration in micrograms per liter. Sample collection date is March/May 2019 unless otherwise noted.
- U=Non-detect qualifier

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group LLC
Engineers and Scientists

Figure 31

Cross-Section E-E'
(Revision 1)

F (west)

F' (east)

CO11-PZM007

CO173-SB036

CO125-PZM

CO123-PZM

CO124-PZM

CO171-SB031

CO71-PZM006
(extraction well)

CO26-PZM well pair:
-007 (shallow)
-032 (interm.)

Turning Basin

Pore water sampling locations

BH-SED-13A

N: 2.1
(Dec. 2001)

N: 719

N: 961

N: 48.6
(Dec. 2019)

ELEVATION (feet)

20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800

DISTANCE (feet)

LEGEND

- Slag
- Sand
- Silt/Clay
- Pore Water Sampling Location (~30 ft spacing)
- NAPL Observation (offshore sample from Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point; EA, 2009)
- Shallow Well Groundwater Elevation
- Groundwater Flow Direction

NOTES:

- Cross-section is vertically exaggerated.
- Groundwater levels measured 7/17/2019.
- N: Naphthalene concentration in micrograms per liter. Sample collection date is March/May 2019 unless otherwise noted.

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 190342M

ARM Group LLC
Engineers and Scientists

Figure 32

Cross-Section F-F'
(Revision 1)

Parcel B4

Parcel B18

Parcel B5

Parcel B13

Parcel B10

Parcel B11

Parcel B12

Cell 1

Cell 2

Cell 3

Cell 5

Cell 6

CO191-PZM 0.24
CO-MWS 0.57
CO18-PZM020 0.47
COK-MWS 0.56
COL-MWS 0.47
COU-MWS 0.57
CO27-PZM012 0.27
CO39-PZM007 0.55
CO42-PZM004 2.27
CO18-PZM006 0.67
CO-MWS 0.54
CO40-PZM005 0.57
CO33-PZM005 0.5
CO28-PZM010 0.64
CO41-PZM001 1.12
CO7-MWS 0.59
COU-MWS 1.22
CO18-PZM006 1.12
CO3-MWS 0.57
COW-MWS 1.07
CO42-PZM004 0.91
COX-MWS 1.11
CO100-PZM 1.89
CO93-PZM 1.92
CO19-PZM004 2.12
CO88-PZM 1.04
COY-MWS 1.07
CO16-PZM006 1.17
CO2-MWS 1.12
COA-MWS 0.47
CO24-PZM007 1.53
COAA-MWS 0.85
COB-MWS 0.37
CO103-PZM 0.46
COC-MWS 0.38
COD-MWS 0.45
COE-MWS 0.67
CO102-PZM 0.48
CO104-PZM 0.37
COF-MWS 0.55
COH-MWS 0.57
COI-MWS 0.45
CO-MWS 0.52
CO-MWS 0.47
CO39-PZM013 0.53
CO111-PZM 0.47
CO23-PZM008 0.53
COBB-MWS 1.02
COD-MWS 1.01
CO60-PZP001 0.54
COCC-MWS 0.47
CO59-PZP002 0.91
CO55-PZM000 0.85
COEE-MWS 0.0
CO58-PZM001 0.83
COGG-MWS 0.45
CP22-PZM007 0.47
CP21-PZM004 0.64
SW18-PZM008 0.16
CO31-PZM013 0.57
CP07-PZM006 0.35
CP20-PZM008 0.22
CP20-PZM011 0.64
CP19-PZM008 0.72
CP18-PZM009 0.61
CP05-PZM008 0.7
CP12-PZM012 0.14
CP16-PZM008 0.41
CP14-PZM009 0.02
CP10-PZM008 0.22
CP09-PZM010 0.42
CP13-PZM020 0.35
CP11-PZM019 0.68

Notes:
- COA Wells Measured on September 25, 2019
- CPLF Wells Measured on November 18 - December 5, 2019
- Potentiometric surface determined from CPLF well measurements is typically flat and therefore not included in generation of contours

- Shallow Well
- Shallow Well (CMS - Not Surveyed)
- Extraction Well
- Re-injection Well
- Groundwater Elevation Contour (1 ft)
- Interim Measures Cell
- Parcel Boundary

Coke Point Peninsula
Groundwater Elevation Contour Map
Shallow Zone

Figure 33

N

ARM Group Inc.
Engineers and Scientists

1 inch = 200 feet

0 200 400 Feet

Date: 2/28/2020

N

ARM Group Inc.
Engineers and Scientists

1 inch = 100 feet

0 50 100 Feet

Cell 2
Groundwater Elevation Contour Map
Intermediate Zone

Figure 34

Parcel B4
Parcel B18
Parcel B5
Parcel B10
Parcel B11
Parcel B12
Parcel B13
Cell 1
Cell 2
Cell 3
Cell 5
Cell 6
SW13-PZM003 20.4
SW-030-MWS Non-Detect
SW14-PZM004 Non-Detect
TS05-PPM007 360
CO121-PZM 1970
B18-046-PZ Non-Detect
B18-061-PZ Non-Detect
B18-007-PZ 67.2
B18-076-PZ Non-Detect
B18-075-PZ Non-Detect
B18-074-PZ 2.8
CON-MWS 33,400
CO38-PZM003 5,380
COK-MWS 7,420
COL-MWS 18,100
COM-MWS 2,390
CO37-PZM003 22,100
CO42-PZM004 1.1
CO27-PZM012 3,630
CO39-PZM007 282
CO38-PZM006 4,660
CO-MWS 38,400
CO03-PZM005 Non-Detect
CO40-PZM008 40.5
CO41-PZM001 1.7
COT-MWS 337,000
COU-MWS 514,000
CO28-PZM010 20,900
CO15-PZM005 169,000
CO18-PZM006 338,000
COS-MWS 11,100
COW-MWS 210,000
CO02-PZM006 129,000
COX-MWS 148,000
CO93-PZM 162,000
CO88-PZM 166,000
CO-MWS 57,700
COY-MWS 117,000
CO16-PZM006 119,000
CO19-PZM004 409
CO17-PZM005 28,000
CO22-PZM005 560
CO06-PZM008 Non-Detect
CO05-PZM006 1,850
CO04-PZM004 660
CO21-PZM005 0.46
CO20-PZM004 70.9
CO10-PZM006 0.32
TS08-PPM007 Not Sampled
CO09-PZM007 358
CO08-PZM005 15,000
SW17-PZM007 20,000
CO07-PZM008 27,000
CO29-PZM010 15.1
COA-MWS 34,100
CO130-WS25 145
CO24-PZM007 1.5
COAA-MWS Not Sampled
CO129-WS25 10,300
CO60-PZP001 197
CO12-PZM008 590
CO22-PZM008 460
CO25-PZM008 1,210
COCC-MWS Not Sampled
COC-MWS 46,300
COD-MWS 16,400
COE-MWS 4,700
COB-MWS 1,290
CO103-PZM 995
COBB-MWS Not Sampled
CO102-PZM 9,730
CO104-PZM 1.9
COH-MWS 25,800
COJ-MWS 1,440
CO13-PZM008 332
CO56-PZP001 246
CO26-PZM007 98.2
COG-MWS 47,300
CO32-PZM004 0.35
CO11-PZM007 4.4
CO112-PZM 12,300
CODD-MWS Not Sampled
COF-MWS 748
CO30-PZM015 51,000
COI-MWS 145
CO101-PZM 9.8
CO118-PZM007 2,310
COFF-MWS Not Sampled
TS04-PPM008 7.3
CO120-PZM009 1,750
CO55-PZM000 0
CO59-PZP002 Non-Detect
CO58-PZM001 114
COGG-MWS Not Sampled
CO57-PZP002 Non-Detect
CO35-PZM013 109
CP02-PZM007 Non-Detect
CP21-PZM004 4.8
SW18-PZM008 110
CP07-PZM006 410
CP08-PZM008 21,100
CP20-PZM011 77
CP19-PZM008 1,950
CP18-PZM009 669
CP05-PZM008 5.1
CP12-PZM012 17
CP16-PZM008 107
CP14-PZM009 65
CP10-PZM008 7.9
CP09-PZM010 Non-Detect
CP15-PZM020 3.3
CP11-PZM010 9.3

Notes:
- COA Wells Collected March 25-March 28, 2019
  - Most Recent Sample 2014-2016
  - Most Recent Sample 2001-2006
- Supplemental Wells Collected May 1-May 14, 2019
- CPLF Wells Collected May 15-May 29, 2019

- Shallow Well
- DNAPL Recovery Well
- NAPL Recovery Area
- Interim Measures Cell
- Parcel Boundary

Benzene (ug/L)
- ND - 10
- >10 - 100
- >100 - 1,000
- >1,000 - 10,000
- >10,000 - 100,000
- >100,000

Coke Point Peninsula
Groundwater Benzene Distribution
Shallow Zone

Figure 35

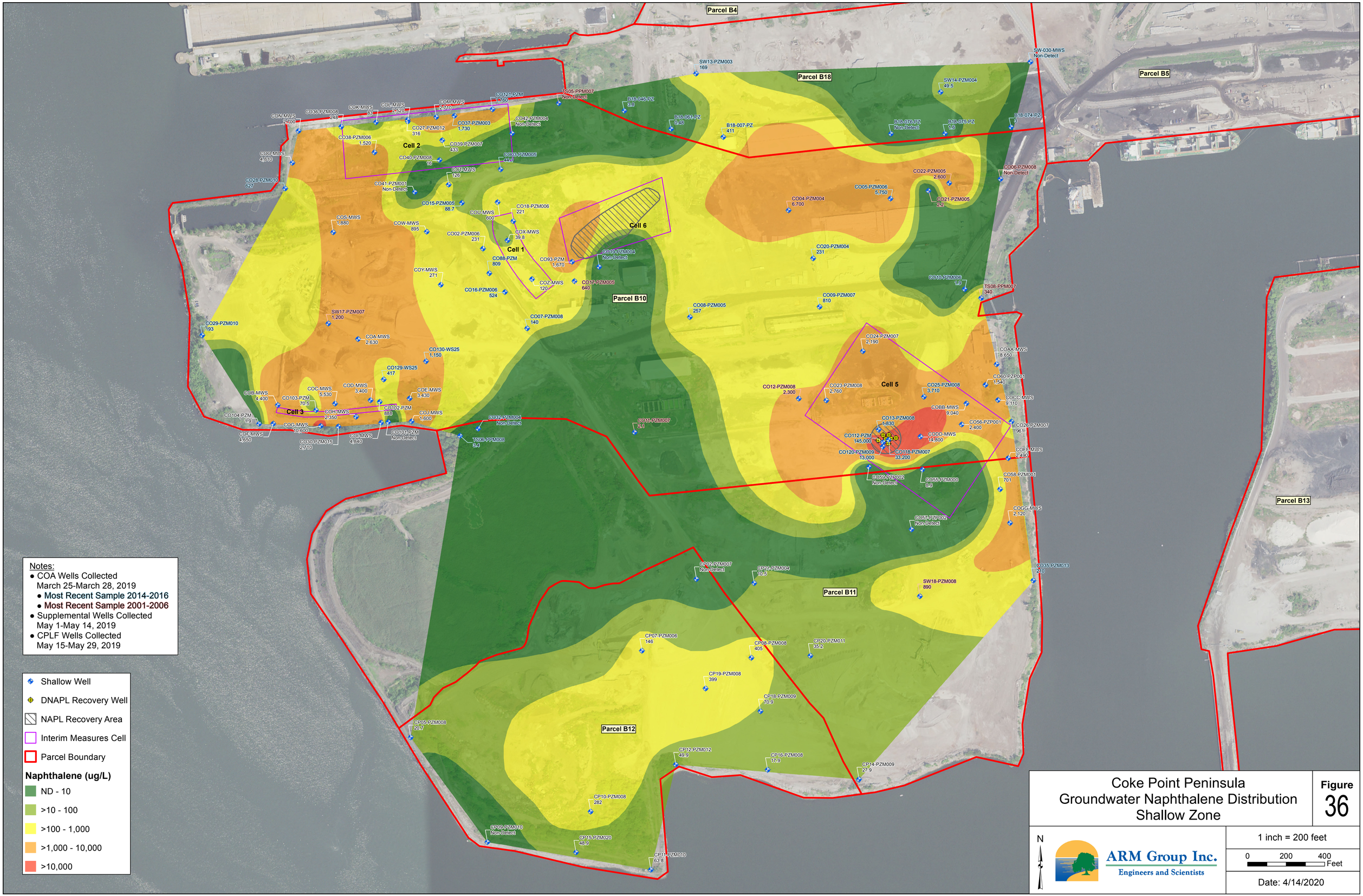
N

ARM Group Inc.
Engineers and Scientists

1 inch = 200 feet

0 200 400 Feet

Date: 4/14/2020



Notes:
- COA Wells Collected March 25-March 28, 2019
  - Most Recent Sample 2014-2016
  - Most Recent Sample 2001-2006
- Supplemental Wells Collected May 1-May 14, 2019
- CPLF Wells Collected May 15-May 29, 2019

- Shallow Well
- DNAPL Recovery Well
- NAPL Recovery Area
- Interim Measures Cell
- Parcel Boundary

Naphthalene (ug/L)
- ND - 10
- >10 - 100
- >100 - 1,000
- >1,000 - 10,000
- >10,000

Coke Point Peninsula
Groundwater Naphthalene Distribution
Shallow Zone

Figure 36

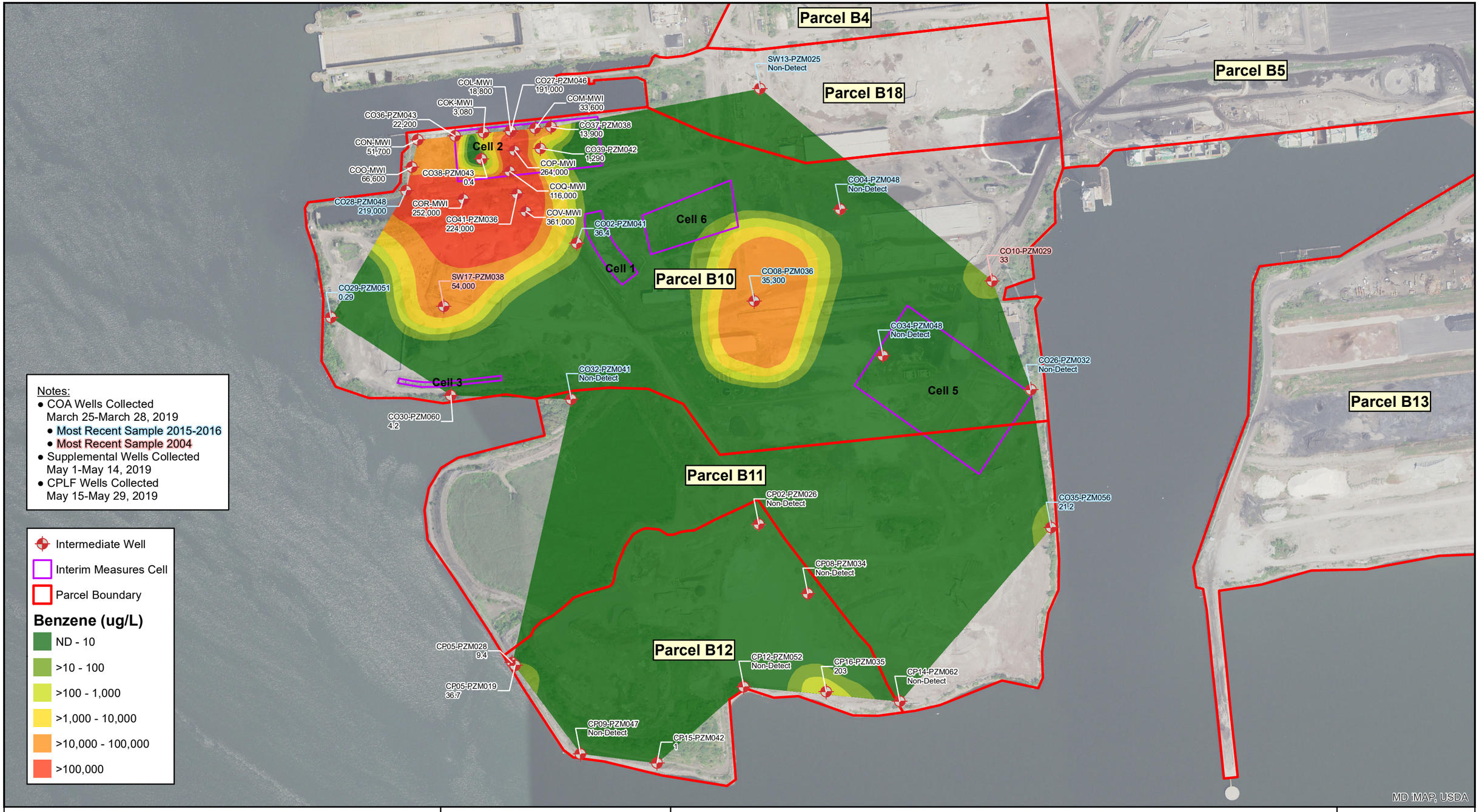
N

ARM Group Inc.
Engineers and Scientists

1 inch = 200 feet

0 200 400 Feet

Date: 4/14/2020



Notes:
- COA Wells Collected March 25-March 28, 2019
  - Most Recent Sample 2015-2016
  - Most Recent Sample 2004
- Supplemental Wells Collected May 1-May 14, 2019
- CPLF Wells Collected May 15-May 29, 2019

- Intermediate Well
- Interim Measures Cell
- Parcel Boundary

Benzene (ug/L)
- ND - 10
- >10 - 100
- >100 - 1,000
- >1,000 - 10,000
- >10,000 - 100,000
- >100,000

N

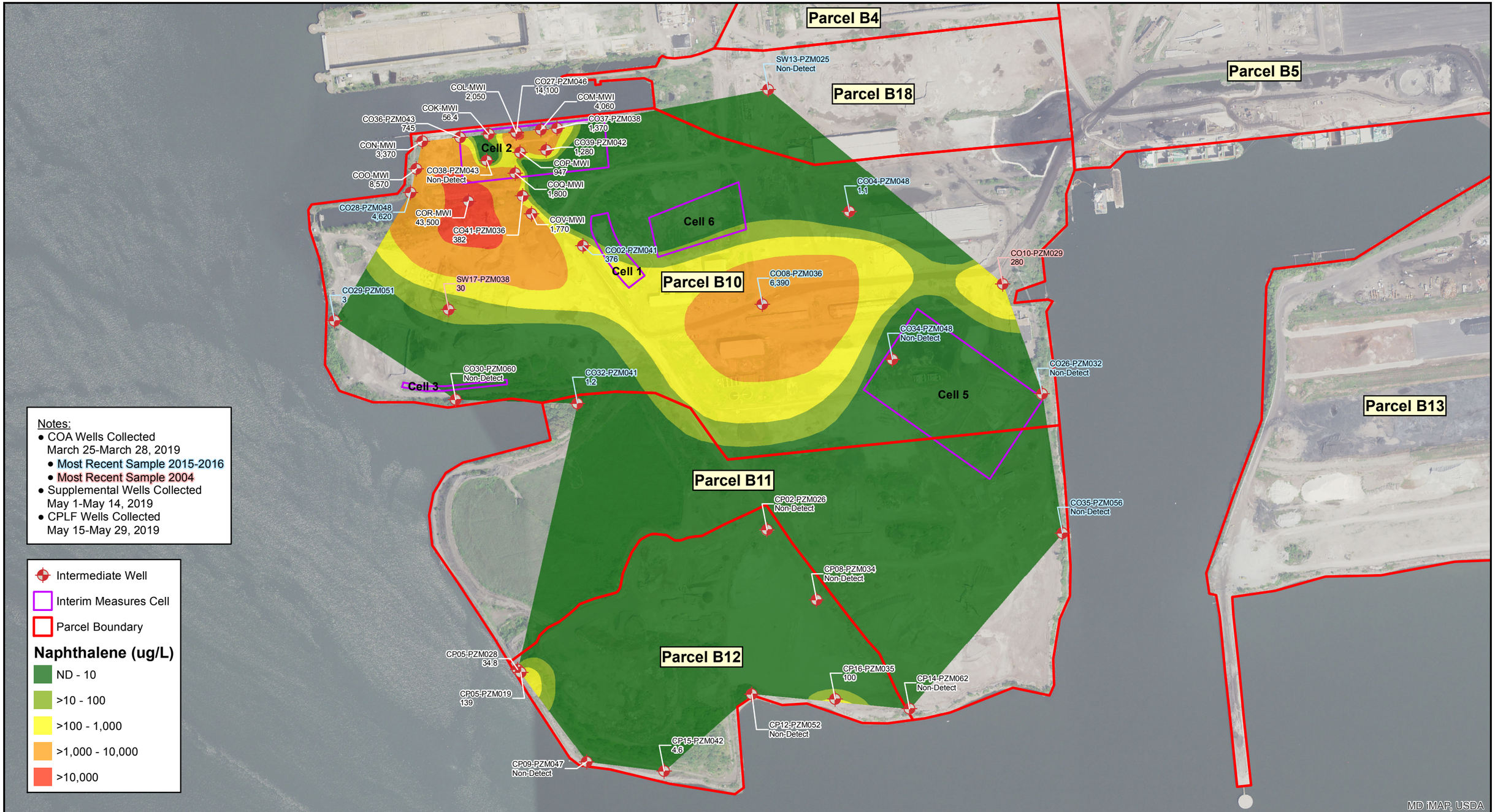
ARM Group Inc.
Engineers and Scientists

1 inch = 550 feet

0 275 550 Feet

Coke Point Peninsula
Groundwater Benzene Distribution
Intermediate Zone
Date: 4/14/2020

Figure 37



Notes:
- COA Wells Collected March 25-March 28, 2019
  - Most Recent Sample 2015-2016
  - Most Recent Sample 2004
- Supplemental Wells Collected May 1-May 14, 2019
- CPLF Wells Collected May 15-May 29, 2019

- Intermediate Well
- Interim Measures Cell
- Parcel Boundary

Naphthalene (ug/L)
- ND - 10
- >10 - 100
- >100 - 1,000
- >1,000 - 10,000
- >10,000

N

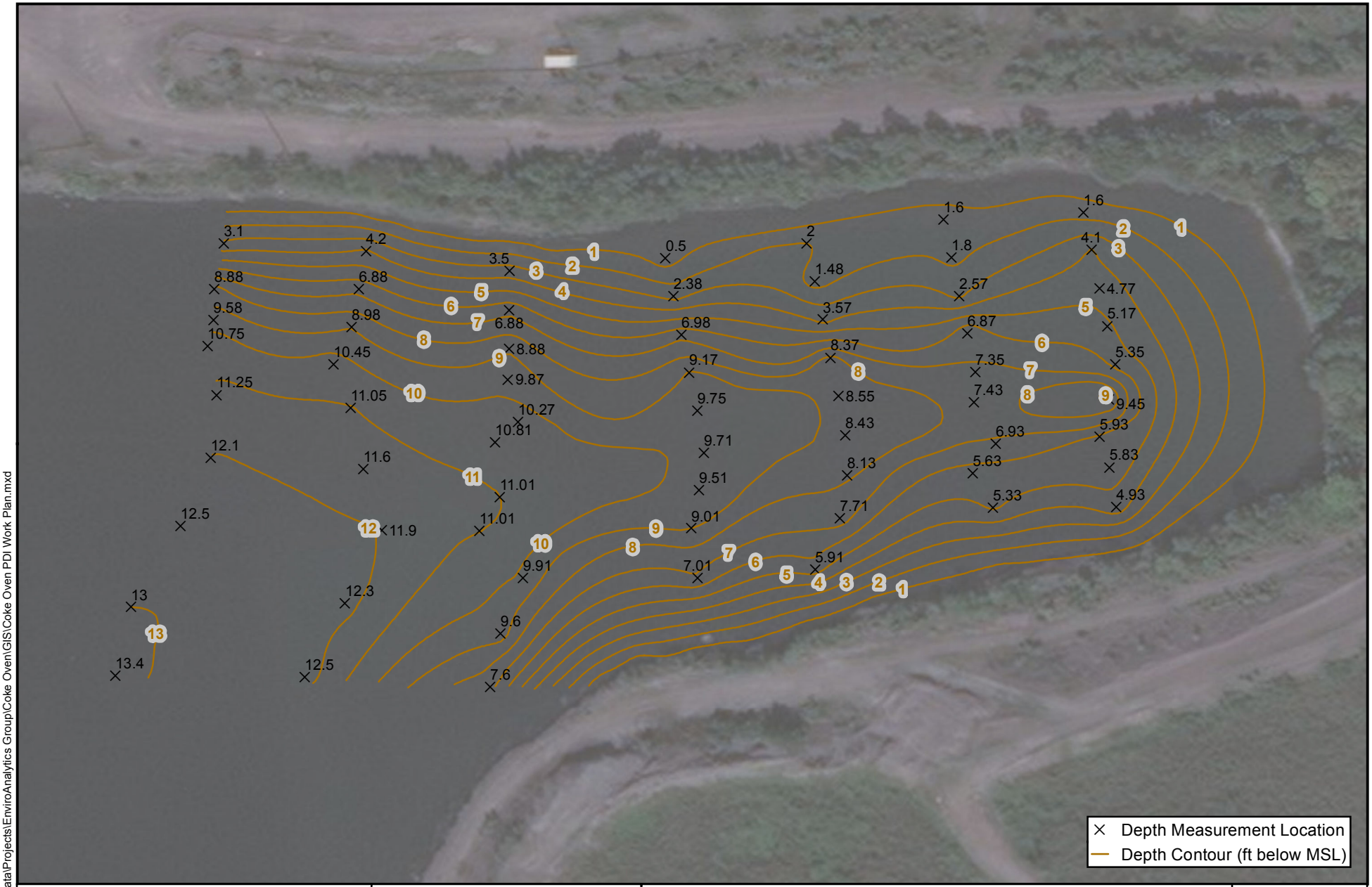
ARM Group Inc.
Engineers and Scientists

1 inch = 550 feet

0 275 550 Feet

Coke Point Peninsula
Groundwater Naphthalene Distribution
Intermediate Zone
Date: 4/14/2020

Figure 38



N

ARM Group Inc.
Engineers and Scientists

1 inch = 100 feet

0 50 100
Feet

Cell 3 Cove
Bathymetric Contour Map

Figure 39

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\Coke Oven PDI Work Plan.mxd

TABLES

Table 1
Cells 1, 2 and 6
Groundwater Elevations

Well Name	Measurement Date	DTW (ft)	TOC Elev (ft)	GW Elev (ft)	Well Name	Measurement Date	DTW (ft)	TOC Elev (ft)	GW Elev (ft)
CO02-PZM006	9/25/2019	14.80	15.71	0.91	CO100-PZM	9/25/2019	10.38	12.27	1.89
CO02-PZM041	7/16/2019	15.96	13.88*	-2.08*	CO121-PZM	9/25/2019	10.93	11.87	0.94
CO03-PZM005	9/25/2019	6.93	13.53	6.6	COK-MWS	9/25/2019	6.06	6.62	0.56
CO16-PZM006	9/25/2019	11.71	12.88	1.17	COK-MWI	7/15/2019	8.58	6.83	-1.75
CO18-PZM006	9/25/2019	12.15	13.57	1.42	COL-MWS	9/25/2019	6.82	7.38	0.56
CO19-PZM004	9/26/2019	10.95	13.27	2.32	COL-MWI	7/15/2019	9.03	7.56	-1.47
CO27-PZM012	9/25/2019	4.50	5.12	0.62	COM-MWS	9/25/2019	7.30	8.11	0.81
CO27-PZM046	7/15/2019	6.98	5.17	-1.81	COM-MWI	7/15/2019	9.25	7.43	-1.82
CO28-PZM010	9/25/2019	11.70	12.34	0.64	CON-MWS	9/25/2019	11.49	12.01	0.52
CO28-PZM048	7/16/2019	11.59	12.69	1.10	CON-MWI	7/15/2019	11.54	11.99	0.45
CO36-PZM008	9/25/2019	6.47	6.94	0.47	COO-MWS	9/25/2019	12.16	12.70	0.54
CO36-PZM043	7/15/2019	7.18	6.92	-0.26	COO-MWI	7/15/2019	12.20	12.68	0.48
CO37-PZM038	7/15/2019	12.07	12.12	0.05	COP-MWI	7/15/2019	8.35	7.53	-0.82
CO38-PZM006	9/25/2019	6.06	6.75	0.69	COQ-MWI	7/15/2019	6.55	6.42	-0.13
CO38-PZM043	7/15/2019	6.82	6.65	-0.17	COR-MWI	7/15/2019	11.05	11.65	0.60
CO39-PZM007	9/25/2019	6.90	7.75	0.85	COS-MWS	9/25/2019	13.86	14.43	0.57
CO39-PZM042	7/15/2019	8.01	7.91	-0.10	COT-MWS	9/25/2019	10.76	11.74	0.98
CO40-PZM008	9/25/2019	6.60	7.47	0.87	COU-MWS	9/25/2019	13.26	14.48	1.22
CO41-PZM001	9/25/2019	12.45	13.57	1.12	COV-MWI	7/15/2019	12.02	12.20	0.18
CO41-PZM036	7/15/2019	13.40	13.60	0.20	COW-MWS	9/25/2019	12.90	13.97	1.07
CO42-PZM004	9/25/2019	8.55	10.83	2.28	COX-MWS	9/25/2019	14.26	15.45	1.19
CO88-PZM	9/25/2019	13.03	14.07	1.04	COY-MWS	9/25/2019	12.41	13.48	1.07
CO93-PZM	9/25/2019	10.70	12.12	1.42	COZ-MWS	9/25/2019	13.50	14.70	1.20

**Note: TOC Elevation for CO02-PZM041 is likely incorrect.*

Table 2
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 2

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-046-PW	-	563037.4667	1454208.472	Could not sample this location due to hard bottom	
CO-047-PW	-	563035.7934	1454248.437	Could not sample this location due to hard bottom	
CO-048-PW-1	9 inches	563115.2998	1454165.659		
CO-048-PW-3	3 feet	563115.2998	1454165.659		
CO-049-PW-1	9 inches	563133.6603	1454201.504		
CO-049-PW-3	3 feet	563133.6603	1454201.504		
CO-050-PW	-	563133.874	1454253.466	Cannot sample this location due to hard bottom	
CO-051-PW-1	9 inches	563361.1131	1454614.597	3 foot sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	
CO-052-PW-1	9 inches	563328.1399	1454612.062	Screen filter is covered in black mud with no petroleum odor	
CO-052-PW-2	2 feet	563328.1399	1454612.062	Screen filter is covered in black mud with no petroleum odor	
CO-053-PW-2	2 feet	563287.0226	1454631.006	9 inch sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	
CO-054-PW-1	9 inches	563380.1098	1454709.354	Screen filter is covered in black mud with no petroleum odor	
CO-054-PW-3	3 feet	563380.1098	1454709.354	Screen filter is covered in black mud with no petroleum odor	
CO-055-PW-1	9 inches	563333.9165	1454724.699	Screen filter is covered in black mud with no petroleum odor	
CO-055-PW-2	2 feet	563333.9165	1454724.699	Screen filter is covered in black mud with no petroleum odor	
CO-056-PW-2	2 feet	563290.0779	1454710.743	9 inch sample was not collected due to low permeability of the substrate; screen filter is covered in black mud with no petroleum odor	Photo: 5

Table 2
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 2

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-057-PW-1	9 inches	563401.094	1454768.381	3 foot sample was not collected due to low permeability of the substrate; screen filter is covered in black mud with no petroleum odor	
CO-058-PW-1	9 inches	563346.5461	1454802.23	Screen filter is covered in black mud with no petroleum odor	
CO-058-PW-2	2 feet	563346.5461	1454802.23	Screen filter is covered in black mud with no petroleum odor	
CO-059-PW	-	563300.4633	1454811.622	Could not sample this location due to low permeability of the substrate; screen filter is covered in black mud with no petroleum odor	Photo: 6
CO-060-PW	-	563400.204	1454901.352	Could not sample this location due to low permeability of the substrate; screen filter is covered in black mud with no petroleum odor	
CO-061-PW-1	9 inches	563355.5803	1454917.679	3 foot sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	Photo: 7
CO-062-PW-1	9 inches	563309.9829	1454887.332	3 foot sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	Photo: 8
CO-063-PW-1	9 inches	563422.9763	1454987.356	Screen filter is covered in black mud with no petroleum odor	
CO-063-PW-2	2 feet	563422.9763	1454987.356	Screen filter is covered in black mud with no petroleum odor	
CO-064-PW-3	3 feet	563367.3641	1455002.893	9 inch sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	
CO-065-PW-1	9 inches	563321.8146	1455011.101	Screen filter is covered in black mud with no petroleum odor	

Table 2
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 2

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-065-PW-2	2 feet	563321.8146	1455011.101	Screen filter is covered in black mud with no petroleum odor	
CO-066-PW-1	9 inches	563418.8298	1455102.179	Screen filter is covered in black mud with no petroleum odor	
CO-066-PW-2	2 feet	563418.8298	1455102.179	Screen filter is covered in black mud with no petroleum odor	
CO-067-PW-1	9 inches	563368.6234	1455077.557	Screen filter is covered in black mud with no petroleum odor	
CO-067-PW-2	2 feet	563368.6234	1455077.557	Screen filter is covered in black mud with no petroleum odor	
CO-068-PW-2	2 feet	563332.4074	1455109.412	9 inch sample was not collected due to low permeability of substrate; screen filter is covered in black mud with no petroleum odor	Photo: 9
CO-069-PW-1	9 inches	563049.7789	1454128.916		
CO-069-PW-2	2 feet	563049.7789	1454128.916		
CO-070-PW-1	9 inches	562946.0499	1454147.482		
CO-070-PW-2	2 feet	562946.0499	1454147.482		
CO-071-PW	-	562941.8181	1454194.334	Could not sample this location due to hard bottom	
CO-072-PW	-	562940.4391	1454234.31	Could not sample this location due to hard bottom	

Table 3
Cell 3 Groundwater Elevations

Well Name	Measurement Date	DTW (ft)	TOC Elev (ft)	GW Elev (ft)
CO30-PZM015	9/25/2019	11.87	12.3	0.43
CO30-PZM060	7/17/2019	13.09	13.29	0.20
CO101-PZM	9/25/2019	11.90	12.39	0.49
CO102-PZM	9/25/2019	12.40	12.88	0.48
CO103-PZM	9/25/2019	13.02	13.48	0.46
CO104-PZM	9/25/2019	12.92	13.29	0.37
COA-MWS	9/25/2019	15.14	15.63	0.49
COB-MWS	9/25/2019	13.86	14.23	0.37
COC-MWS	9/25/2019	13.94	14.32	0.38
COD-MWS	9/25/2019	13.29	13.74	0.45
COE-MWS	9/25/2019	13.39	13.98	0.59
COF-MWS	9/25/2019	14.13	14.51	0.38
COG-MWS	9/25/2019	13.30	13.77	0.47
COH-MWS	9/25/2019	13.39	13.76	0.37
COI-MWS	9/25/2019	12.89	13.30	0.41
COJ-MWS	9/25/2019	13.34	13.86	0.52

Table 4
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 3

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-016-PW-1	9 inches	561553.5854	1454927.706	Screen filter is covered in black mud with petroleum odor; 3 foot sample was not collected due to low permeability of substrate	Photo: 1
CO-017-PW	-	561589.8535	1454935.465	Could not sample this location due to hard bottom	
CO-018-PW	-	561619.6198	1454931.728	Could not sample this location due to hard bottom	
CO-019-PW	-	561571.7742	1454723.153	Could not sample this location due to hard bottom	
CO-020-PW-1	9 inches	561559.2165	1454610.617	Pore water and surface water specific conductance did not have a 30% difference and had significant differences in temp., ORP and DO; 3 foot sample could not be collected due to hard bottom	
CO-021-PW	-	561589.0102	1454607.104	Could not sample this location due to hard bottom	
CO-022-PW	-	561588.1813	1454827.463	Could not sample this location due to hard bottom	
CO-025-PW-1	9 inches	561527.9356	1454615.503	Screen filter is covered in black mud with petroleum odor; 3 foot sample could not be collected due to low permeability of the substrate	Photo: 2
CO-026-PW	-	561542.1386	1454727.814	Could not sample this location due to hard bottom	
CO-027-PW	-	561601.4099	1454718.491	Could not sample this location due to hard bottom	
CO-028-PW	-	561617.8169	1454822.801	Could not sample this location due to hard bottom	
CO-029-PW	-	561558.5456	1454832.124	Could not sample this location due to hard bottom	
CO-034-PW	-	561618.8039	1454603.592	Could not sample this location due to hard bottom	
CO-035-PW	-	561631.0455	1454713.83	Could not sample this location due to hard bottom	
CO-036-PW	-	561647.4526	1454818.14	Could not sample this location due to hard bottom	
CO-037-PW	-	561649.3861	1454927.99	Could not sample this location due to hard bottom	
CO-038-PW	-	561620.9393	1454383.395	Could not sample this location due to hard bottom	
CO-039-PW	-	561591.2518	1454379.076	Could not sample this location due to hard bottom	
CO-040-PW-1	9 inches	561567.131	1454356.522	Screen filter is covered in black mud	Photo: 3

Table 4
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 3

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-040-PW-3	3 feet	561567.131	1454356.522	Screen filter is covered in black mud	
CO-041-PW	-	561531.8769	1454370.438	Could not sample this location due to low permeability of the substrate; screen filter is covered in black mud with petroleum odor	
CO-042-PW	-	561605.4205	1454490.065	Could not sample this location due to hard bottom	
CO-043-PW	-	561575.4205	1454490.065	Could not sample this location due to hard bottom	
CO-044-PW	-	561545.4205	1454490.065	Could not sample this location due to low permeability of the substrate; screen filter is covered in black mud	
CO-045-PW	-	561515.4205	1454490.065	Could not sample this location due to low permeability of the substrate; screen filter is covered in black mud with petroleum odor	Photo: 4

Table 5
Cell 5 Groundwater Elevations

Well Name	Measurement Date	DTW (ft)	TOC Elev (ft)	GW Elev (ft)
CO23-PZM008	9/25/2019	14.79	15.74	0.95
CO24-PZM007	9/25/2019	14.42	15.95	1.53
CO35-PZM013	9/25/2019	10.31	11.06	0.75
CO55-PZM000	9/25/2019	14.22	15.10	0.88
CO56-PZP001	9/25/2019	15.06	15.92	0.86
CO58-PZM001	9/25/2019	13.48	14.31	0.83
CO59-PZP002	9/25/2019	15.84	16.75	0.91
CO60-PZP001	9/25/2019	14.99	15.83	0.84
SW18-PZM008	9/25/2019	13.2	13.36	0.16
COAA-MWS	9/25/2019	9.8	10.65	0.85
COBB-MWS	9/25/2019	15.25	16.27	1.02
COCC-MWS	9/25/2019	15.08	15.55	0.47
CODD-MWS	9/25/2019	13.36	14.37	1.01
COFF-MWS	9/25/2019	13.88	14.78	0.90
COGG-MWS	9/25/2019	12.21	12.69	0.48

Table 6
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 5

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-073-PW-1	9 inches	562099.775	1458102.681	3 foot sample was not collected due to hard bottom	
CO-074-PW-1	9 inches	562077.8959	1458136.024		
CO-074-PW-2	2 feet	562077.8959	1458136.024		
CO-075-PW	-	561949.4456	1458096.093	Could not sample this location due to hard bottom	
CO-076-PW	-	561953.4747	1458125.821	9 inch sample could not be collected due to low permeability of substrate; 3 foot sample could not be collected due to hard bottom	
CO-077-PW	-	561957.5039	1458155.55	Could not sample this location due to hard bottom	
CO-078-PW	-	561850.9765	1458109.439	Could not sample this location due to hard bottom	
CO-079-PW-1	9 inches	561852.7893	1458139.384		
CO-080-PW-1	9 inches	561853.247	1458165.104		
CO-081-PW	-	561750.0392	1458115.549	Could not sample this location due to hard bottom	
CO-082-PW	-	561753.1364	1458145.389	Could not sample this location due to hard bottom	
CO-083-PW	-	561756.2337	1458175.229	Could not sample at this location due to low permeability of substrate; screen filter is covered in black mud with slight petroleum odor	Photo: 10
CO-084-PW	-	561637.447	1458127.236	Could not sample this location due to hard bottom	
CO-085-PW	-	561637.447	1458157.236	Could not sample this location due to hard bottom	
CO-086-PW-1	9 inches	561666.1498	1458183.07	3 foot sample could not be collected due to low permeability of substrate	
CO-087-PW	-	561541.0459	1458128.612	Could not sample this location due to hard bottom	
CO-088-PW	-	561541.0459	1458158.612	Could not sample this location due to hard bottom	
CO-089-PW	-	561541.0459	1458188.612	Could not sample this location due to low permeability of substrate; screen filter is covered in black mud with slight petroleum odor	Photo: 11 Photo: 12
CO-090-PW	-	561448.53	1458126.511	Could not sample this location due to hard bottom	
CO-091-PW	-	561448.53	1458156.511	Could not sample this location due to hard bottom	

Table 6
Pore Water Sampling Locations
Descriptions and Notes
Coke Oven Area: Cell 5

Sample	Depth	Sampling Coordinates		Description/Notes	Picture (in Appendix E)
		Northing	Easting		
CO-092-PW	-	561448.53	1458186.511	Could not sample this location due to low permeability of substrate; screen filter is covered in black mud with slight petroleum odor	
CO-093-PW	-	561348.1177	1458135.579	Could not sample this location due to hard bottom	
CO-094-PW	-	561350.816	1458165.457	Could not sample this location due to hard bottom	
CO-095-PW-1	9 inches	561360.0423	1458199.751	Screen filter is covered in black mud with slight petroleum odor	
CO-095-PW-2	2 feet	561360.0423	1458199.751	Screen filter is covered in black mud with slight petroleum odor	Photo: 13
CO-096-PW	-	561252.7034	1458149.966	Could not sample this location due to hard bottom	
CO-097-PW	-	561257.1765	1458179.631	Could not sample this location due to hard bottom	
CO-098-PW-1	-	561238.9088	1458208.577	Screen filter is covered in black mud with slight petroleum odor; 3 foot sample could not be collected due to low permeability of substrate	
CO-099-PW	-	562193.4503	1458068.083	Could not sample this location due to hard bottom	
CO-100-PW	-	562195.4336	1458098.018	Could not sample this location due to hard bottom	
CO-101-PW	-	562197.417	1458127.952	Could not sample this location due to <30% difference in specific conductance between pore water and surface water	
CO-102-PW	-	562069.9233	1458076.268	Could not sample this location due to hard bottom	

Table 7
Cells 1, 2 and 6
Shallow Groundwater Sample Results

Parameter	Units	COK-MWS	COL-MWS	COM-MWS	CON-MWS	COO-MWS	COS-MWS	COT-MWS	COU-MWS
Volatile Organic Compounds									
Benzene	µg/L	**7,420**	**16,100**	**2,390**	**33,400**	**38,400**	**11,100**	**337,000**	**514,000**
Ethylbenzene	µg/L	**31.5**	**231**	**299**	**147**	**155**	**17**	**1,020**	**780**
Toluene	µg/L	**331**	**8,270**	**3,260**	**8,330**	**9,020**	**663**	**122,000**	**23,200**
Xylene	µg/L	**240**	**1,980**	**2,970**	**2,540**	**2,420**	**269**	**24,400**	**11,100**
Semi-Volatile Organic Compounds									
2-Methylnaphthalene	µg/L	**0.4**	**69.7 J**	**121**	**68.5 J**	**156**	**10**	*NA*	*NA*
Acenaphthene	µg/L	**0.22**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.68**	*NA*	*NA*
Acenaphthylene	µg/L	**0.2**	*103 U*	*98.5 U*	**40.1 J**	**102**	**2.7**	*NA*	*NA*
Anthracene	µg/L	**0.056 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.2**	*NA*	*NA*
Benzo(a)anthracene	µg/L	*0.1 U*	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.068 J**	*NA*	*NA*
Benzo(a)pyrene	µg/L	**0.019 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.062 J**	*NA*	*NA*
Benzo(b)fluoranthene	µg/L	**0.041 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.1**	*NA*	*NA*
Benzo(g,h,i)perylene	µg/L	*0.1 U*	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.039 J**	*NA*	*NA*
Benzo(k)fluoranthene	µg/L	**0.036 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.092 J**	*NA*	*NA*
Chrysene	µg/L	*0.1 U*	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.047 J**	*NA*	*NA*
Dibenz(a,h)anthracene	µg/L	*0.1 U*	*103 U*	*98.5 U*	*98 U*	*99 U*	*0.098 U*	*NA*	*NA*
Fluoranthene	µg/L	**0.077 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.27**	*NA*	*NA*
Fluorene	µg/L	**0.17**	*103 U*	*98.5 U*	*98 U*	*99 U*	**1.0**	*NA*	*NA*
Indeno(1,2,3-cd)pyrene	µg/L	*0.1 U*	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.035 J**	*NA*	*NA*
Naphthalene	µg/L	**83**	**2,520**	**2,710**	**2,700 J**	**4,810 J**	**1,880**	**126**	**600**
Phenanthrene	µg/L	**0.2**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.94**	*NA*	*NA*
Pyrene	µg/L	**0.059 J**	*103 U*	*98.5 U*	*98 U*	*99 U*	**0.19**	*NA*	*NA*
TPH									
Diesel Range Organics	µg/L	**1,010 J**	**4,300**	**10,300**	**3,100**	**4,550**	**2,160 J**	**3,780**	**4,540**
Gasoline Range Organics	µg/L	**16,500**	**48,800**	**17,300**	**92,700**	**89,100**	**30,000**	**615,000 J**	**726,000 J**

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 7
Cells 1, 2 and 6
Shallow Groundwater Sample Results

Parameter	Units	COW-MWS	COX-MWS	COY-MWS	COZ-MWS	CO02-PZM006	CO18-PZM006	CO27-PZM012	CO36-PZM008
Volatile Organic Compounds									
Benzene	µg/L	**210,000**	**148,000**	**117,000**	**57,700**	**127,000**	**338,000**	**3,630**	**5,380**
Ethylbenzene	µg/L	**316**	**49.5**	**269**	**194**	**252**	**63.5**	**35.2**	**15.3**
Toluene	µg/L	**23,100**	**9,200**	**11,900**	**2,850**	**86**	**5,360**	**854**	**1,160**
Xylene	µg/L	**4,120**	**437**	**2,750**	**548**	**206**	**1,480**	**308**	**536**
Semi-Volatile Organic Compounds									
2-Methylnaphthalene	µg/L	**14.9**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthene	µg/L	**8.6**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthylene	µg/L	**2.7**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Anthracene	µg/L	**2.7**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)anthracene	µg/L	**0.41**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)pyrene	µg/L	**0.16**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(b)fluoranthene	µg/L	**0.3**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(g,h,i)perylene	µg/L	**0.037 J**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(k)fluoranthene	µg/L	**0.27**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Chrysene	µg/L	**0.23**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Dibenz(a,h)anthracene	µg/L	**0.04 J**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluoranthene	µg/L	**3.5**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluorene	µg/L	**8.9**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indeno(1,2,3-cd)pyrene	µg/L	**0.043 J**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Naphthalene	µg/L	**895**	**39.8**	**271**	**120**	**231**	**221**	**316**	**248**
Phenanthrene	µg/L	**15.8**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Pyrene	µg/L	**2.0**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
TPH									
Diesel Range Organics	µg/L	**4,030 J**	**2,450**	**4,110**	**3,460**	*NA*	*NA*	*NA*	*NA*
Gasoline Range Organics	µg/L	**871,000**	**180,000 J**	**146,000 J**	**68,000 J**	*NA*	*NA*	*NA*	*NA*

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 7
Cells 1, 2 and 6
Shallow Groundwater Sample Results

Parameter	Units	CO38-PZM006	CO39-PZM007	CO40-PZM008	CO41-PZM001	CO42-PZM004	CO93-PZM
Volatile Organic Compounds							
Benzene	µg/L	**4,660**	**282**	**40.5**	**1.7**	**1.1**	**162,000**
Ethylbenzene	µg/L	**59**	**0.99 J**	*1 U*	*1 U*	*1 U*	**752**
Toluene	µg/L	**1,100**	**9.9**	**4.7**	**0.60 J**	**1.4**	**425,00**
Xylene	µg/L	**490**	**4.7**	**2.8 J**	*3 U*	**1.4 J**	**9,840**
Semi-Volatile Organic Compounds							
2-Methylnaphthalene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthylene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(b)fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(g,h,i)perylene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(k)fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Chrysene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Dibenz(a,h)anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluorene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indeno(1,2,3-cd)pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Naphthalene	µg/L	**1,520**	**433**	**16**	*2 U*	*2 U*	**1670**
Phenanthrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
TPH							
Diesel Range Organics	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Gasoline Range Organics	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 8
Cells 1, 2 and 6
Intermediate Groundwater Sample Results

Parameter	Units	COK-MWI	COL-MWI	COM-MWI	CON-MWI	COO-MWI	COP-MWI	COQ-MWI	COR-MWI	COV-MWI
Volatile Organic Compounds										
Benzene	µg/L	**3,080**	**18,800**	**33,600**	**51,700**	**66,600 J**	**264,000**	**116,000**	**252,000**	**361,000**
Ethylbenzene	µg/L	**9.2**	**206**	**379**	**182**	**271**	**917**	**716**	**574**	**918**
Toluene	µg/L	**50.8**	**6,460**	**9,900**	**11,700**	**17,500**	**37,100**	**42,700**	**57,000**	**50,200**
Xylene	µg/L	**46.7**	**1,750**	**2,580**	**2,870**	**4,210**	**10,800**	**13,800**	**8,940**	**58,500**
Semi-Volatile Organic Compounds										
2-Methylnaphthalene	µg/L	**0.55**	**59.5 J**	**165**	**75.9 J**	**293**	*NA*	*NA*	*NA*	**41.6 J**
Acenaphthene	µg/L	**0.45**	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**4.9**
Acenaphthylene	µg/L	**0.21**	*103 U*	*99.5 U*	**43.1 J**	**182**	*NA*	*NA*	*NA*	**9.7**
Anthracene	µg/L	**0.14**	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**2.2**
Benzo(a)anthracene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**0.17**
Benzo(a)pyrene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**0.038 J**
Benzo(b)fluoranthene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**0.083 J**
Benzo(g,h,i)perylene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	*0.099 U*
Benzo(k)fluoranthene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**0.074 J**
Chrysene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**0.084 J**
Dibenz(a,h)anthracene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	*0.099 U*
Fluoranthene	µg/L	**0.35**	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**2.5**
Fluorene	µg/L	**0.66**	*103 U*	*99.5 U*	*99 U*	**55.3 J**	*NA*	*NA*	*NA*	**7.7**
Indeno(1,2,3-cd)pyrene	µg/L	*0.099 U*	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	*0.099 U*
Naphthalene	µg/L	**56.4**	**2,050**	**4,060**	**3,370 J**	**8,570**	**947 J**	**1,800 J**	**43,500 J**	**1,770**
Phenanthrene	µg/L	**1.7**	*103 U*	*99.5 U*	*99 U*	**56.8 J**	*NA*	*NA*	*NA*	**11.4**
Pyrene	µg/L	**0.23**	*103 U*	*99.5 U*	*99 U*	*97.6 U*	*NA*	*NA*	*NA*	**1.4**
TPH										
Diesel Range Organics	µg/L	**348 J**	**3,910**	**6,330**	**2,940**	**5,320**	**3,510**	**4,050**	**24,200**	**5,110 J**
Gasoline Range Organics	µg/L	**6,620**	**49,500**	**76,100**	**123,000**	**147,000**	**419,000 J**	**234,000 J**	**600,000**	**472,000**

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 8
Cells 1, 2 and 6
Intermediate Groundwater Sample Results

Parameter	Units	CO27-PZM046	CO36-PZM043	CO37-PZM038	CO38-PZM043	CO39-PZM042	CO41-PZM036
Volatile Organic Compounds							
Benzene	µg/L	**191,000**	**22,200**	**13,900**	**0.4 J**	**1,290**	**224,000**
Ethylbenzene	µg/L	**552**	**76.1**	**244**	*1 U*	**12.3**	**520**
Toluene	µg/L	**35,100**	**4,210**	**8,190**	*1 U*	**377**	**71,800**
Xylene	µg/L	**7,360**	**1,150**	**1,930**	*3 U*	**117**	**11,300**
Semi-Volatile Organic Compounds							
2-Methylnaphthalene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Acenaphthylene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(a)pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(b)fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(g,h,i)perylene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Benzo(k)fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Chrysene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Dibenz(a,h)anthracene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluoranthene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Fluorene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indeno(1,2,3-cd)pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Naphthalene	µg/L	**14,100**	**745**	**1,370**	*2 U*	**1,280**	**382**
Phenanthrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Pyrene	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
TPH							
Diesel Range Organics	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Gasoline Range Organics	µg/L	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 9
Cell 2 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-046-PW	CO-047-PW	CO-048-PW-1	CO-048-PW-3	CO-049-PW-1	CO-049-PW-3	CO-050-PW	CO-051-PW-1	CO-052-PW-1	CO-052-PW-2	CO-053-PW-2	CO-054-PW-1	CO-054-PW-3
Volatile Organic Compounds															
Benzene	µg/L	90*	*NS (HB)*	*NS (HB)*	*1 U*	*1 U*	**149**	**19,100**	*NS (HB)*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Ethylbenzene	µg/L	130‡	*NS (HB)*	*NS (HB)*	*1 U*	*1 U*	**1.6**	**34.2**	*NS (HB)*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	*NS (HB)*	*NS (HB)*	*1 U*	*1 U*	**34.9**	**631**	*NS (HB)*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Xylene	µg/L	---	*NS (HB)*	*NS (HB)*	*3 U*	*3 U*	**25.4**	**382**	*NS (HB)*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*
Semi-Volatile Organic Compounds															
2-Methylnaphthalene	µg/L	---	*NS (HB)*	*NS (HB)*	**0.13**	*102 U*	**3.2 J**	**1,980**	*NS (HB)*	**0.15 J**	**0.16**	*0.1 U*	**0.31**	*0.15 U*	**0.041 J**
Acenaphthene	µg/L	90‡	*NS (HB)*	*NS (HB)*	**0.06 J**	**55 J**	*10.3 U*	*1,020 U*	*NS (HB)*	*0.27 U*	**0.076 J**	*0.1 U*	*0.1 U*	*0.15 U*	*0.1 U*
Acenaphthylene	µg/L	306.9~	*NS (HB)*	*NS (HB)*	**0.38**	*102 U*	**3.9 J**	**1,590**	*NS (HB)*	**0.24 J**	**0.3**	*0.1 U*	**0.14**	*0.15 U*	**0.084 J**
Anthracene	µg/L	400‡	*NS (HB)*	*NS (HB)*	**0.37**	*102 U*	*10.3 U*	*1,020 U*	*NS (HB)*	**0.27**	**0.38**	*0.1 U*	*0.1 U*	*0.15 U*	**0.073 J**
Benzo(a)anthracene	µg/L	0.0013‡	*NS (HB)*	*NS (HB)*	**1.0**	*102 U*	**4.5 J**	*1,020 U*	*NS (HB)*	**0.62**	**0.97**	**0.05 J**	**0.048 J**	**0.061 J**	**0.19**
Benzo(a)pyrene	µg/L	0.00013‡	*NS (HB)*	*NS (HB)*	**1.9**	*102 U*	**3.3 J**	*1,020 U*	*NS (HB)*	**1.2**	**1.8**	**0.067 J**	**0.045 J**	**0.068 J**	**0.35**
Benzo(b)fluoranthene	µg/L	0.0013‡	*NS (HB)*	*NS (HB)*	**3.2**	*102 U*	**5.6 J**	*1,020 U*	*NS (HB)*	**2.1**	**3.0**	**0.096 J**	**0.065 J**	**0.13 J**	**0.67**
Benzo(g,h,i)perylene	µg/L	0.4391~	*NS (HB)*	*NS (HB)*	**1.1**	*102 U*	*10.3 U*	*1,020 U*	*NS (HB)*	**0.68**	**1.1**	*0.1 U*	**0.036 J**	*0.15 U*	**0.21**
Benzo(k)fluoranthene	µg/L	0.013‡	*NS (HB)*	*NS (HB)*	**2.7**	*102 U*	**4.8 J**	*1,020 U*	*NS (HB)*	**1.9**	**2.8**	**0.034 J**	*0.1 U*	**0.11 J**	**0.57**
Chrysene	µg/L	0.13‡	*NS (HB)*	*NS (HB)*	**1.1**	*102 U*	*10.3 U*	*1,020 U*	*NS (HB)*	**0.72**	**1.0**	*0.1 U*	*0.1 U*	*0.15 U*	**0.22**
Dibenz(a,h)anthracene	µg/L	0.00013‡	*NS (HB)*	*NS (HB)*	**0.33**	*102 U*	*10.3 U*	*1,020 U*	*NS (HB)*	**0.16 J**	**0.29**	*0.1 U*	*0.1 U*	*0.15 U*	**0.044 J**
Fluoranthene	µg/L	20‡	*NS (HB)*	*NS (HB)*	**2.8**	*102 U*	**11.6**	*1,020 U*	*NS (HB)*	**1.5**	**1.5**	**0.07 J**	**0.07 J**	**0.11 J**	**0.45**
Fluorene	µg/L	70‡	*NS (HB)*	*NS (HB)*	**0.12**	*102 U*	*10.3 U*	**436 J**	*NS (HB)*	**0.11 J**	**0.14**	*0.1 U*	*0.1 U*	*0.15 U*	*0.1 U*
Indeno(1,2,3-cd)pyrene	µg/L	0.0013‡	*NS (HB)*	*NS (HB)*	**1**	*102 U*	*10.3 U*	*1,020 U*	*NS (HB)*	**0.57**	**0.89**	*0.1 U*	*0.1 U*	*0.15 U*	**0.17**
Naphthalene	µg/L	193.5~	*NS (HB)*	*NS (HB)*	**2.9**	**6,380**	**500**	**72,000**	*NS (HB)*	**1.7 J**	**2**	**0.096 J**	**11.5**	0.45 B	0.42 B
Phenanthrene	µg/L	19.13~	*NS (HB)*	*NS (HB)*	**0.61**	**56.9 J**	*10.3 U*	**862 J**	*NS (HB)*	**0.45**	**0.62**	*0.1 U*	**0.048 J**	*0.15 U*	**0.11**
Pyrene	µg/L	30‡	*NS (HB)*	*NS (HB)*	**2.6**	*102 U*	**9.7 J**	*1,020 U*	*NS (HB)*	**1.3**	**1.4**	**0.1**	**0.059 J**	**0.099 J**	**0.36**
TPH															
Diesel Range Organics	µg/L	50^	*NS (HB)*	*NS (HB)*	**343 J**	**4,620**	**1,210 J**	**26,400**	*NS (HB)*	**3,970 J**	**2,610 J**	**118 J**	69.4 B	**262**	**265 J**
Gasoline Range Organics	µg/L	1,700^	*NS (HB)*	*NS (HB)*	*200 U*	*200 U*	**457**	**47,400**	*NS (HB)*	**185 J**	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria.
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value
^Marine No Observed Effect Concentrations (NOEC) Environmental Effects-Based Concentrations for TPH, Toxicity in Marine Water and Freshwater

Table 9
Cell 2 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-055-PW-1	CO-055-PW-2	CO-056-PW-2	CO-057-PW-1	CO-058-PW-1	CO-058-PW-2	CO-059-PW	CO-060-PW	CO-061-PW-1	CO-062-PW-1	CO-063-PW-1	CO-063-PW-2	CO-064-PW-3
Volatile Organic Compounds															
Benzene	µg/L	90*	*1 U*	*1 U*	*1 U*	*1 U*	**0.80 J**	*1 U*	*NS (LP)*	*NS (LP)*	*1 U*	*1 U*	**3.4**	*1 U*	*1 U*
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*NS (LP)*	*NS (LP)*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*NS (LP)*	*NS (LP)*	*1 U*	*1 U*	**1**	*1 U*	*1 U*
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*NS (LP)*	*NS (LP)*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*
Semi-Volatile Organic Compounds															
2-Methylnaphthalene	µg/L	---	**0.72**	**0.03 J**	*0.1 U*	**0.09 J**	**0.68 J**	**0.097 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**0.54 J**	**4.4**	**0.059 J**	**0.03 J**
Acenaphthene	µg/L	90‡	**0.41**	*0.099 U*	*0.1 U*	*0.28 U*	**0.25 J**	*0.34 U*	*NS (LP)*	*NS (LP)*	*0.18 U*	**0.24 J**	**2**	**0.031 J**	*0.098 U*
Acenaphthylene	µg/L	306.9~	**1.6**	**0.055 J**	*0.1 U*	*0.28 U*	**0.83**	*0.34 U*	*NS (LP)*	*NS (LP)*	*0.18 U*	**0.68**	**8.1**	**0.13**	*0.098 U*
Anthracene	µg/L	400‡	**1.9**	**0.052 J**	*0.1 U*	*0.28 U*	**1.1**	**0.12 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**1.1**	**7.8**	**0.14**	*0.098 U*
Benzo(a)anthracene	µg/L	0.0013‡	**5.4**	**0.12**	*0.1 U*	**0.15 J**	**3.1**	**0.3 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**2.3**	**23.2**	**0.61**	**0.054 J**
Benzo(a)pyrene	µg/L	0.00013‡	**9.1**	**0.19**	**0.018 J**	**0.17 J**	**4.9**	**0.47**	*NS (LP)*	*NS (LP)*	**0.061 J**	**3.8**	**42.2**	**0.76**	**0.094 J**
Benzo(b)fluoranthene	µg/L	0.0013‡	**15.2**	**0.34**	*0.1 U*	**0.33**	**8.2**	**0.63**	*NS (LP)*	*NS (LP)*	**0.11 J**	**7.3**	**72.1**	**1.3**	**0.12**
Benzo(g,h,i)perylene	µg/L	0.4391~	**5.5**	**0.12**	*0.1 U*	*0.28 U*	**3.1**	**0.32 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**2.2**	**15.9**	**0.35**	**0.061 J**
Benzo(k)fluoranthene	µg/L	0.013‡	**14**	**0.32**	*0.1 U*	**0.28 J**	**7.7**	**0.25 J**	*NS (LP)*	*NS (LP)*	**0.11 J**	**6.2**	**61.6**	**1.1**	**0.046 J**
Chrysene	µg/L	0.13‡	**5.8**	**0.11**	*0.1 U*	*0.28 U*	**3.1**	**0.29 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**2.7**	**24.6**	**0.34**	**0.052 J**
Dibenz(a,h)anthracene	µg/L	0.00013‡	**1.6**	**0.031 J**	*0.1 U*	*0.28 U*	**0.84**	*0.34 U*	*NS (LP)*	*NS (LP)*	*0.18 U*	**0.6 J**	**4.8**	**0.083 J**	*0.098 U*
Fluoranthene	µg/L	20‡	**6.3**	**0.26**	*0.1 U*	**0.24 J**	**5.3**	**0.67**	*NS (LP)*	*NS (LP)*	**0.094 J**	**4.5**	**32.2**	**1.6**	**0.19**
Fluorene	µg/L	70‡	**0.74**	*0.099 U*	*0.1 U*	*0.28 U*	**0.42 J**	*0.34 U*	*NS (LP)*	*NS (LP)*	*0.18 U*	**0.38 J**	**3.2**	**0.051 J**	*0.098 U*
Indeno(1,2,3-cd)pyrene	µg/L	0.0013‡	**4.5**	**0.1**	*0.1 U*	*0.28 U*	**2.7**	**0.26 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**1.8**	**15.2**	**0.29**	**0.046 J**
Naphthalene	µg/L	193.5~	**8.4**	**0.33**	**0.35**	**1.5 J**	**6.2**	**0.59**	*NS (LP)*	*NS (LP)*	0.14 B	**6.4**	**63.9 J**	1.2 B	**0.29**
Phenanthrene	µg/L	19.13~	**3.2**	**0.086 J**	*0.1 U*	*0.28 U*	**1.8**	**0.2 J**	*NS (LP)*	*NS (LP)*	*0.18 U*	**1.7**	**13.3**	**0.17**	*0.098 U*
Pyrene	µg/L	30‡	**7.1**	**0.27**	*0.1 U*	**0.2 J**	**4.9**	**0.59**	*NS (LP)*	*NS (LP)*	*0.18 U*	**4.4**	**38.4**	**1.5**	**0.2**
TPH															
Diesel Range Organics	µg/L	50^	**565 J**	**113 J**	**113 J**	**245 J**	**158 J**	**1150 J**	*NS (LP)*	*NS (LP)*	**379 J**	**1,010 J**	**6,280**	**193 J**	**143 J**
Gasoline Range Organics	µg/L	1,700^	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*NS (LP)*	*NS (LP)*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria.
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value
^Marine No Observed Effect Concentrations (NOEC) Environmental Effects-Based Concentrations for TPH, Toxicity in Marine Water and Freshwater

Table 9
Cell 2 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-065-PW-1	CO-065-PW-2	CO-066-PW-1	CO-066-PW-2	CO-067-PW-1	CO-067-PW-2	CO-068-PW-1	CO-068-PW-2	CO-069-PW-1	CO-069-PW-2	CO-070-PW-1	CO-070-PW-2	CO-071-PW	CO-072-PW
Volatile Organic Compounds																
Benzene	µg/L	90*	*1 U*	*1 U*	**0.78 J**	**0.62 J**	*1 U*	*1 U*	*1 U*	*1 U*	**0.99 J**	**104**	**17,200**	**9,470**	*NS (HB)*	*NS (HB)*
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	**0.53 J**	**41**	**127**	*NS (HB)*	*NS (HB)*
Toluene	µg/L	520‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	**1,910**	**128**	*NS (HB)*	*NS (HB)*
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	**2.5 J**	**511**	**421**	*NS (HB)*	*NS (HB)*
Semi-Volatile Organic Compounds																
2-Methylnaphthalene	µg/L	---	*0.1 U*	*0.1 U*	*0.17 U*	*0.099 U*	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**0.07 J**	*33.3 U*	**679 J**	*1,020 U*	*NS (HB)*	*NS (HB)*
Acenaphthene	µg/L	90‡	*0.1 U*	*0.1 U*	*0.17 U*	**0.037 J**	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**0.22**	*33.3 U*	*990 U*	**956 J**	*NS (HB)*	*NS (HB)*
Acenaphthylene	µg/L	306.9~	*0.1 U*	*0.1 U*	*0.17 U*	**0.049 J**	*0.099 U*	**0.037 J**	*NS (LP)*	*0.099 U*	**0.32**	*33.3 U*	**580 J**	*1,020 U*	*NS (HB)*	*NS (HB)*
Anthracene	µg/L	400‡	*0.1 U*	*0.1 U*	*0.17 U*	**0.043 J**	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**0.83**	**11.1 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Benzo(a)anthracene	µg/L	0.0013‡	*0.1 U*	**0.045 J**	**0.075 J**	**0.13**	*0.099 U*	**0.058 J**	*NS (LP)*	*0.099 U*	**1.3**	**20.5 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Benzo(a)pyrene	µg/L	0.00013‡	**0.013 J**	**0.052 J**	**0.11 J**	**0.13**	*0.099 U*	**0.071 J**	*NS (LP)*	*0.099 U*	**2.8**	**29.9 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Benzo(b)fluoranthene	µg/L	0.0013‡	*0.1 U*	**0.072 J**	**0.22**	**0.26**	*0.099 U*	**0.11**	*NS (LP)*	*0.099 U*	**3.4**	**52.9**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Benzo(g,h,i)perylene	µg/L	0.4391~	*0.1 U*	*0.1 U*	*0.17 U*	**0.058 J**	*0.099 U*	**0.041 J**	*NS (LP)*	*0.099 U*	**1.5**	**16.6 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Benzo(k)fluoranthene	µg/L	0.013‡	*0.1 U*	**0.032 J**	**0.19**	**0.22**	*0.099 U*	**0.1**	*NS (LP)*	*0.099 U*	**1.4**	**45.4**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Chrysene	µg/L	0.13‡	*0.1 U*	*0.1 U*	*0.17 U*	**0.1**	*0.099 U*	**0.05 J**	*NS (LP)*	*0.099 U*	**1.5**	**20.5 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Dibenz(a,h)anthracene	µg/L	0.00013‡	*0.1 U*	*0.1 U*	*0.17 U*	*0.099 U*	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**0.38**	*33.3 U*	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Fluoranthene	µg/L	20‡	*0.1 U*	**0.085 J**	**0.16 J**	**0.48**	*0.099 U*	**0.13**	*NS (LP)*	*0.099 U*	**7.5**	**83.7**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Fluorene	µg/L	70‡	*0.1 U*	*0.1 U*	*0.17 U*	*0.099 U*	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**0.28**	*33.3 U*	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Indeno(1,2,3-cd)pyrene	µg/L	0.0013‡	*0.1 U*	*0.1 U*	*0.17 U*	**0.05 J**	*0.099 U*	**0.034 J**	*NS (LP)*	*0.099 U*	**1.4**	**14.9 J**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
Naphthalene	µg/L	193.5~	0.10 B	0.15 B	0.31 B	0.44 B	0.045 B	**0.33**	*NS (LP)*	*0.099 U*	**3.6**	**192**	**52,000**	**63,200**	*NS (HB)*	*NS (HB)*
Phenanthrene	µg/L	19.13~	*0.1 U*	*0.1 U*	*0.17 U*	**0.052 J**	*0.099 U*	*0.099 U*	*NS (LP)*	*0.099 U*	**1.3**	**20.8 J**	*990 U*	**609 J**	*NS (HB)*	*NS (HB)*
Pyrene	µg/L	30‡	*0.1 U*	**0.085 J**	**0.15 J**	**0.4**	*0.099 U*	**0.12**	*NS (LP)*	**0.041 J**	**8**	**115**	*990 U*	*1,020 U*	*NS (HB)*	*NS (HB)*
TPH																
Diesel Range Organics	µg/L	50^	**114 J**	60.7 B	**247 J**	**186 J**	**82.7 J**	**273 J**	*NS (LP)*	**217 J**	**1,070 J**	**2,220 J**	**10,100**	**18,000**	*NS (HB)*	*NS (HB)*
Gasoline Range Organics	µg/L	1,700^	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	*200 U*	**202**	**38,200**	**22,900**	*NS (HB)*	*NS (HB)*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria.
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value
^Marine No Observed Effect Concentrations (NOEC) Environmental Effects-Based Concentrations for TPH, Toxicity in Marine Water and Freshwater

Table 10
Cell 2 Surface Water Sample Results

Parameter	Units	Water Quality Criteria	CO-047-SW-2	CO-048-SW-2	CO-048-SW-8	CO-049-SW-2	CO-049-SW-6
Volatile Organic Compounds							
Benzene	µg/L	90*	**1.2**	**2.8**	**1**	*1 U*	**1.1**
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	**0.41 J**	**0.86 J**	*1 U*	*1 U*	*1 U*
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*
Semi-Volatile Organic Compounds							
Naphthalene	µg/L	193.5~	**0.19**	**0.56**	**1.5**	**0.18**	**0.32**

Parameter	Units	Water Quality Criteria	CO-069-SW-2	CO-069-SW-6	CO-070-SW-2	CO-070-SW-7.5	CO-072-SW-2
Volatile Organic Compounds							
Benzene	µg/L	90*	*1 U*	**0.34 J**	*1 U*	*1 U*	*1 U*
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*
Semi-Volatile Organic Compounds							
Naphthalene	µg/L	193.5~	**0.34 J**	**0.24**	**0.064 J**	**0.055 J**	**0.099 J**

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 11
Cell 3 Shallow Groundwater Sample Results

Parameter	Units	COA-MWS	COB-MWS	COC-MWS	COD-MWS	COE-MWS	COF-MWS	COG-MWS	COH-MWS
Volatile Organic Compounds									
Benzene	µg/L	**34,100**	**1,290**	**46,300**	**16,400**	**4,700**	**748**	**47,300**	**25,800**
Ethylbenzene	µg/L	**53.1**	**4.8 J**	**83.5**	**33.6**	**12.1**	**4.6 J**	**90.9**	**40.6**
Toluene	µg/L	**2,770**	**160**	**4,140**	**1,330**	**389**	**145**	**3,560**	**1,910**
Xylene	µg/L	**609**	**75.1**	**1,120**	**395**	**127**	**71.3**	**1,440**	**537**
Semi-Volatile Organic Compounds									
Naphthalene	µg/L	**2,630**	**4,400**	**5,530**	**3,400 J**	**3,430 J**	**4,650**	**10,600**	**2,350**

Parameter	Units	COI-MWS	COJ-MWS	CO30-PZM015	CO101-PZM	CO102-PZM	CO103-PZM	CO104-PZM
Volatile Organic Compounds								
Benzene	µg/L	**145**	**1,440**	**51,000**	**10**	**9,730**	**995**	**1.9**
Ethylbenzene	µg/L	**0.97 J**	**3.2**	**87.3**	*1 U*	**17.4**	**2.5 J**	*1 U*
Toluene	µg/L	**12.7**	**120**	**3,890**	*1 U*	**716**	**53.6**	*1 U*
Xylene	µg/L	**9.8**	**41**	**1,190**	*3 U*	**202**	**31.1**	*3 U*
Semi-Volatile Organic Compounds								
Naphthalene	µg/L	**4,840**	**1,600**	**2,710**	*2 U*	**888**	**71**	**1.9 J**

Detections in bold

U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.

J: The positive result reported for this analyte is a quantitative estimate.

Table 12
Cell 3 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-016-PW-1	CO-017-PW	CO-018-PW	CO-019-PW	CO-020-PW-1	CO-021-PW	CO-022-PW
Volatile Organic Compounds									
Benzene	µg/L	90*	*1 U*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**1,990**	*NS (HB)*	*NS (HB)*
Ethylbenzene	µg/L	130‡	*1 U*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**2.9**	*NS (HB)*	*NS (HB)*
Toluene	µg/L	520‡	*1 U*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**141**	*NS (HB)*	*NS (HB)*
Xylene	µg/L	---	*3 U*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**45.4**	*NS (HB)*	*NS (HB)*
Semi-Volatile Organic Compounds									
Naphthalene	µg/L	193.5~	*NS (LP)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**176**	*NS (HB)*	*NS (HB)*

Parameter	Units	Water Quality Criteria	CO-025-PW-1	CO-026-PW	CO-027-PW	CO-028-PW	CO-029-PW	CO-034-PW	CO-035-PW
Volatile Organic Compounds									
Benzene	µg/L	90*	**19.4**	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*
Ethylbenzene	µg/L	130‡	**1.4**	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*
Toluene	µg/L	520‡	**8.6**	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*
Xylene	µg/L	---	**17.8**	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*
Semi-Volatile Organic Compounds									
Naphthalene	µg/L	193.5~	**18,700**	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 12
Cell 3 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-036-PW	CO-037-PW	CO-038-PW	CO-039-PW	CO-040-PW-1	CO-040-PW-3	CO-041-PW
Volatile Organic Compounds									
Benzene	µg/L	90*	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**9.9**	**165**	*NS (LP)*
Ethylbenzene	µg/L	130‡	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**1.6**	**14.4**	*NS (LP)*
Toluene	µg/L	520‡	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**3.6**	**110**	*NS (LP)*
Xylene	µg/L	---	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**7.5**	**332**	*NS (LP)*
Semi-Volatile Organic Compounds									
Naphthalene	µg/L	193.5~	*NS (HB)*	*NS (HB)*	*NS (HB)*	*NS (HB)*	**7,160**	**17,900**	*NS (LP)*

Parameter	Units	Water Quality Criteria	CO-042-PW	CO-043-PW	CO-044-PW	CO-045-PW
Volatile Organic Compounds						
Benzene	µg/L	90*	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (LP)*
Ethylbenzene	µg/L	130‡	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (LP)*
Toluene	µg/L	520‡	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (LP)*
Xylene	µg/L	---	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (LP)*
Semi-Volatile Organic Compounds						
Naphthalene	µg/L	193.5~	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (LP)*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 13
Cell 3 Surface Water Sample Results

Parameter	Units	Water Quality Criteria	SW-14-2	SW-14-4	SW-15-2	SW-15-4	SW-16-2	SW-16-4	SW-17-2	SW-18-2	SW-19-1
Volatile Organic Compounds											
Benzene	µg/L	90*	**121**	**46.5**	**158**	**64.5**	**99.1**	**67.7**	**75.6**	**91.4**	**7.8**
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	**9.5**	**3.8**	**12.3**	**5.1**	**7.8**	**5.4**	**6**	**7.2**	**0.70 J**
Xylene	µg/L	---	**3.3**	**0.94 J**	**4.4**	**1.8 J**	**2.6 J**	**1.9 J**	**2.1 J**	**2.4 J**	*3 U*
Semi-Volatile Organic Compounds											
Naphthalene~	µg/L	193.5~	**8.8**	**2.3**	**7**	**2.7**	**5.3**	**3.1**	**4.1**	**4**	**0.46**

Parameter	Units	Water Quality Criteria	SW-20-2	SW-20-4.5	SW-21-2	SW-22-2	SW-23-2	SW-23-8.5	SW-24-2	SW-24-7	SW-25-2
Volatile Organic Compounds											
Benzene	µg/L	90*	**19.2**	**25.5**	**5.6**	**2.4**	**2.5**	*1 U*	**1.5**	**36.3**	**27.3**
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	**1.6**	**2.1**	**0.57 J**	*1 U*	*1 U*	*1 U*	*1 U*	**2.9**	**2.4**
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	**0.81 J**
Semi-Volatile Organic Compounds											
Naphthalene	µg/L	193.5~	**1.2**	**1.5**	**0.41**	**0.12**	**0.084 J**	*0.10 U*	**0.12**	**0.72**	**3.4**

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NS: Not sampled
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 13
Cell 3 Surface Water Sample Results

Parameter	Units	Water Quality Criteria	SW-25-4	SW-26-1	SW-27-1	SW-28-1	SW-29-2	SW-30-2	SW-30-6.5	SW-31-2	SW-31-4.5
Volatile Organic Compounds											
Benzene	µg/L	90*	**10.1**	**373**	**736**	**50.9**	**142**	**11.6**	**1.8**	**6.4**	**11.6**
Ethylbenzene	µg/L	130‡	*1 U*	**0.74 J**	**1.5**	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Toluene	µg/L	520‡	**0.99 J**	**27.7**	**67.2**	**4.1**	**10.7**	**1**	*1 U*	**0.64 J**	**1**
Xylene	µg/L	---	*3 U*	**8.6**	**21.4**	**1.1 J**	**3.8**	*3 U*	*3 U*	*3 U*	*3 U*
Semi-Volatile Organic Compounds											
Naphthalene~	µg/L	193.5~	**0.78**	**4.4**	**18.5**	**1.7**	**4.3**	**0.36**	**0.060 J**	**0.45**	**0.35**

Parameter	Units	Water Quality Criteria	SW-32-2	SW-32-5	SW-33-2	SW-33-6	SW-34	SW-35	SW-36	SW-37
Volatile Organic Compounds										
Benzene	µg/L	90*	**26.8**	**8.5**	**3.1**	**1**	*NS*	*NS*	*NS*	*NS*
Ethylbenzene	µg/L	130‡	*1 U*	*1 U*	*1 U*	*1 U*	*NS*	*NS*	*NS*	*NS*
Toluene	µg/L	520‡	**2**	**0.78 J**	**0.34 J**	*1 U*	*NS*	*NS*	*NS*	*NS*
Xylene	µg/L	---	*3 U*	*3 U*	*3 U*	*3 U*	*NS*	*NS*	*NS*	*NS*
Semi-Volatile Organic Compounds										
Naphthalene	µg/L	193.5~	**0.38**	**0.2**	**0.4**	**0.054 J**	*NS*	*NS*	*NS*	*NS*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NS: Not sampled
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 14
Cell 5 Shallow Groundwater Sample Results

Parameter	Units	COAA-MWS	COBB-MWS	COCC-MWS	CODD-MWS	COEE-MWS	COFF-MWS
Semi-Volatile Organic Compounds							
Naphthalene	µg/L	**8,650 J**	**9,040 J**	**9,110 J**	**14,800 J**	*NA*	**2,490 J**

Parameter	Units	COGG-MWS	CO23-PZM008	CO24-PZM007	CO26-PZM007	CO55-PZM000	CO56-PZP001
Semi-Volatile Organic Compounds							
Naphthalene	µg/L	**2,120 J**	**2,760**	**2,190**	**961**	**8.9**	**2,400**

Parameter	Units	CO57-PZP002	CO58-PZM001	CO59-PZP002	CO60-PZP001
Semi-Volatile Organic Compounds					
Naphthalene	µg/L	*2 U*	**701**	*2 U*	**1,540**

Detections in bold
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
NA: Not Analyzed

Table 15
Cell 5 Pore Water Sample Results

Parameter	Units	Water Quality Criteria	CO-073-PW-1	CO-074-PW-1	CO-074-PW-2	CO-075-PW	CO-076-PW	CO-077-PW	CO-078-PW	CO-079-PW-1
Semi-Volatile Organic Compounds										
Naphthalene	µg/L	193.5~	**1,530**	**9,230**	**8,880**	*NS (HB)*	*NS (HB/LP)*	*NS (HB)*	*NS (HB)*	**3,680**

Parameter	Units	Water Quality Criteria	CO-080-PW-1	CO-081-PW	CO-082-PW	CO-083-PW	CO-084-PW	CO-085-PW	CO-086-PW-1	CO-087-PW
Semi-Volatile Organic Compounds										
Naphthalene	µg/L	193.5~	**0.41**	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (HB)*	*NS (HB)*	**0.33**	*NS (HB)*

Parameter	Units	Water Quality Criteria	CO-088-PW	CO-089-PW	CO-090-PW	CO-091-PW	CO-092-PW	CO-093-PW	CO-094-PW	CO-095-PW-1
Semi-Volatile Organic Compounds										
Naphthalene	µg/L	193.5~	*NS (HB)*	*NS (LP)*	*NS (HB)*	*NS (HB)*	*NS (LP)*	*NS (HB)*	*NS (HB)*	**0.14**

Parameter	Units	Water Quality Criteria	CO-095-PW-2	CO-096-PW	CO-097-PW	CO-098-PW-1	CO-099-PW	CO-100-PW	CO-101-PW	CO-102-PW
Semi-Volatile Organic Compounds										
Naphthalene	µg/L	193.5~	**30.4**	*NS (HB)*	*NS (HB)*	**352**	*NS (HB)*	*NS (HB)*	*NS (30)*	*NS (HB)*

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
NS (HB): Not sampled due to hard bottom
NS (LP): Not sampled due to low porosity
NS (30): Not sampled due to <30% difference in specific conductance between pore water and surface water
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

Table 16
Cell 5 Surface Water Sample Results

Parameter	Units	Water Quality Criteria	CO-073-SW-2	CO-073-SW-5	CO-074-SW-2	CO-074-SW-9	CO-075-SW-2	CO-075-SW-5
Semi-Volatile Organic Compounds								
Naphthalene	µg/L	193.5~	**0.5**	**1.1**	**0.051 J**	**0.058 J**	**0.45**	**0.67**

Parameter	Units	Water Quality Criteria	CO-079-SW-2	CO-079-SW-8.5	CO-081-SW-2	CO-084-SW-2	CO-087-SW-2	CO-090-SW-2
Semi-Volatile Organic Compounds								
Naphthalene	µg/L	193.5~	*0.1 U*	**0.064 J**	**0.3**	**0.59**	**0.25**	**0.31**

Parameter	Units	Water Quality Criteria	CO-093-SW-2	CO-098-SW-2	CO-098-SW-4	CO-099-SW-1
Semi-Volatile Organic Compounds						
Naphthalene	µg/L	193.5~	**0.045 J**	*0.1 U*	**0.11**	**0.065 J**

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
*Human health Ambient Water Quality Criteria for consumption of organism only (noncarcinogenic)
‡Human health Ambient Water Quality Criteria for consumption of organism only (carcinogenic)
~Narcosis Secondary Chronic Value

APPENDIX A

Boring and Well Construction Logs

ARM Group Inc.
Engineers and Scientists

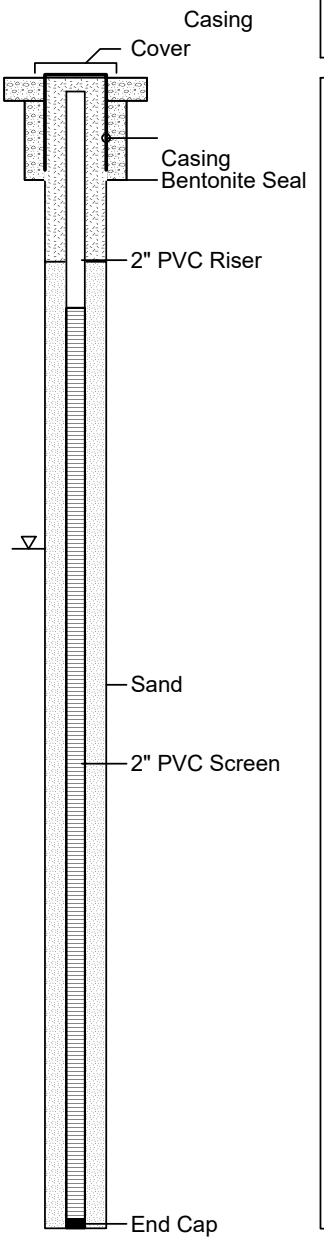
Well ID: COAA-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561979.89
Easting (ft)	: 1457970.98
Date/Time Started	: 4/13/19 1450
Date/Time Completed	: 4/13/19 1535
Surf. Elev. (ft AMSL)	: 11.27
TOC Elev. (ft AMSL)	: 10.65
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 10.18' TOC
Depth to Water (ft)	: 48 hr: 9.93' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		12.9	(0-24') SLAG SAND and GRAVEL-sized, with SILT, loose, brown grading to black at 20' bgs, moist, non-plastic, non-cohesive	GW-GM
		5.5		
		11.5		
		6.7		
		21.3		
5	100	-		
		7.6		
		17.1		
		12.2		
		7.7		
10		28.6		
		42.9		
	100	20.7		
		5.5		
		4.7		
15		13.6		
		9.9		
		4.0		
		4.2		
		2.5		
20	100	-		
		10.2		
		7.3		
		1.6		
25		3.0	(24-25') SAND, very fine, very dense, greenish brown, wet, non-plastic, non-cohesive	SP



COMPLETION DETAILS

4" Protective Steel Casing with Locking Flush Mount Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 0'

Wet at 14' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Development
Date: 04/25/2019
Purged Amount: 16 gallons
Well Volumes Removed: 6.56

ARM Group Inc.
Engineers and Scientists

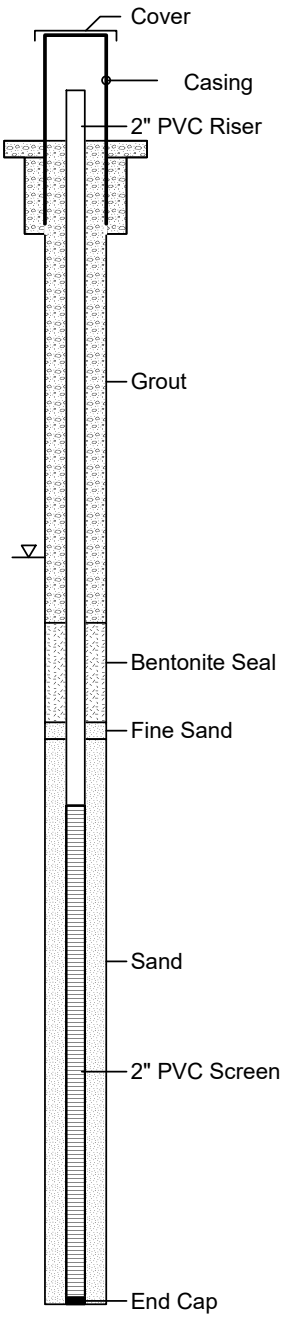
Well ID: COA-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	:
Easting (ft)	:
Date/Time Started	: 4/28/19 0745
Date/Time Completed	: 4/28/19 0915
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 15.31' TOC
Depth to Water (ft)	: 48 hr: 15.28' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		45.8	(0-10') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, moist, non-plastic, non-cohesive	
		40.2		
		14.0		
		6.4		
5	100	4.6		SW/GW
		-		
		14.0		
		-		
		23.4		
		37.4		
10		12.2	(10-25') SLAG, SAND and GRAVEL-sized, loose, dark gray with some black, wet, non-plastic, non-cohesive	
	100	15.0		
		14.6		
		12.4		
15		9.2		
		-		SW/GW
		-		
		-		
20	100	-		
		-		
		-		
		-		
		-		
25		-	(25-35') SAND, very fine, medium dense, gray then very light brown, wet, non-plastic, non-cohesive	
		-		
		-		
		-		
30	100	-		SP
		-		
		-		
		-		
		-		
35		-	End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.77'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 14.5' bgs
Bottom: 17.5' bgs

Sand Blotter: #1 Sand
Top: 17.5' bgs
Bottom: 18' bgs

Filter Pack: #2 Sand
Top: 18' bgs
Bottom: 35' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 20' bgs
Bottom: 35' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/07/2019
Purged Amount: 15 gallons
Well Volumes Removed: 4.04

06-18-2019 P:\EnviroAnalytics Group\190342M COA Onshore Supplemental Investigation\Documents\Boring Logs\2_Bor Logs\COA-MWS.bor

ARM Group Inc.
Engineers and Scientists

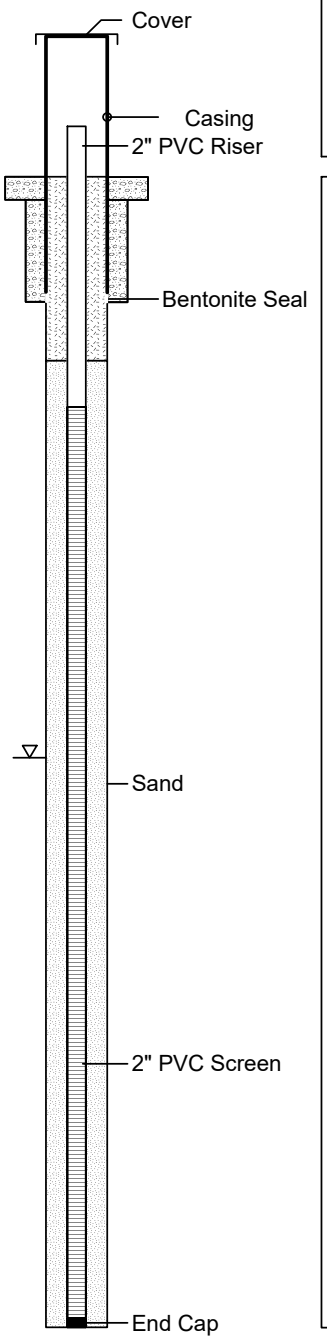
Well ID: COBB-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561776.15
Easting (ft)	: 1457813.75
Date/Time Started	: 4/13/19 1400
Date/Time Completed	: 4/13/19 1735
Surf. Elev. (ft AMSL)	: 13.61
TOC Elev. (ft AMSL)	: 16.27
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 14.47' TOC
Depth to Water (ft)	: 48 hr: 15.37' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		4.0	(0-25') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, moist then wet at 14.5' bgs, non-plastic, non-cohesive	
		2.7		
		2.1		
		3.7		
		12.6		
5	100	-		
		58.2		
		78.8		
		25.5		
		14.4		
10		2.7		
		1.2		
	100	4.0		SW/GW
		1.5		
		26.3		
15		-		
		13.6		
		4.9		
		3.1		
		1.7		
20	100	-		
		2.0		
		13.2		
		29.8		
		29.4		
25			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.69'

Wet at 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Development
Date: 04/25/2019
Purged Amount: 16 gallons
Well Volumes Removed: 8.12

ARM Group Inc.
Engineers and Scientists

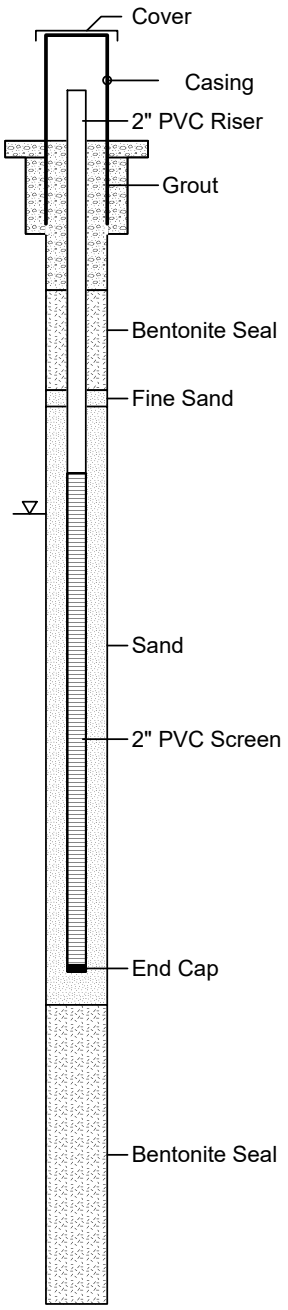
Well ID: COB-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561768.07
Easting (ft)	: 1454242.77
Date/Time Started	: 4/27/19 0945
Date/Time Completed	: 4/27/19 1130
Surf. Elev. (ft AMSL)	: 11.30
TOC Elev. (ft AMSL)	: 14.23
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 13.82' TOC
Depth to Water (ft)	: 48 hr: 13.97' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		-	(0-10') SILT and SLAG, SAND and GRAVEL-sized, loose, dark brown to gray, dry, non-plastic, non-cohesive	
5	100	-		ML/GW
		0.0		
		0.0		
		0.2		
		0.1		
10		0.1	(10-25') SLAG, SAND and GRAVEL-sized, loose, dark brown and gray, moist, wet at 15' bgs, non-plastic, non-cohesive	
	100	0.2		
		0.2		
		0.2		
15		0.0		SW/GW
		2.1		
		-		
		0.2		
20	100	0.0		
		0.0		
		0.4		
		-		
		2.2		
		2.4		
25		0.0	(25-35') CLAY, very firm, gray, moist, low plasticity, cohesive	
		0.0		
		0.0		
		0.0		
30	100	0.0		CL
		0.0		
		0.0		
		0.0		
		0.0		
		0.0		
35			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.88'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 4.5' bgs

Bentonite Seal: 3/8" chips
Top: 4.5' bgs and 26' bgs
Bottom: 7.5' bgs and 35' bgs

Sand Blotter: #1 Sand
Top: 7.5' bgs
Bottom: 8' bgs

Filter Pack: #2 Sand
Top: 8' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 10' bgs
Bottom: 25' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/07/2019
Purged Amount: 10 gallons
Well Volumes Removed: 5.32

ARM Group Inc.
Engineers and Scientists

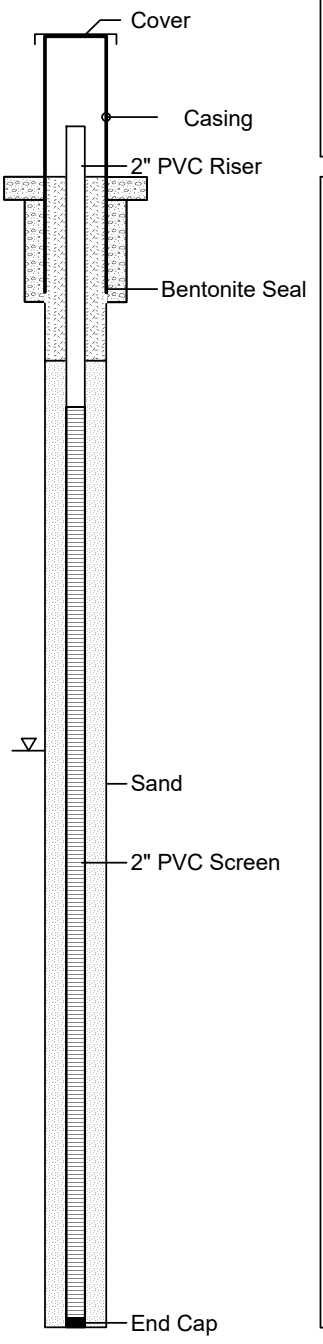
Well ID: COCC-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561794.48
Easting (ft)	: 1457978.39
Date/Time Started	: 4/13/19 1345
Date/Time Completed	: 4/13/19 1430
Surf. Elev. (ft AMSL)	: 13.16
TOC Elev. (ft AMSL)	: 15.55
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 15.21' TOC
Depth to Water (ft)	: 48 hr: 15.22' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	0.0, 0.8, 2.3, 1.0, 3.5	(0-4.5') SILT with SAND, loose, dark brown, moist, non-plastic, non-cohesive	ML
5		4.1	(4.5-6') CONCRETE	NA
	100	35.5, 18.0, 12.2, 18.3	(6-14') SLAG, SAND and GRAVEL-sized, loose, dark brown, dry, non-plastic, non-cohesive	SW/GW
10	100	19.2, 8.5, 13.7, 38.9		
15		19.2, 9.5	(14-16') SILT with SAND, loose, dark brown, moist then wet at 14.5' bgs, non-plastic, non-cohesive	ML
	100	4.0, 15.5, 16.7, 7.5, 21.8, 11.5, 37.8, 10.5, 21.4	(16-25') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, wet, non-plastic, non-cohesive	SW/GW
20				
25			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.73'

Wet at 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Development
Date: 04/25/2019
Purged Amount: 23 gallons
Well Volumes Removed: 10.70

ARM Group Inc.
Engineers and Scientists

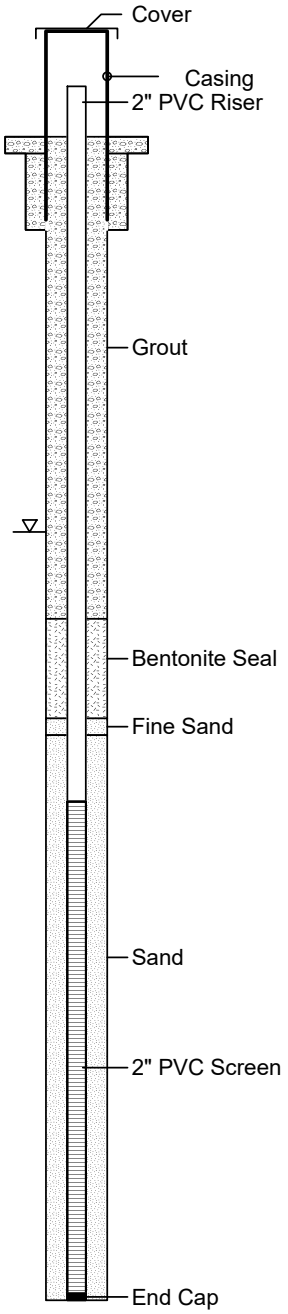
Well ID: COC-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561775.58
Easting (ft)	: 1454539.22
Date/Time Started	: 4/27/19 1215
Date/Time Completed	: 4/27/19 1515
Surf. Elev. (ft AMSL)	: 11.56
TOC Elev. (ft AMSL)	: 14.32
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 13.98' TOC
Depth to Water (ft)	: 48 hr: 14.64' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	0.0, 0.0, 0.3, 0.7, 3.8, -, 4.6, 7.6, 9.1, 13.1	(0-10') SLAG, SAND and GRAVEL-sized, loose, dark brown and gray, dry, non-plastic, non-cohesive	SW/GW
10	100	-, -, -, -, -	(10-15') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown and gray, moist, dry then wet at 13' bgs, non-plastic, non-cohesive	GW-GM
15	100	20.6, 32.1, 47.4, 43.9, 843.5, -, 75.1, 32.8, 48.0, 8.4, 6.9, 11.2, 24.1, 98.7, 140.7, -, -	(15-32') SLAG, SAND and GRAVEL-sized, loose, gray, wet, non-plastic, non-cohesive	SW/GW
30	100	-, -, -	(32-35') SAND, very fine, medium dense, very light brown, wet, non-plastic, non-cohesive	SP
35			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.91'

Wet at 13' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 14.5' bgs
Bottom: 17.5' bgs

Sand Blotter: #1 Sand
Top: 17.5' bgs
Bottom: 18' bgs

Filter Pack: #2 Sand
Top: 18' bgs
Bottom: 35' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 20' bgs
Bottom: 35' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/07/2019
Purged Amount: 16 gallons
Well Volumes Removed: 3.94

ARM Group Inc.
Engineers and Scientists

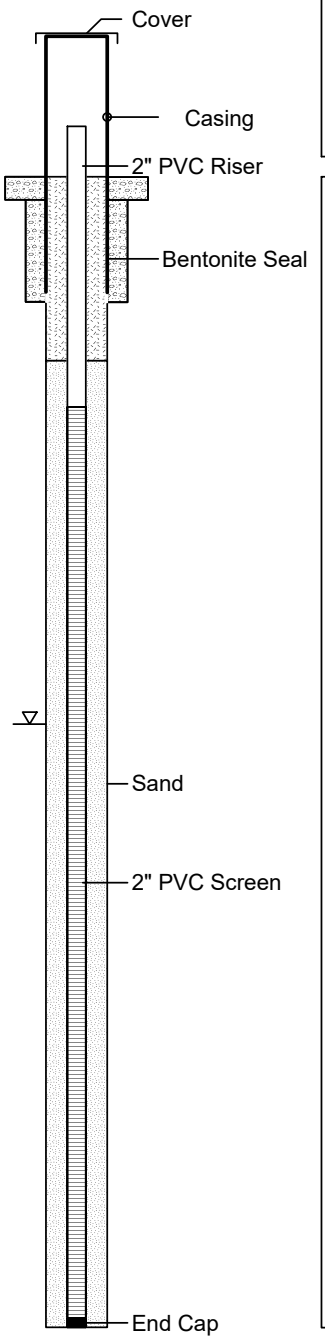
Well ID: CODD-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561604.50
Easting (ft)	: 1457576.29
Date/Time Started	: 4/14/19 1100
Date/Time Completed	: 4/14/19 1205
Surf. Elev. (ft AMSL)	: 12.30
TOC Elev. (ft AMSL)	: 14.37
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 15.01' TOC
Depth to Water (ft)	: 48 hr: 13.55' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		1.1	(0-23') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, dry then wet at 10.5' bgs, non-plastic, non-cohesive	
		1.8		
		3.3		
		0.6		
		1.7		
5	100	-		
		1.1		
		3.1		
		1.0		
		2.1		
10		10.4		SW/GW
		3.5		
	100	3.3		
		1.3		
		3.4		
15		3.3		
		7.2		
		2.9		
		11.4		
		4.2		
20	100	-		
		35.0		
		3.4		
		13.3	(23-25') SAND, very fine, dense, black grading to gray, wet, non-plastic, non-cohesive	SP
25		39.1		
			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 3.81'

Wet at 10.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/02/2019
Purged Amount: 19 gallons
Well Volumes Removed: 8.41

ARM Group Inc.
Engineers and Scientists

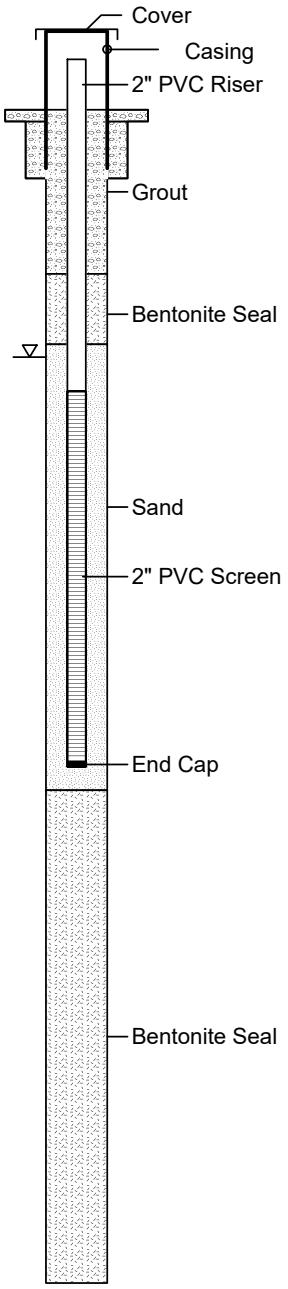
Well ID: COD-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561792.57
Easting (ft)	: 1454723.99
Date/Time Started	: 4/9/19 0930
Date/Time Completed	: 4/10/19 1700
Surf. Elev. (ft AMSL)	: 11.63
TOC Elev. (ft AMSL)	: 13.74
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 16.82' TOC
Depth to Water (ft)	: 48 hr: 13.29' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	653.1 252.3 6618 1702 3841 - 309.6	(0-6.5') SILT with trace SLAG GRAVEL, soft, dark brown, dry, non-plastic, non-cohesive	ML
5		180.6 125.8 67.1	(6.5-10') SILTY SAND with SLAG GRAVEL, loose, dark brown, dry, non-plastic, non-cohesive	SM
10	100	76.3 49.0 119.8 6386 - 13.3	(10-11') SLAG GRAVEL and SILT, loose, dark brown, dry, non-plastic, non-cohesive	GW/ML
			(11-15') SILT with trace SLAG GRAVEL, soft, dark brown, dry then very moist at 12.5' bgs, non-plastic, non-cohesive	ML
15	100	3205 15000 3167 2679	(15-20') SILTY SAND and SLAG GRAVEL, loose, dark brown, wet,non-plastic, non-cohesive	SM
20	100	636.1 264.9 608.2 493.4 877.4	(20-24.5') SILTY SAND and SLAG GRAVEL, loose, dark brown, wet, non-plastic, non-cohesive, strong naphtalene-like odor and product at 24.5' bgs	SM/GW
25	100	424.5 273.3 320.5 141.7 89.9	(24.5-27') SILT and SAND, loose, black, wet, non-plastic, non-cohesive	ML/SW
			(27-29.8') CLAY, very soft, black, wet, low plasticity, cohesive	CL
30	100	-	(29.8-30') SAND, fine, very dense, light brown, moist, non-plastic, non-cohesive, oil present at 30' bgs	SP SM ML
		-	(30-32.4') SILTY SAND, very loose, black, wet, non-plastic, non-cohesive	ML
35	100	- 0.3 1.7 3.4	(32.4-34.2') SANDY SILT grading to SILT with CLAY, soft, black, wet, non-plastic, non-cohesive	CL
40	100	- 3.8 0.7	(32.7-34.2') CLAYEY SILT, very soft, black, wet, non-plastic, non-cohesive	
			(34.2-39') CLAY, very soft, black, wet, low plasticity, cohesive	
45	100	-	(39-50') SAND, fine, very dene, very light brown, wet, non-plastic, non-cohesive	SP
50			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.54'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 7' bgs

Bentonite Seal: 3/8" chips
Top: 7' bgs
Bottom: 10' bgs

Filter Pack: #2 Sand
Top: 10' bgs
Bottom: 28' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 12' bgs
Bottom: 28' bgs
Total Screen: 16'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Development
Date: 04/22/2019
Purged Amount: 19 gallons
Well Volumes Removed: 6.93

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ARM Group Inc.
Engineers and Scientists

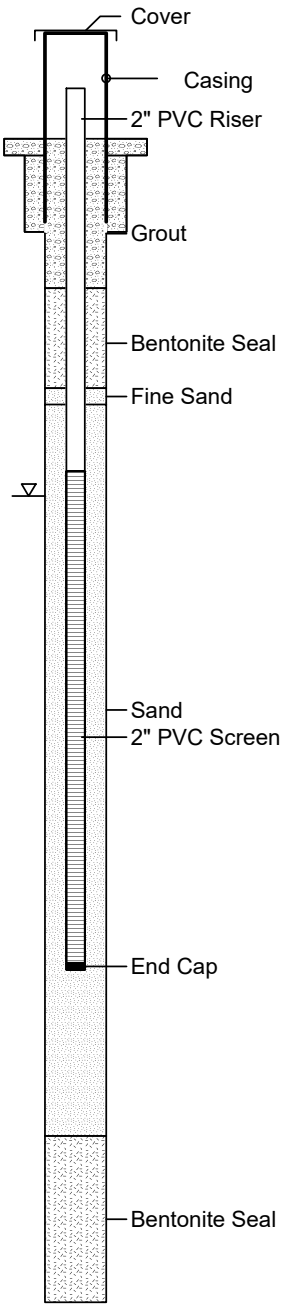
Well ID: COE-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561802.96
Easting (ft)	: 1454925.93
Date/Time Started	: 4/24/19 1320
Date/Time Completed	: 4/24/19 1700
Surf. Elev. (ft AMSL)	: 11.34
TOC Elev. (ft AMSL)	: 13.98
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 13.37' TOC
Depth to Water (ft)	: 48 hr: 13.50' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		3.1	(0-15') SILT with SLAG, SAND and GRAVEL-sized, soft, dark brown, dry, non-plastic, non-cohesive	
		1.1		
		7.7		
		1.5		
		11.9		
5	100	-		
		18.2		
		13.2		ML/GW
		48.4		
		11.5		
10		0.6		
		0.3		
	100	3.6		
		14.6		
		4.6		
15		6.2	(15-25') SLAG, SAND and GRAVEL-sized, loose, dark brown, wet, non-plastic, non-cohesive	
		5.9		
		3.5		
		3.6		
		69.8		
20	100	-		GW/SW
		25.5		
		3.4		
		1.8		
		12.4		
25		0.0	(25-35') CLAY, soft, dark brown, moist, low plasticity, cohesive	
		0.0		
		0.0		
		0.0		
		0.0		
30	100	0.0		CL
		0.0		
		0.0		
		0.0		
		0.0		
		0.0		
35		0.0		
			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.61'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 4.5' bgs

Bentonite Seal: 3/8" chips
Top: 4.5' bgs and 30' bgs
Bottom: 7.5' bgs and 35' bgs

Filter Pack: #2 Sand
Top: 8' bgs
Bottom: 30' bgs

Sand: #1
Top: 7.5' bgs
Bottom: 8' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 10' bgs
Bottom: 25' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/06/2019
Purged Amount: 10 gallons
Well Volumes Removed: 4.29

ARM Group Inc.
Engineers and Scientists

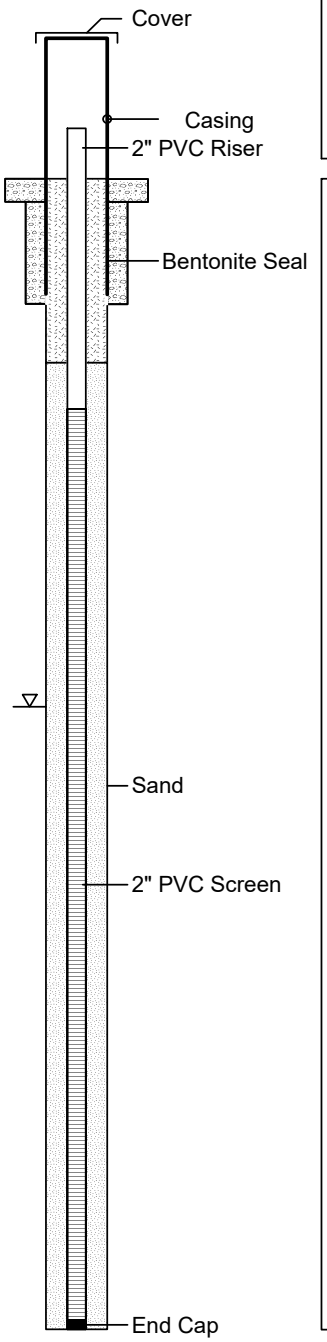
Well ID: COFF-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561492.27
Easting (ft)	: 1458030.69
Date/Time Started	: 4/14/19 0800
Date/Time Completed	: 4/14/19 0850
Surf. Elev. (ft AMSL)	: 11.72
TOC Elev. (ft AMSL)	: 14.78
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 14.04' TOC
Depth to Water (ft)	: 48 hr: 14.22' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.8	(0-14') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, dry then wet at 11' bgs, non-plastic, non-cohesive	
		0.8		
		0.7		
		10.2		
		29.1		
5	100	-		
		11.1		SW/GW
		21.4		
		4.1		
		6.6		
10		-		
		12.7		
	100	3.2		
		9.7		
		3.1	(14-15') BRICK, red	NA
15		6.0	(15-25') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, wet, non-plastic, non-cohesive	
		0.9		
		5.5		
		6.4		
		3.1		
20	100	-		SW/GW
		4.8		
		14.7		
		2.2		
		1.1		
25			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 3.03'

Wet at 11' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/25/2019
Purged Amount: 22 gallons
Well Volumes Removed: 9.40

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ARM Group Inc.
Engineers and Scientists

Well ID: COF-MWS

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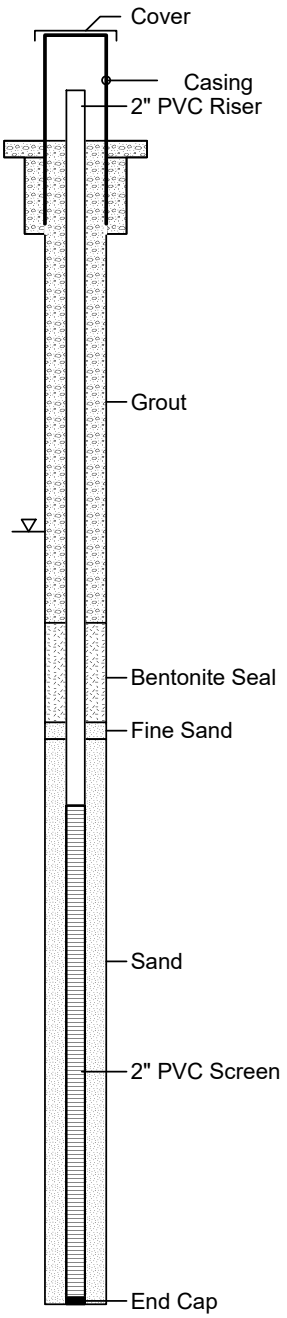
Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561671.42
Easting (ft)	: 1454219.19
Date/Time Started	: 4/26/19 1400
Date/Time Completed	: 4/27/19 0930
Surf. Elev. (ft AMSL)	: 11.62
TOC Elev. (ft AMSL)	: 14.51
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 14.05' TOC
Depth to Water (ft)	: 48 hr: 14.51' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		2.1	(0-7') SLAG, SAND and GRAVEL-sized, loose, dark brown to gray, dry, non-plastic, non-cohesive	SW/GW
		0.1		
		0.1		
		1.2		
5	100	2.7		
		-		
		0.0		
		0.0	(7-10') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown, dry, non-plastic, non-cohesive	SW/GW
		0.7		
10		1.6		
		0.0	(10-24') SLAG, SAND and GRAVEL-sized, loose, dark brown to gray, then gray at 15' bgs, dry then wet at 14.5' bgs, non-plastic, non-cohesive, napthalene-like odor from 23-25' bgs	SW/GW
		0.1		
	100	0.2		
		0.3		
15		0.5		
		0.2		
		0.3		
		0.0		
		0.4		
		6.7		
20	100	-		
		0.8		
		2.8		
		60.6		
		155.8	(24-25') SANDY CLAY, medium dense, gray, wet, low plasticity, cohesive	CL
25		7.5	(25-33') SILTY SLAG, SAND and GRAVEL-sized, medium dense, gray, wet, non-plastic, non-cohesive	GM/SM
		16.6		
		6.4		
		2.2		
		0.9		
30	100	-		
		3.5		
		12.4		
		1.7	(33-35') SILTY CLAY, medium dense, gray, wet, low plasticity, cohesive	CL
35		1.6		
			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.88'

Wet at 14.5' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 14.5' bgs
Bottom: 17.5' bgs

Filter Pack: #2 Sand
Top: 18' bgs
Bottom: 35' bgs

Sand Blotter: #1 Sand
Top: 17.5' bgs
Bottom: 18' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 20' bgs
Bottom: 35' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/07/2019
Purged Amount: 16 gallons
Well Volumes Removed: 4.11

ARM Group Inc.
Engineers and Scientists

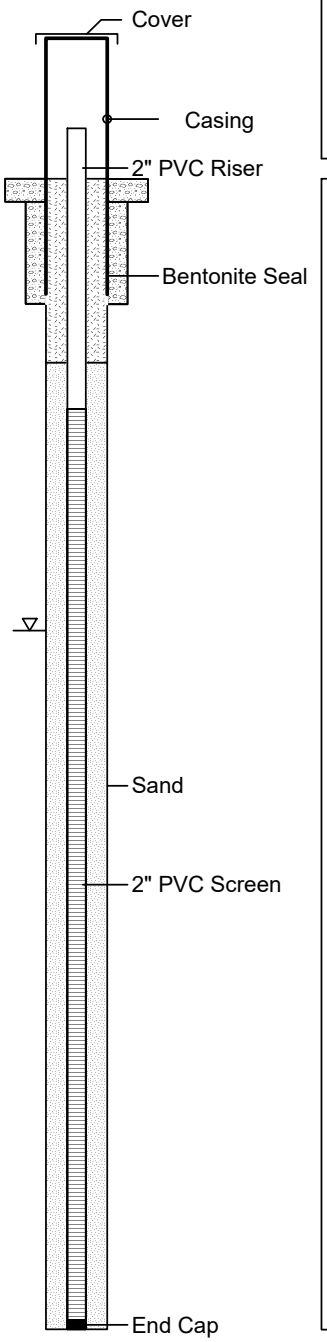
Well ID: COGG-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 5
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561156.32
Easting (ft)	: 1458040.33
Date/Time Started	: 4/14/19 0915
Date/Time Completed	: 4/14/19 1010
Surf. Elev. (ft AMSL)	: 10.60
TOC Elev. (ft AMSL)	: 12.69
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 12.50' TOC
Depth to Water (ft)	: 48 hr: 12.57' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		3.3	(0-25') SLAG, SAND and GRAVEL-sized, and SILT, loose, dark brown, dry then wet at 11.5' bgs, non-plastic, non-cohesive	
		0.7		
		16.4		
		1.6		
		4.7		
5	100	-		
		10.0		
		4.9		
		3.3		
		0.4		
10		9.8		
		7.9		
	100	7.3		SW/GW
		12.3		
		0.8		
15		0.7		
		0.4		
		0.7		
		0.3		
		5.5		
20	100	-		
		4.1		
		2.9		
		4.7		
		6.5		
25			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.31'

Wet at 11.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 25' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 25' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/25/2019
Purged Amount: 17.5 gallons
Well Volumes Removed: 7.00

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ARM Group Inc.
Engineers and Scientists

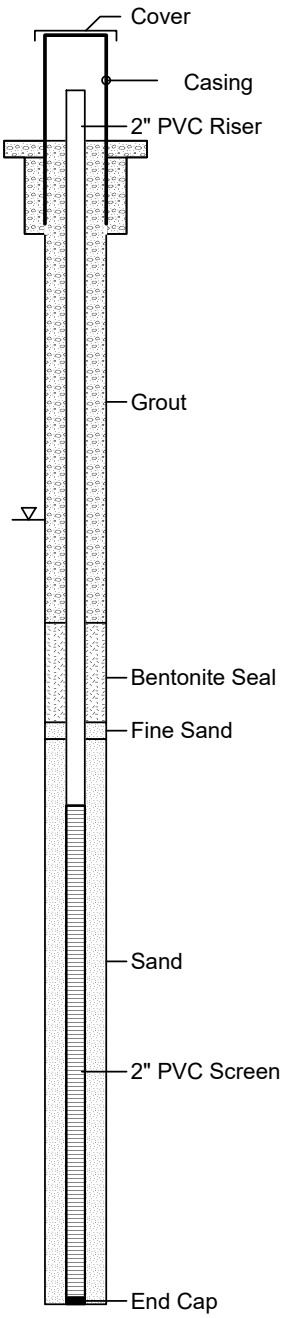
Well ID: COG-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561660.62
Easting (ft)	: 1454465.55
Date/Time Started	: 4/26/19 1030
Date/Time Completed	: 4/26/19 1200
Surf. Elev. (ft AMSL)	: 11.28
TOC Elev. (ft AMSL)	: 13.77
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 13.64' TOC
Depth to Water (ft)	: 48 hr: 13.99' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.0	(0-8') SILTY SLAG GRAVEL, loose, brown, moist, non-plastic, non-cohesive	GM
		0.1		
		0.2		
		0.0		
5	100	0.0		
		-		
		0.0		
		0.0		
		3.1	(8-13.5') SLAG, SAND and GRAVEL-sized, loose, brown and gray, moist, non-plastic, non-cohesive	GW/SW
		0.3		
10		0.0		
	100	0.0		
		0.0		
		0.0	(13.5-15') SILT with SLAG, loose, brown, moist, non-plastic, non-cohesive	ML
15		307.5	(15-30') SLAG, SAND and GRAVEL-sized, loose, gray, wet, non-plastic, non-cohesive	SW/GW
		569.5		
		91.8		
		51.6		
		1996		
20	100	-		
		9.1		
		99.4		
		150.6		
		15.5		
25		1.2		
		1.3		
		1.8		
		10.2		
		224.6		
30	100	-	(30-32') CLAY, soft, gray, moist, low plasticity, cohesive	CL
		1.6		
		17.3	(32-35') SAND, fine, dense, gray, wet, non-plastic, non-cohesive	SP
		1.7		
35		1.5		
			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.51'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 14.5' bgs
Bottom: 17.5' bgs

Filter Pack: #2 Sand
Top: 18' bgs
Bottom: 35' bgs

Sand Blotter: #1 Sand
Top: 17.5' bgs
Bottom: 18' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 20' bgs
Bottom: 35' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/07/2019
Purged Amount: 16 gallons
Well Volumes Removed: 3.97

ARM Group Inc.
Engineers and Scientists

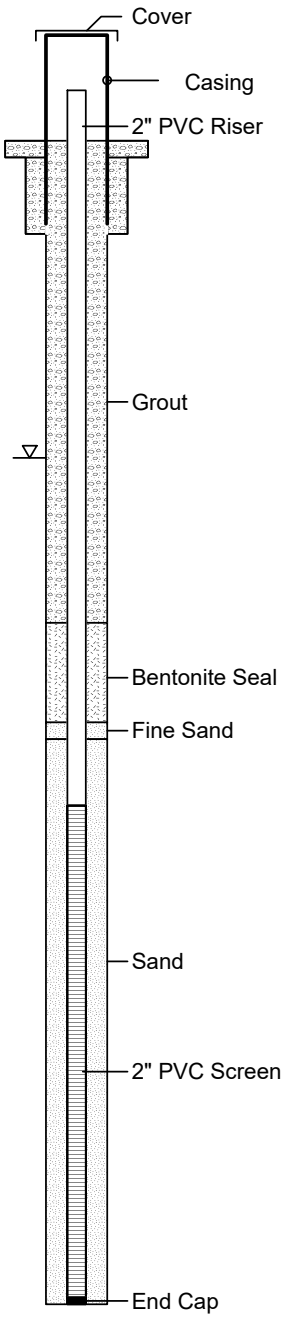
Well ID: COH-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig

Northing (ft)	: 561707.14
Easting (ft)	: 1454648.50
Date/Time Started	: 4/26/19 0750
Date/Time Completed	: 4/26/19 1000
Surf. Elev. (ft AMSL)	: 10.60
TOC Elev. (ft AMSL)	: 13.76
Total Well Depth (ft)	: 35' bgs
Depth to Water (ft)	: 0 Hr: 12.09' TOC
Depth to Water (ft)	: 48 hr: 12.29' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		-		
		0.0	(0-3') SILT, loose, dark brown, dry, non-plastic, non-cohesive	ML
		0.0		
		0.3		
		0.7	(3-10') SLAG, SAND and GRAVEL-sized, loose, dark brown, dry, non-plastic, non-cohesive	
5	100	-		
		0.5		GW
		1.2		
		0.2		
		0.9		
10		0.7	(10-11') SILTY SLAG, loose, dark brown, moist, non-plastic, non-cohesive	GM
		1.4		
	100	4.6	(11-21.5') SLAG, SAND and GRAVEL-sized, loose, light brow to very pale brown 11-14' bgs, dark brown 14-15' bgs, gray 15-21.5' bgs, dry, non-plastic, non-cohesive	
		10.2		
15		5.0		
		0.2		SW/GW
		1.9		
		42.0		
		30.3		
		46.0		
20	100	-		
		6.7		
		7.7	(21.5-33') SILTY SLAG, loose, gray, wet, non-plastic, non-cohesive	
		50.7		
		41.2		
25		42.4		
		298.8		GM
		34.8		
		-		
		954.7		
30	100	-		
		143.9		
		309.7		
		278.0	(33-35') SLAG, SAND and GRAVEL-sized, loose, gray, wet, non-plastic, non-cohesive	SW/GW
35		71.5		
			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.11'

Wet at 14' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 14.5' bgs

Bentonite Seal: 3/8" chips
Top: 14.5' bgs
Bottom: 17.5' bgs

Filter Pack: #2 Sand
Top: 18' bgs
Bottom: 35' bgs

Sand Blotter: #1 Sand
Top: 17.5' bgs
Bottom: 18' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 20' bgs
Bottom: 35' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/06/2019
Purged Amount: 20 gallons
Well Volumes Removed: 4.80

ARM Group Inc.
Engineers and Scientists

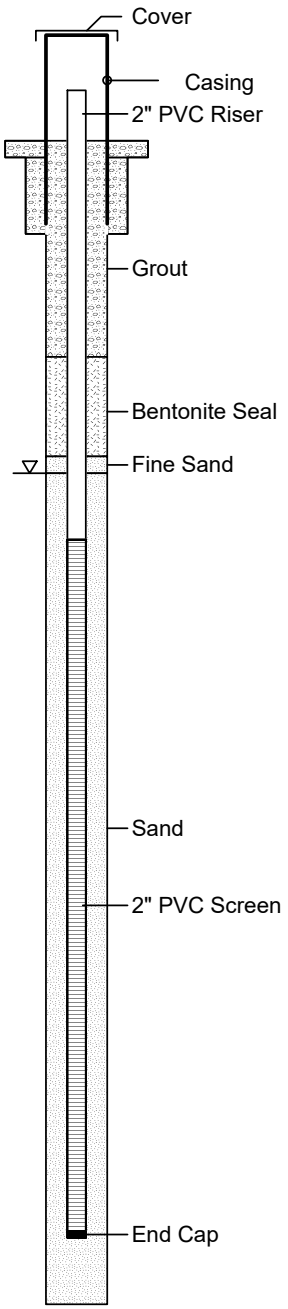
Well ID: COI-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561676.61
Easting (ft)	: 1454778.73
Date/Time Started	: 4/25/19 1230
Date/Time Completed	: 4/26/19 1000
Surf. Elev. (ft AMSL)	: 10.77
TOC Elev. (ft AMSL)	: 13.30
Total Well Depth (ft)	: 32' bgs
Depth to Water (ft)	: 0 Hr: 12.35' TOC
Depth to Water (ft)	: 48 hr: 12.75' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.1	(0-9.5') SLAG, SAND and GRAVEL-sized, loose, brown to black, moist, non-plastic, non-cohesive	
		0.2		
		0.2		
		0.3		
5	100	0.3		SW/GW
		-		
		0.2		
		0.0		
		0.1		
		0.0		
10		0.0	(9.5-10.5') CLAY with SILT, very firm, very light brown to light brown, dry, low plasticity, cohesive	CL
		0.0	(10.5-28') SLAG, SAND and GRAVEL-sized, with some SILT 10.5-15' bgs, loose, brown to black, moist then wet at 15' bgs, non-plastic, non-cohesive	
	100	0.0		
		0.0		
		0.0		
15		-		
		-		
		-		
		-		
		-		SW/GW
20	100	-		
		-		
		-		
		-		
		-		
		-		
25		98.5		
		78.2		
		127.9		
		0.8	(28-30') SILTY SAND, very fine, dense, gray, wet, non-plastic, non-cohesive	SM
		17.5		
30	100	-	(30-35') CLAY, very firm, brown, moist, low plasticity, cohesive	
		65.1		
		78.5		CL
		2.9		
		1.5		
35			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.13'

Wet at 15' bgs

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 6.5' bgs

Bentonite Seal: 3/8" chips
Top: 6.5' bgs
Bottom: 9.5' bgs

Filter Pack: #2 Sand
Top: 10' bgs
Bottom: 35' bgs

Sand Blotter: #1 Sand
Top: 9.5' bgs
Bottom: 10' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 12' bgs
Bottom: 32' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/06/2019
Purged Amount: 14 gallons
Well Volumes Removed: 3.76

ARM Group Inc.
Engineers and Scientists

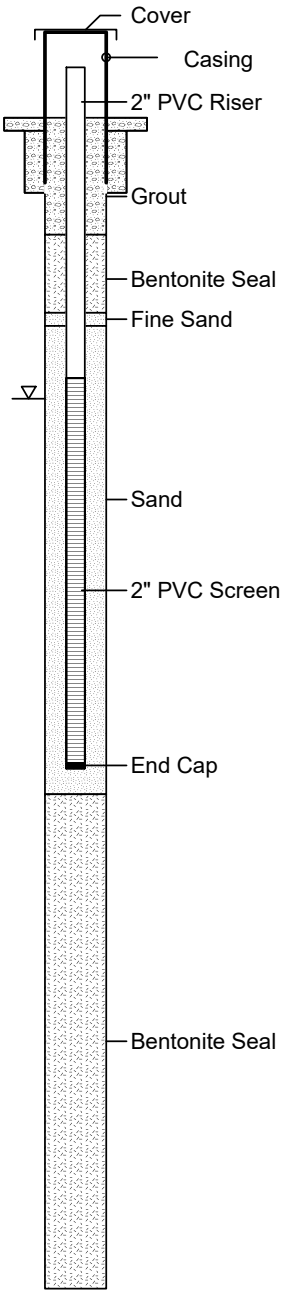
Well ID: COJ-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 3
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 561684.22
Easting (ft)	: 1454936.95
Date/Time Started	: 4/25/19 730
Date/Time Completed	: 4/25/19 1100
Surf. Elev. (ft AMSL)	: 10.38
TOC Elev. (ft AMSL)	: 13.86
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0 Hr: 13.14' TOC
Depth to Water (ft)	: 48 hr: 13.55' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		2.1	(0-25') SLAG, SAND and GRAVEL-sized, loose, brown to dark brown, dry then wet at 15' bgs, non-plastic, non-cohesive	
5	100	1.8 2.5 3.6 11.1 - 2.3 4.9 1.9 0.5		
10	100	4.6 5.8 3.0 23.8 2.4 - - - - - - - - - -		SW/GW
15				
20	100			
25		0.0	(25-35') CLAY, very firm, brown, moist, low plasticity, cohesive	
30	100	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0		CL
35		-	(35-45') SLAG, SAND and GRAVEL-sized, loose, brown to dark brown, wet, non-plastic, non-cohesive	
40	100	- - - - - - - - - -		SW/GW
45			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 3.65'

Wet at 15' bgs
Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 4.5' bgs

Bentonite Seal: 3/8" chips
Top: 4.5' bgs
Bottom: 7.5' bgs

Filter Pack: #2 Sand
Top: 8' bgs
Bottom: 25' bgs

Sand Blotter: #1 Sand
Top: 7.5' bgs
Bottom: 8' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 10' bgs
Bottom: 25' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/06/2019
Purged Amount: 12 gallons
Well Volumes Removed: 5.06

ARM Group Inc.
Engineers and Scientists

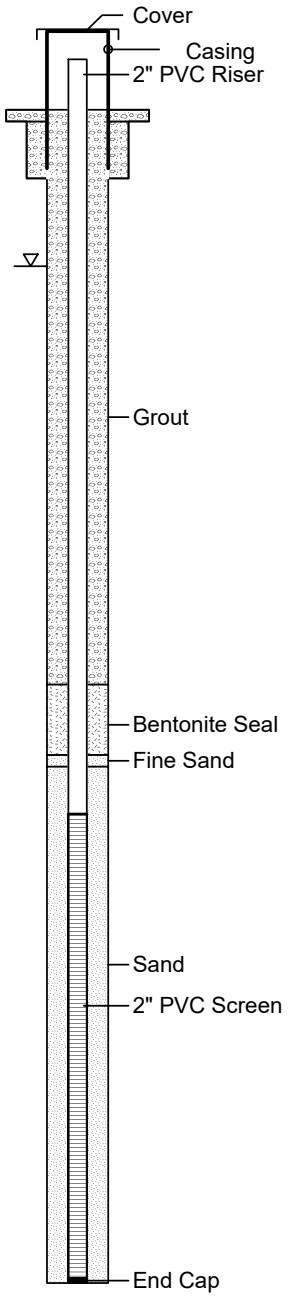
Well ID: COK-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563234.63
Easting (ft)	: 1454749.25
Date/Time Started	: 4/12/19 0825
Date/Time Completed	: 4/12/19 0920
Surf. Elev. (ft AMSL)	: 4.60
TOC Elev. (ft AMSL)	: 6.83
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 8.72' TOC
Depth to Water (ft)	: 48 hr: 9.42' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	15.4, 21.8, 31.5, 39.7	(0-4') SANDY SILT, medium dense, brown, dry, non-plastic, non-cohesive	ML
5		67.4, 187.7, 172.7	(4-6') SAND and GRAVEL, loose, dark brown, dry, non-plastic, non-cohesive	SW/GW
	100	28.5, 66.2, 88.9	(6-9.9') SAND, very fine, dense, dark brown, wet, non-plastic, non-cohesive	SP
10		54.8, 73.3, 108.6	(9.9-11.5') Fine GRAVEL and SAND, medium, loose, brown, wet, non-plastic, non-cohesive	GW/SW
	100	171.8, 91.8	(11.5-18') SLAG, SAND and GRAVEL-sized, loose, gray to light gray, wet, non-plastic, non-cohesive	GW/SW
15		- - -		
	100	4.9, 0.8	(18-29') SLAG, SAND and GRAVEL-sized, loose, light gray grading to gray, then grading to dark gray, wet, non-plastic, non-cohesive	SW/GW
20		- - - - - - - - -		
25	100	3.9		
30		17.9 -	(29-50') SAND, very fine, very dense, light gray then black at 48' bgs, wet, non-plastic, non-cohesive	SP
35	100			
40				
45	100	4.8, 12.6, 26.0, 14.1, 8.1, 34.7, 6.7		
50			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.39'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 6' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/24/2019
Purged Amount: 36 gallons
Well Volumes Removed: 5.15

ARM Group Inc.
Engineers and Scientists

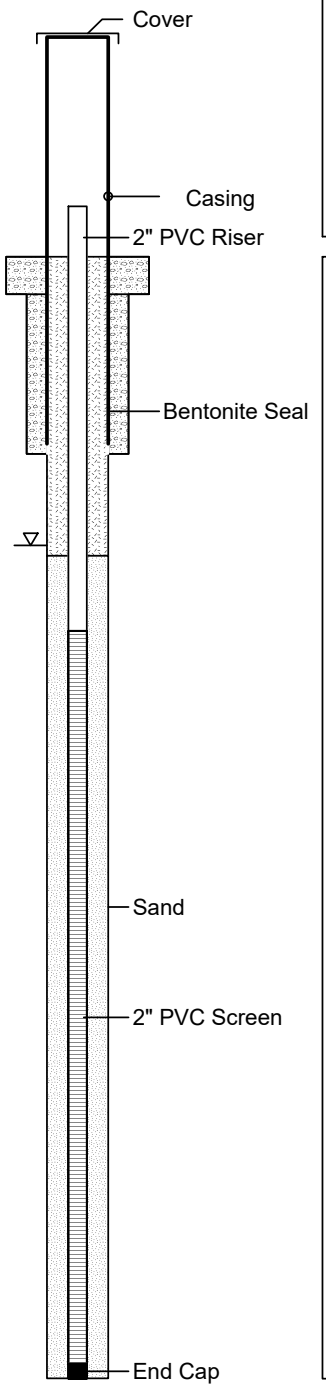
Well ID: COK-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563234.96
Easting (ft)	: 1454751.72
Date/Time Started	: 4/12/19 0740
Date/Time Completed	: 4/12/19 0815
Surf. Elev. (ft AMSL)	: 4.61
TOC Elev. (ft AMSL)	: 6.62
Total Well Depth (ft)	: 15' bgs
Depth to Water (ft)	: 0 Hr: 6.69' TOC
Depth to Water (ft)	: 48 hr: 6.61' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		15.4	(0-4') SANDY SILT, medium dense, brown, dry, non-plastic, non-cohesive	ML
	100	21.8		
		31.5		
		39.7		
		67.4	(4-6') SAND and GRAVEL, loose, dark brown, dry, non-plastic, non-cohesive	SW/GW
5		187.7		
		172.7	(6-9.9') SAND, very fine, dense, dark brown, wet, non-plastic, non-cohesive	SP
	100	28.5		
		66.2		
		88.9		
10		54.8	(9.9-11.5') Fine GRAVEL and SAND, medium, loose, brown, wet, non-plastic, non-cohesive	GW/SW
		73.3	(11.5-15') SLAG, SAND and GRAVEL-sized, loose, gray to light gray, wet, non-plastic, non-cohesive	GW/SW
	100	108.6		
		171.8		
		91.8		
15			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.79'

Wet at 6' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 15' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 15' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/24/2019
Purged Amount: 7 gallons
Well Volumes Removed: 3.83

ARM Group Inc.
Engineers and Scientists

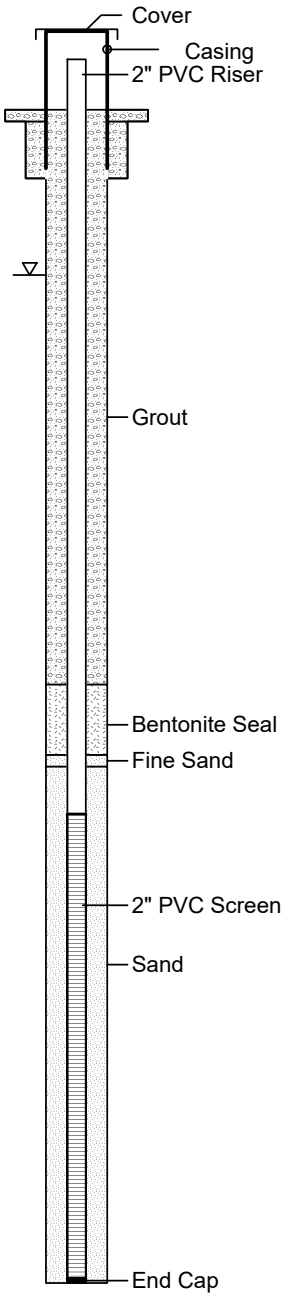
Well ID: COL-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563246.33
Easting (ft)	: 1454911.00
Date/Time Started	: 4/11/19 1440
Date/Time Completed	: 4/11/19 1600
Surf. Elev. (ft AMSL)	: 4.62
TOC Elev. (ft AMSL)	: 7.56
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 9.99' TOC
Depth to Water (ft)	: 48 hr: 9.80' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		4.4 4.6	(0-2') CLAY, firm, red to light red, dry, low plasticity, cohesive	CL
		27.4 15.2 48.9	(2-5') SILT, SAND and GRAVEL, medium dense, brown, moist, non-plastic, non-cohesive	ML/SW
5	100	- 6.2 28.9 70.7 58.4	(5-11') SLAG, SAND-sized, very fine, dense, black, wet, non-plastic, non-cohesive	SP
10		297.9 462.9		
	100	167.6 2009	(11-13') SLAG, SAND and GRAVEL-sized, medium dense, dark bluish gray, wet, non-plastic, non-cohesive	SW/GW
15		360.6 31.6 93.5	(13-18.5') SAND with some GRAVEL, medium dense, dark gray, wet, non-plastic, non-cohesive	SW
	100	399.6 3107		
		2315	(18.5-19.5') CLAY, soft to firm, dark gray, wet, low plasticity, cohesive	CL
20		3031 407.9 1246	(19.5-23') GRAVEL and SAND, fine, dense, dark gray, wet, non-plastic, non-cohesive	GW/SW
		1591 87.9	(23-25') SAND, very fine, dense, dark gray, wet, non-plastic, non-cohesive	SP
25	100	- 30.0 79.1 42.2	(25-35.7') SANDY CLAY, hard, very pale brown, moist, low plasticity, cohesive, with a sand lens from 28-28.2' bgs	CL
30		58.6 -		
		15.9 27.6		
		21.3 72.4		
35	100	- 36.7	(35.7-37.5') SAND, very fine, very dense, very pale brown, wet, non-plastic, non-cohesive	SP
		- 297.5		CL
40		357.1 -	(37.5-40') SANDY CLAY, hard, very pale brown, moist, low plasticity, cohesive	
		6447 2008	(40-50') SAND, very fine, very dense, dark gray, wet, non-plastic, non-cohesive	
		1879 2208		
45	100	392.4 7047		SP
		15000 1482		
50		2143	End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.86'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 5' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Product odor 11-50' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/23/2019
Purged Amount: 33 gallons
Well Volumes Removed: 4.63

ARM Group Inc.
Engineers and Scientists

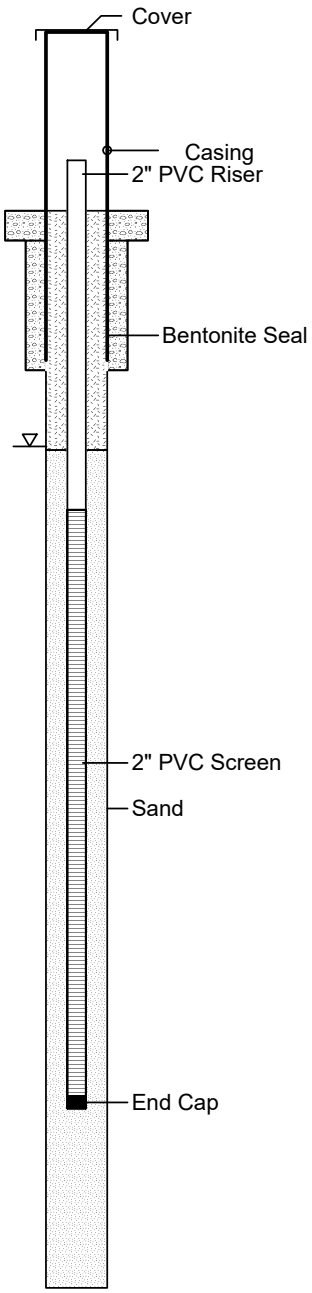
Well ID: COL-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563247.85
Easting (ft)	: 1454916.39
Date/Time Started	: 4/11/19 1340
Date/Time Completed	: 4/11/19 1430
Surf. Elev. (ft AMSL)	: 4.65
TOC Elev. (ft AMSL)	: 7.38
Total Well Depth (ft)	: 15' bgs
Depth to Water (ft)	: 0 Hr: 6.74' TOC
Depth to Water (ft)	: 48 hr: 6.69' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		4.4	(0-2') CLAY, medium, red to light red, dry, low plasticity, cohesive	CL
		4.6		
		27.4	(2-5') SILT, SAND and GRAVEL, medium dense, brown, moist, non-plastic, non-cohesive	ML/SW
		15.2		
		48.9		
5	100	-	(5-11') SLAG, SAND-sized, very fine, dense, black, wet, non-plastic, non-cohesive	SP
		6.2		
		28.9		
		70.7		
		58.4		
10		297.9		
		462.9	(11-13') SLAG, SAND and GRAVEL-sized, medium dense, dark bluish gray, wet, non-plastic, non-cohesive	SW/GW
	100	167.6		
		2009	(13-18') SAND with some GRAVEL, medium dense, dark gray, wet, non-plastic, non-cohesive	SW
		360.6		
15		31.6		
	100	93.5		
		399.6		
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.72'

Wet at 5' bgs

Product-like odor in core
11-18' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 15' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 15' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/23/2019
Purged Amount: 18 gallons
Well Volumes Removed: 10.29

ARM Group Inc.
Engineers and Scientists

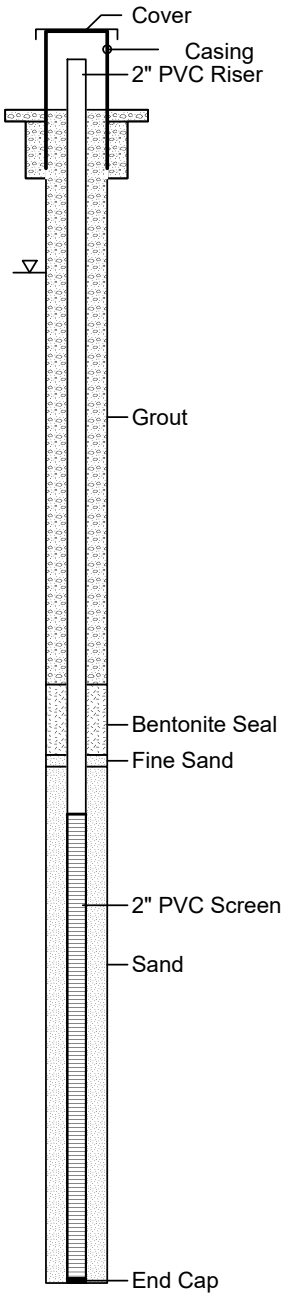
Well ID: COM-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563260.43
Easting (ft)	: 1455059.50
Date/Time Started	: 4/11/19 0930
Date/Time Completed	: 4/11/19
Surf. Elev. (ft AMSL)	: 5.70
TOC Elev. (ft AMSL)	: 7.43
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 9.83' TOC
Depth to Water (ft)	: 48 hr: 9.70' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	2.7 8.1 29.1 113.7 188.9	(0-1') CLAY, firm, brown, dry, low plasticity, cohesive	CL
			(1-5') SILT and CLAY with GRAVEL, soft, black, dry, low plasticity, cohesive	ML
5	100	15000 4238 2693 2739	(5-9') SAND, fine, dense, black, wet, non-plastic, non-cohesive	SP
10	100	2496 3466 6986 2897 15000	(9-11') SLAG, SAND and GRAVEL-sized, loose, gray, wet, non-plastic, non-cohesive	SW/GW
15	100	15000 - 590.1 488.2 1408	(11-21.5') SLAG, SAND-sized, fine, and some GRAVEL-sized, medium dense, gray to green, wet, non-plastic, non-cohesive	SW/GW
20	100	363.2 - 380.0 738.7 1867	(21.5-28.5') CLAY, soft, gray, wet, low plasticity, cohesive	CL
25	100	698.2 44.2 - 355.9 795.4	(28.5-37') SAND, fine, dense, brown to light brown then gray to dark gray 29-37' bgs, wet, non-plastic, non-cohesive	SP
30	100	3178 959.8 1026 141.7 1108	(37-39') SAND, very fine, very dense, light gray, moist, non-plastic, non-cohesive	SP
35	100	- 658.7 1159 3537 4971	(39-46') SAND, fine, dense, gray to dark gray, wet, non-plastic, non-cohesive	SP
40	100	1574 15000 15000 -	(46-50') SAND, very fine, very dense, light gray, moist, non-plastic, non-cohesive	SP
45	100	- - - - 8688		
50		15000 814.9	End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 1.58'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 5' bgs

Product in core 5-11' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/23/2019
Purged Amount: 33 gallons
Well Volumes Removed: 4.65

ARM Group Inc.
Engineers and Scientists

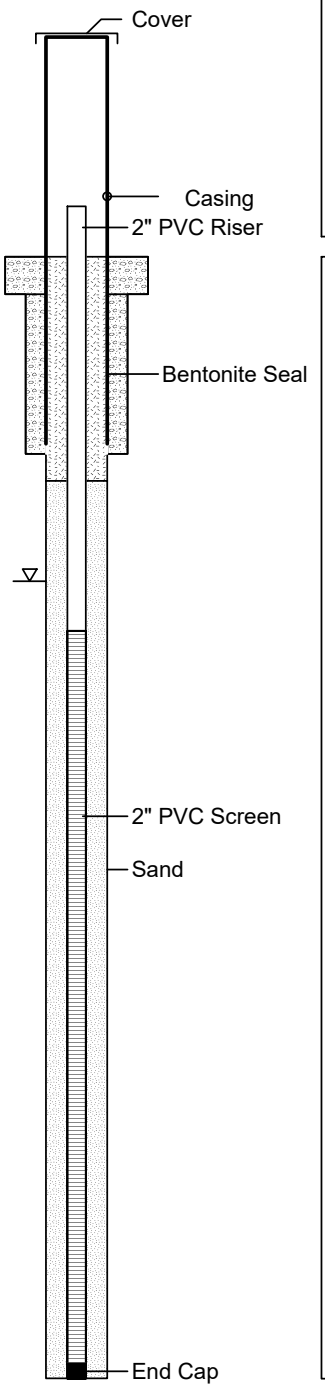
Well ID: COM-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563262.59
Easting (ft)	: 1455064.51
Date/Time Started	: 4/11/19 0830
Date/Time Completed	: 4/11/19 0915
Surf. Elev. (ft AMSL)	: 5.80
TOC Elev. (ft AMSL)	: 8.11
Total Well Depth (ft)	: 15' bgs
Depth to Water (ft)	: 0 Hr: 6.61' TOC
Depth to Water (ft)	: 48 hr: 7.09' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		2.7	(0-1') CLAY, firm, brown, dry, low plasticity, cohesive	CL
		8.1	(1-5') SILT and CLAY with GRAVEL, soft, black, dry, low plasticity, cohesive	ML
	100	29.1		
		113.7		
		188.9		
5		15000	(5-9') SAND, fine, dense, black, wet, non-plastic, non-cohesive	SP
		4238		
	100	2693		
		2739		
		2496	(9-11') SLAG, SAND and GRAVEL-sized, loose, gray, wet, non-plastic, non-cohesive	SW/GW
10		3466		
		6986	(11-15') SLAG, SAND-sized, fine, and some GRAVEL-sized, medium dense, gray to green, wet, non-plastic, non-cohesive	SW/GW
	100	2897		
		15000		
		15000		
15			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.38'

Wet at 5' bgs

Product in core 5-11' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 3' bgs

Filter Pack: #2 Sand
Top: 3' bgs
Bottom: 15' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 15' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/23/2019
Purged Amount: 14 gallons
Well Volumes Removed: 8.28

ARM Group Inc.
Engineers and Scientists

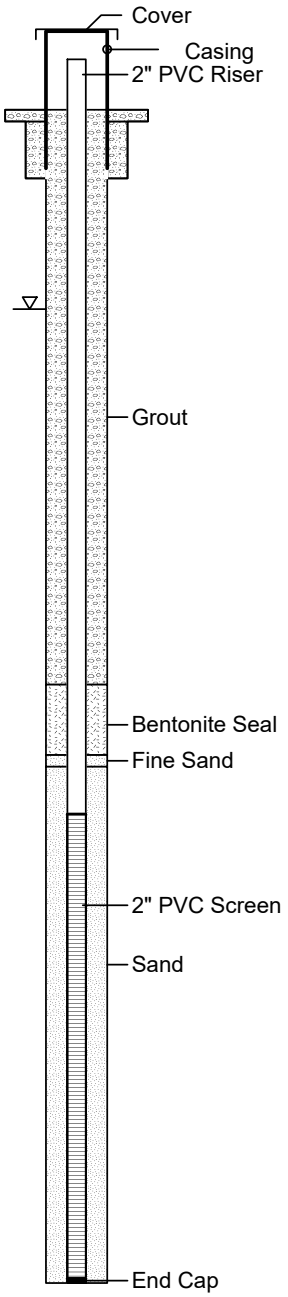
Well ID: CON-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563192.15
Easting (ft)	: 1454354.47
Date/Time Started	: 4/12/19 1150
Date/Time Completed	: 4/12/19 1510
Surf. Elev. (ft AMSL)	: 10.11
TOC Elev. (ft AMSL)	: 11.99
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 10.97' TOC
Depth to Water (ft)	: 48 hr: 11.25' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	1.3, 0.2, 1.5, 0.1, 1.3	(0-10') SANDY SILT, loose, brown then red (2-3.5' bgs), dark brown grading to black (3.5-5' bgs), dry, non-plastic, non-cohesive	ML
5	100	9.6, 5.8, 6.8, 1.0, 4.7		
10	100	0.9, 80.7, 346.2, 2162, 2387	(10-44.5') SLAG, SAND and GRAVEL-sized, loose, gray to black, wet, non-plastic, non-cohesive	SW/GW
15	100	28.8, 238.5, 60.1, 330.3, 5744		
20		- - - - -		
25	100	237.4, 279.9, 69.0, 59.2		
30		- - - - - - - - - -		
35	100			
40		3.1, 4.8, 5.7, 50.6, 111.9		
45	100	- 80.2, 24.7, 10.3, 1.9	(44.5-50') SAND, very fine, very dense, gray grading to light brown, wet, non-plastic, non-cohesive	SP
50			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.14'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 9' bgs

Odor in core 14-20' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/24/2019
Purged Amount: 22 gallons
Well Volumes Removed: 3.26

06-18-2019 P:\EnviroAnalytics Group\190342M COA Onshore Supplemental Investigation\Documents\Boring Logs\2_Bor Logs\CON-MWI.bor

ARM Group Inc.
Engineers and Scientists

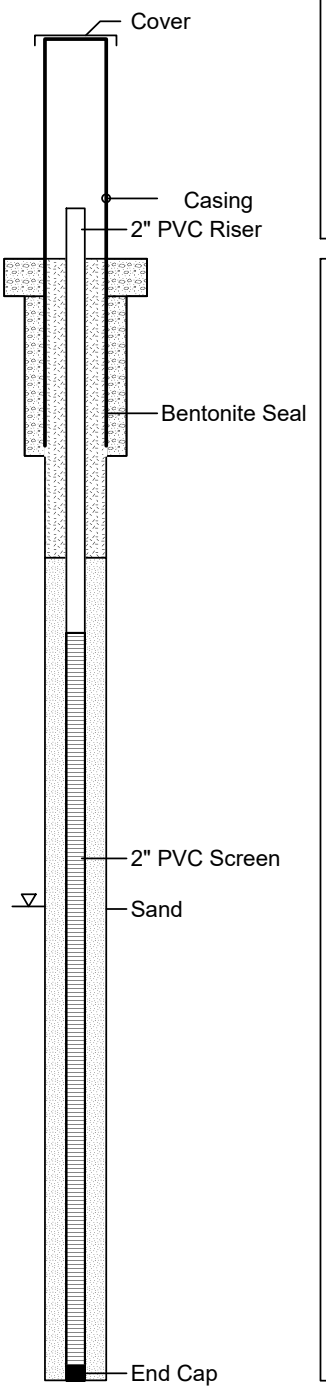
Well ID: CON-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563190.14
Easting (ft)	: 1454350.59
Date/Time Started	: 4/12/19 1120
Date/Time Completed	: 4/12/19 1150
Surf. Elev. (ft AMSL)	: 10.03
TOC Elev. (ft AMSL)	: 12.01
Total Well Depth (ft)	: 15' bgs
Depth to Water (ft)	: 0 Hr: 10.95' TOC
Depth to Water (ft)	: 48 hr: 11.41' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0				
		1.3	(0-10') SANDY SILT, loose, brown then red (2-3.5' bgs), dark brown grading to black (3.5-5' bgs), dry, non-plastic, non-cohesive	
		0.2		
	100	1.5		
		0.1		
		1.3		
5				ML
		9.6		
		5.8		
	100	6.8		
		1.0		
		4.7		
10				
		0.9	(10-15') SLAG, SAND and GRAVEL-sized, loose, gray to black, wet, non-plastic, non-cohesive	
		80.7		
	100	346.2		SW/GW
		2162		
		2387		
15			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.10'

Wet at 9' bgs

Odor in core from 14-15' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 15' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 15' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/24/2019
Purged Amount: 19 gallons
Well Volumes Removed: 18.10

ARM Group Inc.
Engineers and Scientists

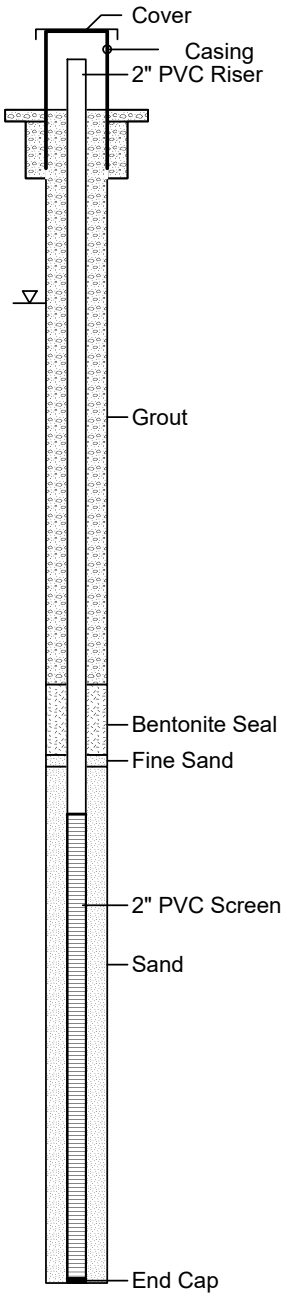
Well ID: COO-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563028.38
Easting (ft)	: 1454319.03
Date/Time Started	: 4/13/19 0830
Date/Time Completed	: 4/13/19 0945
Surf. Elev. (ft AMSL)	: 10.38
TOC Elev. (ft AMSL)	: 12.68
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 11.00' TOC
Depth to Water (ft)	: 48 hr: 10.99' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		4.4		
	100	6.5	(0-9') SILT with SAND and GRAVEL, loose, dark brown, dry, non-plastic, non-cohesive	ML
		8.9		
5		15.0		
	100	22.9		
		20.9		
		13.3		
	100	21.1		
		22.8		
10		67.0	(9-40') SLAG, SAND and GRAVEL-sized, loose, dark brown, wet, non-plastic, non-cohesive	
		1.5		
	100	29.6		
		120.5		
		235.5		
15		201.5		
	100	201.5		
		89.8		
		243.7		
		248.7		
20		264.8		
	100	358.6		
		166.5		
		9900		
		44.9		SW/GW
25		392.2		
	100	-		
		3061		
		301.4		
		248.3		
30		210.3		
	100	186.1		
		133.7		
		366.0		
		339.9		
35		13959		
	100	-		
		243.4		
		112.8		
		147.9		
40		71.8		
	100	184.6	(40-50') SAND, very fine, very dense, light gray to very pale brown, wet, non-plastic, non-cohesive	SP
		173.7		
45		-		
		-		
		-		
		-		
		-		
50		36.5		
		42.7		
			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 1.62'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 9' bgs

Napthalene-like odor in core 17-40' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/25/2019
Purged Amount: 22 gallons
Well Volumes Removed: 3.30

ARM Group Inc.
Engineers and Scientists

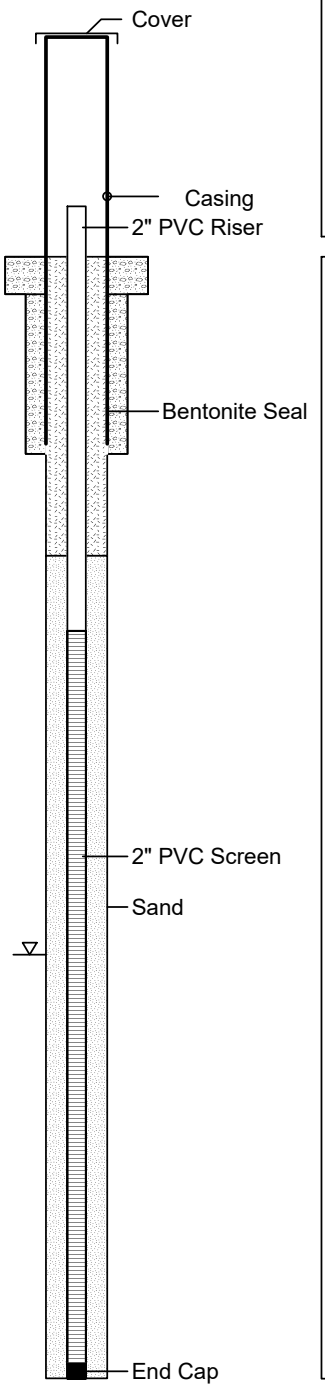
Well ID: COO-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563024.25
Easting (ft)	: 1454318.34
Date/Time Started	: 4/13/19 0750
Date/Time Completed	: 4/13/19 0820
Surf. Elev. (ft AMSL)	: 10.31
TOC Elev. (ft AMSL)	: 12.70
Total Well Depth (ft)	: 15' bgs
Depth to Water (ft)	: 0 Hr: 12.50' TOC
Depth to Water (ft)	: 48 hr: 12.08' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0				
		4.4	(0-9') SILT with SAND and GRAVEL, loose, dark brown, dry, non-plastic, non-cohesive	
		6.5		
	100	8.9		
		15.0		
		22.9		ML
5				
		20.9		
		13.3		
	100	21.1		
		22.8		
		67.0	(9-15') SLAG, SAND and GRAVEL-sized, loose, dark brown, wet, non-plastic, non-cohesive	
10				
		1.5		
		29.6		SW/GW
	100	120.5		
		235.5		
		201.5		
15			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.48'

Wet at 9' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 15' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 15' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/15/2019
Purged Amount: 17 gallons
Well Volumes Removed: 19.32

ARM Group Inc.
Engineers and Scientists

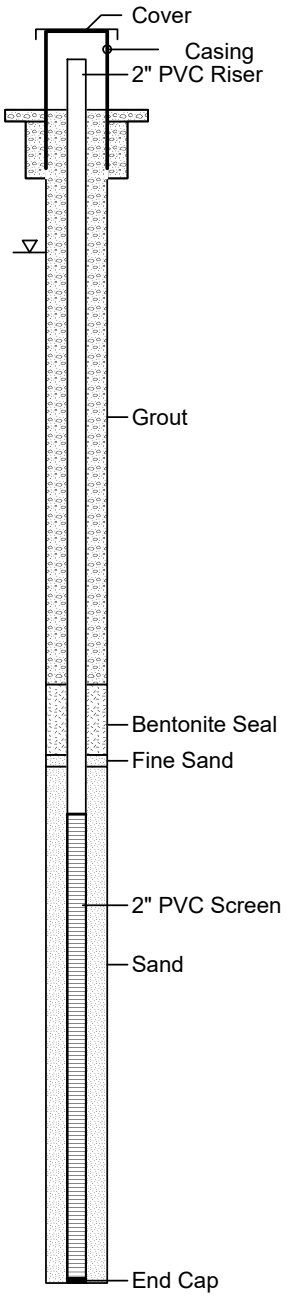
Well ID: COP-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563127.66
Easting (ft)	: 1454935.03
Date/Time Started	: 4/24/19 1100
Date/Time Completed	: 4/24/19 1330
Surf. Elev. (ft AMSL)	: 5.11
TOC Elev. (ft AMSL)	: 7.53
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 8.38' TOC
Depth to Water (ft)	: 48 hr: 8.84' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.5		
		0.5		
		1.0		
		0.2		
		0.4		
5	100	-	(0-15') SLAG, SAND and GRAVEL-sized, loose, dark black to brown (0-9' bgs), blueish gray (10-15' bgs), dry to wet at 5.5' bgs, non-plastic, non-cohesive	SW/GW
		0.2		
		0.3		
		0.6		
		7.1		
10		40.2		
		23.0		
		14.2		
		32.9		
		107.2		
15	100	-		
		48.7	(15-19') SAND, fine, medium dense, brown, wet, non-plastic, non-cohesive	SP
		215.8		
		68.3		
		70.2		
20		7.8	(19-20') CLAY, firm, brown, wet, low plasticity, cohesive	CL
		37.5	(20-37') SAND, fine, medium dense, brown, wet, non-plastic, non-cohesive	
		223.3		
		229.3		
		106.8		
25	100	-		
		240.9		
		939.2		
		38.4		SP
		44.8		
30		232.2		
		150.1		
		22.9		
		48.0		
		223.2		
35	100	-		
		58.3		
		20.0		
		4.5	(37-41.5') CLAYEY SAND, fine, dense, very pale brown to light brown, then light gray at 41.5' bgs, wet, non-plastic, non-cohesive	
		28.7		
40		2.2		
		0.8		
		1.9		
		0.7		SC
		2.4		
45	100	-		
		0.7		
		1.7		
		0.7		
		2.0		
50			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.52'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 5.5' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/3/2019
Purged Amount: 34 gallons
Well Volumes Removed: 4.72

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ARM Group Inc.
Engineers and Scientists

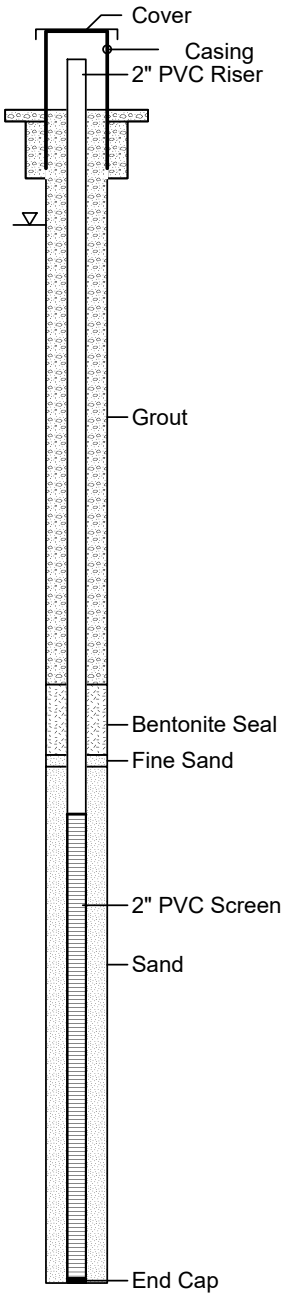
Well ID: COQ-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 563001.86
Easting (ft)	: 1454907.17
Date/Time Started	: 4/24/19 0800
Date/Time Completed	: 4/24/19 0940
Surf. Elev. (ft AMSL)	: 3.78
TOC Elev. (ft AMSL)	: 6.42
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 7.57' TOC
Depth to Water (ft)	: 48 hr: 6.67' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.2		
		0.2		
		0.4		
		0.3		
5	100	0.3	(0-18') SLAG, SAND and GRAVEL-sized, loose, black to dark gray, moist to wet at 6' bgs, non-plastic, non-cohesive	
		-		
		0.9		
		0.6		
		13.8		
		6.5		SW/GW
10		14.3		
		2.9		
		21.9		
		12.5		
		27.1		
15	100	-		
		1.1		
		4.7		
		16.4		
		73.9	(18-35') SAND, fine, medium dense to dense, brown (19-22' bgs), reddish yellow (22-24' bgs), very pale brown (24-25' bgs), and brown (25-35' bgs), wet, non-plastic, non-cohesive	
		13.4		
20		80.4		
		64.3		
		13.8		
		0.2		
25	100	-		SP
		1.0		
		57.1		
		189.8		
		24.6		
30		-		
		-		
		-		
		-		
35	100	-	(35-40') CLAYEY SAND, medium dense, gray, wet, non-plastic, non-cohesive	SC
		-		
		-		
		-		
		-		
40		201.6		
		810.2		
		9.0		
		6.7	(40-50') SAND, fine to coarse, medium dense, brown, wet, non-plastic, non-cohesive	
		65.9		
45	100	-		SW
		25.7		
		56.7		
		855.3		
50		12.3		
			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 3.57'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 6' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/3/2019
Purged Amount: 42 gallons
Well Volumes Removed: 5.69

ARM Group Inc.
Engineers and Scientists

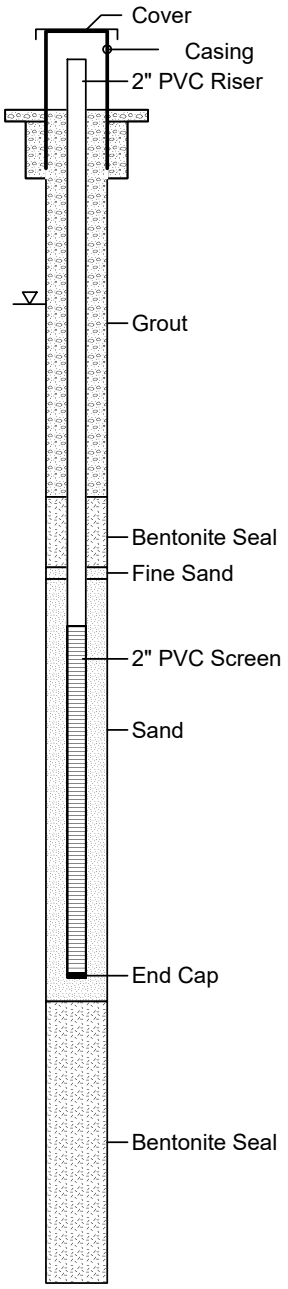
Well ID: COR-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562836.85
Easting (ft)	: 1454628.12
Date/Time Started	: 4/23/19 0800
Date/Time Completed	: 4/23/19 1130
Surf. Elev. (ft AMSL)	: 9.59
TOC Elev. (ft AMSL)	: 11.65
Total Well Depth (ft)	: 37' bgs
Depth to Water (ft)	: 0 Hr: 11.24' TOC
Depth to Water (ft)	: 48 hr: 11.04' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		6.6	(0-26') SLAG, SAND and GRAVEL-sized, with SILT, loose, dark brown grading to gray/black with light gray from 10-12' bgs, dry then wet at 10' bgs, non-plastic, non-cohesive	
5	100	3.0		
		1.0		
		12.2		
		13.8		
		-		
		3.7		
		0.8		
10		0.6		
		0.3		
		35.3		
	100	35.6		SW/GW
		2.1		
		15.3		
15		73.8		
		6.2		
	100	1.1		
		10.9		
		77.6		
20		203.6		
		1466		
		3303		
	100	3783		
		2402		
		2985		
25		-		
		1106	(26-30') SAND, very fine, dense, black, wet, non-plastic, non-cohesive	SP
		3416		
		3058		
		317.1		
30		34.3	(30-50') SAND, very fine, very dense, very pale brown to white grading to light brown at 46' bgs, wet, non-plastic, non-cohesive	
		134.9		
		2516		
		2713		
		708.3		
35	100	-		
		69.7		
		89.1		
		112.0		
		33.5		
40		19.6		SP
		152.7		
		128.6		
		95.4		
		10.3		
45	100	-		
		218.9		
		228.3		
		124.4		
50		25.7		
			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.21'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 16.5' bgs

Wet at 10' bgs

Product in core 26-30' bgs

Bentonite Seal: 3/8" chips
Top: 16.5' bgs
Bottom: 19.5' bgs

Sand Blotter: #1 Sand
Top: 19.5' bgs
Bottom: 20' bgs

Filter Pack: #2 Sand
Top: 20' bgs
Bottom: 37' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 22' bgs
Bottom: 37' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/8/2019
Purged Amount: 20 gallons
Well Volumes Removed: 4.47

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ARM Group Inc.
Engineers and Scientists

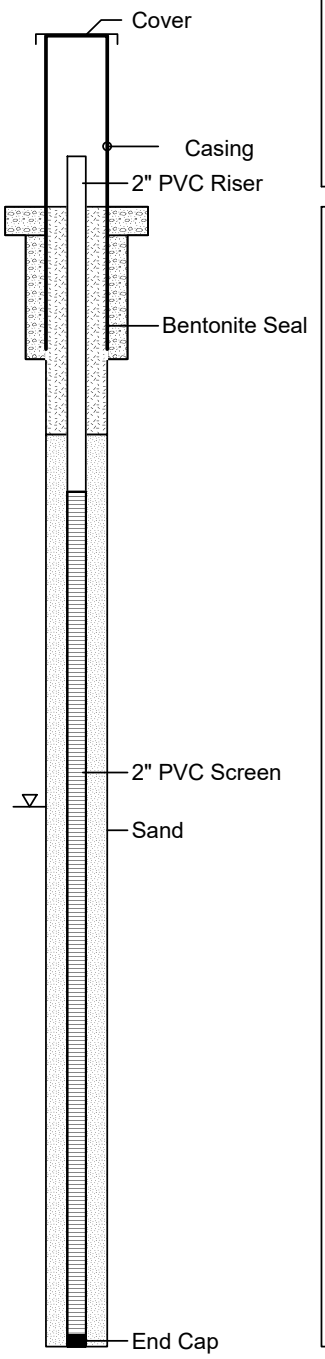
Well ID: COS-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562664.68
Easting (ft)	: 1454530.10
Date/Time Started	: 4/17/19 0730
Date/Time Completed	: 4/17/19 0830
Surf. Elev. (ft AMSL)	: 11.47
TOC Elev. (ft AMSL)	: 14.43
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 13.50' TOC
Depth to Water (ft)	: 48 hr: 13.28' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		0.2	(0-20') SLAG, SAND and GRAVEL-sized, loose, dark brown, moist then wet at 10.5' bgs, non-plastic, non-cohesive	
		0.0		
		4.3		
		0.9		
		11.4		
5	100	-		
		0.6		
		3.6		
		2.8		
		0.0		
10		0.1		SW/GW
		3.6		
		1.0		
		4.5		
		33.7		
15	100	-		
		17.8		
		4.8		
		85.3		
20		2532		
			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.29'

Wet at 10.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 20' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/2/2019
Purged Amount: 14 gallons
Well Volumes Removed: 8.92

ARM Group Inc.
Engineers and Scientists

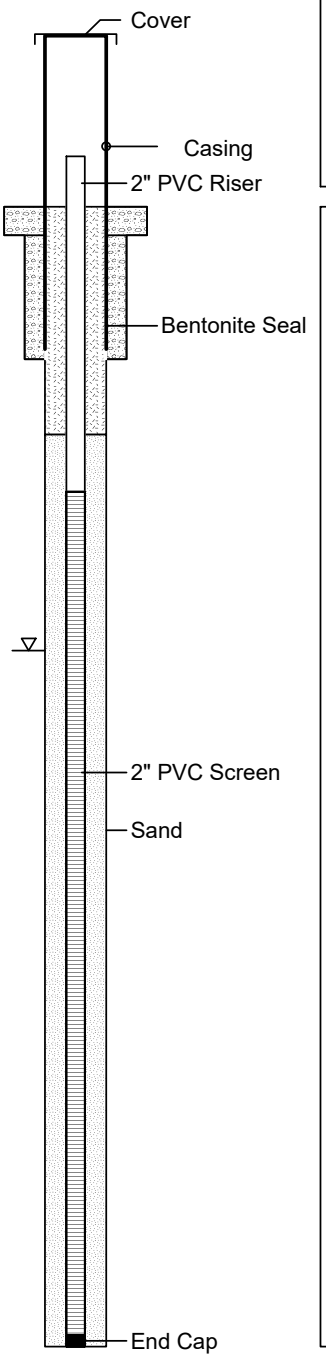
Well ID: COT-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562911.80
Easting (ft)	: 1455128.85
Date/Time Started	: 4/23/19 1250
Date/Time Completed	: 4/23/19 1420
Surf. Elev. (ft AMSL)	: 9.39
TOC Elev. (ft AMSL)	: 11.74
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 10.42' TOC
Depth to Water (ft)	: 48 hr: 10.54' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		29.5	(0-20') SLAG, SAND and GRAVEL-sized, medium dense, dark brown then light gray 18-20' bgs, dry then wet at 11.5' bgs, non-plastic, non-cohesive	
	100	5.4		
		8.5		
		4.8		
		7.7		
5		25.8		
	100	15.8		
		0.7		
		20.4		
		8.4		SW/GW
10		4.8		
	100	0.4		
		35.7		
		58.9		
		93.7		
15		381.8		
	100	848.8		
		50.2		
		-		
20		-		
			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.07'

Wet at 11.5' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Product sheen in core 13-15' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 20' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/3/2019
Purged Amount: 10 gallons
Well Volumes Removed: 4.98

ARM Group Inc.
Engineers and Scientists

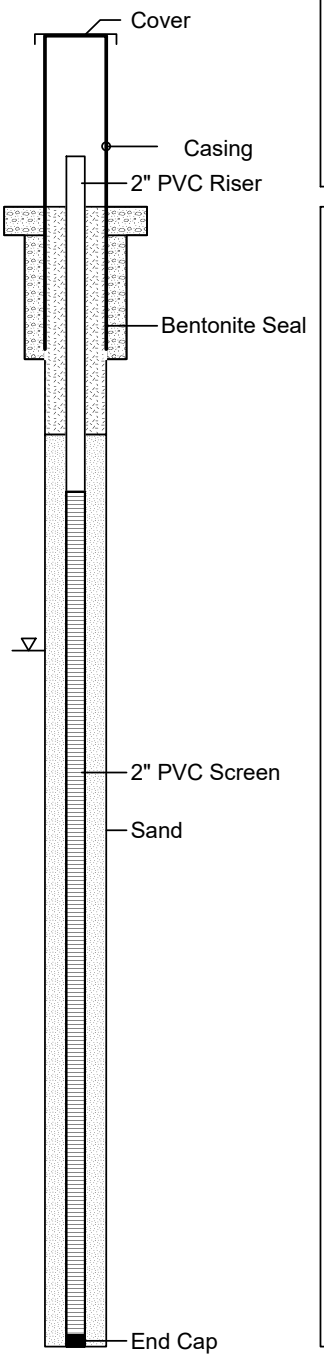
Well ID: COU-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562820.60
Easting (ft)	: 1455382.44
Date/Time Started	: 4/23/19 1430
Date/Time Completed	: 4/23/19 1630
Surf. Elev. (ft AMSL)	: 11.64
TOC Elev. (ft AMSL)	: 14.48
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 13.16' TOC
Depth to Water (ft)	: 48 hr: 13.34' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0	100	24.1 10.1 9.3 2669	(0-4') SILT with SLAG, loose, dark brown, dry, non-plastic, non-cohesive	ML
		1524	(4-5') CLAY, hard, gray, dry, low plasticity, cohesive	CL
5	100	3.8 3.7 4.1 1.3 69.4	(5-10') SILT with SLAG, loose, dark brown, moist then wet at 10' bgs, non-plastic, non-cohesive	ML
10	100	1192 1776 2092 608.7 8386 - 4041 3838 7897 980.2	(10-20') SLAG, SAND and GRAVEL-sized, medium dense, black, wet, non-plastic, non-cohesive	SW/GW
15				
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 3.08'

Wet at 10' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Product sheen in core 12-20' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 20' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/3/2019
Purged Amount: 20 gallons
Well Volumes Removed: 11.63

ARM Group Inc.
Engineers and Scientists

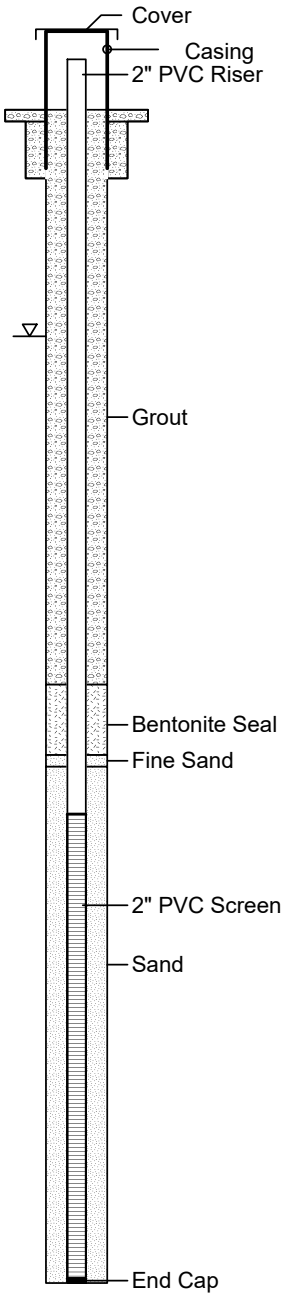
Well ID: COV-MWI

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562760.83
Easting (ft)	: 1455004.68
Date/Time Started	: 4/16/19 1300
Date/Time Completed	: 4/16/19 1545
Surf. Elev. (ft AMSL)	: 10.36
TOC Elev. (ft AMSL)	: 12.20
Total Well Depth (ft)	: 50' bgs
Depth to Water (ft)	: 0 Hr: 16.31' TOC
Depth to Water (ft)	: 48 hr: 12.41' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		20.5	(0-10.5') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, dry then wet at 9.5' bgs, non-plastic, non-cohesive	
5	100	7.7 13.4 7.2 22.2 - 32.9 43.0 12.5 24.7		SW/GW
10		101.2	(10.5-19') SAND, very fine, very dense, black, wet, non-plastic, non-cohesive	
15	100	148.5 764.5 5900 15000 - 15000 15000 15000		SP
20		15000	(19-20') CLAY, soft, black, moist, low plasticity, cohesive	CL
25	100	80.3 27.4 275.6 2619 - - 61.1 1962 7784	(20-39') SAND, very fine, very dense, dark gray and yellow (20-27' bgs), red to brownish red (27-31' bgs), brown and yellow (31-38' bgs), very light red (38-38.5' bgs), pale brown to white (38.5-39' bgs), wet, non-plastic, non-cohesive	SW
30		2350 - - - - - -		
35	100	139.1 387.3 - - - 99.6 1891		
40		1761	(39-50') CLAYEY SAND, very fine, very dense, white to light gray, wet, non-plastic, non-cohesive	
45	100	2122 - 2472 174.1 2100 3563		SC
50			End of boring	



COMPLETION DETAILS

4" Protective Steel Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.09'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 24.5' bgs

Wet at 9.5' bgs

Product Sheen in core 10-19' bgs

Bentonite Seal: 3/8" chips
Top: 24.5' bgs
Bottom: 27.5' bgs

Sand Blotter: #1 Sand
Top: 27.5' bgs
Bottom: 28' bgs

Filter Pack: #2 Sand
Top: 28' bgs
Bottom: 50' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 30' bgs
Bottom: 50' bgs
Total Screen: 20'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/2/2019
Purged Amount: 60 gallons
Well Volumes Removed: 9.68

ARM Group Inc.
Engineers and Scientists

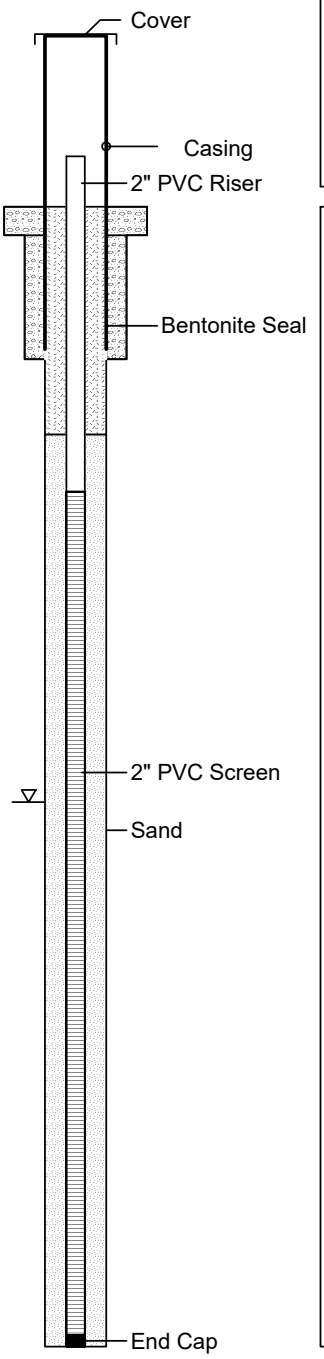
Well ID: COW-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562667.55
Easting (ft)	: 1455015.35
Date/Time Started	: 4/16/19 1120
Date/Time Completed	: 4/16/19 1145
Surf. Elev. (ft AMSL)	: 11.75
TOC Elev. (ft AMSL)	: 13.97
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 13.13' TOC
Depth to Water (ft)	: 48 hr: 13.20' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		12.2	(0-15.5') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, dry then wet at 11' bgs, non-plastic, non-cohesive	
		11.0		
		12.6		
		9.4		
		51.2		
5	100	-		
		7.3		
		17.4		SW/GW
		7.3		
		32.9		
10		300.1		
		245.1		
		380.6		
		202.1		
		8389		
15	100	-		
		11954	(15.5-20') SAND, fine, medium dense, black, wet, non-plastic, non-cohesive	
		267.3		SP
		79.9		
		2785		
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.32'

Wet at 11' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Product sheen in core 14.5-15.5' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 20' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/2/2019
Purged Amount: 17 gallons
Well Volumes Removed: 10.97

ARM Group Inc.
Engineers and Scientists

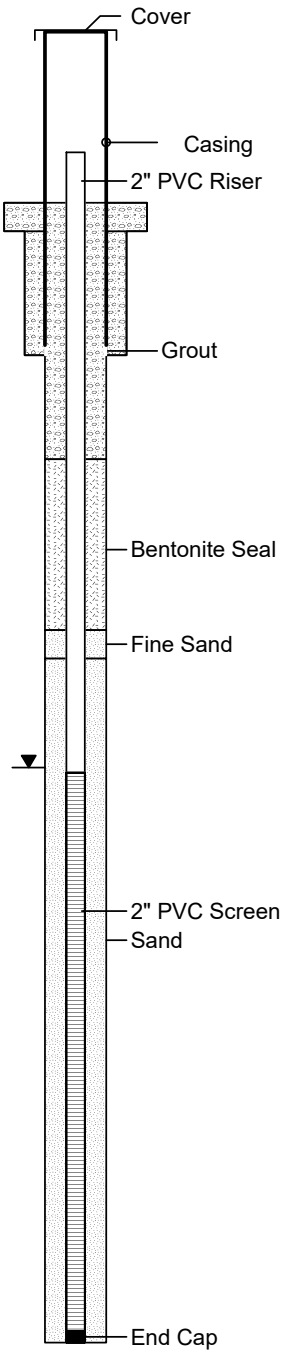
Well ID: COX-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562623.23
Easting (ft)	: 1455434.17
Date/Time Started	: 4/16/19 0830
Date/Time Completed	: 4/16/19 0910
Surf. Elev. (ft AMSL)	: 12.18
TOC Elev. (ft AMSL)	: 15.45
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 12.66' TOC
Depth to Water (ft)	: 48 hr: Bubbling over
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		1.2	(0-14') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, dry, moist at 9' bgs, then wet at 10' bgs, non-plastic, non-cohesive	
		0.0		
		2.7		
		0.0		
		0.9		
5	100	-		
		10.4		SW/GW
		87.1		
		8.9		
		34.2		
10		2.9		
		1.7		
	100	9.4		
		77.3		
		10.4	(14-14.2') WOOD	NA
			(14.2-15') GRAVEL, loose, black, wet, non-plastic, non-cohesive	GW
15		45.1	(15-18.5') SAND, loose, black, wet, non-plastic, non-cohesive	
		216.7		SW
	100	207.1		
		15000	(18.5-19') SAND, fine, medium dense, black, wet, non-plastic, non-cohesive	SP
		15000	(19-20') CLAYEY SAND, medium dense, black, wet, non-plastic, non-cohesive	SC
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 1.96'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 4.5' bgs

Wet at 10' bgs

Bentonite Seal: 3/8" chips
Top: 4.5' bgs
Bottom: 7.5' bgs

Product odor in core 14-20' bgs with product in core from 14-15' bgs

Sand Blotter: #1 Sand
Top: 7.5' bgs
Bottom: 8' bgs

Filter Pack: #2 Sand
Top: 8' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 10' bgs
Bottom: 20' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/2/2019
Purged Amount: 9 gallons
Well Volumes Removed: 5.56

ARM Group Inc.
Engineers and Scientists

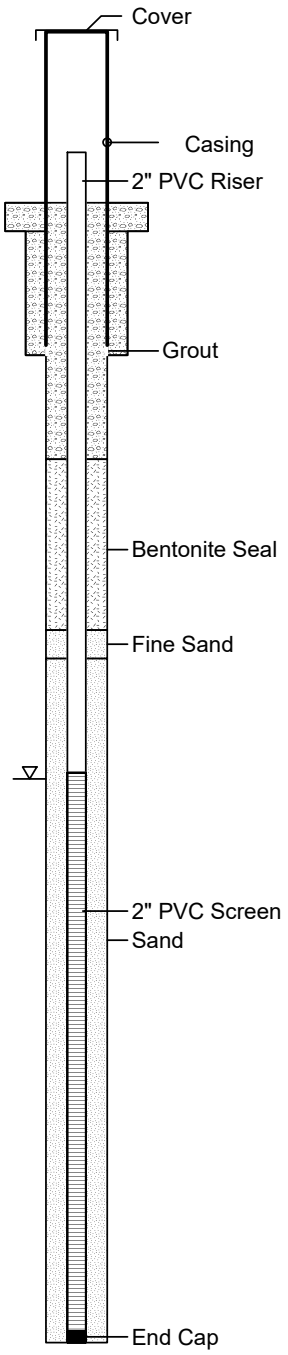
Well ID: COY-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562392.83
Easting (ft)	: 1455088.30
Date/Time Started	: 4/16/19 1015
Date/Time Completed	: 4/16/19 1100
Surf. Elev. (ft AMSL)	: 11.49
TOC Elev. (ft AMSL)	: 13.48
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 11.50' TOC
Depth to Water (ft)	: 48 hr: 12.86' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		11.8	(0-20') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, dry then wet at 10' bgs, non-plastic, non-cohesive	
		4.0		
		92.8		
		16.1		
		130.2		
5	100	-		
		16.7		
		67.1		
		58.9		
		50.0		
10				SW/GW
		7.2		
		8.9		
		4980		
		3428		
		6044		
15	100	-		
		123.7		
		223.5		
		375.1		
		2373		
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.44'

Wet at 10' bgs

Bentonite Seal: 3/8" chips
Top: 0' bgs
Bottom: 4' bgs

Filter Pack: #2 Sand
Top: 4' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 5' bgs
Bottom: 20' bgs
Total Screen: 15'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 05/2/2019
Purged Amount: 23 gallons
Well Volumes Removed: 14.20

06-18-2019 P:\EnviroAnalytics Group\190342M COA Onshore Supplemental Investigation\Documents\Boring Logs\2_Bor Logs\COY-MWS.bor

ARM Group Inc.
Engineers and Scientists

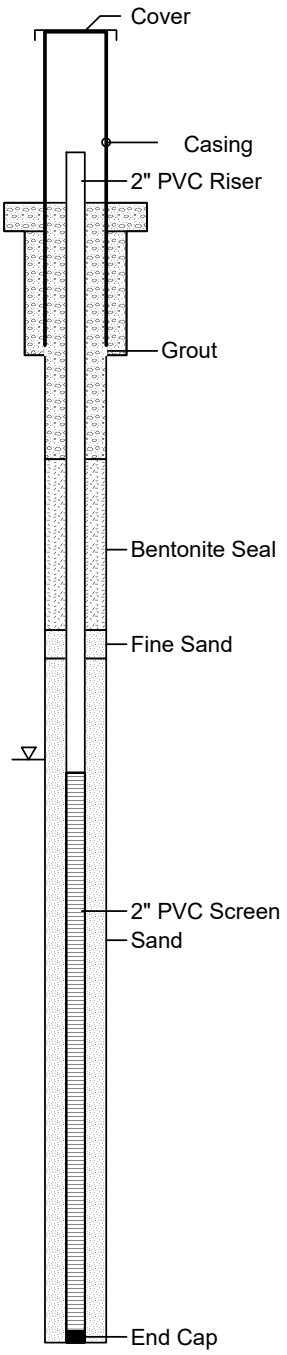
Well ID: COZ-MWS

(page 1 of 1)

Project Name	: COA Onshore Supp. Inv.
Project Number	: 190342M-2
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: Cell 2
ARM Representative	: L. Glumac
Checked by	: M. Replogel, EIT
Drilling Company	: Geologic Explorations
Driller	: Kenny Sargent
Drilling Equipment	: Sonic Rig 8140LS

Northing (ft)	: 562421.66
Easting (ft)	: 1455560.77
Date/Time Started	: 4/16/19 0935
Date/Time Completed	: 4/16/19 1000
Surf. Elev. (ft AMSL)	: 11.88
TOC Elev. (ft AMSL)	: 14.70
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0 Hr: 12.53' TOC
Depth to Water (ft)	: 48 hr: 12.52' TOC
Bit/Auger Size (in.)	: 4.25"

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	USCS
0		2.9	(0-15') SLAG, SAND and GRAVEL-sized, loose, dark brown grading to black, moist then wet at 10.5' bgs, non-plastic, non-cohesive	
		0.0		
		0.4		
		0.2		
		1.5		
5	100	-		
		0.2		
		0.3		SW/GW
		1.1		
		1.0		
10		8.5		
		9.2		
		14.7		
		22.7		
		194.5		
15	100	-	(15-20') SAND, fine, medium dense, black, wet, non-plastic, non-cohesive	
		-		
		-		SP
		83.8		
		22.4		
20			End of boring	



COMPLETION DETAILS

4" Protective Steel
Casing with Locking Lid
2x2' concrete pad
2" expandable-type cap

Riser: Sch 40 PVC
Riser Diameter: 2 in
Riser Stickup (ags): 2.08'

Grout: Portland w/ 5% Bentonite
Top: 0' bgs
Bottom: 4.5' bgs

Wet at 10.5' bgs

Bentonite Seal: 3/8" chips
Top: 4.5' bgs
Bottom: 7.5' bgs

Odor in core 15-20' bgs with product in core from 15-16' bgs

Sand Blotter: #1 Sand
Top: 7.5' bgs
Bottom: 8' bgs

Filter Pack: #2 Sand
Top: 8' bgs
Bottom: 20' bgs

Screen: Sch 40 PVC
Screen Diameter: 2 in
Slot Size: 0.010"
Top: 10' bgs
Bottom: 20' bgs
Total Screen: 10'

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface
W - weight of hammer

Monitoring Well Developent
Date: 04/24/2019
Purged Amount: 18 gallons
Well Volumes Removed: 11.11

APPENDIX B

Well Development Logs

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COAA-MW5 **Well Permit No.:** _____

ARM Project No.: 150-190342M	Date/Time Started: 4-25-19 / 0917	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 1006	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 5 to 25
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 25.01

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 25.02 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 10.03 ft. (C)
Petroleum/Product Present? Y or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 14.99 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Bore Volume: (A x D) 2.44 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	20-25	10	4.0		black
2	15-20	10	4.0		black
3	10-15	10	4.0		black
4	5-10	10	4.0		dark grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	16.0		

Final Depth to Water (from TOC): 10.02 Final well depth: 25.04

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COA-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-7-19 / 1207	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-7-19 / 1300	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 23 to 38
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.77	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 38.52

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 37.67 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 14.93 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 22.74 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.95 ft.	Wetted Well Volume: (A x D) 3.71 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	33-38	10	5		dark grey, VOC odor
2	28-33	10	5		dark grey, VOC odor
3	23-28	10	5		dark grey, VOC odor
		Cumulative Totals: (Minimum of 3 Well Volumes)	15		

Final Depth to Water (from TOC): 14.95 Final Total Well Depth (from TOC): 37.81

Thickness of Any Sediment Remaining in Well: 0.71

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COBB-MW5 **Well Permit No.:** _____

ARM Project No.: 150-19034.2M	Date/Time Started: 4-25-19 / 1020	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 1116	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 28
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.69	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 28.08

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 27.56 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 15.46 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 12.10 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.52 ft.	Wetted Bore Volume: (A x D) 1.97 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	23-28	10	4.0		black
2	18-23	10	4.0		black
3	13-18	10	4.0		black
4	8-13	10	4.0		black
		Cumulative Totals: (Minimum of 3 Well Volumes)	16.0		

Final Depth to Water (from TOC): 15.86 Final well depth: 27.71

Thickness of Any Sediment Remaining in Well: 0.37

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COB-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-7-19 / 1023	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-7-19 / 1102	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 10 to 25
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.66 *	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 25.30 *

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 25.00 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.49 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 11.51 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.30 ft.	Wetted Well Volume: (A x D) 1.88 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	20-25	10	4		brownish grey
2	15-20	10	3		grey
3	10-15	10	3		grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	10		

Final Depth to Water (from TOC): 13.49 * Final Total Well Depth (from TOC): 25.00

Thickness of Any Sediment Remaining in Well: 0.30

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COCC - MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-25-19 / 1127	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 1232	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 28
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 1.98	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 28.96

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 28.47 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 15.27 ft. (C)
Petroleum/Product Present? *Y* or *N* Thickness (ft.): _____	Height of Water Column: (B - C) 13.20 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.49 ft.	Wetted Bore Volume: (A x D) 2.15 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	23-28	10	6.0		black
2	18-23	10	6.0		black
3	13-18	10	6.0		black
4	8-13	10	5.0		black
	Cumulative Totals: (Minimum of 3 Well Volumes)		23.0		

Final Depth to Water (from TOC): 15.27 Final well depth: 29.53

Thickness of Any Sediment Remaining in Well: 0.43

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COC-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-7-19 / 1107	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-7-19 / 1158	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 24 to 39
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.91 *	Measured Total Depth of Well When Installed (TOC) (F): ___ ft. (See Original Well Construction Diagram) 39.09 *

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 38.48 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.58 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 24.90 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.61 ft.	Wetted Well Volume: (A x D) 4.06 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	34-39	10	6		dark grey
2	29-34	10	5		dark grey
3	24-29	10	5		dark grey
	Cumulative Totals: (Minimum of 3 Well Volumes)		16		

Final Depth to Water (from TOC): 13.62 Final Total Well Depth (from TOC): 38.48

Thickness of Any Sediment Remaining in Well: 0.61

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CDD-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 1352	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 1441	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 9 to 29
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 3.81	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 28.92

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 24.53 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.66 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 13.87 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.39 ft.	Wetted Well Volume: (A x D) 2.26 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	24 - 29	10	5		dark grey, VOC odor
2	19 - 24	10	5		dark grey, VOC odor
3	14 - 19	10	5		dark grey, VOC odor
4	9 - 14	10	4		grey, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		19		

Final Depth to Water (from TOC): 13.67 Final Total Well Depth (from TOC): 24.90

Thickness of Any Sediment Remaining in Well: 0.12

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CO0-MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-22-19 / 1408	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-22-19 / 1520	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 20 to 30
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.54	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 30.80

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 30.10 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 13.25 ft. (C)
Petroleum/Product Present? *Y* or *N* Thickness (ft.): _____	Height of Water Column: (B - C) 16.85 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.70 ft.	Wetted Bore Volume: (A x D) 2.74 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	25-30	10	8.0		dark grey
2	29-25	10	11.0		dark grey
Cumulative Totals: (Minimum of 3 Well Volumes)			19.0		

Final Depth to Water (from TOC): 13.34 Final well depth: 30.93

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COE-MW5 **Well Permit No.:** _____

ARM Project No.: 190342 m	Date/Time Started: 5-6-19 / 1144	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-6-19 / 1223	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 13 to 28
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.61	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 28.23

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 27.92 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.51 ft. (C)
Petroleum/Product Present? *Y* or *N* Thickness (ft.): _____	Height of Water Column: (B - C) 14.31 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.41 ft.	Wetted Well Volume: (A x D) 2.33 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	23-28	10	4		grey
2	18-23	10	3		grey
3	13-18	10	3		grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	10		

Final Depth to Water (from TOC): 13.51 Final Total Well Depth (from TOC): 27.94

Thickness of Any Sediment Remaining in Well: 0.39

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COFF-MW5 **Well Permit No.:** _____ Page 1 of 2

ARM Project No.: 150190342M	Date/Time Started: 4-25-19 / 1416	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 1502	Company:
Well Location: Area B, Parcel C0	Weather/Site Conditions: Cloudy 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 9 to 29
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -) 3.03	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) ≥ 9.11

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 24.45 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 14.09 ft. (C)
Petroleum/Product Present? Y or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 14.36 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.66 ft.	Wetted Bore Volume: (A x D) 2.34 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	24 - 29	10	6.5		dark grey
2	19 - 24	10	5.5		dark grey
3	14 - 19	10	5.0		dark grey
4	9 - 14	10	5.0		dark grey
	Cumulative Totals: (Minimum of 3 Well Volumes)		22.0		

Final Depth to Water (from TOC): 14.09 Final well depth 24.77

Thickness of Any Sediment Remaining in Well: 0.34

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COF - MW5 **Well Permit No.:** _____

ARM Project No.: 190342.M	Date/Time Started: 5-7-19 / 0824	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-7-19 / 0908	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 23 to 38
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.84 *	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 39.01 *

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 37.47 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.63 ft. (C)
Petroleum/Product Present? *Y* or N Thickness (ft.): _____	Height of Water Column: (B - C) 23.84 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 1.54 ft.	Wetted Well Volume: (A x D) 3.89 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	33-38	10	6		grey
2	29-33	10	5		grey
3	23-29	10	5		light grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	16		

Final Depth to Water (from TOC): 13.62 Final Total Well Depth (from TOC): 38.55

Thickness of Any Sediment Remaining in Well: 0.46

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COGG-MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-25-19 / 1329	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 1411	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 28
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.31	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 28.23

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 27.70 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 12.36 ft. (C)
Petroleum/Product Present? Y or N Thickness (ft.): _____	Height of Water Column: (B - C) 15.34 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.53 ft.	Wetted Bore Volume: (A x D) 2.50 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	23-28	10	4.5		dark grey
2	18-23	10	4.0		dark grey
3	13-18	10	4.0		dark grey
4	8-13	10	5.0		dark grey
	Cumulative Totals: (Minimum of 3 Well Volumes)		17.5		

Final Depth to Water (from TOC): 12.47 Final well depth: 27.88

Thickness of Any Sediment Remaining in Well: 0.35

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CDG-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-7-19 / 0737	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-7-19 / 0821	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 23 to 38
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 38.16

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 37.74 ft. (B)
Well Volume: 0.163 gal/ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.03 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 24.71 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.42 ft.	Wetted Well Volume: (A x D) 4.03 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	33-34	10	6		brownish grey
2	24-33	10	5		brownish grey
3	23-24	10	5		brownish grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	16		

Final Depth to Water (from TOC): 13.07 Final Total Well Depth (from TOC): 37.79

Thickness of Any Sediment Remaining in Well: 0.37

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COH-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-6-19 / 1411	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-6-19 / 1500	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 24 to 39
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.11	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 38.12

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 39.08 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.48 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 25.60 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Well Volume: (A x D) 4.17 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	34-39	10	4		greyish brown
2	29-34	10	6		brown
3	24-29	10	6		brown
		Cumulative Totals: (Minimum of 3 Well Volumes)	20		

Final Depth to Water (from TOC): 13.53 Final Total Well Depth (from TOC): 39.09

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

Well ID: _____

Date: _____

ID Numbers of IDW Drums Generated:

1. _____
2. _____
3. _____

D. Checklists

Equipment Check List:

- ☐ Original Well Construction Diagram
- ☐ Well Development Form
- ☐ Clean Weighted Tape for Determining Total Well Depth and Depth to Any Sediment or Possible Blockages Within the Well
- ☐ Water Level Meter and/or Oil-Water Interface Probe
- ☐ Surge Block and appropriate ID PVC Casing Extensions
- ☐ Appropriate Pump
- ☐ Disposable Pump Tubing
- ☐ Clean Paper Towels
- ☐ Alconox Detergent
- ☐ Clean Brushes for Decontamination Work
- ☐ Distilled Water for Rinsing Equipment
- ☐ 2 New, Clean Spray Bottles for Spray Distilled Water
- ☐ 2 to 3 Clean Five-gallon Buckets
- ☐ 55-gallon Drum(s) for Development Water; Drum Non-hazardous Waste Labeling Supplies
- ☐ Personal Protective Equipment Per Health and Safety Plan

Quality Control Procedures Include:

- ☐ Decon All Equipment that Goes Down-hole per Appropriate Standard Operating Procedure (SOP)
- ☐ Staging Down-hole Equipment, Tubing, etc. on Clean Plastic Sheeting
- ☐ _____

E. Notes/Comments

_____

_____

_____

_____

_____

_____

F. Signatures

Field Representative(s): _____ _____ _____

Print Name | Signature | Date

_____ _____ _____

Print Name | Signature | Date

All depths reported are from reference notch in top of TOC.
All measurements made in 10^{ths} of feet

TOC = from Top of PVC Casing
Grd = Ground Surface
TD = Total Depth

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COI-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-6-19 / 1314	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-6-19 / 1358	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 26 to 36
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 35.92

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 35.73 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 12.94 ft. (C)
Petroleum/Product Present? *Y* or (N.) Thickness (ft.): _____	Height of Water Column: (B - C) 22.81 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.19 ft.	Wetted Well Volume: (A x D) 3.72 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	31-36	10	7		brownish grey
2	26-31	10	7		
	Cumulative Totals: (Minimum of 3 Well Volumes)		14		

Final Depth to Water (from TOC): 12.97 Final Total Well Depth (from TOC): 35.90

Thickness of Any Sediment Remaining in Well: 0.12

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COJ-MW5 **Well Permit No.:** _____

ARM Project No.: 190342	Date/Time Started: 5-6-19 / 1230	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-6-19 / 1309	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 13 to 28
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 3.64 *	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 28.4 *

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 27.95 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.40 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 14.55 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.45 ft.	Wetted Well Volume: (A x D) 2.37 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	23-28	10	4		dark grey
2	18-23	10	4		dark grey
3	13-18	10	4		dark grey
	Cumulative Totals: (Minimum of 3 Well Volumes)		12		

Final Depth to Water (from TOC): 13.41 Final Total Well Depth (from TOC): 27.95

Thickness of Any Sediment Remaining in Well: 0.45

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COK-MW1 **Well Permit No.:** _____

ARM Project No.: 150-199342	Date/Time Started: 4-24-19 / 0839	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-24-19 / 1016	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 32 to 52
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+)/ -) 2.39	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 52.15

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 51.19 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 8.28 ft. (C)
Petroleum/Product Present? Y or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 42.91 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.96 ft.	Wetted Bore Volume: (A x D) 6.99 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	47 - 52	10	9.0		dark grey
2	42 - 47	10	11.0		dark grey
3	37 - 42	10	8.0		dark grey
4	32 - 37	10	8.0		grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	36.0		

Final Depth to Water (from TOC): 8.54 Final well depth: 51.42

Thickness of Any Sediment Remaining in Well: 0.73

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COK-MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-24-19 / 1019	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-24-19 / 1049	Company:
Well Location: Area 15, Parcel CO	Weather/Site Conditions: Sunny 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 7 to 17
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.79	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 17.87

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 17.14 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 5.90 ft. (C)
Petroleum/Product Present? *Y* or *N*. Thickness (ft.): _____	Height of Water Column: (B - C) 11.24 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.73 ft.	Wetted Bore Volume: (A x D) 1.83 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	12 - 17	10	3.0		dark grey
2	7 - 12	10	4.0		dark grey
Cumulative Totals: (Minimum of 3 Well Volumes)			7.0		

Final Depth to Water (from TOC): 5.97 Final well depth 17.25

Thickness of Any Sediment Remaining in Well: 0.64

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COL-MW1 **Well Permit No.:** _____

ARM Project No.: 150190342M	Date/Time Started: 4-23-19 / 0918	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-23-19 / 1055	Company:
Well Location: Area 13, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 33 to 53
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.86	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 53.23

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 52.71 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 8.96 ft. (C)
Petroleum/Product Present? *Y* or *N*. Thickness (ft.): _____	Height of Water Column: (B - C) 43.75 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.52 ft.	Wetted Bore Volume: (A x D) 7.13 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	48 - 53	10	7.0		grey
2	43 - 48	10	8.0		grey
3	38 - 43	10	8.0		grey
4	33 - 38	10	10.0		grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	33.0		

Final Depth to Water (from TOC): 9.15 Final well depth: 52.80

Thickness of Any Sediment Remaining in Well: 0.43

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COL-MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342	Date/Time Started: 4-23-19 / 0748	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-23-19 / 0830	Company:
Well Location: Area 3, Parcel CO	Weather/Site Conditions: Sunny 70	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 18
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -) 2.72	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 17.81

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 17.73 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 6.98 ft. (C)
Petroleum/Product Present? Y or N. Thickness (ft.): _____	Height of Water Column: (B - C) 10.75 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.08 ft.	Wetted Bore Volume: (A x D) 1.75 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" Surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	13-18	10	8.0		dark grey
2	8-13	10	10.0		dark grey
Cumulative Totals: (Minimum of 3 Well Volumes)			18.0		

Final Depth to Water (from TOC): 7.84 Final well depth: 17.82

Thickness of Any Sediment Remaining in Well: 0.90

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COM-MW1 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-23-19 / 1257	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-23-19 / 1422	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 33 to 53
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (⊕/-) 1.58	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 53.39

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 52.77 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 9.25 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 43.52 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.62 ft.	Wetted Bore Volume: (A x D) 7.09 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	48 - 53	10	8.0		grey
2	43 - 48	10	7.0		grey
3	38 - 43	10	8.0		grey
4	33 - 38	10	10.0		grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	33.0		

Final Depth to Water (from TOC): 9.22 Final well depth: 52.90

Thickness of Any Sediment Remaining in Well: 0.49

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COM-MW5 **Well Permit No.:** _____

ARM Project No.: 150-190342.M	Date/Time Started: 4-23-19 / 1208	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-23-19 / 1244	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 18
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -) 2.38	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 17.91

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 17.48 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 7.14 ft. (C)
Petroleum/Product Present? Y or N Thickness (ft.): _____	Height of Water Column: (B - C) 10.34 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.43 ft.	Wetted Bore Volume: (A x D) 1.69 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	13-18	10	7.0		dark grey
2	6-13	10	7.0		dark grey
Cumulative Totals: (Minimum of 3 Well Volumes)			14.0		

Final Depth to Water (from TOC): 7.42 Final well depth: 17.40

Thickness of Any Sediment Remaining in Well: 0.11

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CON-MW1 **Well Permit No.:** _____

ARM Project No.: 150 190342.M	Date/Time Started: 4-24-19 / 1109	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-24-19 / 1218	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 33 to 53
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.14	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 53.52

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 52.66 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 11.23 ft. (C)
Petroleum/Product Present? Y or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 41.43 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.86 ft.	Wetted Bore Volume: (A x D) 6.75 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	48 - 53	10	6.0		dark grey
2	43 - 48	10	6.0		grey
3	38 - 43	10	5.0		grey
4	33 - 38	10	5.0		light grey
		Cumulative Totals: (Minimum of 3 Well Volumes)	22.0		

Final Depth to Water (from TOC): 11.20 Final well depth: 52.64

Thickness of Any Sediment Remaining in Well: 0.68

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CON - MW5 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-24-19 / 1228	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-24-19 / 1304	Company:
Well Location: Area B, Parcel CON	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 18
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.10	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 17.81

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 17.69 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 11.22 ft. (C)
Petroleum/Product Present? Y or N. Thickness (ft.): _____	Height of Water Column: (B - C) 6.47 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.12 ft.	Wetted Bore Volume: (A x D) 1.05 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" Surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	13 - 18	10	12.0		dark grey
2	8 - 13	10	7.0		dark grey
Cumulative Totals: (Minimum of 3 Well Volumes)			19.0		

Final Depth to Water (from TOC): 11.25 Final well depth: 17.78

Thickness of Any Sediment Remaining in Well: 0.03

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CDD-MW1 **Well Permit No.:** _____

ARM Project No.: ~~150~~ 190342M	Date/Time Started: 4-25-19 / 0732	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-25-19 / 0852	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: cloudy 50's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 33 to 53
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -) 1.62	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 53.21

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 53.30 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 12.43 ft. (C)
Petroleum/Product Present? *Y* or *N* Thickness (ft.): _____	Height of Water Column: (B - C) 40.87 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Bore Volume: (A x D) 6.66 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	48 - 53	10	6.0		grey
2	43 - 48	10	6.0		light grey
3	38 - 43	10	5.0		light grey
4	33 - 38	10	5.0		light grey
	Cumulative Totals: (Minimum of 3 Well Volumes)		22.0		

Final Depth to Water (from TOC): 12.42 Final well depth 53.58

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CCO - MW 5 **Well Permit No.:** _____

ARM Project No.: 190342.M	Date/Time Started: 4/15/19 / 1300	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4/15/19 / 1400	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 50°	Checked by:

A. Well Construction Details

Well Cover Type: (*Stick-up*) or *Flush-Mount*	PVC Screen Interval: 5 to 15
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 17.85

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2	Total Well Depth (TOC): 17.58 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 12.16 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 5.42 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.27 ft.	Wetted Well Volume: (A x D) 0.88 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" Surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	14.67 - 18	10	~3		dark brown / VOC odor
2	11.33 - 14.67	10	~4		dark brown / VOC odor
3	8 - 11.33	10	~8		dark brown / VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		~17		

Final Depth to Water (from TOC): 12.16' Final Total Well Depth (from TOC): 17.85'

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COP-MW1 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-3-19 / 0729	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-3-19 / 0845	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Drizzle 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 34 to 54
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 53.98

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 53.54 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 9.34 ft. (C)
Petroleum/Product Present? *Y* or (*N*) Thickness (ft.): _____	Height of Water Column: (B - C) 44.2 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.44 ft.	Wetted Well Volume: (A x D) 7.20 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	49 - 54	10	9		brown, VOC odor
2	44 - 49	10	8		brown, VOC odor
3	39 - 44	10	8		brown, VOC odor
4	34 - 39	10	9		brown, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		34		

Final Depth to Water (from TOC): 9.50 Final Total Well Depth (from TOC): 53.63

Thickness of Any Sediment Remaining in Well: 0.35

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COQ-MW1 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-3-19 / 0848	Developed by: JCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-3-19 / 1004	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 33 to 53
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 3.57	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 53.14

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 52.42 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 7.20 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 45.22 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.71 ft.	Wetted Well Volume: (A x D) 7.38 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	48-53	10	11		grey, VOC odor
2	43-48	10	10		grey, VOC odor
3	38-43	10	10		grey, VOC odor
4	33-38	10	11		grey, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		42		

Final Depth to Water (from TOC): 7.22 Final Total Well Depth (from TOC): 52.64

Thickness of Any Sediment Remaining in Well: 0.54

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COR-MW1 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-8-19 / 0735	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-8-19 / 0900	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: _____ to _____
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.21	Measured Total Depth of Well When Installed (TOC) (F): ___ ft. (See Original Well Construction Diagram) 39.04

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 38.56 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 11.15 ft. (C)
Petroleum/Product Present? (Y) or N. Thickness (ft.): ~1.5	Height of Water Column: (B - C) 27.41 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.48 ft.	Wetted Well Volume: (A x D) 4.47 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1		10	5		grey / DNAPL
2		10	5		brownish grey
3		10	5		brownish grey
4		10	5		
	Cumulative Totals: (Minimum of 3 Well Volumes)		20		

Final Depth to Water (from TOC): 11.14 Final Total Well Depth (from TOC): 36.60

Thickness of Any Sediment Remaining in Well: 0.44

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COS-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 1305	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 1342	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 9 to 24
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 23.06

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 23.71 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 14.07 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 9.64 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Well Volume: (A x D) 1.57 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	19-24	10	5		dark grey, VOC odor
2	14-19	10	5		dark grey, VOC odor
3	9-14	10	4		dark grey, VOC odor
		Cumulative Totals: (Minimum of 3 Well Volumes)	14		

Final Depth to Water (from TOC): 14.04 Final Total Well Depth (from TOC): 23.72

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COT-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-3-19 / 1019	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-3-19 / 1054	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 7 to 22
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 22.08

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 23.40 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 11.05 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 12.35 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Well Volume: (A x D) 2.01 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	17-22	10	3		light grey
2	12-17	10	4		dark grey
3	7-12	10	3		
	Cumulative Totals: (Minimum of 3 Well Volumes)		10		

Final Depth to Water (from TOC): 11.05 Final Total Well Depth (from TOC): 23.40

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COU-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-3-19 / 1059	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-3-19 / 1141	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 9 to 24
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 3.04 *	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 23.29 *

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 23.95 ft. (B)
Well Volume: 0.163 gal/ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.40 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 10.55 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Well Volume: (A x D) 1.72 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	19-24	10	7		black, VOC odor
2	14-19	10	6		black, VOC odor
3	9-14	10	7		black, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		20		

Final Depth to Water (from TOC): 13.41 Final Total Well Depth (from TOC): 24.12

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COV-MW1 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 0741	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 0938	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Cloudy 60's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 31 to 51
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -) 2.09	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 53.02

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 50.41 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 12.36 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 38.05 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 2.61 ft.	Wetted Well Volume: (A x D) 6.20 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block.

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	46 - 51	10	15		light brown
2	41 - 46	10	16		light brown
3	36 - 41	10	14		light brown
4	31 - 36	10	15		light brown
	Cumulative Totals: (Minimum of 3 Well Volumes)		60		

Final Depth to Water (from TOC): 12.44 Final Total Well Depth (from TOC): 52.25

Thickness of Any Sediment Remaining in Well: 0.27

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COW-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 1140	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 1224	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 8 to 23
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.32	Measured Total Depth of Well When Installed (TOC) (F): ____ft. (See Original Well Construction Diagram) 22.96

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 22.79 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 13.19 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 9.51 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.26 ft.	Wetted Well Volume: (A x D) 1.55 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	18-23	10	6		black, VOC odor
2	13-18	10	5		black, VOC odor
3	8-13	10	6		dark grey, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		17		

Final Depth to Water (from TOC): 13.19 Final Total Well Depth (from TOC): 22.77

Thickness of Any Sediment Remaining in Well: 0.19

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COX-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 1229	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 1300	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 14 to 24
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+ / -)	Measured Total Depth of Well When Installed (TOC) (F): ___ ft. (See Original Well Construction Diagram) 22.91

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 24.33 ft. (B)
Well Volume: 0.163 gal./ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 14.40 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): /	Height of Water Column: (B - C) 9.93 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.00 ft.	Wetted Well Volume: (A x D) 1.62 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	19-24	10	5		black, VOC odor
2	14-19	10	4		black, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		9		

Final Depth to Water (from TOC): 14.40 Final Total Well Depth (from TOC): 24.33

Thickness of Any Sediment Remaining in Well: 0.00

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Tradepoint Atlantic – Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: COY-MW5 **Well Permit No.:** _____

ARM Project No.: 190342M	Date/Time Started: 5-2-19 / 1034	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 5-2-19 / 1127	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 7 to 22
Well riser/screen material: *PVC*	Sand Pack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.44	Measured Total Depth of Well When Installed (TOC) (F): ____ ft. (See Original Well Construction Diagram) 22.84

B. Wetted Bore Volume Determination

Well (PVC) Diameter (in.): 2.0	Total Well Depth (TOC): 22.31 ft. (B)
Well Volume: 0.163 gal/ft. (2" PVC) or 0.652 gal/ft (4" PVC) (A)	Depth to Static Water Level (TOC): 12.40 ft. (C)
Petroleum/Product Present? *Y* or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 9.91 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.53 ft.	Wetted Well Volume: (A x D) 1.62 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	17 - 22	10	7		black, VOC odor
2	12 - 17	10	7		dark grey, VOC odor
3	7 - 12	10	9		dark grey, VOC odor
	Cumulative Totals: (Minimum of 3 Well Volumes)		23		

Final Depth to Water (from TOC): 12.70 Final Total Well Depth (from TOC): 22.62

Thickness of Any Sediment Remaining in Well: 0.22

All depths reported are from reference notch in top of TOC.

ARM Group Inc.

Earth Resource Engineers and Consultants

Sparrows Point

Monitoring Well Development Form – Surge and Pump Method

Well ID: CO2-MW5 **Well Permit No.:** _____

ARM Project No.: 150-19342M	Date/Time Started: 4-24-19 / 1455	Developed by: TCV
Client: **EnviroAnalytics Group**	Date/Time Completed: 4-24-19 / 1533	Company:
Well Location: Area B, Parcel CO	Weather/Site Conditions: Sunny 70's	Checked by:

A. Well Construction Details

Well Cover Type: *Stick-up* or *Flush-Mount*	PVC Screen Interval: 12 to 22
Well riser/screen material: *PVC*	Sandpack Interval: _____ to _____
Difference between Ground Surface and TOC: (+/-) 2.08	Measured Total Depth of Well When Installed (TOC) (F): (See Original Well Construction Diagram) 22.92

B. Wetted Bore Volume Determination

Well (PVC) Diameter: 2.0 in.	Well Total Depth (TOC): 22.55 ft. (B)
Well (PVC) Volume: 0.163 gal./ft. (A)	Depth to Static Water Level (TOC): 12.64 ft. (C)
Petroleum/Product Present? Y or (N) Thickness (ft.): _____	Height of Water Column: (B - C) 9.91 ft. (D)
Initial Thickness of Sediment in Bottom of Well (F - B): 0.37 ft.	Wetted Bore Volume: (A x D) 1.62 gal. (E)

C. Surge and Pump Event Summary Data

Description of Surge Equipment: 2" surge block

Event No.	Screen Interval (ft.)	No. of Surge Strokes	Volume of Water Removed (gal.)	Bore Volumes of Water Removed	Qualitative Description of Color/Turbidity/Odors/Other
1	17-22	10	9.0		black
2	12-17	10	9.0		black
Cumulative Totals: (Minimum of 3 Well Volumes)			18.0		

Final Depth to Water (from TOC): 12.64 Final well depth: 22.71

Thickness of Any Sediment Remaining in Well: _____

All depths reported are from reference notch in top of TOC.

APPENDIX C

Survey Data

June 11, 2019

Mr. James Calenda
EnviroAnalytis Group, LLC
1650 Des Peres Road, Suite 303
St. Louis, MO 63131

Re: Sparrows Point Well Survey
Sparrows Point, MD
Triad Engineering Job No. 03-15-0343

Mr. Calenda:
Below are the specified surveyed wells, date of last field work completed on June 6, 2019. The coordinate values shown were derived from G.P.S. observations based on National Geodetic Surveys stations “GIS 1”, PID AC7684 and “GIS 2”, PID AC7685 which purport to be on NAD83(2011) Maryland Grid coordinate system with NAVD88 (AMSL) elevations.

FORMER COKE OVEN AREA WELL LOCATIONS					
DESCRIPTION	***NORTHING***	***EASTING***	***TOP CASING ELEVATION***	***GROUND AT WELL ELEVATION***	***NOTES***
COAA-MWS	561979.891	1457970.981	10.65	11.27	FLUSH MOUNT
COA-MWS	NO WELL FOUND				
COBB-MWS	561776.152	1457813.750	16.27	13.61	
COB-MWS	561768.065	1454242.766	14.23	11.30	
COCC-MWS	561794.484	1457978.386	15.55	13.16	
COC-MWS	561775.581	1454539.223	14.32	11.56	
CODD-MWS	561604.499	1457576.287	14.37	12.30	
COD-MWS	561792.574	1454723.993	13.74	11.63	
COEE-MWS	NO WELL FOUND				
COE-MWS	561802.955	1454925.926	13.98	11.34	
COFF-MWS	561492.274	1458030.691	14.78	11.72	GROUND SHOT TAKEN ON SOUTHERN SIDE
COF-MWS	561671.419	1454219.187	14.51	11.62	

COGG-MWS	561156.320	1458040.330	12.69	10.60	
COG-MWS	561660.615	1454465.549	13.77	11.28	
COH-MWS	561707.142	1454648.497	13.76	10.60	
COI-MWS	561676.613	1454778.725	13.30	10.77	
COJ-MWS	561684.219	1454936.945	13.86	10.38	
COK-MWI	563234.629	1454749.248	6.83	4.60	

DESCRIPTION	NORTHING	EASTING	TOP CASING ELEVATION	GROUND AT WELL ELEVATION	NOTES
COK-MWS	563234.958	1454751.722	6.62	4.61	
COL-MWI	563246.333	1454911.001	7.56	4.62	
COL-MWS	563247.848	1454916.386	7.38	4.65	WELL SHOT ON LOWER, EASTERN POINT OF CASING
COM-MWI	563260.434	1455059.494	7.43	5.70	
COM-MWS	563262.594	1455064.514	8.11	5.80	
CON-MWI	563192.145	1454354.472	11.99	10.11	
CON-MWS	563190.136	1454350.586	12.01	10.03	
COO-MWI	563028.379	1454319.031	12.68	10.38	
COO-MWS	563024.252	1454318.335	12.70	10.31	
COP-MWI	563127.662	1454935.030	7.53	5.11	
COQ-MWI	563001.855	1454907.172	6.42	3.78	
COR-MWI	562836.854	1454628.124	11.65	9.59	
COS-MWS	562664.676	1454530.099	14.43	11.47	
COT-MWS	562911.804	1455128.854	11.74	9.39	
COU-MWS	562820.595	1455382.444	14.48	11.64	
COV-MWI	562760.829	1455004.678	12.20	10.36	
COW-MWS	562667.550	1455015.345	13.97	11.75	
COX-MWS	562623.230	1455434.171	15.45	12.18	GROUND SHOT TAKEN ON WESTERN SIDE
COY-MWS	562392.829	1455088.298	13.48	11.49	
COZ-MWS	562421.661	1455560.773	14.70	11.88	

APPENDIX D

Purge and YSI Calibration Logs

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190342M
Well Number: COAA-MW5	Date: 5/14/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 9.50	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 25.48	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0838	.1	9.5	15.22	11.31	3.385	1.3	177.1		turbid
0843	.5	9.5	15.23	11.50	3.364	0.73	103.9		
0848	.9		15.33	11.53	3.344	0.56	89.2		clear
0853	1.3		15.41	11.56	3.383	0.49	74.9		
0858	1.7		15.53	11.59	3.427	0.58	68.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COAA-MW5	0903	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
naOh

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_______ft x _______gal/ft = _______(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sys	Project Number: 190242.m
Well Number: COA-MW5	Date: 5/13/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 14.81	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 38.29	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1226	0	14.81	15.19	12.28	1.484	4.98	-126.9		
1231	.4	14.81	15.15	12.26	1.465	0.66	-171.6		
1236	.8		15.39	12.26	1.460	0.43	-184.7		
1241	1.2		15.18	12.26	1.455	0.38	-196.7		
1246	1.6		14.27	12.28	1.431	0.35	-201.8		
1251	2		14.01	12.24	1.416	0.31	-199.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COA-MW5	1256	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:
BTEX + napL

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Orchard Sup	Project Number: 190342-m
Well Number: COBB-MW5	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 15.38	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 28.22	Condition of Pad/Cover: good good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1138	0	15.38	17.25	10.54	3.336	5.99	-50.2		
1143	0.4	15.38	16.78	11.16	3.378	1.29	-110.8		
1148	0.8	15.38	16.69	11.25	3.411	0.25	-136.9		
1153	1.2		16.67	11.28	3.434	0.76	-141.4		
1158	1.6		16.66	11.32	3.478	0.83	-151.3		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COBB-MW5	1203	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
NaN

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ft x _____gal/ft = _____(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore	Project Number: 190340.M
Well Number: COB-MW5	Date: 5/13/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.56	Flow Rate (mL/min) 250
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 24.88	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1008	0	13.56	13.81	13.04	7.983	3.72	22.6		
1013	.4	13.56	13.86	13.10	8.077	1.28	129.4		
1018	.8		14.09	13.10	8.133	0.87	99.6		
1023	1.2		14.11	13.15	8.140	0.74	79.0		
1028	1.6		14.15	13.18	8.150	0.65	63.6		
1033	2		14.32	13.20	8.148	0.59	56.3		
1038	2.4		14.42	13.20	8.150	0.52	53.5		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COB-MW5	1043	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments: BTEX naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ft x _____gal/ft = _____(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190342M
Well Number: COCC-MW5	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 15.17	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 28.99	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1222	0.1	15.17	16.98	11.54	3.195	3.04	-119.3		
1227	0.5	15.17	16.80	11.53	3.212	0.62	-149.4		
1232	0.9	15.17	16.79	11.52	3.174	0.52	-155.7		
1237	1.3		16.80	11.52	3.198	0.35	-157.7		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COCC-MW5	1242	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: naph

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft

_______ft x _______gal/ft = _______(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: [illegible] Orchard Supply	Project Number: 190342M
Well Number: OOC-MW5	Date: 5/13/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.58	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 38.89	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1116	0	13.58	15.93	12.73	2.331	2.84	-7.2		
1121	.4	13.58	15.45	12.65	2.301	0.88	-64.1		
1126	.8		15.66	12.63	2.255	0.61	-95.2		
1131	1.2		15.72	12.61	2.270	0.49	-113.3		
1136	1.6		15.86	12.59	2.263	0.43	-123.8		
1141	2		15.86	12.58	2.266	0.40	-131.2		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
OOC-MW5	1146	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: ML

Comments:

BTEX mph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Offshore Sys	Project Number: 190342.m
Well Number: CODD-MW5	Date: 3/14/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.11	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 29.13	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0937	0	13.11	15.76	10.08	4.805	1.25	29.9		turbid
0942	.4	13.11	16.23	9.90	9.242	0.69	30.6		
0947	.8		16.26	9.88	9.033	0.40	33.3		
0952	1.2		16.45	10.16	5.590	0.31	17.0		
0957	1.6		16.13	10.33	4,557	0.29	11.9		
1002	2		15.63	10.39	4,300	0.28	9.7		
1007	2.4		15.46	10.43	4,225	0.28	7.4		
1012	2.8		15.48	10.45	4,200	0.27	4.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
CODD-MW5	1019	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
naph

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Offshore Supplemental	Project Number: 190342M
Well Number: COP-MWS(15-20)	Date: 4/9/19
Well Diameter (in): 2 s/u = 5' ags	One Well Volume (gal): 1.4
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 16.34	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 25	Condition of Pad/Cover: na / na

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1100	4		19.26	11.92	2.096	2.74	-28.0		
1105	4.6	15.55	18.68	11.91	2.033	1.32	-117.1		
1110	5.2	15.50	18.52	11.88	2.065	1.16	-145.7		
1115	5.8	15.45	18.50	11.90	2.076	1.10	-155.8		
1120	6.4	15.40	18.44	11.92	2.082	0.99	-163.7		
1125									

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COP-MWS(15-20)	1130	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: WMG

Comments:
BTEX + naphthalene

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supplemental	Project Number: 190342m
Well Number: COA-MWS(20-25)	Date: 4/9/19
Well Diameter (in): 2	One Well Volume (gal): 2.4
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.09	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 27	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1400	7	14.13	19.64	11.87	2.072	0.65	-133.6		
1405	7.6	13.57	19.50	11.82	2.046	0.16	-156.0		
1410	8.2	12.09	19.36	11.81	2.042	0.12	-166.5		
1415	8.8	12.09	19.49	11.80	2.046	0.10	-175.0		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COA-MWS(20-25)	1420	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:
BTEX + naphthalene

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supplemental	Project Number: 190242M
Well Number: COA-MWS(25-30)	Date: 4/10/19
Well Diameter (in): 2	One Well Volume (gal): 0.8
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 16.71	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 31	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0823	2.5	16.00	17.33	10.73	0.850	0.06	-125.5		
0827	3.1	16.13	17.30	10.83	0.895	0.04	-152.6		
0833	3.7	16.26	17.34	10.91	0.945	0.03	-176.0		
0837	4.3		17.28	10.94	0.966	0.03	-185.5		
0843	4.9		17.39	10.97	0.996	0.02	-194.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COA-MWS(25-30)	0847	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

BTEX + naphthalene

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supplemental	Project Number: 190342M
Well Number: COP-MWS(20-35)	Date: 4/10/19
Well Diameter (in): 2 S/U: 1.23	One Well Volume (gal): 0.8
Depth to Product (ft): None	QED Controller Settings:
Depth to Water (ft): 14.62	Flow Rate (mL/min) 500
Product Thickness (ft): None	Length of time Purged (min)
Depth to Bottom (ft): 36.23	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1003	2.5	15.82	18.16	9.24	1.640	0.07	-39.6		
1008	3.1	15.42	18.18	9.09	1.757	0.06	-71.4		
1013	3.7	15.22	18.19	9.02	1.838	0.06	-116.7		
1018	4.3		18.21	8.99	1.860	0.07	-150.1		
1023	4.9		18.17	8.96	1.882	0.08	-170.8		
1028	5.5		18.22	8.94	1.889	0.07	-183.6		
1033	6.1		18.25	8.92	1.899	0.07	-192.3		
1038	6.7		18.30	8.91	1.909	0.08	-202.5		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COP-MWS(30-35)	1043	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMC

Comments:

BTEX + naphthalene

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supplemental	Project Number: 190342M
Well Number: COD - MWS(35-40)	Date: 4/10/19
Well Diameter (in): 2 S/W: .79	One Well Volume (gal): .8
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 16.12	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 40.79	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1200	2.5	17.19	19.80	7.90	8.54	13.14	-161.3		
1205	3.1	16.56	19.45	7.06	10.03	0.24	-153.9		
1210	3.7	16.12	19.47	6.92	10.38	0.28	-151.4		
1215	4.3		19.52	6.86	10.54	0.25	-151.1		
1220	4.9		19.37	6.85	10.42	0.21	-151.3		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COD - MWS(35-40)	1225	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: BTEX + naphthalene

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supplemental	Project Number: 190342 M
Well Number: COA-MWS(40-45)	Date: 4/10/19
Well Diameter (in): 2 Vol: .62	One Well Volume (gal): .8
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 15.31	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 45.62	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1328	2.5	16.42	20.20	8.31	2.123	3.78	-27.1		
1333	3.1	16.02	20.42	8.21	2.112	2.86	-20.6		
1338	3.7	15.62	20.51	7.88	2.719	1.52	-12.16		
1343	4.3		20.68	7.58	3.269	0.93	-34.16		
1348	4.9		20.77	7.02	5.822	0.71	-98.6		
1353	5.5		20.71	6.98	5.856	0.53	-106.2		
1358	6.1		20.58	6.92	5.924	0.3	-113.0		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COA-MWS(40-45)	1403	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: BTEX + naph.

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: LOA Onshore Supplemental	Project Number: 190342M
Well Number: COD-MWS(45-50)	Date: 4/10/19
Well Diameter (in): 2 s/u = 2.12	One Well Volume (gal): .8
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 17.40	Flow Rate (mL/min) 500
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 52.12	Condition of Pad/Cover:

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1515	2.5		20.08	6.97	7.742	0.35	-129.3		
1520	3.0		19.90	6.92	7.650	0.21	-135.2		
1525	3.5		19.90	6.91	7.659	0.22	-140.9		
1530	4.0		19.83	6.91	7.689	0.20	-144.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COD-MWS(45-50)	1535	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:
BTEX + naph.

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sump	Project Number: 190342M
Well Number: COA-MWS	Date: 5/14/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.61	Flow Rate (mL/min) 250
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 30.47	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1320	.2	12.61	17.11	12.35	2.440	0.86	-89.2		
1325	.6	12.61	16.94	12.21	2.449	0.69	-135.6		
1330	1		16.94	12.25	2.457	0.38	-156.2		
1335	1.4		16.78	12.29	2.469	0.32	-169.2		
1340	1.8		16.66	12.31	2.455	0.31	-178.5		
1345	2.2		16.68	12.33	2.451	0.30	-173.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COA-MWS	1355	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX & naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: CoA Onshore Sup	Project Number: 190342-m
Well Number: COE-MW5	Date: 5/14/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.83	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 28.28	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C) ± 0.1	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1220	0	12.83	16.55	11.67	1.373	2.92	-60.4		turbid
1225	.4	12.83	16.09	11.60	1.365	0.41	-102.8		
1230	.8	12.83	16.14	11.67	1.364	0.38	-123.2		
1235	1.2		16.18	11.71	1.362	0.36	-135.1		
1240	1.6		16.10	11.72	1.361	0.34	-143.1		
1245	2		16.07	11.73	1.358	0.34	-149.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COE-MW5	1250	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:
BTEX naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sub	Project Number: 190342.m
Well Number: OFF-MW5	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 14.00	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 29.21	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1258	0	14.00	14.42	11.90	3,529	1.80	-152.9		
1303	0.4	14.00	17.33	11.91	3,485	0.52	-176.5		
1308	0.8	14.00	17.46	11.93	3.498	0.44	-173.4		
1313	1.2		17.46	11.94	3,534	0.43	-181.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
OFF-MW5	1318	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

Naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore SNP	Project Number: 190342A
Well Number: COF-MW5	Date: 5/10/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.51	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 39.23	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1143	0.1	13.51	18.19	12.62	7.137	3.11	-153.2		
1148	0.5	13.51	18.78	12.55	7.444	0.67	-207.1		
1153	0.9	13.51	18.46	12.57	7.536	0.46	-220.8		
1158	1.3		18.60	12.59	7.534	0.34	-220.6		
1203	1.7		18.52	12.59	7.528	0.29	-217.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COF-MW5	1208	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX MSD

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sump	Project Number: 190212m
Well Number: COGG-MWS	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.22	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 28.32	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1346	0.0	12.22	19.16	11.90	3.551	4.41	-102.7		
1351	0.4	12.22	19.33	11.84	3.530	0.63	-125.5		
1356	0.8	12.22	19.19	11.88	3.520	0.42	-131.9		
1401	1.2		19.25	11.89	3.538	0.36	-138.1		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COGG-MWS	1406	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: CPA Onshore Sup	Project Number: 190340.m
Well Number: COG-MW5	Date: 5/10/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): None	QED Controller Settings:
Depth to Water (ft): 12.78	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 38.51	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1248	0	12.78	18.65	12.44	4.121	2.14	-155.7		
1253	0.4	12.78	18.80	12.42	4.199	0.59	-195.7		
1258	0.8		18.92	12.42	4.192	0.35	-209.1		
1303	1.2		18.82	12.43	4.153	0.30	-199.7		
1308	1.6		18.66	12.43	4.144	0.38	-194.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COG-MW5	1313	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

BTEX naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore	Project Number: 190342m
Well Number: COH-MW5	Date: 5/10/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.92	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 39.75	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1040	0.1	12.92	12.74	11.91	2.009	2.57	-124.0		
1045	0.5	12.92	18.46	11.94	2.111	0.79	-176.6		
1050	0.9	12.92	18.73	12.03	2.145	0.47	-218.6		
1055	1.3		18.86	12.08	2.134	0.37	-228.1		
1100	1.7		18.89	12.08	2.140	0.31	-210.3		
1105	2.1		18.92	12.09	2.141	0.28	-215.1		
1110	2.5		18.97	12.09	2.142	0.25	-219.3		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COH-MW5	1115	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
naph BTEX

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Supp	Project Number: 190342M
Well Number: CO1-MW5	Date: 5/10/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.26	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 36.53	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1344	0	12.26	17.28	11.34	1.969	3.80	-49.1		
1349	0.4	12.26	17.92	11.19	1.978	1.98	-42.7		
1354	0.8	12.26	17.92	11.24	2.050	2.76	-26.8		
1359	1.2		17.60	11.26	2.049	1.87	-29.6		
1404	1.6		17.65	11.30	2.094	1.73	-30.2		
1409	2.0		17.16	11.32	2.084	1.74	-33.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
CO1-MW5	1414	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LmG

Comments:

BTEX naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190340.10
Well Number: COJ-MW5	Date: 5/13/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.94	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 28.42	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1327	0	12.94	15.83	12.25	1.784	3.28	-165.5		
1332	.4	12.94	15.16	12.09	1.621	0.53	-172.3		
1337	.8		14.95	12.13	1.613	0.38	-187.9		
1342	1.2		14.98	12.13	1.597	0.32	-199.1		
1347	1.6		14.57	12.15	1.572	0.29	-205.5		
1352	2		14.69	12.15	1.569	0.27	-211.2		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COJ-MW5	1357	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:
BTEX 1ngth

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Offshore Sump	Project Number: 190342M
Well Number: COK-MW1	Date: 5/6/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 8.98	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 52.58	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1327	0	8.98	16.18	10.62	1.690	2.33	-213.6		
1332	.5	9.01	16.50	9.92	1.732	0.49	-216.4		
1337	1	9.04	16.39	9.73	1.738	0.34	-214.3		
1342	1.5	9.07	16.55	9.58	1.745	0.28	-228.7		
1347	2	9.1	16.49	9.49	1.741	0.28	-255.6		
1352	2.5	9.13	16.54	9.44	1.739	0.25	-262.7		
1357	3	9.16	16.50	9.40	1.739	0.24	-258.4		
1402	3.5	9.19	16.53	9.35	1.737	0.22	-271.5		
1407	4	9.21	16.68	9.33	1.736	0.22	-259.2		
1412	4.5	9.24	16.57	9.31	1.734	0.21	-266.0		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COK-MW1	1417	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: ORP d/n stabilize

BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 40342m
Well Number: COK-MW5	Date: 5/6/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 6.09	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 17.36	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1237	0	6.09	15.25	11.30	1.561	3.15	-241.7		
1242	0.5	6.09	15.19	11.48	1.553	0.75	-236.0		
1247	1	6.09	15.43	11.53	1.545	0.44	-281.6		
1252	1.5		15.47	11.50	1.515	0.35	-302.9		
1257	2		15.40	11.42	1.484	0.30	-265.5		
1302	2.5		15.45	11.41	1.430	0.27	-257.7		
1307	3		15.43	11.42	1.425	0.26	-264.8		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COK-MW5	1312	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMA

Comments:

BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling Permanent Wells	**ARM Group Inc.** Earth Resource Engineers and Consultants
Project Name: COA On-Site	Project Number: 190342h
Well Number: COL-MW1	Date: 5/1/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.15	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 53.32	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1332	0.2	10.15	17.1	11.58	1.830	0.71	-278.0		
1337	0.7		16.9	11.56	1.853	0.22	-294.1		
1342	1.2		16.9	11.56	1.852	0.06	-300.9		
1347	1.7		17.0	11.56	1.851	0.01	-303.5		
1352	2.2		16.9	11.56	1.854	0.00	-306.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COL-MW1	1357	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LWG

Comments: BTEX not DRO + GRO

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA On. Sup.	Project Number: 190340-m
Well Number: COL-MW5	Date: 5/1/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 7.10	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 17.98	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1212	0.1	7.1	15.2	11.94	1.737	0.46	-286.1		
1217	0.6	7.1	15.4	11.98	1.714	0.14	-306.0		
1222	1.1	7.1	15.4	11.98	1.698	0.07	-288		
1227	1.6		15.4	11.99	1.699	0.04	-304.9		
1232	2.1		15.5	12.00	1.700	0.02	-306.7		
1237	2.6		15.4	12.01	1.715	0.02	-306.0		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COL-MW5	1242	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COP Ont. Sup.	Project Number: 190242M
Well Number: COM-MW1	Date: 5/1/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.11	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 53.59	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1110	0.2	10.11	16.0	11.52	1.355	0.77	-254.9		
1115	0.7	10.13	15.9	10.84	1.287	0.13	-302.4		
1120	1.2	10.15	16.0	10.67	1.286	0.03	-320.5		
1125	1.7	10.19	16.2	10.61	1.283	0.00	-327.9		
1130	2.2	10.19	16.1	10.52	1.292	-0.01	-328.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COM-MW1	1135	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: JMG

Comments:
BTEX, naph, DRO + GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ft x _____gal/ft = _____(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190342 M
Well Number: COM-MW5	Date: 5/1/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 7.36	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 17.92	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1025	0.6	7.36	14.8	12.87	9.6816	0.90	-216.4		
1030	1.1	7.36	13.4	12.90	9.715	0.21	-150.2		
1035	1.6		13.3	12.92	9.725	0.10	-172.8		
1040	2.1		13.2	12.92	9.724	0.016	-182.2		
1045	2.6		13.3	12.93	9.722	0.03	-187.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COM-MW5	1050	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX, naph, DRO, GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: CAA Offshore Sup	Project Number: 1903/2m
Well Number: ON-MW1	Date: 5/7/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.59	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 54.03	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0923	0.2	10.59	16.82	12.02	1.707	0.67	-178.5		
0928	0.7	10.59	17.06	12.18	2.341	0.52	-205.9		
0933	1.2	10.60	17.20	12.23	2.510	0.42	-219.5		
0938	1.7	10.60	17.22	12.28	2.605	0.38	-222.4		
0943	2.2	10.61	17.43	12.29	2.682	0.33	-227.1		
0948	2.7		17.41	12.29	2.712	0.30	-226.0		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
ON-MW1	0953	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore	Project Number: 190342.m
Well Number: CON-MW5	Date: 5/7/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.54	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 18.01	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0841	0.1	10.54	15.24	11.79	2.328	3.02	-31.5		
0846	0.6	10.54	15.22	11.89	2.239	1.49	-124.4		
0851	1.1	10.54	15.39	11.98	2.223	1.18	-137.1		
0856	1.6		15.41	12.00	2.200	0.89	-136.1		
0901	2.1		15.39	12.04	2.198	0.77	-141.7		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
CON-MW5	0906	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore	Project Number: 190342.n
Well Number: COO-MW1	Date: 5/7/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 11.36	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 54.61	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1108	0.2	11.36	19.01	12.06	2.352	3.03	-182.9		
1113	0.7	11.36	19.49	12.11	2.490	0.51	-217.9		
1118	1.2	11.36	19.36	12.14	2.547	0.32	-211.5		
1123	1.7		19.33	12.15	2.547	0.26	-204.2		
1128	2.2		19.24	12.16	2.537	0.22	-199.2		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COO-MW1	1133	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ft x _____gal/ft = _____(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sump	Project Number: 190342m
Well Number: 100 - MW5	Date: 5/7/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 11.35	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 18.04	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1030	0.1	11.35	17.80	11.93	2.295	2.25	-148.4		
1035	0.6	11.35	18.04	11.93	2.284	0.163	-173.4		
1040	1.1	11.36	17.97	11.98	2.260	0.44	-173.0		
1045	1.6		17.92	12.01	2.244	0.36	-178.2		
1050									

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COO - MW5	1050	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:
BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore SM	Project Number: 19034m
Well Number: COP-MW1	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 8.89	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 54.47	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1019	0.1	8.89	17.25	9.07	0.704	4.26	-92.9		
1024	0.5	8.89	16.78	8.45	0.677	0.88	-96.6		
1029	0.9	8.90	16.82	8.27	0.663	0.61	-97.4		
1034	1.3	8.90	16.76	8.17	0.663	0.49	-100.9		
1039	1.7	8.91	16.82	8.09	0.678	0.44	-110.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COP-MW1	1044	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

BTEX, naph, DRO, GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Site	Project Number: 190342
Well Number: COQ - MW1	Date: 5/9/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 6.78	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 53.41	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0903	0	6.78	16.66	6.06	1.521	2.54	-135.8		
0908	0.5	6.78	16.73	8.55	1.521	1.38	-199.3		
0913	1.0	6.78	16.75	9.44	1.543	0.94	-253.4		
0918	1.5		16.83	9.95	1.582	0.21	-282.[illegible]		
0923	2.0		16.83	10.30	1.629	0.54	-291.5		
0928	2.5		16.87	10.48	1.704	0.44	-302.1		
0933	3.0		16.94	10.59	1.719	0.38	-305.8		
0938	3.5		16.95	10.65	1.725	0.42	-307.8		
0943	4.0		16.96	10.68	1.721	0.49	-332.9		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COQ-MW1	0948	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: BTex nap DRO GRO

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft
_______ft x _______gal/ft = _______(gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190349-M
Well Number: COR-MW1	Date: 5/14/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.33	Flow Rate (mL/min) 350
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 39.19	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1053	1.5	10.33	16.40	10.26	0.622	8.88	1.0		
1058	1.9		16.52	10.30	0.533	0.67	-23.4		
1103	2.3		16.42	10.34	0.509	0.49	-26.9		
1108	2.7		16.50	10.37	0.502	0.54	-26.8		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COR-MW1	1113	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: purged ~1.5 gal due to sheen in water
DRO GRO BTEX Naph

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore	Project Number: 190342M
Well Number: COS-MW5	Date: 5/16/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 14.00	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 24.07	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0856	0.3	14.00	16.09	11.57	1.171	2.84	202.6		
0901	0.8	14.00	16.04	11.64	1.123	1.68	44.7		
0906	1.3	14.00	15.96	11.69	1.128	0.90	17.4		
0911	1.8		15.91	11.75	1.150	0.71	-6.0		
0916	2.3		15.93	11.82	1.167	0.59	-36.2		
0921	2.8		15.94	11.86	1.171	0.52	-61.2		
0926	3.3		15.98	11.93	1.172	0.47	-88.7		
0931	3.8		15.97	11.95	1.166	0.44	-89.2		
0936	4.3		15.99	11.96	1.159	0.41	-99.1		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COS-MW5	0941	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMC

Comments:
BTEX, naph. DRO, GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sump	Project Number: 190342.M
Well Number: COT-MW5	Date: 5/8/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 10.82	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 23.71	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
0855	0.1	10.82	16.07	10.47	1.154	2.33	-201.5		
0900	0.6		16.18	11.20	1.211	0.43	-250.3		
0905	1.1		16.17	11.34	1.197	0.40	-248.0		
0910	1.6		16.19	11.37	1.140	0.33	-251.7		
0915	2.1		16.21	11.39	1.107	0.31	-270.3		
0920	2.6		16.13	11.40	1.090	0.29	-264.8		
0925	3.1		16.28	11.42	1.079	0.27	-254.5		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COT-MW5	0930	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: BTEX, naph, DRO, GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190342m
Well Number: COU-MW5	Date: 5/8/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.42	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 24.46	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1358	0.1	13.42	17.12	8.97	2.105	0.64	-53.2		
1403	0.6	13.42	16.75	8.99	1.480	0.26	-90.7		
1408	1.1	13.42	16.27	8.84	1.163	0.20	-118.5		
1413	1.6		16.20	8.77	0.996	0.18	-147.3		
1418	2.1		16.03	8.74	0.931	0.16	-164.4		
1423	2.6		15.94	8.74	0.892	0.15	-186.8		
1428	3.1		15.85	8.74	0.860	0.15	-203.2		
1433	3.6		15.82	8.74	0.842	0.14	-221.1		
1438	4.1		15.80	8.76	0.821	0.14	-240.2		
1443	4.6		15.81	8.77	0.811	0.13	-255.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COU-MW5	1448	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments: ORP only stab/2+ BTEX and DRO GRO

Casing Volume: 1" I.D. = 0.041 gal/ft - 2" I.D. = 0.163 gal/ft - 4" I.D. = 0.653 gal/ft - 6" I.D. = 1.47 gal/ft

______ ft x ______ gal/ft = ______ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 90342m
Well Number: COV-MW1	Date: 5/6/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.23	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 53.21	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1108	0.2	12.23	17.87	10.17	0.1649	1.19	-151.2		
1113	0.7	12.23	17.91	10.04	0.1643	0.48	-150.6		
1118	1.2	12.23	17.89	10.08	0.1647	0.36	-159.7		
1123	1.7		18.01	10.05	0.1649	0.29	-164.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COV-MW1	1128	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
		Matrix Spike			
		Duplicate			

Sampled By: LMG

Comments:

BTEX nach DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Orchard Sup	Project Number: 190242-M
Well Number: LOW-MW5	Date: 5/16/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.19	Flow Rate (mL/min) 406
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 23.04	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1012	0.3	13.19	18.08	11.59	1.065	1.24	-147.9		
1017	0.8	13.21	17.90	11.69	1.067	0.54	-168.4		
1022	1.3	13.24	17.74	11.73	1.059	0.36	-194.4		
1027	1.8	13.24	17.85	11.75	1.064	0.32	-191.6		
1032	2.3	13.29	17.92	11.75	1.063	0.30	-197.8		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
LOW-MW5	1037	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

BTEX, naph, DRO, GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Smp	Project Number: 190240.m
Well Number: COX-MW5	Date: 5/8/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 14.46	Flow Rate (mL/min)
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 24.97	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1256	0.2	14.46	19.14	7.54	3.026	0.62	-184.3		
1301	0.7	14.46	19.01	7.40	2.892	0.31	-183.4		
1306	1.2	14.46	18.67	7.39	1.873	0.28	-202.1		
1311	1.7		18.56	7.42	1.544	0.29	-201.2		
1316	2.2		18.32	7.43	1.500	0.33	200.0		
1321	2.7		18.48	7.43	1.478	0.31	-198.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COX-MW5	1326	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

Comments:

BTEX nap DRO CRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: COA Onshore Sup	Project Number: 190242m
Well Number: COY-MW5	Date: 5/8/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 12.35	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 22.96	Condition of Pad/Cover: good / good

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1025	0.1	12.35	17.51	11.36	0.942	0.95	-235.5		
1030	0.6	12.40	17.39	11.40	0.931	0.39	-263.4		
1035	1.1	12.43	17.52	11.48	0.923	0.31	-252.6		
1040	1.6	12.50	17.49	11.49	0.918	0.33	-227.7		
1045	2.1	12.55	17.51	11.51	0.916	0.32	-210.3		
1050	2.6	12.60	17.57	11.52	0.918	0.28	-212.0		
1055	3.1	12.65	17.57	11.54	0.920	0.25	-213.4		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
COY-MW5	1100	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: MG

Comments:

BTEX naph DRO GRO

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft

_____ ft x _____ gal/ft = _____ (gal)

Low Flow Sampling
Permanent Wells

ARM Group Inc.
Earth Resource Engineers and Consultants

Project Name: [illegible] Sump	Project Number: 19042.m
Well Number: CO2-MW5	Date: 5/8/19
Well Diameter (in): 2	One Well Volume (gal):
Depth to Product (ft): none	QED Controller Settings:
Depth to Water (ft): 13.60	Flow Rate (mL/min) 400
Product Thickness (ft): none	Length of time Purged (min)
Depth to Bottom (ft): 23.98	Condition of Pad/Cover: good 1000d

PURGING RECORD

Time	Volume Purged (gallons)	DTW (feet)	Temp (°C)	pH (s.u.) ± 0.1	Specific Conductance (ms/cm) ± 3%	Dissolved Oxygen (mg/L) ± 0.3	ORP (mV) ± 10	Turbidity (NTU) ± 10% or < 5	Comments
1145	0.2	13.10	18.00	8.61	0.788	0.73	-125.7		
1150	0.7	13.6	17.94	8.38	0.767	0.41	-152.5		
1155	1.2	13.6	17.87	8.32	0.673	0.32	-172.1		
1200	1.7		17.66	8.14	0.607	0.28	-182.4		
1205	2.2		17.69	8.50	0.585	0.25	-168.3		
1210	2.7		17.66	8.49	0.587	0.23	-156.3		
1215	3.2		17.71	8.48	0.582	0.22	-146.6		

MONITORING SAMPLE RECORD

Sample ID	Time Collected	Parameter/Order	Container	Perservative	Collected?
CO2-MW5	1220	TCL-VOCs	3 - 40 mL VOA	HCl	
		TPH-GRO	3 - 40 mL VOA	HCl	
		TPH-DRO	2 - 1 L Amber	none	
		TCL-SVOCs	2- 1 L Amber	none	
		Oil & Grease	2- 1 L Amber	HCl	
		TAL-Metals & Mercury (total)	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (total)	1 - 250 mL Plastic	none	
		Total Cyanide	1 - 250 mL Plastic	NaOH	
		TAL-Metals & Mercury (Dissolved) **Field Filtered**	1 - 250 mL Plastic	HNO3	
		Hexavalent Chromium (Dissolved) **Field Filtered**	1 - 250 mL Plastic	none	
		PCB	2 - 1 L Amber	None	
Matrix Spike					
Duplicate					

Sampled By: LMG

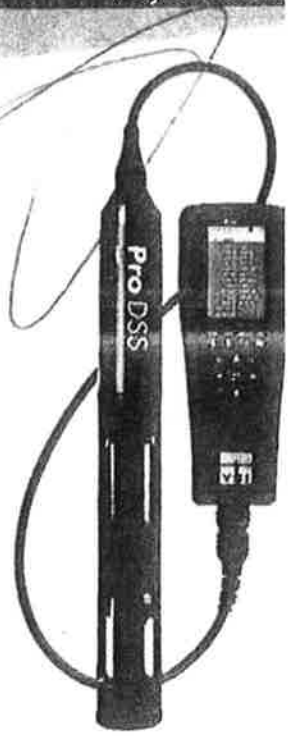
Comments:
BTEX naf DRO CLG

Casing Volume: **1" I.D.** = 0.041 gal/ft - **2" I.D.** = 0.163 gal/ft - **4" I.D.** = 0.653 gal/ft - **6" I.D.** = 1.47 gal/ft
_____ ft x _____ gal/ft = _____ (gal)

ProDSS Calibration Worksheet

YSI a xylem brand

When the Environment Demands It



This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results. 55e mPS

Calibration Date 4/9/19 **Technician:** LMG

Handheld Serial Number: _____ **Handheld Software Version:** _____

Cable Serial Number: Pine #15015

Temperature

Reading when sensor is dry and in room temp air: 19.27 *Accurate?* **Y** **N**

Conductivity

Reading when sensor is dry and in room temp air: ~~0.12 5mS/cm~~ 0.109 *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 1.448 mS/cm

Reading in calibration solution after calibration is completed: 1.413 mS/cm

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

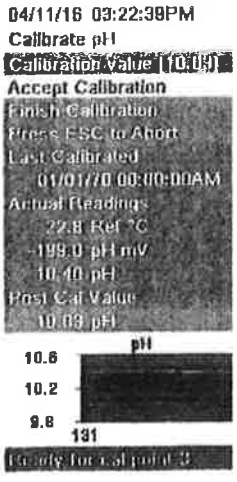
Optical Dissolved Oxygen

Barometric pressure: 29.70 in Hg

Actual Reading before DO% calibration is accepted: 123.37

Reading in DO% calibration environment after calibration is completed: 98.72

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**



pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7				-50 mV to 50 mV
4	4	4.55		+165 to +180 from pH 7 buffer mV value
10	10	9.97		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ProDSS Calibration Worksheet

YSI a xylem brand

When the Environment Demands It

ORP

Actual Reading in solution before calibration is accepted: 246.5mV

Reading in calibration solution after calibration is completed: 240mV

ORP Cal Offset in GLP record after calibration: _____ *Acceptable range is* **-100** *to* **50**

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* **-10** *to* **10** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*

Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without chilling a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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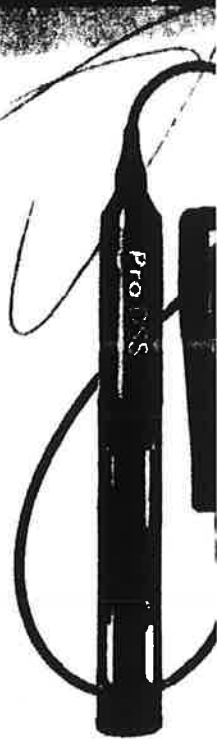
ProDSS Calibration Worksheet

a xylem

When the Environment



This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date: 5/6/19 **Technician:** LMG

Handheld Serial Number: 15E1015655 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 20.27 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.052 *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.507

Reading in calibration solution after calibration is completed: 4.491

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

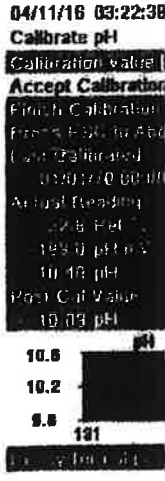
Optical Dissolved Oxygen

Barometric pressure: 759

Actual Reading before DO% calibration is accepted: 122.9%

Reading in DO% calibration environment after calibration is completed: 100%

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**



pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	7.22		-50 mV to 50 mV
4	4	4.29		+165 to +180 from pH 7 buffer mV value
10	10	10.06		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ORP

Actual Reading in solution before calibration is accepted: 257.5

Reading in calibration solution after calibration is completed: 240

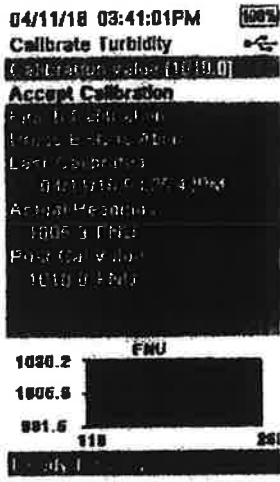
ORP Cal Offset in GLP record after calibration: ✓ *Acceptable range is* **-100** *to* **50**

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* **-10** *to* **10** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*



Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without rinsing a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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When the Environment Counts

This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/7/19 **Technician:** LMG

Handheld Serial Number: 15F101565 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 19.25 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.058 mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.573 mS

Reading in calibration solution after calibration is completed: 4.49 mS

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

Optical Dissolved Oxygen

Barometric pressure: 760

Actual Reading before DO% calibration is accepted: 108.8 %

Reading in DO% calibration environment after calibration is completed: 100%

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**

pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	7.06		-50 mV to 50 mV
4	4	3.87		+165 to +180 from pH 7 buffer mV value
10	10	10.08		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ORP

Actual Reading in solution before calibration is accepted: 239.6 mV

Reading in calibration solution after calibration is completed: 240 mV

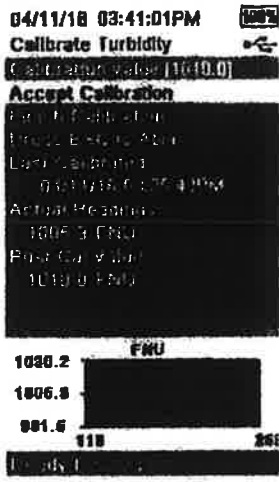
ORP Cal Offset in GLP record after calibration: ____ *Acceptable range is* ***-100*** *to* ***50***

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* ***-10*** *to* ***10*** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*



Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without rinsing a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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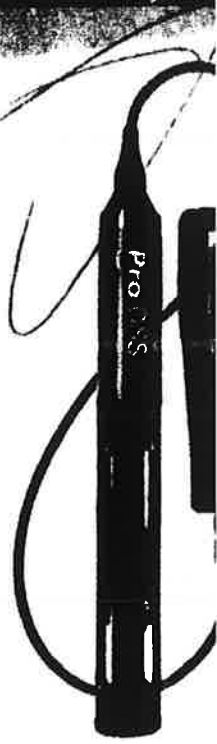
When the Environment



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Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/8/19 **Technician:** LMG

Handheld Serial Number: 15F101565 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 20.98 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.046 mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.992 mS

Reading in calibration solution after calibration is completed: 4.49 mS.

Conductivity Cell Constant in GLP record after calibration:* ~~_____~~

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

Optical Dissolved Oxygen

Barometric pressure: 760.1

Actual Reading before DO% calibration is accepted: 94.7%

Reading in DO% calibration environment after calibration is completed: 100%

ODO gain in GLP record after calibration: ~~_____~~ *Acceptable range is* **0.75** *to* **1.50**

pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	7.04		-50 mV to 50 mV
4	4	3.97		+165 to +180 from pH 7 buffer mV value
10	10	10.4		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ORP

Actual Reading in solution before calibration is accepted: 240.9

Reading in calibration solution after calibration is completed: 240

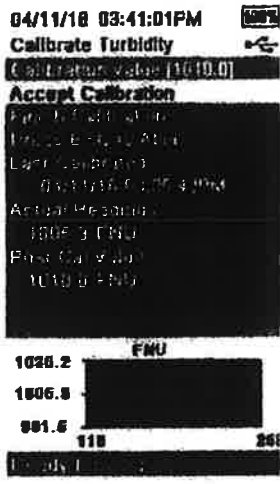
ORP Cal Offset in GLP record after calibration: ____ *Acceptable range is* **-100** *to* **50**

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* **-10** *to* **10** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*



Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without pulling a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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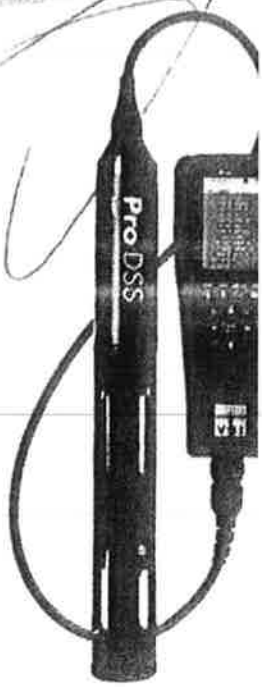
When the Environment Is Critical



This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/9/19 **Technician:** LMG

Handheld Serial Number: 15F101565 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 20.34 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.026mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.49mS

Reading in calibration solution after calibration is completed: 4.609mS

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

Optical Dissolved Oxygen

Barometric pressure: 767.8

Actual Reading before DO% calibration is accepted: 98.2

Reading in DO% calibration environment after calibration is completed: 101.0

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**

pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	6.96		-50 mV to 50 mV
4	4	3.99		+165 to +180 from pH 7 buffer mV value
10	10	10.01		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ORP

Actual Reading in solution before calibration is accepted: 236.8

Reading in calibration solution after calibration is completed: 240

ORP Cal Offset in GLP record after calibration: _____ *Acceptable range is* **-100** *to* **50**

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* **-10** *to* **10** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*

Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without adding a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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When the Environment Matters

This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/10/19 **Technician:** LMG

Handheld Serial Number: 15F101565 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 20.4 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.018mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.498 mS

Reading in calibration solution after calibration is completed: 4.49mS

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

Optical Dissolved Oxygen

Barometric pressure: 763.0

Actual Reading before DO% calibration is accepted: 99.3 %

Reading in DO% calibration environment after calibration is completed: 100.3 %

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**

pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	6.96		-50 mV to 50 mV
4	4	4.04		+165 to +180 from pH 7 buffer mV value
10	10	10.00		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ORP

Actual Reading in solution before calibration is accepted: 238.5

Reading in calibration solution after calibration is completed: 240mV

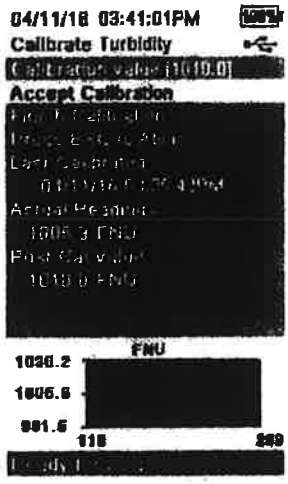
ORP Cal Offset in GLP record after calibration: _____ *Acceptable range is* **-100** *to* **50**

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* **-10** *to* **10** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*



Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without running a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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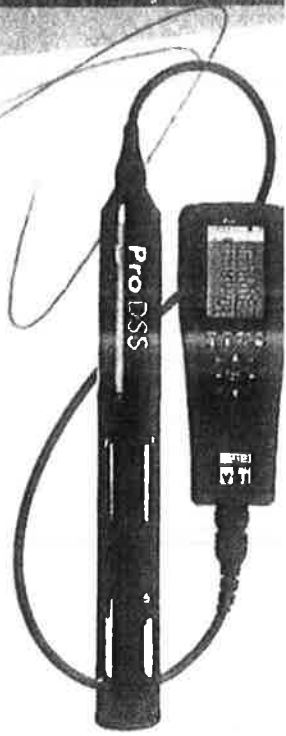
When the Environment Demands It



This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/13/19 **Technician:** LMG

Handheld Serial Number: 15F101565 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 18.43 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.089 mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.333 mS

Reading in calibration solution after calibration is completed: 4.49 mS

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

Optical Dissolved Oxygen

Barometric pressure: 763

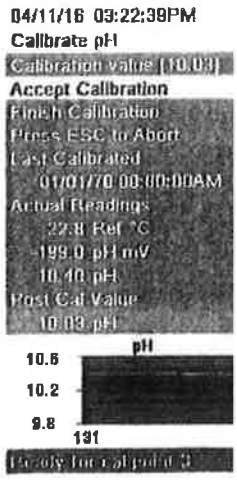
Actual Reading before DO% calibration is accepted: 95.5

Reading in DO% calibration environment after calibration is completed: 100.4

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**

pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer:
7	7	7.05		-50 mV to 50 mV
4	4	3.98		+165 to +180 from pH 7 buffer mV value
10	10	9.81		-165 to -180 from pH 7 buffer mV value



pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ProDSS Calibration Worksheet

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When the Environment Demands It

ORP

Actual Reading in solution before calibration is accepted: 244.2

Reading in calibration solution after calibration is completed: 240

ORP Cal Offset in GLP record after calibration: _____ *Acceptable range is* ***-100*** *to* ***50***

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* ***-10*** *to* ***10*** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*

Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without chilling a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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ProDSS Calibration Worksheet

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When the Environment Changes It

This calibration worksheet can help document your calibration and track the performance of your sensors. Please follow the detailed calibration procedures in the ProDSS manual or your facility's standard operating procedure (SOP) to ensure all calibrations are as accurate and as consistent as possible.

Refer to the *YSI Solution Expiration Dates* document to ensure your calibration solutions are fresh. In addition to using fresh standards, never accept an out-of-range or questionable calibration results.

Calibration Date 5/14/19 **Technician:** LMG

Handheld Serial Number: 16F101568 **Handheld Software Version:** _____

Cable Serial Number: _____

Temperature

Reading when sensor is dry and in room temp air: 20.52 *Accurate?* (Y) N

Conductivity

Reading when sensor is dry and in room temp air: 0.037mS *Acceptable value is less than* **1 µS/cm**

Actual Reading in solution before calibration is accepted: 4.637

Reading in calibration solution after calibration is completed: 4.49mS

Conductivity Cell Constant in GLP record after calibration:* ✓

Acceptable range for ProDSS conductivity/temperature sensors (626902) is **4.5** *to* **6.5**

Acceptable range for integral (i.e. built-in) sensors on ODO/CT assemblies is **4.4** *to* **6.4**

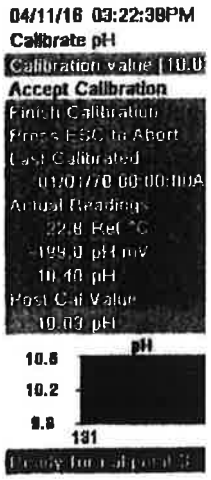
Optical Dissolved Oxygen

Barometric pressure: 765

Actual Reading before DO% calibration is accepted: 106.2%

Reading in DO% calibration environment after calibration is completed: 100.4%

ODO gain in GLP record after calibration: ✓ *Acceptable range is* **0.75** *to* **1.50**



pH

		Actual Readings during calibration		
Buffer	Calibration Value	pH	pH mV**	Acceptable pH mV in buffer
7	7	6.96		-50 mV to 50 mV
4	4	4.27		+165 to +180 from pH 7 buffer mV value
10	10	10.19		-165 to -180 from pH 7 buffer mV value

pH slope in GLP record after calibration: _____ *Acceptable range is ~* **55** *to* **60** *pH/mV (Ideal is 59.16 mV/pH)*

**GLP stands for Good Laboratory Practice file This calibration record contains important information about the calibration result.*

***The pH mV at the time of calibration (Sensor Value) can also be seen in the final pH GLP record.*

ProDSS Calibration Worksheet

a xylem br

When the Environment Demands It

ORP

Actual Reading in solution before calibration is accepted: 239.4

Reading in calibration solution after calibration is completed: 240

ORP Cal Offset in GLP record after calibration: _____ *Acceptable range is* ***-100*** *to* ***50***

Turbidity

Calibration value (FNU)*	Actual Reading during calibration
0	
12.4*	
124*	
1010	

Acceptable range for ***Actual Reading*** *during calibration of the first point is* ***-10*** *to* ***10*** *FNU*

***Note:** The turbidity sensor can be calibrated to 3 points. Either 12.4 or 124 FNU standard can be used for the second point, but not both. Other calibration values can be used when calibrating.*

Depth (Completed in Air)

Actual Reading before calibration is accepted: _____

Reading in air after calibration is completed: _____

Ammonium

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			-20 mV to 20 mV
2nd point: 100 mg/L			+90 to +130 from mV value in 1 mg/L standard

Nitrate

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 1 mg/L			180 mV to 220 mV
2nd point: 100 mg/L			-90 to -130 from mV value in 1 mg/L standard

Chloride

	Actual Readings during calibration		
Concentration** (i.e. Calibration Value)	mg/L	mV***	Acceptable mV when the sensor is new
1st point: 10 mg/L			205 mV to 245 mV
2nd point: 1,000 mg/L			-80 to -130 from mV value in 10 mg/L standard

***Other standard concentrations can be used. A 2 point calibration without chilling a third calibration solution is extremely accurate and is the preferred method. However, if there is a large temperature variation during sampling, a chilled third calibration point is recommended.*

****The mV at the time of calibration (Sensor Value) for each point can also be seen in the GLP record after a calibration is complete.*

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APPENDIX E

Pore Water Sampling Photograph Log

Photo 1: View of CO-016-PW-3 after attempting a 3 foot sample in Cell 3 of the Coke Oven Area.

Photo 2: View of CO-025-PW-1 after attempting a 9 inch sample in Cell 3 of the Coke Oven Area.

Photo 3: View of CO-040-PW-1 after attempting a 9 inch sample in Cell 3 of the Coke Oven Area.

Photo 4: View of CO-045-PW-3 after attempting a 3 foot sample in Cell 3 of the Coke Oven Area.
Black mud extends nearly up to the flange of the push-point sampler.

Photo 5: View of CO-056-PW-1 after attempting a 9 inch sample in Cell 2 of the Coke Oven Area. .

Photo 6: View of CO-059-PW-1 after attempting a 9 inch sample in Cell 2 of the Coke Oven Area. .

Photo 7: View of CO-061-PW-2 after attempting a 2 foot sample in Cell 2 of the Coke Oven Area. .

Photo 8: View of CO-062-PW-1 after attempting a 9 inch sample in Cell 2 of the Coke Oven Area. .

Photo 9: View of CO-068-PW-1 after attempting a 9 inch sample in Cell 2 of the Coke Oven Area. .

Photo 10: View of CO-083-PW-3 after attempting a 3 foot sample in Cell 5 of the Coke Oven Area. .

Photo 11: View of CO-089-PW-1 after attempting a 9 inch sample in Cell 5 of the Coke Oven Area. .

Photo 12: View of CO-089-PW-3 after attempting a 3 foot sample in Cell 5 of the Coke Oven Area.

Photo 13: View of CO-095-PW-2 after attempting a 2 foot sample in Cell 5 of the Coke Oven Area. .

APPENDIX F

QA/QC Tracking Log

QA/QC Tracking Log

Trip Blank:	Date:	Sample IDs		
Y	5/1/2019	1)	COM-MWS	
Y		2)	COM-MWI	
Y		3)	COL-MWS	
Y		4)	COL-MWI	
Y	5/6/2019	5)	COS-MWS	
Y		6)	COW-MWS	
Y		7)	COV-MWI	Duplicate: COV-MWI
Y		8)	COK-MWS	Date: 5/6/2019
Y		9)	COK-MWI	MS/MSD: COO-MWI
Y	5/7/2019	10)	CON-MWS	Date: 5/7/2019
Y		11)	CON-MWI	Field Blank:
Y		12)	COO-MWS	Date: 5/7/2019
Y		13)	COO-MWI	Eq. Blank: -
Y	5/8/2019	14)	COT-MWS	Date: -
Y		15)	COY-MWS	
Y		16)	COZ-MWS	
Y		17)	COX-MWS	
Y		18)	COU-MWS	
Y	5/9/2019	19)	COQ-MWI	
Y		20)	COP-MWI	

Trip Blank:	Date:	Sample IDs		
		1)	COBB-MWS	
		2)	COCC-MWS	
		3)	COFF-MWS	
		4)	COGG-MWS	
Y	5/10/2019	5)	COH-MWS	
Y		6)	COF-MWS	
Y		7)	COG-MWS	Duplicate: COB-MWS
Y		8)	COI-MWS	Date: 5/13/2019
Y	5/13/2019	9)	COB-MWS	MS/MSD: COAA-MWS
Y		10)	COC-MWS	Date: 5/14/2019
Y		11)	COA-MWS	Field Blank:
Y		12)	COJ-MWS	Date: 5/13/2019
	5/14/2019	13)	COAA-MWS	Eq. Blank: -
		14)	CODD-MWS	Date: -
Y		15)	COR-MWI	
Y		16)	COE-MWS	
Y		17)	COD-MWS	
		18)		
		19)		
		20)		

Trip Blank:	Date:	Sample IDs	
		1)	
		2)	
		3)	
		4)	
		5)	
		6)	
		7)	Duplicate:
		8)	Date:
		9)	MS/MSD:
		10)	Date:
		11)	Field Blank:
		12)	Date:
		13)	Eq. Blank:
		14)	Date:
		15)	
		16)	
		17)	
		18)	
		19)	
		20)	

		1)		
		2)		
		3)		
		4)		
		5)		
		6)		
		7)		Duplicate:
		8)		Date:
		9)		MS/MSD:
		10)		Date:
		11)		Field Blank:
		12)		Date:
		13)		Eq. Blank:
		14)		Date:
		15)		
		16)		
		17)		
		18)		
		19)		
		20)		

APPENDIX G

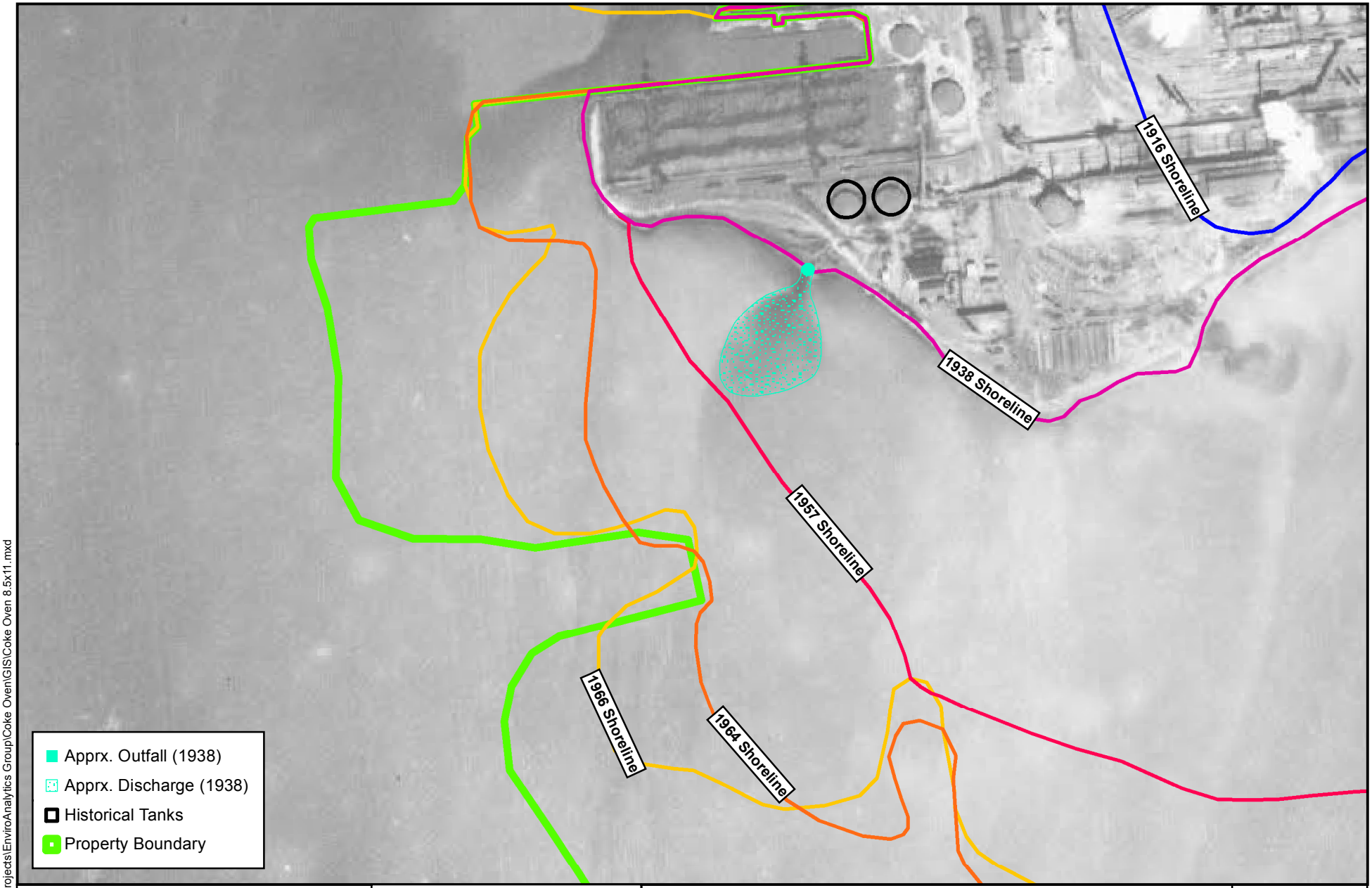
Evaluation of Data Completeness

EVALUATION OF DATA COMPLETENESS
Percentage of Non-Rejected Results vs. Total Results

Parameter	Matrix	Unit	Number of Validated Results	Detections	Number of Rejected Results	Number of Non-rejected Results	Completeness
Benzene	Groundwater	ug/L	31	31	0	31	100%
Ethylbenzene	Groundwater	ug/L	31	31	0	31	100%
Toluene	Groundwater	ug/L	31	31	0	31	100%
Xylene	Groundwater	ug/L	31	31	0	31	100%
Naphthalene	Groundwater	ug/L	37	37	0	37	100%
Diesel Range Organics	Groundwater	ug/L	21	21	0	21	100%
Gasoline Range Organics	Groundwater	ug/L	21	21	0	21	100%
Benzene	Pore Water	ug/L	38	14	0	38	100%
Ethylbenzene	Pore Water	ug/L	38	9	0	38	100%
Toluene	Pore Water	ug/L	38	9	0	38	100%
Xylene	Pore Water	ug/L	38	9	0	38	100%
Naphthalene	Pore Water	ug/L	45	37	0	45	100%
Diesel Range Organics	Pore Water	ug/L	32	32	0	32	100%
Gasoline Range Organics	Pore Water	ug/L	33	6	0	33	100%
Benzene	Surface Water	ug/L	57	35	0	57	100%
Ethylbenzene	Surface Water	ug/L	57	2	0	57	100%
Toluene	Surface Water	ug/L	57	27	0	57	100%
Xylene	Surface Water	ug/L	57	13	0	57	100%
Naphthalene	Surface Water	ug/L	57	54	0	57	100%

APPENDIX H

1938-1982 Aerial Plumes



N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500
Feet

Former Coke Oven Area
Shoreline Progression &
1938 Source Tank Discharge

Figure 1

\\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\Coke Oven 8.5x11.mxd

N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Shoreline Progression &
1948 Source Tank Discharge

Figure 2

\\armgroup.lcl\CorpData\Projects\EnviroAnalytics Group\Coke Oven\GIS\Coke Oven 8.5x11.mxd

N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Shoreline Progression &
1952 Source Tank Discharge

Figure 3

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N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Shoreline Progression &
1957 Source Tank Discharge

Figure 4

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N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Shoreline Progression &
1964 Source Tank Discharge

Figure 5

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N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500
Feet

Former Coke Oven Area
Shoreline Progression &
1966 Source Tank Discharge

Figure 6

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N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Shoreline Progression &
1982 Source Tank Discharge

Figure 7

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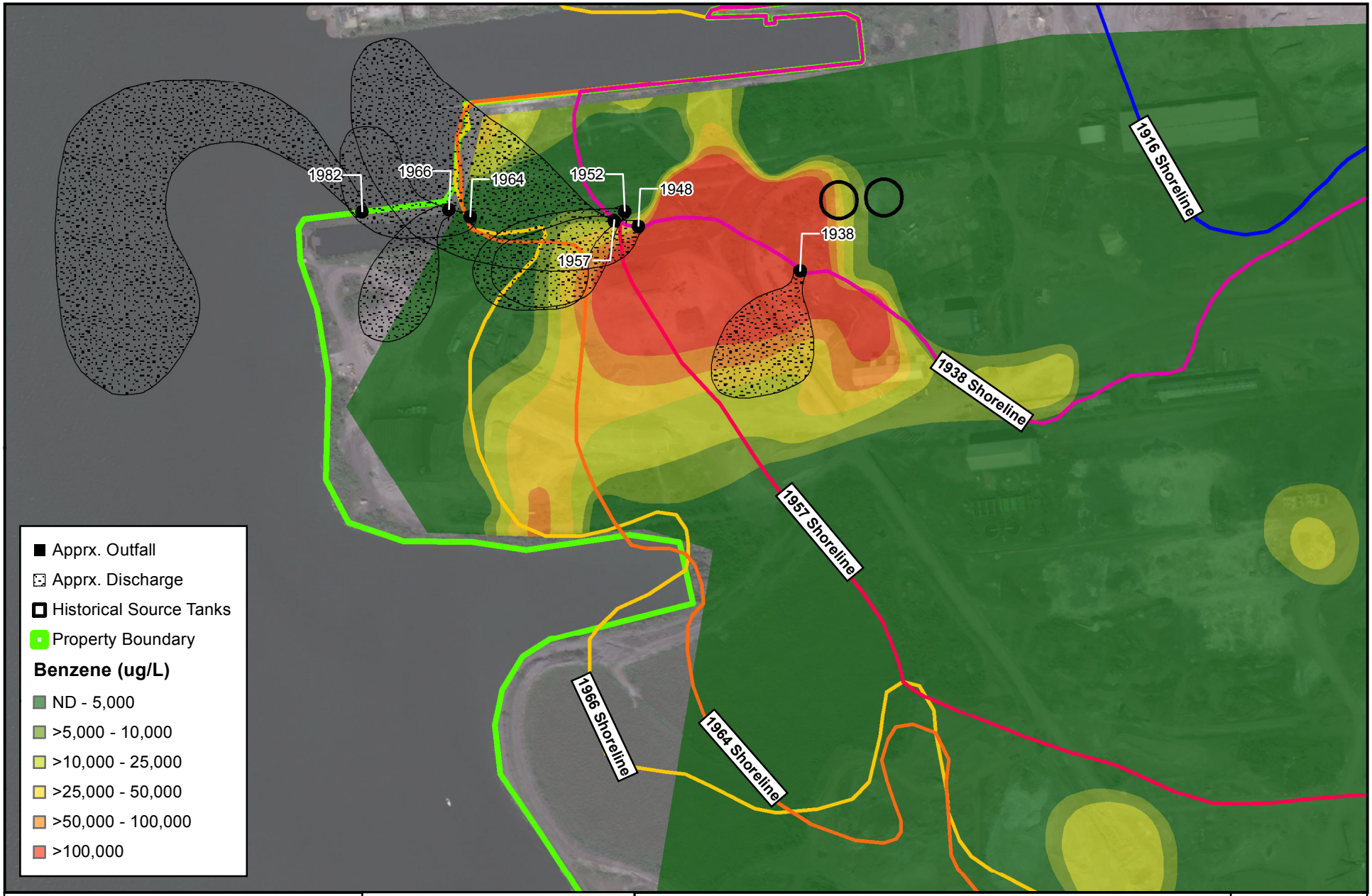

N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Historical Source Tank Discharge
Shallow Benzene

Figure 8

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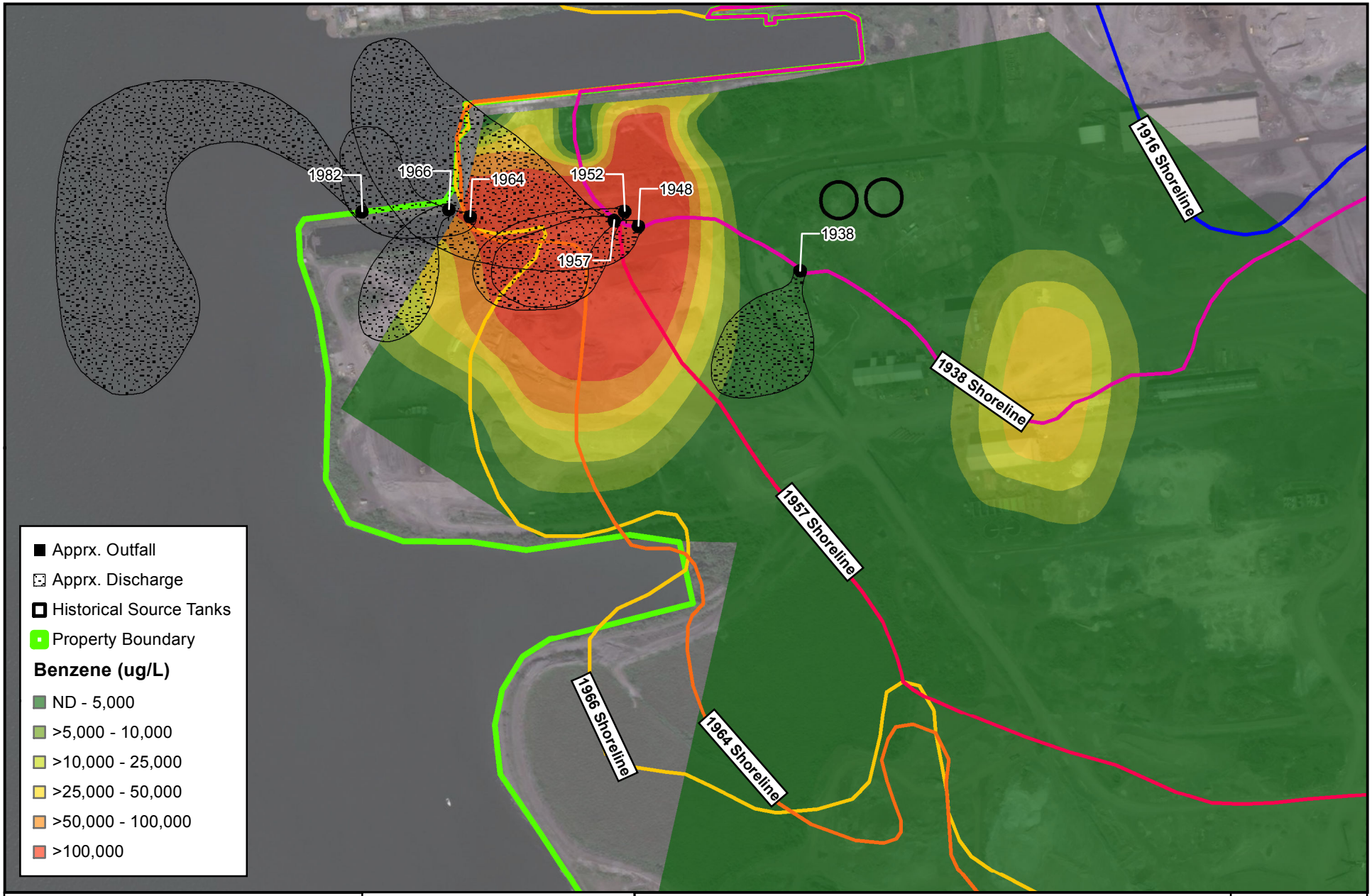

N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Historical Source Tank Discharge
Intermediate Benzene

Figure 9

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N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Historical Source Tank Discharge
Shallow Naphthalene

Figure 10

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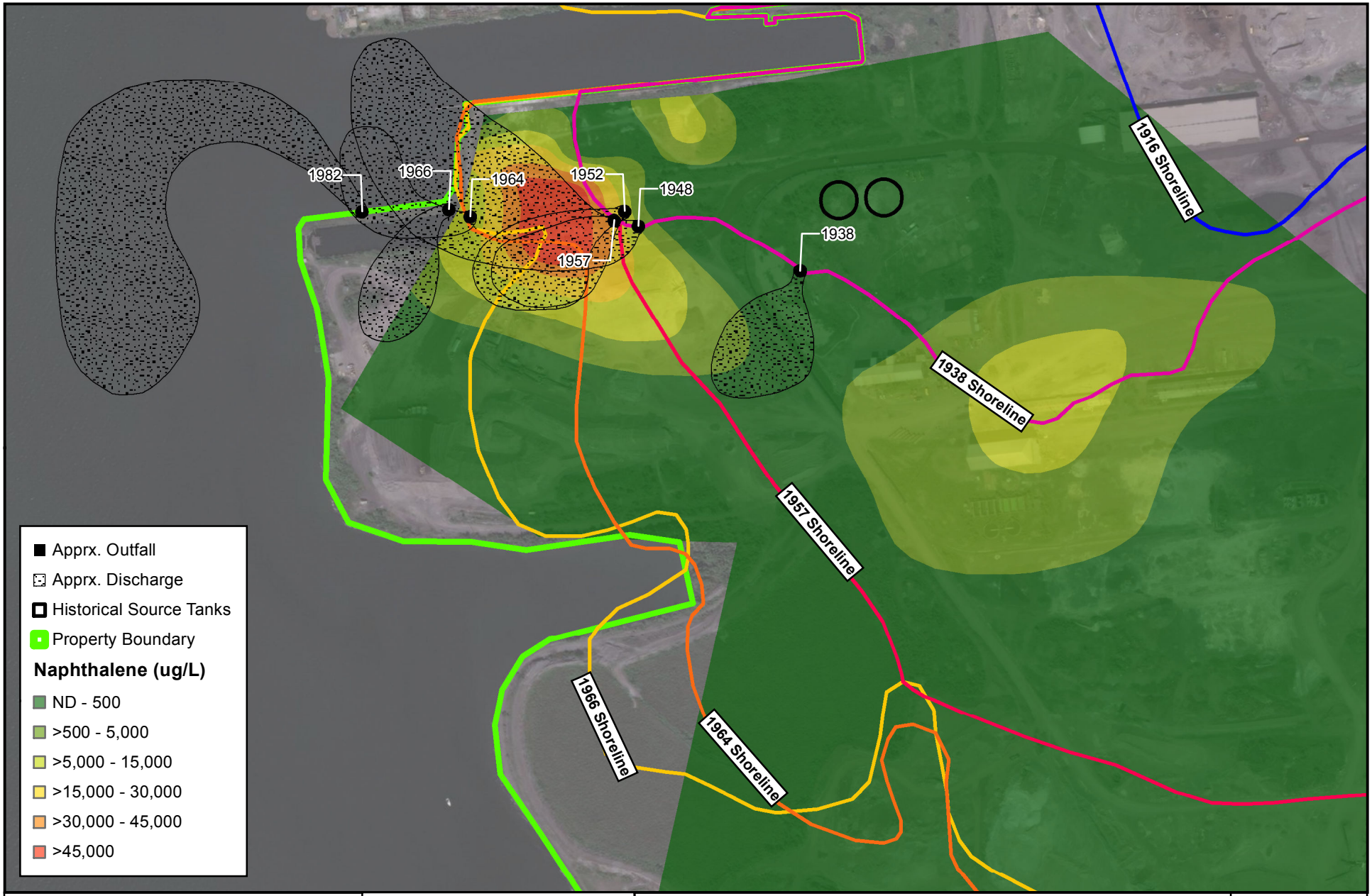

N

ARM Group Inc.
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Former Coke Oven Area
Historical Source Tank Discharge
Intermediate Naphthalene

Figure 11

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APPENDIX I

Select Figures and Table from Previous Offshore Studies

Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point

Legend

Field Screening Evidence of Hydrocarbon Sheen and Odors Observed in Subsurface Sediment Samples

Sampling Locations

Shallow Aquifer Groundwater Flow Direction

Area of Concern

Sources
ESRI, i-cubed, GeoEye, 2009
Tele Atlas North America Inc., ESRI, 2006

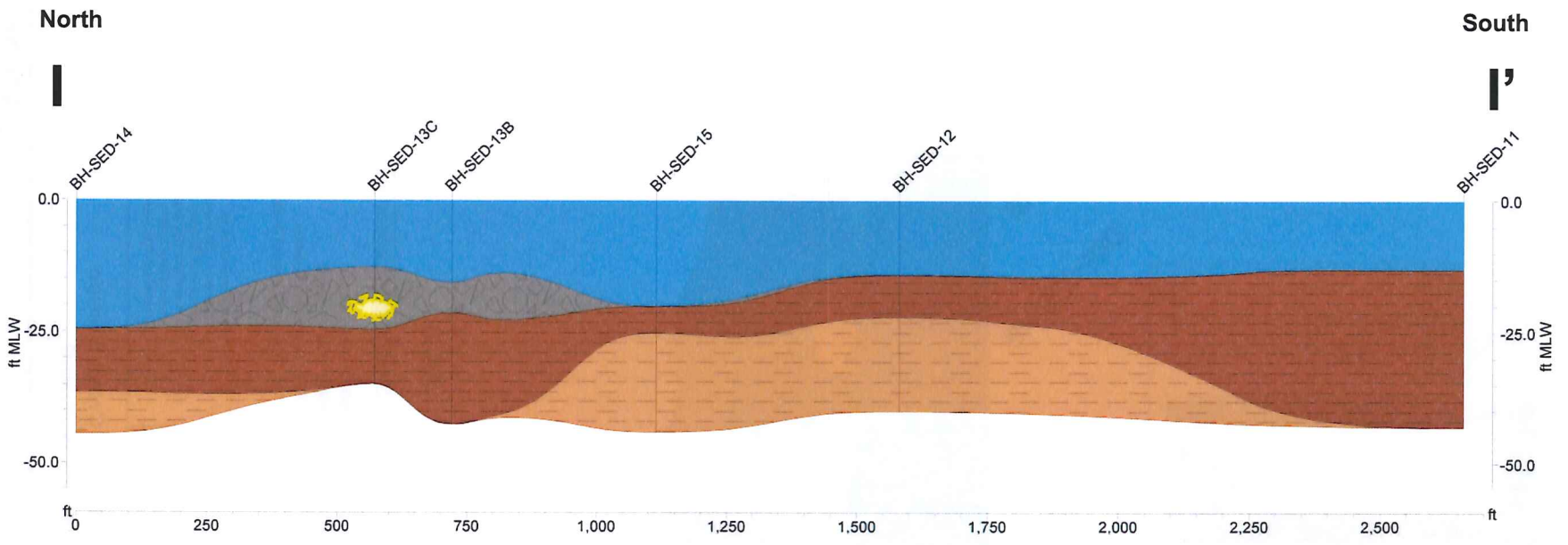
N

Feet
0 500 1,000

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

H:\projects\1453406\MXD\2009_Report\FieldImpacts

Figure 4-4. Offshore Locations of Field-Observed Impacts, Coke Point Peninsula, Baltimore, Maryland



Line of Section.

Stratigraphy Legend

- Water Column
- Slag Fill Material
- River Bottom Sediment
- Pleistocene Lowland Deposit
- Field Observance of Hydrocarbon Sheen and/or Indication of Residual NAPL (Hydrophobic Dye Shaker Tests) in Subsurface Sediment Samples

Figure 4-6. Offshore Turning Basin Geologic Cross Section Coke Point Peninsula, Baltimore, Maryland.

Table 4-9. Field Screening Indicators of Non-Aqueous Phase Liquid and/or Highly Impacted Sediment Surrounding the Coke Point Peninsula

Sparrows Point Site Assessment (2009), Baltimore, Maryland

	Location 1			Location 2			Location 3A			Location 3B			Location 3C		
Depth Interval (ft bgs)	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor
0 - 2	--	0.4	SLIGHT	--	3.6	SLIGHT	SHEEN	--	YES	--	8.6	YES	SHEEN	5.0	YES
2 - 4	--	0.0	SLIGHT	--	--	--	--	0.0	YES	POSITIVE	0.4	YES	SHEEN	0.0	YES
4 - 6	--	0.0	SLIGHT	POSITIVE	8.4	YES	NEGATIVE	0.0	YES	--	11.0	YES	--	0.0	YES
6 - 8	POSITIVE	0.0	VERY SLIGHT	POSITIVE	14.2	SLIGHT	--	0.0	YES	--	1.5	YES	--	0.0	YES
8 - 10	SHEEN	0.0	YES	SHEEN	24.0	YES	--	0.0	YES	--	1.0	YES	--	0.0	SLIGHT
10 - 12	POSITIVE	0.0	YES	SHEEN	21.8	YES	--	0.0	YES	--	0.0	NO	--	0.0	--
12 - 14	--	0.0	SLIGHT	SHEEN	20.0	YES	--	0.0	SLIGHT	--	0.8	NO	--	0.0	--
14 - 16	--	0.0	--	--	2.6	--	--	0.0	NO	--	0.0	--	--	0.0	SLIGHT
16 - 18	--	0.0	--	--	57.0	--	--	0.0	SLIGHT	--	0.0	--	--	0.0	--
18 - 20	--	0.0	--	POSITIVE	112.0	YES	--	0.0	SLIGHT	--	0.0	--	--	0.0	--
20 - 22	--	0.0	--	--	30.2	YES	--	0.0	SLIGHT						
22 - 24	--	0.0	--		13.0	YES									
24 - 26	--	0.0	YES												
26 - 28	--	0.0	YES												
28 - 30	--	--	--												

Notes:

-- = No field screening results noted on borelog.

Bold font and shaded cells indicate definite presence of NAPL.

Bold font cells indicate highly impacted sediment with possible presence of NAPL.

Sheen and odor in the 0 - 2 interval for location 3A were noted during surface sediment sampling

Table 4-9. (continued)

Depth Interval (ft bgs)	Location 3D			Location 3E			Location 4			Location 5			Location 6		
	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor
0 - 2	**SHEEN**	0.0	**YES**	--	0.0	NO	--	0.0	**SLIGHT**	--	--	--	--	7.1	**YES**
2 - 4	**SHEEN**	0.0	**YES**	NEGATIVE	0.0	--	--	--	--	--	0.0	**YES**	--	9.0	**YES**
4 - 6	--	0.0	**YES**	--	0.0	NO	--	0.0	**YES**	NEGATIVE	0.0	**YES**	--	14.2	**YES**
6 - 8	--	0.0	**YES**	--	0.0	NO	--	0.0	**YES**	--	0.0	**SLIGHT**	NEGATIVE	220.0	--
8 - 10	--	0.0	**SLIGHT**	--	0.0	NO	NEGATIVE	0.0	**YES**	--	0.0	**SLIGHT**	--	2.5	--
10 - 12	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	**SLIGHT**	--	0.2	--
12 - 14	--	0.0	NO	--	0.0	NO	--	0.0	--	**SHEEN**	0.0	**YES**	--	0.0	--
14 - 16	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**	**SHEEN**	0.0	**YES**	--	1.7	--
16 - 18	--	0.0	NO	--	0.0	NO	--	0.0	NO	--	0.0	**YES**	--	0.0	--
18 - 20	--	0.0	NO	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	--
20 - 22	--	0.0	NO				--	0.0	NO	--	0.0	**SLIGHT**			
22 - 24							--	0.0	NO	--	0.0	**SLIGHT**			
24 - 26										--	0.0	**SLIGHT**			
26 - 28															
28 - 30															

Notes:

-- = No field screening results noted on borelog.

Bold font and shaded cells indicate definite presence of NAPL.

Bold font cells indicate highly impacted sediment with possible presence of NAPL.

Table 4-9. (continued)

Depth Interval (ft bgs)	Location 7			Location 8			Location 9			Location 10			Location 11		
	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor
0 - 2	--	0.0	NO	--	0.0	NO	--	--	--	--	0.0	**SLIGHT**	--	0.0	NO
2 - 4	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	INCONCLUSIVE	0.0	**SLIGHT**	NEGATIVE	0.0	**YES**
4 - 6	--	0.0	**SLIGHT**	--	0.0	NO	--	--	--	--	0.0	NO	--	0.0	**SLIGHT**
6 - 8	NEGATIVE	0.0	NO	--	--	--	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	**SLIGHT**
8 - 10	--	0.0	NO	--	0.0	**YES**	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**
10 - 12	--	0.0	NO	NEGATIVE	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	NO
12 - 14	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO
14 - 16	--	0.0	--	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO
16 - 18	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO
18 - 20	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	NO
20 - 22							--	0.0	NO	--	0.0	NO	--	0.0	NO
22 - 24							--	0.0	NO	--	0.0	NO	--	0.0	NO
24 - 26							--	0.0	NO	--	0.0	NO	--	0.0	NO
26 - 28							--	0.0	NO	--	0.0	NO	--	0.0	NO
28 - 30							--	0.0	NO	--	0.0	NO	--	0.0	NO

Notes:

-- = No field screening results noted on borelog.

Bold font and shaded cells indicate definite presence of NAPL.

Bold font cells indicate highly impacted sediment with possible presence of NAPL.

Table 4-9. (continued)

	Location 12			Location 13A			Location 13B			Location 13C			Location 14		
Depth Interval (ft bgs)	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor
0 - 2	--	0.0	--	--	0.0	**YES**	--	0.0	NO	--	0.0	--	--	--	--
2 - 4	--	0.0	--	--	--	--	--	0.0	NO	--	0.0	**YES**	--	--	--
4 - 6	--	0.0	--	NEGATIVE	0.0	**YES**	--	0.0	NO	--	0.0	**SLIGHT**	--	--	--
6 - 8	--	0.0	--	--	0.0	**YES**	--	0.0	NO	--	0.0	**YES**	--	0.0	NO
8 - 10	--	0.0	--	--	0.0	**YES**	--	0.0	NO	**SHEEN**	0.0	**SLIGHT**	--	0.0	**YES**
10 - 12	--	0.0	--	**SHEEN**	0.0	**YES**	--	0.0	NO	--	0.0	**SLIGHT**	--	0.0	**YES**
12 - 14	--	0.0	--	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	NO
14 - 16	--	0.0	--	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	NO
16 - 18	--	0.0	--	--	--	--	--	0.0	NO	--	0.0	NO	--	0.0	NO
18 - 20	--	0.0	--	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	NO
20 - 22	--	0.0	--	--	0.0	NO	--	0.0	NO	--	0.0	NO			
22 - 24	--	0.0	--	--	0.0	**SLIGHT**	--	0.0	NO						
24 - 26	--	0.0	--	--	0.0	--	--	0.0	NO						
26 - 28				--	0.0	NO									
28 - 30				--	0.0	NO									

Notes:

-- = No field screening results noted on borelog.

Bold font and shaded cells indicate definite presence of NAPL.

Bold font cells indicate highly impacted sediment with possible presence of NAPL.

Table 4-9. (continued)

Depth Interval (ft bgs)	Location 15			Location 16			Location 17			Location 18		
	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor	Dye test / Visual	PID (ppm)	Odor
0 - 2	--	0.0	NO	NEGATIVE	0.0	NO	NEGATIVE	0.0	NO	NEGATIVE	0.0	**SLIGHT**
2 - 4	NEGATIVE	0.0	**SLIGHT**	--	0.0	NO	--	--	--	--	--	--
4 - 6	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**
6 - 8	--	0.0	**SLIGHT**	--	0.0	NO	--	0.0	NO	--	0.0	**SLIGHT**
8 - 10	--	0.0	NO	--	0.0	NO	--	0.0	NO	--	0.0	NO
10 - 12	--	0.0	**SLIGHT**				--	0.0	NO	--	0.0	--
12 - 14	--	0.0	NO				--	0.0	NO	--	0.0	NO
14 - 16	--	0.0	NO				--	0.0	NO	--	0.0	NO
16 - 18	--	0.0	NO				--	0.0	NO	--	0.0	NO
18 - 20	--	0.0	NO				--	0.0	NO	--	0.0	NO
20 - 22	--	0.0	NO				--	0.0	NO	--	0.0	NO
22 - 24	--	0.0	NO				--	0.0	NO	--	0.0	NO
24 - 26							--	0.0	NO	--	0.0	NO
26 - 28							--	0.0	NO	--	0.0	NO
28 - 30							--	0.0	NO			

Notes:

-- = No field screening results noted on borelog.

Bold font and shaded cells indicate definite presence of NAPL.

Bold font cells indicate highly impacted sediment with possible presence of NAPL.