ARM Group Inc.
Engineers and Scientists

July 8, 2019

Ms. Barbara Brown
Project Coordinator
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Re: Parcel A10 Phase II Investigation Report
(Revision 1)
Comment Response Letter
Tradepoint Atlantic
Sparrows Point, MD 21219

Dear Ms. Brown:

On behalf of EnviroAnalytics Group, LLC (EAG), ARM Group Inc. (ARM) is pleased to provide the following responses to comments provided by the Maryland Department of the Environment (MDE) via email on September 25, 2018 regarding the previous submission of the Phase II Investigation Report (Revision 0 dated April 9, 2018) for Parcel A10 of the Tradepoint Atlantic property located in Sparrows Point, Maryland.

Hard copy replacement pages are provided for incorporation into the Parcel A10 Phase II Investigation Report. The revised report text is included as **Attachment 1**. The enclosed CD provides a compiled PDF of the entire report with the inserted replacement pages. Revised cover and spine cardstock sheets are also provided for insertion into the binders. Select attachments previously included in the Phase II Investigation Report can be discarded as noted below. Responses to specific MDE comments are given below; the original comments are included in italics with responses following.

1. *MDE Phase II WP Comments stated - Section 1.2.2 Building Inspection (Work Plan) states "ARM observed the presence of a concrete pad 35 feet southwest of the repair shop" and the Response to Comments, Item No. 1, also describes the concrete pad as southwest of the repair shop and states "Soil boring A10-021-SB (and associated piezometer) has been relocated from its former position to target this concrete pad, and has been located directly adjacent." However, figures included in the Work Plan depict soil boring and piezometer A10-021-SB to the southeast corner of the repair shop area. Please address this discrepancy. –* ***This discrepancy seems to have been fixed in the report. The location of the concrete pad has been changed from the Work Plan to accurately identify its location***

southeast of the repair shop. No borings were advanced to the southwest of the repair shop. Appendix D shows a drawing of the pad location to the SW of the shop.

As stated above, the Parcel A10 Phase II Investigation Report correctly identifies the location of the concrete pad as 35 feet southeast of the repair shop. No borings were completed to the southwest of the repair shop. The concrete pad shown in **Appendix D**, (highlighted in blue) is located to the southeast of the repair shop, which is indicated on the sketch as "building". The sketch in **Appendix D** may have been misinterpreted. Please note the direction of the north arrow on the sketch.

2. *Section 7.5 Recommendations: "A separate Work Plan to provide additional delineation of associated groundwater conditions will be coordinated with the MDE and submitted in the future." The Department agrees with this recommendation and anticipates that this Work Plan will be submitted in the near future.*

   A separate Work Plan for the investigation of chlorinated volatile organic compounds (CVOCs) in groundwater in Parcel A10 will be submitted to the agencies in the near future.

3. *EPA has requested that Construction Worker SLRA's be completed and reported in the Phase II Investigation Reports to aide in the completion of a Statement of Basis for entire parcels. Please confirm that a revision to this report will be submitted that contains this update.*

   Since the receipt of this comment, the approach has been updated in accordance with the Phase II Investigation Report Approach Letter: Screening Level Risk Assessments (SLRAs) for Parcel-Specific Statement of Basis (dated April 22, 2019). The United States Environmental Protection Agency (USEPA) and MDE have recommended that the SLRAs based upon hypothetical EUs be removed from future Phase II Investigation Reports. As outlined in the referenced letter, the SLRA for Construction and Composite Workers should not be included in the Phase II Investigation Reports (with a few noted exceptions) since each development boundary will include its own site-specific SLRA. Therefore, the SLRA (previously Section 6.0 and Section 7.4) has been removed from this revised Parcel A10 Phase II Investigation Report. Some information previously contained in these sections, such as the discussion of locations exhibiting potential exceedances of the established non-aqueous phase liquid (NAPL)/petroleum, lead, or PCB delineation criteria has been relocated within Section 4.1.3. In addition to removing Section 6.0 and Section 7.4, the recommendations (previously Section 7.5 but now Section 6.4) have also been revised to exclude the SLRA findings that are not relevant. The SLRA tables (**Table 15** through **Table 20**) have been removed from this revised submission, and can be discarded from the report copies currently held by the agencies. The attached CD provides the updated electronic attachments, which do not include the ProUCL Input/Output files or the lead evaluation spreadsheet.

4. *Please note that an MDE email dated 2/26/18 stated that NAPL delineation piezometers could be abandoned as per the request letter submitted 2/15/18 on Parcel A10.*

   The comment is acknowledged. However, since the receipt of this comment measurable NAPL was identified in A10-006-PZ. The NAPL has subsequently been delineated via the installation of additional NAPL screening piezometers. The findings of the NAPL delineation will be reported outside of the scope of this Phase II Investigation Report to avoid the need for continued future updates. The presence of NAPL is noted in the revised Phase II Investigation Report text (Section 4.3 and Section 6.3) but subsequent reporting will be handled under separate cover.

If you have any questions, or if we can provide any additional information at this time, please do not hesitate to contact ARM Group Inc. at 410-290-7775.

Respectfully submitted,
ARM Group Inc.

Taylor R. Smith, P.E.
Project Engineer

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

Attachment 1

PHASE II
INVESTIGATION REPORT

AREA A: PARCEL A10
TRADEPOINT ATLANTIC
SPARROWS POINT, MARYLAND

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Respectfully Submitted,

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Project Engineer

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

Revision 1 – July 8, 2019

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1.0 INTRODUCTION

ARM Group Inc. (ARM), on behalf of EnviroAnalytics Group (EAG), has completed a Phase II Investigation of a portion of the Tradepoint Atlantic property (formerly Sparrows Point Terminal, LLC) that has been designated as Area A: Parcel A10 (the Site). Parcel A10 is comprised of 31.7 acres of the approximately 3,100-acre former steel making facility (**Figure 1**). The Site is bounded to the south by a wooded area (within Parcel B7) and residential area beyond Sparrows Point Road, to the north by a stormwater impoundment beyond Warehouse Road, to the west by the former Hot Strip Mill facilities (within Parcel B6), and to the east by commercial/industrial facilities and vegetated areas located beyond the boundary of the Tradepoint Atlantic property.

The Phase II Investigation was performed in accordance with procedures outlined in the approved Phase II Investigation Work Plan – Area A: Parcel A10. This Work Plan (dated April 21, 2016) was approved by the Maryland Department of the Environment (MDE) and the United States Environmental Protection Agency (USEPA) on April 28, 2016 in compliance with requirements pursuant to the following:

- Administrative Consent Order (ACO) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the MDE effective September 12, 2014; and
- Settlement Agreement and Covenant Not to Sue (SA) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the USEPA effective November 25, 2014.

Parcel A10 is part of the acreage that was removed (Carveout Area) from inclusion in the Multimedia Consent Decree between Bethlehem Steel Corporation, the USEPA, and the MDE (effective October 8, 1997) as documented in correspondence received from the USEPA on September 12, 2014. Based on this agreement, the USEPA determined that no further investigation or corrective measures will be required under the terms of the Consent Decree for the Carveout Area. However, the SA reflects that the property within the Carveout Area will remain subject to the USEPA's Resource Conservation and Recovery Act (RCRA) Corrective Action authorities.

An application to enter the full Tradepoint Atlantic property (3,100 acres) into the Maryland Department of the Environment Voluntary Cleanup Program (MDE-VCP) was submitted to the MDE and delivered on June 27, 2014. The property's current and anticipated future use is Tier 3 (Industrial), and plans for the property include demolition and redevelopment over the next several years.

1.1. SITE HISTORY

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

The eastern areas of Parcel A10 were formerly occupied by the Nelson Box Company facility including several lumber storage buildings and sheds. Other smaller buildings and facilities associated with the steel mill (Maintenance of Way Yard, ATEC Storeroom and Shop, Office, and Repair Shop) were also present at the Site. The Nelson Box Company building structure was located directly south of the lumber storage areas, and is presumed to be the former consumer of these materials. The Nelson Box Company provided wood packaging to the steel mill beginning in 1921. Operations included the production of wood pallets, cable/wire reels, and industrial packaging products. Through the years, the company expanded its operations to produce crates, corrugated products, angleboard, and slipsheets, and more recently (post 1990) metal and plastic products. All of the large buildings associated with lumber storage and the Nelson Box Company have been demolished. Several smaller buildings associated with the Maintenance of Way Yard (ATEC Storeroom and Shop, Office, and Repair Shop) still remain at the Site. Numerous rail tracks occupy the central and northern portions of the Site.

1.2. OBJECTIVES

The objective of this Phase II Investigation was to fully characterize the nature and extent of contamination at the Site. A summary table of the site investigation locations, including the boring identification numbers and the analyses performed, is provided as **Appendix A**. This report includes a summary of the work performed, including the environmental setting, site investigation methods, analytical results and data usability assessment, and findings and recommendations.

2.0 ENVIRONMENTAL SETTING

2.1. LAND USE AND SURFACE FEATURES

The Tradepoint Atlantic property consists primarily of the former Sparrows Point steel mill, but other industrial occupants such as the Nelson Box Company were also historically located at the Site. According to the Phase I Environmental Site Assessment (ESA) prepared by Weaver Boos dated May 19, 2014, the property is zoned Manufacturing Heavy-Industrial Major (MH-IM). Surrounding property zoning classifications (beyond Tradepoint Atlantic) include the following: Manufacturing Light (ML); Resource Conservation (RC); Density Residential (DR); Business Roadside (BR); Business Major (BM); Business Local (BL); and Residential Office (RO). Light industrial and commercial properties are located northeast of the property and northwest of the property across Bear Creek. Residential areas of Edgemere and Fort Howard are located northeast of the property across Jones Creek and to the southeast across Old Road Bay, respectively. Residential and commercial areas of Dundalk are located northwest of the property across Bear Creek.

According to topographic maps provided by EAG, the Site is at an elevation of approximately 12 to 20 feet above mean sea level (amsl) in most areas. Elevations at the Site range from 4 to 36 feet amsl across the entire parcel area. In the northwestern corner of the parcel, the ground slopes sharply downward from 36 to 12 feet amsl. Across most of the Site, elevations are fairly uniform and overland flow appears to discharge across the northern boundary of the Site toward the stormwater impoundment located beyond Warehouse Road. According to Figure B-2 of the Stormwater Pollution Prevention Plan (SWPPP) Revision 5 dated June 1, 2017, runoff waters from Parcel A10 are ultimately directed to the Humphrey Creek Wastewater Treatment Plant (HCWWTP). Surface waters which are collected and treated at the HCWWTP flow through the National Pollutant Discharge Elimination System (NPDES) permitted Outfall 014, which discharges to Bear Creek across the western boundary of the Tradepoint Atlantic property.

2.2. REGIONAL GEOLOGY

The Site is located within the Atlantic Coastal Plain Physiographic Province (Coastal Plain). The western boundary of the Coastal Plain is the “Fall Line”, which separates the Coastal Plain from the Piedmont Plateau Province. The Fall Line runs from northeast to southwest along the western boundary of the Chesapeake Bay, passing through Elkton (MD), Havre de Grace (MD), Baltimore City (MD), and Laurel (MD). The eastern boundary of the Coastal Plain is the off-shore Continental Shelf.

The unconsolidated sediments beneath the Site belong to the Talbot Formation (Pleistocene), which is then underlain by the Cretaceous formations which comprise the Potomac Group (Patapsco Formation, Arundel Formation and the Patuxent Formation). The Potomac Group

formations are comprised of unconsolidated sediments of varying thicknesses and types, which may be several hundred feet to several thousand feet thick. These unconsolidated formations may overlie deeper Mesozoic and/or Precambrian bedrock. Depth to bedrock is approximately 700 feet within the Site.

2.3. SITE GEOLOGY/HYDROGEOLOGY

Groundcover at the Site is comprised of approximately 95% natural soils and 5% fill materials based on the approximate shoreline of the Sparrows Point Peninsula in 1916, as shown on **Figure 2** (adapted from Figure 2-20 in the Description of Current Conditions (DCC) Report prepared by Rust Environment and Infrastructure dated January 1998).

In general, the encountered subsurface geology included natural soils, which included fine-grained sediments (clays and silts) and coarse grained sediments (sands). Slag fill materials were encountered at depths of up to 9.5 feet below the ground surface (bgs). Shallow groundwater was observed in soil cores from 5 to 20 feet bgs across the Site. Soil boring logs are provided in **Appendix B**. Please note that unless otherwise indicated, all Unified Soil Classification System (USCS) group symbols provided on the attached boring logs are from visual observations, and not from laboratory testing.

Temporary groundwater sample collection points were installed at 11 locations across the Site to investigate shallow groundwater conditions. One existing historical well (SG06-PDM001) was also sampled during this investigation. The locations of the groundwater sampling points are indicated on **Figure 3**. The temporary groundwater sample collection points and the existing permanent well were surveyed by a Maryland-licensed surveyor. Supporting documentation from the surveys is included in **Appendix C**. A synoptic round of groundwater level measurements was collected on January 9, 2017 from each of the groundwater points included in the parcel-specific sampling plan, with the exception of A10-021-PZ. Sample location A10-021-PZ was observed to be bent at the surface, and a water level measurement could not be obtained due to the damage. Surveyed top of casing (TOC) and ground surface elevations for all applicable locations can be found in **Table 1**, along with the depth to water (DTW) measurements from this date.

A groundwater potentiometric surface map was constructed for the shallow hydrogeologic zone based on the field measurements. The localized potentiometric map for shallow groundwater has been included on **Figure 3**. The groundwater elevation contours indicate that groundwater flows from the southern portion of the Site (groundwater elevation of approximately 17 feet amsl) to the northern portion of the Site (groundwater elevation of approximately 4 feet amsl) toward the stormwater impoundment located beyond Warehouse Road. This flow direction appears to be uniform across the Site, but the groundwater elevations decrease at a much steeper gradient in the southern portion of the Site as compared to the northern portion of the Site (near the presumed discharge location of the stormwater impoundment).

3.0 SITE INVESTIGATION

A total of 78 soil samples (from 34 boring locations) and 12 groundwater samples were collected for analysis between July 6, 2016 and July 21, 2016 as part of the Parcel A10 Phase II Investigation. This Phase II Investigation utilized methods and protocols that 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. Information regarding the project organization, field activities and sampling methods, sampling 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 Parcel A10 Work Plan dated April 21, 2016, and the QAPP.

All site characterization activities were conducted under the site-specific Health and Safety Plan (HASP) provided as Appendix E of the approved Work Plan.

3.1. SAMPLE TARGET IDENTIFICATION

Previous activities within and around the buildings and facilities located on the Tradepoint Atlantic property may have been historical sources of environmental contamination. If present, source areas were identified as targets for sampling through a careful review of historical documents. When a sampling target was identified, a boring was placed at or next to its location using Geographic Information Systems (GIS) software (ArcMap Version 10.2.2).

Sampling targets included, as applicable, 1) Recognized Environmental Conditions (RECs) shown on the REC Location Map provided in Weaver Boos' Phase I ESA, 2) additional findings (non-RECs) from the Phase I ESA which were identified as potential environmental concerns, and 3) Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified from the DCC Report prepared by Rust Environment and Infrastructure. The following RECs were identified in the Parcel A10 Work Plan: Hazardous Materials Storage (REC 10A, Finding 240), Large Historical Aboveground Storage Tank (AST) (REC 10B, Finding 241), and Maintenance of Way Yard Underground Storage Tank (UST) (REC 12A, Finding 246). Additional information regarding these identified RECs was provided in the Phase II Investigation Work Plan dated April 21, 2016. There were no additional SWMUs or AOCs identified at the Site based on the DCC Report.

Four sets of historical drawings were also reviewed to identify potential sampling targets for the Site. These drawings included the 5000 Set (Plant Arrangement), the 5100 Set (Plant Index), the 5500 Set (Plant Sewer Lines), and a set of drawings indicating coke oven gas distribution drip leg locations. Drip legs are points throughout the distribution system where coke oven gas condensate was removed from the gas pipelines. The condensate from the drip legs was

typically discharged to drums, although it is possible some spilled out of the drums and on to the ground. There were no drip legs identified inside the boundary of Parcel A10. A summary of the specific drawings covering the Site is presented in **Table 2**. Sampling target locations were identified if the historical drawings depicted industrial activities or a specific feature at a location that may have been a source of environmental contamination that potentially impacted the Site.

Based on the review of plant drawings and Phase I ESA documents (or based on direct agency guidance), additional non-REC sampling targets were identified at the Site that included the following: Boiler House, Incinerator, Machine Shop, Maintenance of Way Repair Shop, Oil House, Pump House/Foamite Building, Repair Shop Interior, Lumber Storage Warehouse, and Nelson Box Company Building. A summary of the areas that were investigated, along with the applicable boring identification numbers and the analyses performed, has been provided as **Appendix A**. Additional sample locations were distributed to fill in large spatial gaps between proposed borings to provide complete coverage of the Site. During the completion of fieldwork, it was necessary to shift some borings from the approved locations given in the Work Plan, primarily due to access restrictions and/or refusal. **Table 3** provides the identification numbers of the field adjusted borings, the coordinates of the proposed and final locations, and the distance/direction of the field shifts.

The density of soil borings met the requirements set forth in QAPP Worksheet 17 – Sampling Design and Rationale. Parcel A10 contained a total of 17.0 acres without engineered barriers and 14.6 acres with engineered barriers. Of the 14.6 acres with engineered barriers, 3.0 acres contained former building slabs and 11.7 acres consists of parking/roads. In accordance with the relevant sampling density requirements, a minimum of 15 soil borings were required to cover the area without engineered barriers, and a minimum of 8 soil borings were required to cover areas with barriers. A total of 23 borings were required to meet the density specification; 34 soil borings were completed during the Phase II Investigation to collect analytical soil samples (including one boring, A10-009A-SB, which was added during the course of fieldwork).

3.2. GEOPHYSICS INVESTIGATION (POSSIBLE UST)

As specified in the Parcel A10 Phase II Investigation Work Plan, ARM Geophysics mobilized to the Site to confirm the presence/absence of the Maintenance of Way Yard UST identified as REC 12A, Finding 246. During a previous field visit conducted during the development of the Work Plan, ARM observed a concrete pad roughly 35 feet southeast of the repair shop, which had dimensions of approximately 15 by 30 feet. No apparent manholes or UST fill pipes were noted in the vicinity of the pad, but two signs indicating gasoline and/or smoking warnings were installed on the chain-link fence directly behind the pad. Based on prior experience, ARM suspected that the Maintenance of Way Yard UST (or another UST) could be located below this concrete pad. The objectives of the geophysics investigation were to refine the investigation plan in the vicinity of the concrete pad and to determine whether tank removal might be required.

The geophysics investigation was conducted in the area to the south of the repair shop on June 22, 2016. This investigation utilized EM61 metal detectors, utility and pipe locators, and ground penetrating radar (GPR) to screen the pad and surrounding open ground. Although a few metallic anomalies were noted and marked on the ground, there was no evidence of a UST below the concrete pad or in the surrounding open areas. The field notes obtained during the geophysics investigation are provided in **Appendix D**. Since the UST was not located, there were no changes to the proposed investigation plan.

3.3. SOIL INVESTIGATION

Continuous core soil borings were advanced at 33 locations across the Site to assess the presence or absence of soil contamination, and to assess the vertical distribution of any encountered contamination (**Figure 4**). One additional soil boring (A10-034-SB) was installed to facilitate the collection of a groundwater sample only, and no soil samples were collected at this location as specified in the Parcel A10 Work Plan. The 34 continuous core soil borings were advanced to depths between 6.5 and 27 feet bgs using the Geoprobe® MC-7 Macrocore soil sampler (surface to 10 feet bgs) and the Geoprobe® D-22 Dual-Tube Sampler (depths >10 feet bgs). One additional soil boring (A10-009A-SB) was advanced to a depth of 1-foot bgs using a hand auger and digging bar. This boring was located within the interior of an existing building, so it could not be accessed with the Geoprobe®. The boring was therefore shifted outside of the building along the exterior wall (designated as A10-009-SB), but a 1-foot bgs sample was obtained from the original boring location (designated as A10-009A-SB). At each of the 35 completed locations, each soil core was visually inspected and screened with a hand-held photoionization detector (PID) prior to logging soil types. Soil boring logs have been included as **Appendix B,** and the PID calibration log has been included as **Appendix E**. Unless otherwise indicated, all USCS group symbols provided on the attached boring logs are from visual observations.

One shallow sample was collected from the 0 to 1 foot depth interval, and a deeper sample was collected from the 4 to 5 foot depth interval from each continuous core soil boring. One additional set of samples was also collected from the 9 to 10 foot depth interval if groundwater had not been encountered; however, these samples were held by the laboratory pending the analysis of the 0 to 1 and 4 to 5 foot depth interval samples, and were only analyzed for parameters that were detected in the 5 foot depth samples at concentrations above the Project Action Limits (PALs). If the PID or other field observations indicated contamination to exist at a depth greater than 3 feet bgs but less than 9 feet bgs, and above the water table, the sample from the deeper 4 to 5 foot interval was shifted to the alternate depth interval. It should be noted that soil samples were not collected from a depth that was below the water table.

Soil sampling activities were conducted in accordance with the procedures and methods referenced in **Field Standard Operating Procedure (SOP) Numbers 008, 009, 012, and 013** provided in Appendix A of the QAPP. Down-hole soil sampling equipment was decontaminated

after soil sampling had been concluded at a location, according to the procedures and methods referenced in **Field SOP Number 016** provided in Appendix A of the QAPP.

Soil samples were submitted to Pace Analytical Services, Inc. (PACE), and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) via USEPA Method 8260B, TCL semi-volatile organic compounds (SVOCs) via USEPA Methods 8270D and 8270D SIM, Target Analyte List (TAL) Metals via USEPA Methods 6010C and 7471C, hexavalent chromium via USEPA Method 7196A, cyanide via USEPA Method 9012, and total petroleum hydrocarbon (TPH) diesel range organics (DRO) and gasoline range organics (GRO) via USEPA Methods 8015B and 8015D. The Work Plan requirements for analysis of TPH-DRO/GRO and/or Oil & Grease have evolved throughout the investigation process and changed several times since late-2015 under agency guidance. During the implementation of the Parcel A10 Work Plan, TPH-DRO/GRO analysis was required at every location, but Oil & Grease analysis was not required or completed. Additionally, the shallow soil samples collected across the Site from the 0 to 1 foot bgs interval were also analyzed for polychlorinated biphenyls (PCBs) via USEPA Method 8082. Sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

3.4. GROUNDWATER INVESTIGATION

One historical shallow groundwater monitoring well (SG06-PDM001) and 11 shallow temporary groundwater sample collection points were included in the parcel-specific sampling plan to characterize groundwater and to support the definition of the groundwater potentiometric surface. The locations where shallow groundwater samples were collected are provided on **Figure 3**. The soil boring locations where temporary groundwater sample collection points were installed included A10-002-SB, A10-010-SB, A10-015-SB, A10-018-SB, A10-020-SB, A10-021-SB, A10-024-SB, A10-025-SB, A10-027-SB, A10-029-SB, and A10-034-SB. As specified in the Work Plan, a shallow temporary groundwater sample collection point was installed at A10-034-SB, but soil samples were not collected from this boring. This location was intended to supplement only the groundwater sampling plan. Each sample point was installed in accordance with the procedures and methods referenced in **Field SOP Number 028**. The temporary groundwater sample collection point construction logs have been included as **Appendix F**.

At each location the Geoprobe® DT22 Dual Tube sampling system was advanced to a depth approximately 7 feet below where groundwater was identified in the associated soil cores, the 1.25-inch inner rod string was removed, and the temporary, 1-inch PVC groundwater sample collection point was installed through the outer casing. Following the installation of each sample collection point, the 0-hour depth to water was documented and the collection point was checked for the presence of non-aqueous phase liquid (NAPL) using an oil-water interface probe in accordance with the methods referenced in **Field SOP Number 019** provided in Appendix A of the QAPP.

After the installation of each temporary groundwater sample collection point, down-hole equipment was decontaminated according to the procedures and methods referenced in **Field SOP Number 016** provided in Appendix A of the QAPP.

Groundwater samples were collected in accordance with methods referenced in **Field SOP Number 006** provided in Appendix A of the QAPP; which employed the use of laboratory supplied sample containers and preservatives, a peristaltic pump, dedicated polyethylene tubing, and a water quality multiparameter meter with a flow-through cell. Groundwater samples submitted for analysis of dissolved metals were filtered in the field with an in-line 0.45 micron filter. The sampling and purge logs have been included in **Appendix G**. Calibration of the multiparameter meter was performed before the start of each day of the sampling event, and a calibration post-check was completed at the end of the day. Appropriate documentation of the multiparameter meter calibration has also been included in **Appendix G**.

Groundwater samples were submitted to PACE, and analyzed for TCL-VOCs via USEPA Method 8260B, TCL-SVOCs via USEPA Methods 8270D and 8270D SIM, TPH-DRO/GRO via USEPA Methods 8015B and 8015D, TAL-Dissolved Metals via USEPA Methods 6010C and 7470A, hexavalent chromium (total) via USEPA Method 7196A, and cyanide (total) via USEPA Method 9012A. The Work Plan requirements for analysis of TPH-DRO/GRO and/or Oil & Grease have evolved throughout the investigation process and changed several times since late-2015 under agency guidance. During the implementation of the Parcel A10 Work Plan, only TPH-DRO/GRO analysis was required for the groundwater sample, therefore, groundwater samples were not analyzed for Oil & Grease. Sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP Worksheet 19 & 30 – Sample Containers, Preservation, and Holding Times.

3.5. MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

In accordance with **Field SOP Number 005** provided in Appendix A of the QAPP, potentially impacted materials, or IDW, generated during this Phase II Investigation was containerized in 55-gallon (DOT-UN1A2) drums. The types of IDW that were generated during this Phase II Investigation included the following:

- soil cuttings generated from soil borings or the installation of temporary groundwater points;
- purged groundwater;
- decontamination fluids; and
- used personal protective equipment

Following the completion of field activities, a composite sample was gathered with aliquots from each of the Parcel A10 Phase II IDW soil drums for waste characterization. Following this analysis, the waste soil was characterized as non-hazardous. A list of all results from the soil waste characterization procedure can be found in **Table 4**. IDW drums containing aqueous materials (including aqueous waste generated during the Parcel A10 Phase II Investigation) were characterized by preparing a composite sample from randomly selected drums. The composite sample included aliquots from several individual drums that were chosen as a subset of the aqueous drums being staged on-site at the date of collection. Following this analysis, the aqueous waste was characterized as non-hazardous. A list of all results from the aqueous waste characterization procedure can be found in **Table 5**.

The parcel specific IDW drum log from the Phase II investigation is included as **Appendix H**. All IDW procedures were carried out in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs and Appendix A of the QAPP.

4.0 ANALYTICAL RESULTS

4.1. SOIL CONDITIONS

Soil analytical results were screened against the PALs established in the property-wide QAPP (or other direct guidance from the agencies; i.e. TPH-DRO/GRO) to determine PAL exceedances. PALs are generally based on the USEPA's Regional Screening Levels (RSLs) for the Composite Worker exposure to soil. The Composite Worker is defined by the USEPA as a long-term receptor exposed during the work day who is a full time employee that spends most of the workday conducting maintenance activities (which typically involve on-site exposures to surface soils) outdoors.

The analytical results for the detected parameters are summarized and compared to the PALs in **Table 6** (Organics) and **Table 7** (Inorganics). The laboratory Certificates of Analysis (including Chains of Custody) and Data Validation Reports (DVRs) have been included as electronic attachments. The DVRs contain a glossary of qualifiers for the final flags assigned to individual results in the attached summary tables.

4.1.1. Soil Conditions: Organic Compounds

As provided on **Table 6**, several VOCs were identified above the laboratory's method detection limits (MDLs) in the soil samples collected from across the Site. There were no VOCs detected above their respective PALs.

Table 6 provides a summary of SVOCs detected above the laboratory's MDLs in the soil samples collected from across the Site. The PALs for relevant polynuclear aromatic hydrocarbons (PAHs) have been adjusted upward based on revised toxicity data published in the USEPA RSL Composite Worker Soil Table. Therefore, exceedances for PAHs are based on the adjusted PALs rather than those presented in the QAPP. Three SVOCs, all of which are PAHs, were detected above their respective PALs. These SVOCs were benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene. Each of these three SVOCs exceeded their respective PALs in sample A10-008-SB-4. Benzo[b]fluoranthene and dibenz[a,h]anthracene each exceeded their respective PALs in only a single sample. Benzo[a]pyrene exceeded its PAL in one additional sample (A10-003-SB-1). A summary of the SVOC PAL exceedance locations and results has been provided on **Figure S-1**.

Shallow soil samples collected across the Site from the 0 to 1 foot bgs interval were analyzed for PCBs. **Table 6** provides a summary of the PCBs detected above the laboratory's MDLs. There was only one PAL exceedance for PCBs, with a detection of total PCBs of 1.121 mg/kg in sample A10-027-SB-1. This PAL exceedance of total PCBs had contributions from Aroclor 1248 (with a detection of 0.334 mg/kg), Aroclor 1254 (with a detection of 0.508 mg/kg), and

Aroclor 1260 (with a detection of 0.279 mg/kg). All of the detections of the aroclors were below their individual PALs. This PAL exceedance location has been indicated on **Figure S-2**.

Table 6 provides a summary of the TPH-DRO/GRO detections above the laboratory's MDLs in the soil samples collected in the parcel. The maximum DRO detection (6,000 mg/kg) was identified in sample A10-018-SB-5, which targeted REC 10B (Large Historical AST). The maximum GRO detection (182 mg/kg) was identified in sample A10-022-SB-2, which targeted REC 12B (Maintenance of Way Yard UST and fuel dispensers). None of the detections of DRO or GRO exceeded the PAL of 6,200 mg/kg. There was one location where physical evidence of NAPL was identified in the soil core. This boring (A10-006-SB) is discussed further below.

4.1.2. Soil Conditions: Inorganic Constituents

Table 7 provides a summary of inorganic constituents detected above the laboratory's MDLs in the soil samples collected from across the Site. Five inorganic compounds (arsenic, lead, manganese, thallium, and vanadium) were detected above their respective PALs. Arsenic was by far the most common inorganic exceedance, and was detected above the PAL in 65 (approximately 83%) of the soil samples analyzed for this compound. The maximum detection of arsenic in soil was 71.2 mg/kg in sample A10-006-SB-1. In comparison, lead, manganese, thallium, and vanadium accounted for PAL exceedances in 13 total samples from 9 boring locations. A summary of the inorganic PAL exceedance locations and results has been provided on **Figure S-3**.

4.1.3. Soil Conditions: Results Summary

Table 6 and **Table 7** provide a summary of the detected organic compounds and inorganics in the soil samples submitted for laboratory analysis, and **Figure S-1** through **Figure S-3** present a summary of the soil sample results that exceeded the PALs. **Table 8** provides a summary of results for all PAL exceedances in soil, including maximum values and detection frequencies. **Table 9** indicates which soil impacts (PAL exceedances) are associated with the specific targets listed in the Parcel A10 Work Plan. PAL exceedances in soil within Parcel A10 consisted of five inorganics (arsenic, lead, manganese, thallium, and vanadium), three SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene), and total PCBs. VOCs, DRO, and GRO were not detected above their respective PALs and are not considered to be significant soil contaminants in Parcel A10.

Lead, PCBs, and TPH-DRO/GRO are subject to special requirements as designated by the agencies: lead results above 10,000 mg/kg are subject to additional delineation (and possible excavation), PCB results above 50 mg/kg are subject to delineation and excavation, and TPH-DRO/GRO results above 6,200 mg/kg should be evaluated for the potential presence and mobility of NAPL in any future development planning. Concentrations for these parameters did not exceed the specified thresholds in any soil samples collected at the Site. A10-006-SB

exhibited physical evidence of NAPL in the soil core, and a screening piezometer was subsequently installed to evaluate the presence of potentially mobile NAPL in groundwater. The findings at this location are discussed in Section 4.3.

4.2. GROUNDWATER CONDITIONS

The analytical results for the detected parameters in groundwater are summarized and compared to the PALs in **Table 10** (Organics) and **Table 11** (Inorganics). The laboratory Certificates of Analysis (including Chains of Custody) and DVRs have been included as electronic attachments. The DVRs contain a glossary of qualifiers for the final flags assigned to individual results in the attached summary tables.

4.2.1. Groundwater Conditions: Organic Compounds

As provided on **Table 10**, several VOCs were identified above the laboratory's MDLs in groundwater samples collected from across the Site. A total of seven VOCs (cis-1,2-dichloroethene and 1,2-dichlorethene (total), carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, and vinyl chloride) were detected above their respective PALs. Most notably, tetrachloroethene and its degradation products (trichloroethene, 1,2-dichlorethene, and vinyl chloride) were observed to be present in the eastern and southern areas of the Site. Each VOC parameter exceeded its respective PAL at groundwater sample location A10-025-PZ which is located toward the eastern boundary of the Site and provided parcel coverage. Based on the magnitude of the PAL exceedances, location A10-025-PZ appears to be the most heavily impacted by VOCs including chlorinated ethenes. A summary of the VOC PAL exceedance locations and results has been provided as **Figure GW-1**.

Table 10 provides a summary of SVOCs identified in groundwater samples above the laboratory's MDLs. Similar to the evaluation of soil data, the PALs for relevant PAHs have been adjusted upward based on revised toxicity data published in the USEPA RSL Resident Tapwater Table. Four SVOCs (1,1-biphenyl, 1,4-dioxane, benz[a]anthracene, and naphthalene) were detected above their respective aqueous PALs. Naphthalene was the only SVOC compound to exceed its PAL at multiple locations, with two total exceedances (A10-018-PZ and A10-025-PZ). A summary of the SVOC PAL exceedance locations and results has been provided as **Figure GW-2**.

Table 10 provides a summary of the DRO and GRO detections in groundwater at the Site. DRO was detected above its PAL in nine sample locations distributed throughout the Site, with a maximum detection of 1,130 µg/L (flagged with the "J" qualifier indicating that it is an estimated value) at location A10-018-PZ. GRO was detected above its PAL in only two groundwater samples with a maximum detection of 565 µg/L at location A10-025-PZ. A summary of the TPH-DRO/GRO PAL exceedance locations and results has been provided on **Figure GW-3**. Each location was checked for the potential presence of NAPL using an oil-water interface probe

prior to sampling. During these checks, NAPL was not detected in any of the groundwater sampling locations, although it was detected in the NAPL screening piezometer installed as A10-006-PZ. The presence of NAPL at the Site is discussed in Section 4.3.

4.2.2. Groundwater Conditions: Inorganic Constituents

Table 11 provides a summary of inorganic constituents detected above the MDLs in the groundwater samples collected from across the Site. A total of seven inorganic compounds (dissolved arsenic, dissolved cobalt, dissolved iron, dissolved manganese, dissolved thallium, dissolved vanadium, and total hexavalent chromium) were detected above their respective PALs. Arsenic, thallium, vanadium, and hexavalent chromium exceeded their PALs at only one location each. Cobalt (10 exceedances), manganese (10 exceedances), and iron (3 exceedances) were more widespread at the Site. The hexavalent chromium PAL exceedance in sample location SG06-PDM001 is suspect because results for hexavalent chromium have commonly been impacted by sample color (matrix interferences) at other property locations. A summary of the inorganic PAL exceedance locations and results has been provided as **Figure GW-4**.

4.2.3. Groundwater Conditions: Results Summary

Groundwater data were screened to determine whether individual sample results may exceed the USEPA Vapor Intrusion (VI) Screening Levels (Target Cancer Risk (TCR) of 1E-5 and Target Hazard Quotient (THQ) of 1) as determined by the Vapor Intrusion Screening Level (VISL) Calculator version 3.5 (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls). The PALs specified in the QAPP are based upon drinking water use, which is not a potential exposure pathway for groundwater at the Site. The results of the sample screening against the VI criteria are summarized in **Table 12**.

The parameters which exceeded the individual VI TCR or THQ criteria were tetrachloroethene and trichloroethene. Tetrachloroethene was detected above the VI screening level (240 µg/L) at one shallow groundwater location (A10-025-PZ) with a detection of 1,010 µg/L. Trichloroethene was detected above its VI screening level (22 µg/L) at three shallow groundwater locations (A10-025-PZ, A10-027-PZ, and A10-034-PZ) with a maximum detection of 494 µg/L at sample location A10-025-PZ.

Following the initial screening, a cumulative risk assessment was also performed for each individual sample location, with the results separated by cancer versus non-cancer risk. All compounds with detections were included in the computation of the cumulative cancer risk, and all compounds with detections exceeding 10% of the THQ level were included in the evaluation of non-cancer hazard. The cumulative VI non-cancer hazards exceeded 1 (rounded to one significant digit) at three sample locations: A10-025-PZ, A10-027-PZ, and A10-034-PZ. Exceedances of the cumulative non-cancer hazards for multiple target organs at these three locations were caused by the chlorinated ethenes (tetrachloroethene and trichloroethene). In

addition, the cumulative cancer risks exceeded the allowable limit (1E-5) at locations A10-025-PZ and A10-027-PZ due primarily to the carcinogenic effect of trichloroethene. The results of the cumulative VI comparisons are provided in **Table 13**, with the exceedances highlighted. The groundwater locations which exceeded the cumulative VI criteria are shown in **Figure GW-5**.

The presence and absence of groundwater impacts within the Site boundaries have been adequately described. Groundwater is not used on the Tradepoint Atlantic property (and is not proposed to be utilized). VI risks/hazards were evaluated and identified three locations which may be impacted by elevated VOC concentrations.

4.3. NON-AQUEOUS PHASE LIQUID (NAPL)

Immediately after the installation of each temporary groundwater sample collection point at the Site (11 total), an oil-water interface probe was used to check for the presence of NAPL. During the initial check, NAPL was not detected in any temporary groundwater sample collection point. Additional NAPL checks were completed 48 hours after installation, and again prior to groundwater sampling (July 18 through July 20, 2016). NAPL was not detected in any temporary groundwater point or the existing well (SG06-PDM001) during any of the NAPL checks and no delineation activities were warranted at these locations.

Soil cores were screened for evidence of possible NAPL contamination during the completion of the Phase II soil borings in Parcel A10. During the field screening, only one location had observations of physical evidence of NAPL. Soil boring A10-006-SB had a visible low vicious amber sheen in the soil core from 7 to 8 feet bgs and from 9 to 9.5 feet bgs which was noted on the boring log. A strong odor was also detected accompanying the sheen. An intermediate soil sample (A10-006-SB-7) collected from the 6 to 7 foot bgs interval just above the observed sheen had a DRO detection of 281 mg/kg and a GRO detection of 47.4 mg/kg, which do not exceed the PAL of 6,200 mg/kg. There were no concentrations of DRO or GRO identified above the soil PAL at the Site.

Based on the observation of NAPL, and in accordance with the Work Plan, a temporary NAPL screening piezometer (A10-006-PZ) was installed with a screen interval from 4 to 14 feet bgs according to the same specifications as the temporary groundwater sample collection points completed throughout the Site. After installation, the piezometer was checked for the presence of accumulated product using an oil-water interface probe. The 0-hour (July 7, 2016), 48-hour (July 11, 2016), and 30-day (August 26, 2016) gauging events at this location were all absent of measurable or trace NAPL. An additional gauging event was completed approximately one year after the installation (July 31, 2017), and again NAPL was not detected. Static groundwater was measured at an approximate depth of 7 feet bgs.

The MDE provided an email on February 26, 2018 stating that the NAPL screening piezometer A10-006-PZ could be abandoned. However, prior to its abandonment, trace NAPL was detected

on January 4, 2019 at this screening location. Additional piezometers were subsequently installed surrounding A10-006-PZ in January and February 2019 to delineate the extent of potentially mobile NAPL, and measurable NAPL was discovered in the area. The details and findings of the NAPL delineation will be reported to the MDE outside of the scope of this Phase II Investigation Report. Subsequent investigation activities or response actions (if required) will be coordinated with the MDE as appropriate.

5.0 DATA USABILITY ASSESSMENT

The approved property-wide QAPP specified a process for evaluating data usability in the context of meeting project goals. Specifically, the goal of the Phase II Investigation is to determine if potentially hazardous substances or petroleum products (VOCs, SVOCs, PCBs, TAL-Metals, cyanide, or TPH-DRO/GRO) are present in Site media (soil and groundwater) at concentrations that could pose an unacceptable risk to Site receptors. Individual results are compared to the PALs established in the QAPP (i.e., the most current USEPA RSLs) or based on other direct guidance from the agencies, to identify the presence of exceedances in each environmental medium.

Quality control (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 I**. The following QC samples were submitted for analysis to support the data validation:

- Trip Blank – at a rate of one per cooler with VOC samples per day
  - Soil – VOCs only
  - Water – VOCs only
- Blind Field Duplicate – at a rate of one per twenty samples
  - Soil – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, PCBs, hexavalent chromium, and cyanide
  - Water – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
  - Soil – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, PCBs, and hexavalent chromium
  - Water – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, and hexavalent chromium
- Field Blank and Equipment Blank – at a rate of one per twenty samples
  - Soil – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide
  - Water – VOCs, SVOCs, Metals, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide

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.

5.1. 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 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 at the beginning of each day and re-checked as needed. The logs have been provided in **Appendix E** (PID calibration log) and **Appendix G** (multiparameter meter calibration logs).

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 Chains of Custody 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.

5.2. DATA VALIDATION

USEPA Stage 2B data validation was completed for a representative 50% of the environmental sample analyses performed by PACE and supporting Level IV Data Package information by Environmental Data Quality Inc. (EDQI).

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 have been 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 property-wide 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.

Data Validation has been completed for a representative 50% of all sample results, and the DVRs provided by EDQI have been included as electronic attachments. The USEPA has previously specified that results flagged with a "JB" qualifier are erroneous, and any such results should be revised to display the "B" qualifier only. EDQI reviews and corrects any "JB" qualified results during the data validation procedure. Therefore, any result originally flagged with a "JB" qualifier in the laboratory certificate is reported as a "B" qualified non-detect result in this Phase II Investigation Report. ARM has reviewed all non-validated laboratory reports (those which were not designated to be reviewed by EDQI), and applied the same validation correction to any relevant "JB" qualified results. ARM has also revised the non-validated results to eliminate any laboratory-specific, non-standardized qualifiers (L2, 6c, ip, 4c, etc.), which are customarily removed by EDQI during the validation procedure.

5.3. 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 provided as electronic attachments. 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. A qualifier code glossary is included with each DVR 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. A list of the analytical soil results that were rejected during data validation is provided as **Table 14**. None of the analytical groundwater results were rejected during 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 006, 008, 009, 010, 011, 017, and 024**. Review of the field notes and laboratory sample receipt records indicated that collection of soil and groundwater 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 significant deviations from the QAPP were noted in the dataset.

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 provided in **Appendix J**. This evaluation of completeness includes only the representative 50% of sample results which were randomly selected for validation.

All groundwater compounds had an overall completeness ratio of 100%, indicating that none of the aqueous results were rejected. The only soil compounds with overall completeness values below 90% were methyl acetate, bromomethane, 2,4-dinitrophenol, and 1,4-dioxane. The majority of the methyl acetate dataset was rejected (13.6% completeness), but there were no detections in the validated soil dataset and only one negligible detection (0.012 mg/kg with a "J" qualifier compared to the PAL of 1,200,000 mg/kg) in the non-validated dataset. There were no detections of methyl acetate in groundwater. Bromomethane and 2,4-dinitrophenol had significantly higher completeness ratios of 81.8% and 75.0%, respectively. Although these ratios are below the 90% goal, a significant proportion of the data was deemed suitable for use. In addition, there were no detections of either compound in soil or groundwater throughout the Site.

All of the 1,4-dioxane soil results which underwent the validation process were rejected; however, there were no detections of 1,4-dioxane in soil throughout the parcel. In addition, 1,4-dioxane had a completeness ratio of 100% in groundwater with only five detections out of the 12 groundwater samples. Although one aqueous detection exceeded the PAL, this result (0.55 ug/L in A10-010-PZ) was only slightly above the allowable limit (0.46 ug/L). Sufficient information is available in the groundwater dataset to evaluate the significance of 1,4-dioxane at the Site. Furthermore, the location which exceeded the aqueous PAL for 1,4-dioxane also exhibited exceedances of chlorinated VOCs (tetrachloroethene and trichloroethene). Since 1,4-dioxane is often associated with chlorinated VOCs, any potentially significant concentrations of 1,4-dioxane in the soil would be expected to be accompanied by a significant presence of chlorinated VOCs in the soil, which has not been the case in this parcel.

Overall, the soil and groundwater data can be used as intended, and no significant data gaps were identified. While a limited set of soil compounds did not meet the completeness goal, these compounds do not appear to be significant contaminants at the Site.

6.0 FINDINGS AND RECOMMENDATIONS

The objective of this Phase II Investigation was to fully characterize the nature and extent of contamination at the Site. During the Phase II Investigation, a total of 12 groundwater samples and 78 soil samples (all locations/depths) were collected and analyzed to define the nature and extent of contamination in Parcel A10. The sampling and analysis plan for the parcel was developed to target specific features which represented a potential release of hazardous substances and/or petroleum products to the environment. Soil samples were analyzed for TCL-VOCs, TCL-SVOCs, TPH-DRO/GRO, TAL-Metals, hexavalent chromium, and cyanide. Shallow soil samples (0 to 1 foot bgs) were additionally analyzed for PCBs. Groundwater samples were analyzed for TCL-VOCs, TCL-SVOCs, TPH-DRO/GRO, TAL-Dissolved Metals, total hexavalent chromium, and total cyanide.

6.1. SOIL

The concentrations of constituents in the soil have been characterized by the Phase II Investigation to provide estimates of exposure point concentrations to support risk assessment.

Lead and PCB concentrations are well below the levels that would warrant evaluation of a removal remedy. There were no locations where detections of lead exceeded 10,000 mg/kg, the designated threshold at which delineation would be required. There were no concentrations of total PCBs identified above the mandatory delineation criterion of 50 mg/kg, indicating that further action is not needed.

There were no soil PAL exceedances for VOCs or TPH-DRO/GRO, indicating that these compounds are not significant contaminants in soil at the Site. Exceedances of the PALs in soil within Parcel A10 consisted of five inorganics (arsenic, lead, manganese, thallium, and vanadium), three SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene), and PCBs (total). Arsenic exceeded its PAL in the largest proportion of the samples analyzed for this compound site-wide (65 soil samples or 83%), with a maximum detection of 71.2 mg/kg in sample A10-006-SB-1. In comparison, lead, manganese, thallium, and vanadium exceeded their PALs in three samples, eight samples, 11 samples, and six samples, respectively. Three SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h] anthracene) exceeded the PALs at the Site, all of which were detected above their respective PALs at A10-008-SB-4. Benzo[a]pyrene exceeded its PAL in only one additional sample (A10-003-SB-1). Among the shallow samples collected at the Site, PCBs (total) had one PAL exceedance at a single isolated location (A10-027-SB-1) caused by a mixture of Aroclor 1248, Aroclor 1254, and Aroclor 1260 that contributed to a cumulative PCB detection of 1.121 mg/kg.

6.2. GROUNDWATER

The concentrations of constituents in the groundwater have also been characterized by the Phase II Investigation to provide estimates of exposure point concentrations to support risk assessment.

Analysis of the groundwater samples identified concentrations of seven inorganic compounds that exceeded their PALs (dissolved arsenic, dissolved cobalt, dissolved iron, dissolved manganese, dissolved thallium, dissolved vanadium, and total hexavalent chromium). The single hexavalent chromium exceedance at SG06-PDM001 is suspect because results for hexavalent chromium have commonly been impacted by sample color (matrix interferences) at other locations on the Tradepoint Atlantic property. Arsenic, thallium, and vanadium exceeded their respective PALs at a single location each. Cobalt and manganese each had 10 detections above the aqueous PALs, whereas, iron had three aqueous PAL exceedances.

Seven VOCs exceeded their respective PALs at the Site (cis-1,2-dichloroethene and 1,2-dichlorethene (total), carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, and vinyl chloride), all of which were detected above their PALs in sample location A10-025-PZ. Chloroform, tetrachloroethene, and trichloroethene each exceeded their respective PALs in two, three, and four additional groundwater samples, respectively. Most notably, tetrachloroethene and its degradation products (trichloroethene, 1,2-dichlorethene, and vinyl chloride) were observed to be present in the eastern and southern areas of the Site. Four SVOCs (1,1-biphenyl, 1,4-dioxane, benz[a]anthracene, and naphthalene) were detected at concentrations above the aqueous PALs at one groundwater sample location each, excluding naphthalene which exceeded its PAL in two groundwater samples. Nine out of the 12 groundwater samples exceeded the PAL for DRO, with a maximum detection of 1,130 µg/L (flagged with the "J" qualifier indicating that it is an estimated value) at location A10-018-PZ. GRO exceeded its PAL in two groundwater samples (A10-025-PZ and A10-027-PZ) with a maximum detection of 565 µg/L.

Groundwater is not used on the Tradepoint Atlantic property (and is not proposed to be utilized), therefore there is no potential for direct human exposure for a Composite Worker. In the event that future construction/excavation leads to a potential Construction Worker exposure to groundwater, health and safety plans should be implemented to limit exposure risk. The groundwater data were screened to determine whether any cumulative (or individual) sample results exceeded the USEPA VI TCR (carcinogen) or THQ (non-carcinogen) Screening Levels. Two parameters were detected above the individual VI TCR or THQ criteria: tetrachloroethene and trichloroethene. When the aqueous results were summed by sample location, the cumulative VI non-cancer hazards exceeded 1 (rounded to one significant digit) at three sample locations: A10-025-PZ, A10-027-PZ, and A10-034-PZ. Exceedances of the cumulative non-cancer hazards for multiple target organs at these three locations were caused by the identified chlorinated ethenes. In addition, the cumulative cancer risks exceeded 1E-5 at A10-025-PZ and A10-027-PZ due primarily to the carcinogenic effect of trichloroethene. Further assessment or

mitigation is recommended to address the potential VI risks/hazards identified at A10-025-PZ, A10-027-PZ, and A10-034-PZ if development is proposed in these areas. The selection of appropriate response measures, based on the specific development plan for the parcel, should be addressed in a project-specific Response and Development Work Plan.

6.3. NON-AQUEOUS PHASE LIQUID

There were no elevated detections of DRO or GRO identified above the soil PAL (6,200 mg/kg) at the Site. None of the temporary groundwater sample collection points installed in Parcel A10 for groundwater sampling showed any evidence of NAPL during the mandatory checks. Furthermore, the exiting historical well SG06-PDM001 did not exhibit evidence of NAPL during a gauging event which was completed prior to sampling.

During field screening of the soil cores installed during this investigation, only one location had observations of physical evidence of NAPL. Soil boring A10-006-SB had a visible low vicious amber sheen in the soil core from 7 to 8 feet bgs and from 9 to 9.5 feet bgs. A strong odor was also detected accompanying the sheen. The potential mobility of NAPL to groundwater at location A10-006-SB was investigated via the installation of a temporary NAPL screening piezometer (A10-006-PZ). Based on 0-hour, 48-hour, and 30-day measurements, as well as an additional gauging event completed approximately one year after installation, it was determined that NAPL was not likely to be present in groundwater at quantities that are likely to migrate.

However, prior to the planned abandonment of A10-006-PZ, trace NAPL was detected at this screening location (January 2019). Additional piezometers were subsequently installed to delineate the extent of potentially mobile NAPL, and measurable NAPL was discovered in the area. The details and findings of the NAPL delineation will be reported to the MDE outside of the scope of this Phase II Investigation Report. Subsequent investigation activities or response actions (if required) will be coordinated with the MDE as appropriate.

The proximity of the NAPL-impacted boring A10-006-SB (and the associated piezometers) to proposed utilities should be evaluated in any future development planning for Parcel A10. Appropriate protocols should be documented in a Response and Development Work Plan (as necessary) to prevent the mobilization of any product if future utilities are proposed in the vicinity of these impacts.

6.4. RECOMMENDATIONS

Sufficient remedial investigation data has been collected to present this evaluation of the nature and extent of possible constituents of concern in Parcel A10. The presence and absence of soil and groundwater impacts within Parcel A10 have been adequately described and further site-wide investigation is not warranted to characterize overall conditions; however, additional investigation may be required to further characterize impacts identified in specific areas of the Site. Recommendations for the Site are as follows:

- The boring location with physical observations of NAPL in the associated soil cores (A10-006-SB) should be considered for proximity to proposed utilities in any future development plans. The details and findings of the NAPL delineation will be reported to the MDE outside of the scope of this Phase II Investigation Report. Subsequent investigation activities or response actions (if required) will be coordinated with the MDE as appropriate. If future utilities are proposed in the vicinity of this boring, appropriate protocols for the mitigation of potential product mobility should be specified in a Response and Development Work Plan.

- Tetrachloroethene and its degradation products were observed to be present in groundwater at elevated levels in the eastern and southern areas of the Site. The nature and extent of the groundwater impacts should be further defined to determine whether response actions are warranted to reduce the detected concentrations of these VOCs to acceptable levels. A separate Work Plan to provide additional delineation of associated groundwater conditions will be coordinated with the MDE and submitted in the future.

- If an enclosed structure is proposed for construction in the vicinity of A10-025-PZ, A10-027-PZ, or A10-034-PZ, further assessment or mitigation of the potential for human exposures via the vapor intrusion to indoor air pathway should be addressed in a Response and Development Work Plan. The vapor intrusion risks associated with these locations may be reduced by any future response actions to address VOCs.

7.0 REFERENCES

ARM Group, Inc. (2016). *Phase II Investigation Work Plan: Parcel A10.* Revision 3. April 21, 2016.

ARM Group, Inc. (2016). *Quality Assurance Project Plan: Sparrows Point Terminal Site*. Revision 3. April 5, 2016.

ARM Group, Inc. (2017). *Stormwater Pollution Prevention Plan (SWPPP).* Revision 5. June 1, 2017.

Rust Environment and Infrastructure (1998). *Description of Current Conditions: Bethlehem Steel Corporation*. Final Draft. January 1998.

USEPA (2017). Vapor Intrusion Screening Level (VISL) Calculator version 3.5 (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls).

Weaver Boos Consultants (2014). *Phase I Environmental Site Assessment: Former RG Steel Facility*. Final Draft. May 19, 2014.