ENVIROSEARCH
CONSULTANTS, INC.

PROJECT HEALTH & SAFETY PLAN (HASP)
BRIDGE POINT BRIDESBURG LLC
4501 RICHMOND STREET
PHILADELPHIA, PA

Envirosearch Project # 43322

Prepared For:
BSI Inc.
735 Birch Avenue
Bensalem, PA

Prepared By:
Envirosearch Consultants, Inc.
500 Norristown Road
Ambler, PA 19002

Date Prepared:
July 2022

Joanne Van Rensselaer
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Joanne Van Rensselaer
Principal

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Health and Safety Plan Acknowledgement

Due to the nature of the contaminants identified in the near and subsurface soils and groundwater during the previous environmental investigations and the construction activities that will occur within the project site of the 4501 Richmond Street site, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Therefore, general adherence to the health and safety guidelines set forth in this document, will reduce, but may not eliminate, the potential for injury and illness at this site. Guidelines in this plan were prepared specifically for the project site areas and should not be used on any other site without prior evaluation by trained health and safety personnel.

Site workers will review this Health & Safety Plan (HASP) and will complete a pre-entry briefing prior to initiating this project. The sections of this HASP will be reviewed during this briefing. Workers who were not in attendance at the initial briefing will be trained by the BSI, Inc. project manager on the information covered in the pre-entry briefing as needed. After reading the HASP and attending a pre-entry briefing, workers will sign the following acknowledgment statement that will be placed in front of this HASP. Below is an example of the form that will be used for the acknowledgment statement.

I have read, understand, and/or been briefed on the information set forth in is HASP. I agree to perform my work in accordance with this HASP as well as with any instructions provided by BSI, Construction, Inc. (BSI). or other lead project personnel including but not limited to Roux Associates, Inc. (site representative for Bridge Point Bridesburg). This HASP is to supplement the undersigned's internal corporate safety plan (and not to replace) and the June 2022 Soils Management Plan prepared by Roux Associates, Inc. (Roux), on behalf of Bridge Point Bridesburg LLC (Bridge)

Name (Print and Sign)	*Company*	*Date*

Attach additional acknowledgement forms as necessary and place behind this Page i.

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1.0 INTRODUCTION

The subject site is approximately 63 acres and is currently vacant land with no structures, and was formerly the site of the Philadelphia Coke, Company, Inc. (PCC, Figure 1). According to information provided to Envirosearch, the subject property was operated for coal gas manufacturing from the 1920s to the 1980s. Manufacturing operations ended in 1982 and the site was decommissioned in stages throughout the 1980s and 1990s with oversight from the Pennsylvania Department of Environmental Protection (PADEP) and the US Environmental Protection Agency (EPA). In 1994, the USEPA issued a Certificate of Completion for RCRA following the decommissioning of the former operations.

In 2018, the former property owner, National Grid, submitted a Notice of Intent to Remediate (NIR) to the Pennsylvania Department of Environmental Protection (PADEP) that identified the subject site would be attaining the Act 2 Site Specific Standard (SSS) as part of their request for a release of liability (ROL) site closure. In July 2021, National Grid's consultant prepared a Remedial Investigation Report and Cleanup Plan to the PADEP that details the areas of concern (aka site of contamination) and the way the Sites of contamination would be addressed as part of redevelopment plans and in attainment of the SSS.

1.1 Purpose of HASP

The purpose of this site-specific HASP is to establish practices and procedures to educate and make aware not only the employees of BSI but also subcontractors, site visitors, inspectors and other personnel of the potential hazards posed by redevelopment activities, and the presence of onsite soil and groundwater contamination that exceeds the Act 2 non-residential MSCs.

Amendments, updates, or revisions (e.g., changes in personal protective equipment not provided for in this plan, addition of tasks, etc.) to this HASP will be completed by BSI based upon a change in site conditions and/or recommendations from BSI's consultant. The information provided in this HASP is based upon the Environmental Due Diligence (EDD) provided by Roux in the June 2022 SMP and project files, as well as information provided in the PADEP Facility Files.

- **Groundwater contamination** has been detected beneath the subject site that exceeds the PADEP Act 2 Nonresidential MSCs and includes concentrations of heavy metals, volatile organic compounds (VOCs) and semi-VOCs.

- **Soil contamination** has also been detected onsite that exceeds the Act 2 Non-Residential MSCs, and includes heavy metals, VOCs, semi-VOCs. According to information provide by Roux, the categories of soils/materials that will be encountered at the subject and include:

1. Unrestricted Soil (e.g. Clean Fill)
2. Regulated Soil (exceeds Clean Fill Limits but not Act 2 Non-Residential MSCs)
3. Restricted Use Soil (e.g. exceeds Act 2 Non-Residential MSCs)
4. Unknown Materials

As part of site redevelopment activities and due to the existence of onsite soil and groundwater contamination, this HASP will allow onsite workers and visitors to be aware that regulated wastes may be encountered onsite, and the subject site has been entered into the PADEP Act 2 program to seek a ROL. The **non-restricted areas** of the subject site include:

- Area 1 - Eastern Part of Former Coal Storage
- Area 2 - North/Northwest of Former Tar Storage Area
- Area 3 - South of Former Tar Storage Area
- Area 4 - Former AST Farm East of Former Byproducts

The **restricted area** of the subject site is situated along the southern portion of the site bounded by Orthodox and Carbon Streets. Areas that area restricted will be clearly identified as no materials are permitted to be removed from this area.

The areas of concern (AOCs) are depicted on Figure 2. Onsite workers need to be familiar with the potential hazards that may exist in the areas they are working onsite and take precautions as needed.

According to the June 2022 SMP, Roux indicated contact with groundwater is not expected. It was also stated in the SMP that dewatering of utility trenches will not be required and the potential for direct contact with contaminated groundwater during utility installations would be minimal, if any. However, since the SMP does not address the protocols for dewatering, stormwater events and/or the elevations of the utilities in relation to the elevation of the groundwater table, these issues will be handled based on the progression of the redevelopment activities by Roux with assistance of BSI and the work schedules.

1.2 Goal of HASP

The goal of the HASP is to complete the work within the subject site without incidents of all types, no injuries, no illnesses, and no impacts to the environment or to property and/or equipment. To achieve this goal, the project team must work together to perform an effective hazard assessment. The team will establish appropriate precautions and communicate these daily among project staff and onsite workers. The Project Team will be responsible for communicating changing field conditions to BSI's Superintendent so these conditions and appropriate precautions may be reevaluated as needed.

1.3 Amendments / Updates to HASP

Amendments, updates, or revisions (e.g., changes in personal protective equipment not provided for in this plan, addition of tasks should be documented by indicating the amendment date shown on Table 1.

Table 1 - Sample of Modifications/Updates to Health & Safety Plan

Amendment / Update to HASP	Date HASP Modified	Reason HASP was Modified/Updated	Issue Handled By & Initials	Date Modified HASP Issue Distributed to Project Contacts	Location of Amendment / Update to HASP
1					
2					

If additional Amendment / Update sheets are required, please ensure they are placed behind this page.

1.4 Exceptions & Clarifications

This HASP covers general construction, excavation and/or grading related activities which have the potential to disturb and/or displace contaminated soil and/or groundwater that was previously identified at the site. Related activities include testing, excavation, transportation, stockpiling and handling of soil, underground utility work and/or dewatering of excavations. This HASP was prepared in general accordance with Occupational Safety and Health Administration (OSHA) regulations for hazardous site workers (29 CFR 1910.120 and 29 CFR 1926), and NIOSH/OSHA/USCG/USEPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.*

The level of protection and the procedures specified in this HASP represent the minimum health and safety requirements to be observed by onsite personnel engaged in the referenced construction activities. Unknown conditions may exist and known conditions may change. Should a worker find themselves in a potentially hazardous situation, the worker will immediately discontinue the hazardous procedures(s) and either personally effect appropriate preventative or corrective measures, or immediately notify the BSI's Superintendent of the nature of the hazard.

Each worker is responsible for exercising care and good judgment in protecting their own health and safety and that of fellow workers. Should any worker observe a potentially unsafe condition or situation, it is the responsibility of that employee to immediately bring the observed condition to the attention of an BSI project personnel.

This HASP is not intended for direct, unmodified use by contractors for health and safety. Rather, the HASP provides documentation of previous site investigations, location of contaminated soil and/or groundwater, methods on handling the relocation of contaminated soil, and prevention of cross contamination/erosion during construction. Contractors are responsible for creating and administering their own site-specific health and safety plans based on their worker safety programs.

This HASP primarily focuses on the areas where the soils will be disturbed and have concentrations that exceed the PADEP Act 2 Non-Residential Medium Specific Concentrations (MSCs). Although groundwater contamination has been identified beneath the subject that exceeds the Act 2 non-residential MSCs, Roux has indicated that contact will be minimal, if any during redevelopment.

2.0 SITE HISTORY

According to information provided by the BPB, Roux and obtained from the PADEP facility files, the majority of PPC's manufacturing operations were completed near the central portions of the site. The northern portion of the site was primarily used for bulk coal and coke storage. The southern portion of the site was primarily used for product and waste storage (coal tar and iron oxide waste). The eastern portion of the site (between the railroad and the Delaware River) contained fuel storage tanks and a fuel blending area.

Based upon a review of documents provided, the following is a list of potential areas of contamination:

- Former Coke Operations/production area
- Former raw product and byproduct storage
- Former Tar Plain and Iron Oxide Waste lagoon areas
- Former Fuel Blending Area
- The general industrial use of entire property
- The presence of historic fill throughout the property

According to documents provided, approximately 30,000 tons of waste products and impacted soil was removed from the property in the 1980s during the decommissioning activities. It appears that these soils were excavated from the southern portion of the property (coal tar and oxide storage areas).

The fuel blending area contained 6 aboveground storage tanks (ASTs) and several buildings. The ASTs (and buildings) were reportedly removed free phase product and petroleum contaminated soils were identified near the former fuel blending area and were reportedly remediated.

According to the documents reviewed, underground storage tanks (USTs) were removed from the site in 1991, no closure reports were identified by Envirosearch in the PADEP files. Additionally, 2 oil USTs were abandoned (one in-place and one removed) during site closure activities completed in the 1980s.

The documents indicate that the site has historic fill throughout the property. Historic fill was used extensively along the Delaware River to grade sites for development.

2.1 <u>PADEP Act 2 Cleanup Plan</u>

Pursuant to the EDD, the subject property has been entered into the PADEP Act 2 program to seek a ROL by attaining the SSS. The SSS will be attained as part of the redevelopment plans by pathway elimination. This will be achieved by (1) capping the impacted soils through a 2' previous soil cap, buildings, roadways, parking lots and/or landscaping, (2) executing a PADEP Environmental Covenant (e.g., deed restriction), and (3) installation of a vapor barrier. These approaches are presented in the Proposed Cleanup Plan submitted to the PADEP in July 2021. On-going soil and groundwater investigations and monitoring will continue to be implemented during the redevelopment of the subject site by BPB.

The contaminants of concern (COCs) detected in the onsite soils include heavy metals (e.g. lead, arsenic) and polycyclic aromatic hydrocarbons (PAHs), and is typically encountered in the fill layer or the top few feet of the silt and clay layer. The cleanup plan describes these zones to contain viscous tar, oil-like material, and solidified tar)

Groundwater contamination exceeding the Act 2 non-residential MSCs has also been detected beneath the subject site and include concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and heavy.

3.0 GENERAL PROJECT INFORMATION

The following sections provide general information for the project including the location, the type of activities proposed to be completed within the project area, the COCs for the project and the personnel contacts. The June 2022 SMP details the Act 2 Sites of contamination on the subject property, and is provided in Appendix A.

Onsite workers need to be familiar with the potential hazards that may exist in the areas they are working onsite and take precautions as needed. The following sections provide a summary of the AOCs and the type of contaminants that may be encountered during redevelopment of the subject site. Based upon the Environmental Due Diligence (EDD) completed by Roux and provided in the PADEP Facility Files soil and groundwater contamination exist at the sbuejct site that exceeds the Act 2 non-residential MSCs.

According to the July 2021 Cleanup Plan, four categories of soils/materials will be encountered at the subject and include:

1. Unrestricted Soil (e.g. Certified Clean Fill)
2. Regulated Soil (exceeds Clean Fill Limits but not Act 2 Non-Residential MSCs),
3. Restricted Use Soil (e.g. exceeds Act 2 Non-Residential MSCs)
4. Unknown Materials

It should be noted that as part of the site redevelopment Certified Clean Fill will be imported to the subject site to prepare the building pads, and to construct a 2' pervious soil cBSI. The Clean Fill will have met the Management of Fill Policy (MoFP) analytical requirements prior to placement at the subject site.

Groundwater contamination is present beneath the subject site; however, Roux has indicated in the June 2022 that contact will be minimal based on the redevelopment plans.

3.1 Soil

As part of the Act 2 SSS attainment, four areas of concern (AOCs) in the soils are present onsite where exceedances were detected during the onsite soils investigations. As part of site redevelopment activities and due to the existence of onsite soil and groundwater contamination, this HASP will allow onsite workers and visitors to be aware that regulated wastes may be encountered onsite, and the general location of these AOCs.

3.1.1 Non-Restricted Soils

The four AOCs include the following **non-restricted areas**:

- Area 1 - Eastern Part of Former Coal Storage
- Area 2 - North/Northwest of Former Tar Storage Area
- Area 3 - South of Former Tar Storage Area
- Area 4 - Former AST Farm East of Former Byproducts

The findings of the past soil investigations conducted in these areas were found to be below the Act 2 non-residential MSCs. However, Roux has recommended that care should be taken during earthmoving activities in the event disturbed soils within these areas exhibit evidence of those soils/materials classified as restricted (see Section 2.1.2).

As part of the redevelopment in areas, it is estimated that 66,000 cubic yards (CY) of impacted soil will excavated and be reused elsewhere onsite as fill material, except in the 2' pervious cap and beneath the building pads. Approximately 75,000 CY of Certified Clean Fill will be imported onsite to be used beneath the building pads and roadways/parking areas, and approximately 163,000 CY of Certified Clean Fill for the 2' previous soil cap.

Roux has indicated that no disturbed soils will be taken offsite for disposal/processing at this time, unless unknown/unanticipated materials are encountered during the earthwork activities.

3.1.2 Restricted Soils

The restricted use area is depicted on Figure 2 and situated along the southern portion of the subject site. The restricted soils are defined as "Historical Tar / Fill Area" and this area will be clearly marked during redevelopment since the soils in this area may not be removed from the restricted area and used elsewhere onsite. At this time, Roux had indicated the restricted soils will remain onsite and the area capped. In the event conditions require the restricted soils to be removed or analytical data identified hazardous characteristics, Roux will coordinate with BSI for handling and/or removal of the restricted soils to an offsite permitted disposal facility.

3.1.3 Soil COCs

Based upon the information provided in the December 2017 Phase III for the project area, the following COCs were detected in the surface and subsurface soils. These soil contaminants were detected above the Management of Fill Policy's (MoFP) limits for **unrestricted use, as well as the MoFP limits for Regulated Fill and the PADEP Act 2 non-residential Statewide Health Standards (SHS) standards**.

- ***Surface Soils***

The COCs in the surface soils include: Lead, Arsenic, Benzo a Pyrene, Benzo a Anthracene, Dibenz ah Anthracene, Benzo b Fluoranthene, Benzo k Fluoranthene, and Benzo b Fluoranthene.

- ***Subsurface Soils***

The COCs in the surface soils include:

- *Heavy Metals:* Antimony, Cyanide, Mercury, Nickel, Selenium, Lead, Arsenic;
- *VOCs* : Chlorobenzene, dichloromethane, ethylbenzene, styrene, and toluene; and
- *SVOCs*: Anthracene, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Phenol, Pyrene, Benzo a Pyrene, Benzo a Anthracene, Dibenzo ah Anthracene, Benzo b Fluoranthene, Benzo k Fluoranthene, and Benzo b Fluoranthene.

3.2 Groundwater

According to the June 2022 SMP, groundwater contamination has been characterized beneath the site based on analytical data collected during the monitoring of the 36 onsite monitoring wells (and 7 hydropunch sampling points). The groundwater monitoring was conducted between 2003 and 2005, and most recently between 2018 and 2021. During site construction, where dewatering of trenches is required, concentrations of the following COCs may be encountered based upon the elevation of the excavation required as part of the site redevelopment.

The COCs in the groundwater include:

- *Heavy Metals:* Antimony, Vandaium, Nickel, Manganese, Arsenic;
- *VOCs* : TCE, PCE, Benzene, MTBE; and
- *SVOCs*: Carbazole, Chrysene, Dibenzofuran, Benzo ghi Perylene, Indeno 123 Pyrene, Fluorene, Naphthalene, Benzo a Pyrene, Benzo a Anthracene, Dibenzo ah Anthracene, Benzo ghi Fluoranthene, Benzo b Fluoranthene, Benzo k Fluoranthene, and bis Ethylexyl phthalate.

These COCs were detected in the groundwater exceeding the Residential and Non-Residential MSCs in both the shallow and deep aquifers.

With regard to the proposed redevelopment and the potential for adverse impacts to groundwater, the SMP and the July 2021 RICP indicated that redevelopment activities do not warrant a concern since there will be limited contact based on the depth to groundwater in relation to soil disturbances and elevation of utility trenches. In the event groundwater dewatering is required, a Temporary Groundwater Discharge Permit will be secured form the Philadelphia Water Department that will allow for the discharge of groundwater and/or stormwater through the City's sewer system.

If site conditions change and groundwater will be encountered, this HASP will be revised to document the precautions to be taken for worker safety and the need for dewatering.

4.0 PROJECT HEALTH AND SAFETY ORGANIZATION

The following summarizes the key individuals who are assigned to ensure the HASP protocols are implemented for the safety of onsite personnel and visitors and to reduce the potential exposures to hazardous materials/wastes that may be encountered during the completion of this project.

4.1 Project Personnel Roles & Responsibilities

Provisions of this HASP apply to BSI and other project personnel that may enter the project areas during the earthmoving activities, and/or other field activities. Personnel who will take responsibility for the safe operations of this project include BSI's Construction Manager and Site Safety Manager. Responsibilities of each of the below referenced personnel as they relate to project safety and health are summarized below.

4.1.1 Description of Project Personnel Responsibilities

BSI's Site Safety Manager / Construction Manager and Envirosearch' s PM will work together implementing the HASP and coordinating onsite activities within the AOCs, the unrestricted areas, the restricted areas, and the project schedule. The following summarizes the responsibilities of the project personnel in relation to the HASP:

- **BSI Construction Manager**

The Construction Manager, who will also serve as the Site Safety Manager has overall management authority and responsibility for all site operations, including decision making on safety, as well as the following:

- Review weekly updates regarding working conditions within the project area as they relate to the HASP;
- Inform/update BPB and Roux on the HASP issues and/or emergency responses or project cessations;
- Ensure BSI implements personnel training under the HASP and ensures potential hazards associated with project areas include safe working conditions;
- Coordinate with client as needed regarding project timelines;
- Obtains permission for site access and coordinates activities with appropriate officials.
- Briefs the field team on their specific assignments;
- Coordinates with the BSI and Envirosearch' s project personnel to ensure that health and safety requirements aremet;
- Serves as the liaison with public officials, community and/or PADEP if needed.

- **BSI Site Safety Manager**

The Site Safety Manger (SSM) is an employee of BSI and has been assigned to oversee health and safety requirements for the project and provide needed technical support. BSI's SSM will be the first point-of-contact for all of the project's health and safety matters. Duties include the following:

- Onsite as needed to provide awareness training to project personnel, including visitors, subcontractors, or other representatives on the aspects of health and safety for the project areas;
- Works directly with Envirosearch' s PM and/or BPB's consultant (Roux);
- Oversees safety procedures under HASP & BSI's corporate Site Specific Safety Plan (Appendix B);
- Coordinates with Envirosearch in determining protection level prior to the start of a new activity.
- Coordinates with Envirosearch regarding the schedule for onsite air/dust monitoring activities, if needed, and modifies PPE requirements based on action levels identified in this document and Roux's Summary of Environmental Conditions (Appendix C);
- Assists BSI's Superintendent with site control as needed;
- Periodically inspects protective clothing and equipment;
- Ensures all necessary protective equipment is available for workers, and is properly stored and maintained;
- Coordinates movement in the Restricted Area and the placement of fill in this area;
- Documents placement of unrestricted fill onsite which is required as part of the Cleanup Plan;
- Coordinates importing of Certified Clean Fill;
- Coordinates with Envirosearch and BSI Superintendent the entry and exit points at the designated work zones, if needed.

- **BSI Project Superintendent**
  - Oversee & coordinate with BSI's SSM and Envirosearch' s PM regarding the implementation of the HASP, including but not limited to planning, meetings and supplies for the project;
  - Inform and update BSI's Construction Manger on the HASP issues and/or any emergency responses or project cessations;
  - Ensure BSI's SSM implements personnel training under the HASP and ensures potential hazards associated with project areas include safe working conditions;
  - Coordinates with Envirosearch and/or other BSI personnel regarding inspections of the project area to ensure safe working conditions and to ensure stockpiles are properly labeled and secured;
  - Coordinate with client's onsite representative as needed regarding project timelines.

- **Envirosearch's Project Manager**
  - Provides assistance to BSI's SSM for potential exposure/PPE and onsite during the earthmoving of unrestricted and restricted soils;
  - Coordinate and oversee the perimeter and personal air/dust monitoring as needed through for the project;
  - Envirosearch will assist BSI SSM to ensure BSI is aware of any necessary monitoring and protection that may be required during the activities and/or for the upcoming field activities;
  - Prepare and distribute any amendments to the HASP including placing an approved copy of the amendment in the HASP;
  - Onsite at beginning of initial excavation & demolition activities to address health and safety as needed;
  - Consults with BSI's SSM as needed as well as oversees the need for additional environmental sampling or testing based on encountering unknown materials/conditions.

4.1.2 BSI Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the SSM, in writing, of unsafe conditions and acts.
- The right to contact the SSM or the Safety Professional at any time to discuss potential concerns.

4.1.3 Subcontractors Responsibilities

Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE). BSI considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to BSI for review prior to the start of onsite activities, if required.

BSI's SSM will brief employees of the subcontractor's on the hazards present within the project area, as well as at the location where their work is being conducted.

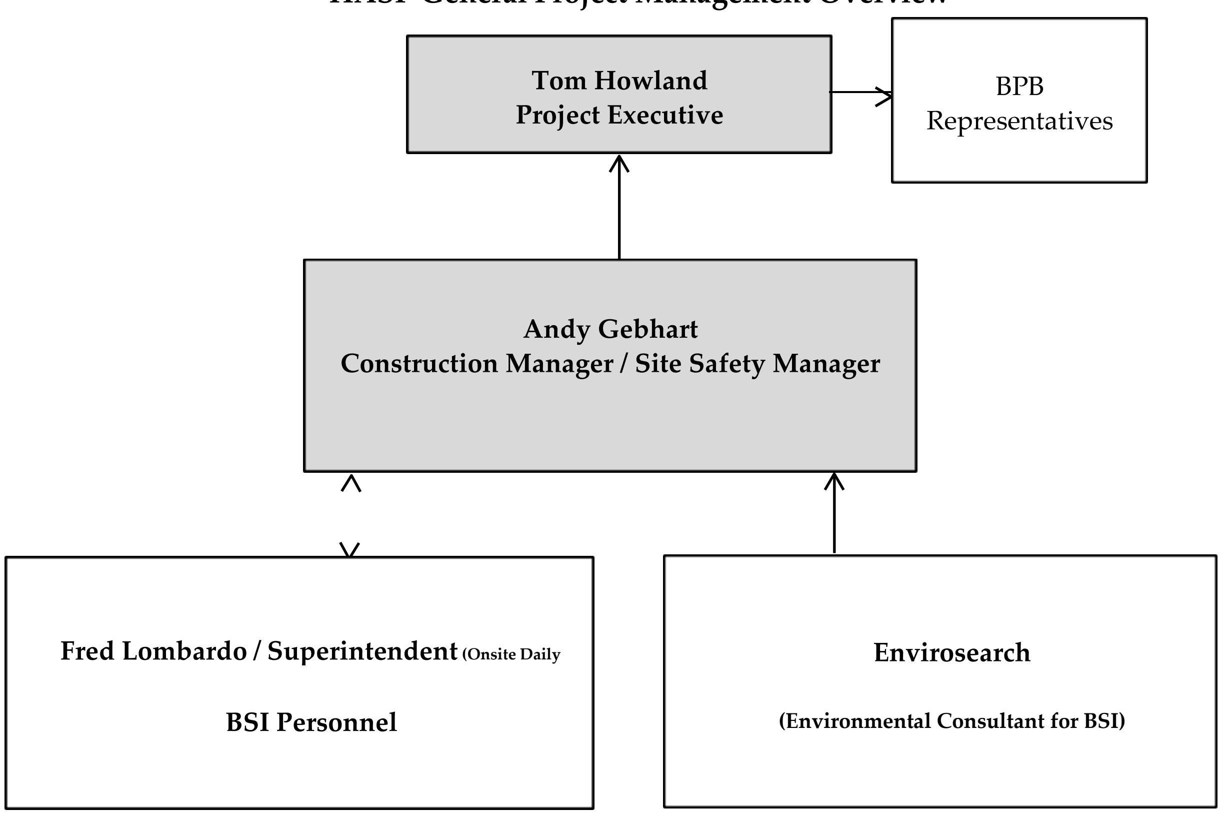
4.1.4 Visitors

Authorized visitors requiring entry to the project area will be briefed by the SSM on the hazards present within the area being visited. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment (PPE) which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

4.2 Description of Onsite Project Communication

Onsite communication between BSI's SSM and project personnel will be conducted through the use of verbal, two way radio, cellular telephone or hand signals. The telephone numbers for each of the project personnel are provided below in Table 2. Table 2 will be updated and/or revised and disseminated as needed. Below is a visual depiction of how project information regarding the HASP will be handled.

Figure 3
HASP General Project Management Overview



4.3 Project Personnel & Local Resources Contact Information

The contact information presented below in Table 2 is to be used for the duration of the project in the event an issue arises that needs to be handled and for general reference. The telephone numbers and emails for each of the onsite project personnel as they relate to project safety and health are provided below for BSI, Envirosearch, representatives. Table 2 will be updated and disseminated as needed. In the event of an incident/accident, contact information is also included below for the necessary emergency personnel, as well as directions to Jefferson Frankford Hospital, which has a trauma unit.

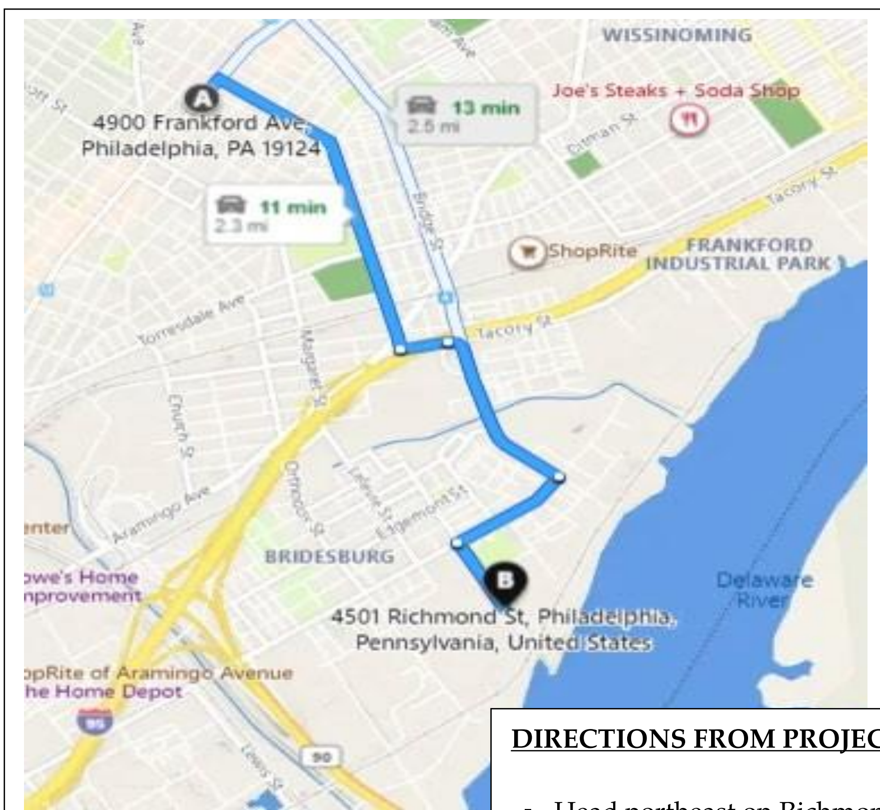
Table 2
Key Project Personnel & Local Resources Contact List

KEY PROJECT PERSONNEL	PHONE NO.	CONTACT
BSI Project Executive	215.805.3822	Tom Howland, Tom@bsiconst.com
BSI Construction Manager	215.532.4157	Andy Gebhart
BSI Project Superintendent	215.694.8504	Fred Lombardo
BSI Site Safety Manger (SSM)	215.532.4157	Andy Gebhart
BSI Consultant	215-850-8444	Joanne Van Rensselaer, Envirosearch jvr@envirosearchconsultants.com
LOCAL RESOURCES	**PHONE NO.**	**CONTACT**
Ambulance	911 215-707-6729	Providers Choice Ambulance Church Street
Hospital Emergency Room / Trauma	215-831-2000	Jefferson Frankford Hospital (Figure 4)
Fire Department	911 / 215-686-1300	Philadelphia Engine 33 4750 Richmond Street
Police Department	911 / 215-686.4519	Philadelphia Police 15th District

Table 2 (continued)
Project Personnel & Local Resources Contact List (continued)

LOCAL RESOURCES	PHONE NO.	CONTACT
Local Regulatory Authority	484-250-5900	PADEP - Southeast Regional Office
DIGSAFE Phone Number	800-242-1776	PA One Call
Water Department	215-686-5000	Philadelphia Water Department
Sewer Department	215-686-5000	Philadelphia Water Department
Electric Company	800-841-4141	PECO Energy Company
Phone Company	800-888-8448	Verizon
Gas Company	215-235-1000	Philadelphia Gas Works

Figure 4
Map from Project Area to Jefferson Frankford Hospital / Emergency & Trauma
(T) 215-831-2000



DIRECTIONS FROM PROJECT TRAILER:

- Head northeast on Richmond Street;
- Turn left onto Bridge Street;
- Turn left onto Tacony Street;
- Turn right onto Wakeling Street;
- Turn left onto Frankford Avenue.

5.0 WORKER TRAINING & HAZARD COMMUNICATION

Environmental, Health, and Safety (EH&S) Training may be required for some of the field activities associated with this project. Training requirements specified in this section will be completed prior to initiation of field activities where hazardous soils/wastes are encountered. Onsite personnel will be required to review the HASP prior to commencement of field activities and conduct all field activities in accordance with plan specifications. Other personnel on the site are expected to follow the provisions of the health and safety procedures outlined in this HASP.

BSI will not assume responsibility for the health and safety of individuals other than those employed by, subcontracted to, or serviced by BSI and Envirosearch, and their subcontractors for the completion of the described activities within the project area. Pre-entry briefing and routine tailgate meetings will be conducted to facilitate onsite training.

General safe work practices that must be implemented during work activities at this site are included in BSI's corporate project-specific safety plan (Appendix B). Subcontractors that enter the project area but where no hazardous materials/wastes are being encountered must implement general safe work practices that are addressed in their internal corporate HASP.

It will be the responsibility of BSI's SSM and Construction Manager to ensure that visitors that are entering the project areas and/or designated zones have the proper site awareness training, and are escorted, if necessary, to assure their safety. Visitors will not be allowed past the Support Zone unless they read, understand, sign, and abide by the requirements outlined in this HASP. Visitors to the site must be identified to BSI's Construction Manager or SSM to ensure awareness training is provided, if required. All visitors will sign-in at the Support Zone (trailer) as needed, and the log will be reviewed as needed to ensure the proper training is being provided (Table 3).

Table 3
Sample Visitors Log

Name	Company Affiliation	Purpose of Visit	Date & Time (Check-in	Date & Time (Check-Out)	Awareness Training & Initials of Trainer (if applicable)	Badge #
					YES NO DATE: -	
					YES NO DATE: -	

5.1 Worker Training

Project personnel who will be involved with redevelopment activities shall undergo the Hazwopper 40 training. It should be noted that Hazardous Waste is not anticipated to be encountered during the excavation and/or other soil disturbances pursuant to Roux's SMP and the contract terms and conditions.

Before field work begins, BSI's SSM or Superintendent will review the HASP and the SMP to determine potential hazards associated with the proposed field activities. Components of the awareness training meeting will include a review of the following, at a minimum:

- Potential chemical, operational and physical hazards present at the site.
- Personal protective equipment (PPE) / personal protection procedures.
- Personal hygiene - general guidelines.
- Designation of Zone Areas.
- Review of the materials that are located within each work area.
- Personal and equipment procedures, if needed.
- Emergency response procedures.
- Symptom awareness.
- Timeline of the activities to be completed.
- Review of project personnel to be contacted in case of emergency, etc.

Periodic awareness meetings with project personnel may be conducted by the SSM pending changes to the scope of work or modification to this HASP, the June 2022 SMP and/or the July 2021 Cleanup Plan.

5.1.1 Safety Meetings

Safety meetings (aka tailgate or toolbox meetings) will be held, as needed, and during the start of excavation activities in the Restricted Area. At this time no Hazardous Waste is anticipated to be encountered. These safety meetings will be implemented, as needed or as conditions change, so that personnel understand activities to be conducted, site conditions and operating procedures, as necessary, to ensure that PPE is being used, if needed for the activity, and to address any potential health and safety issues. Other information that may be provided during these types of meetings is notification of potential visitors to the area(s).

5.2 Hazards – Environmental Contaminant Exposure

This section summarizes the contaminant exposure hazards that may be encountered during the activities specified under this HASP. As summarized in Section 3.0 of this HASP, the potential COCs that are anticipated to be encountered during the redevelopment activities are presented below.

- Soil
  - *Inorganic Metals:* Antimony, Cyanide, Mercury, Nickel, Selenium, Lead, Arsenic;
  - *Volatile Organics*: Chlorobenzene, dichloromethane, ethylbenzene, styrene, and toluene; and
  - *Semi-Volatile Organics*: Anthracene, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Phenol, Pyrene, Benzo a Pyrene, Benzo a Anthracene, Dibenzo ah Anthracene, Benzo b Fluoranthene, Benzo k Fluoranthene, and Benzo b Fluoranthene.

- Groundwater
  - *Volatile Organics:* Benzene, MTBE, TCE
  - *Semi-Volatile Organics*: Anthracene, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Phenol, Pyrene, Indeno 123 Pyrene, Benzo a Pyrene, Benzo a Anthracene, Dibenzo ah Anthracene, Benzo b Fluoranthene, Benzo k Fluoranthene, and Benzo b Fluoranthene.
  - *Inorganic Metals:* Antimony, Manganese, Nickel, Vanadium, Arsenic.

The above potential environmental contaminant hazards are based on the previous environmental investigation completed within the project site and information provided in the July 2021 Cleanup Plan. The evaluation has been conducted to identify chemicals / materials that potentially may be present onsite, and should be considered to ensure that work activities, personnel protection, and emergency response are consistent with the specific contaminants that potentially could be encountered. It should be noted that the additional COCs may be added to the potential lists following receipt of an updated SMP or information from National Grid.

It would be impractical to identify all control measures and standard operating procedures (SOPs) that need to be implemented for every activity that takes place onsite. Therefore, the information below summarizes those activities that would have the highest likelihood of generating potential sources dust or being in contact with hazardous wastes.

- *Soil Sampling / Environmental Sampling (if needed)*

Sub-Activity	Control Measure / PPE	Potential Hazard
WORKER PPE: LEVEL D, unless air monitoring results indicate otherwise. The air monitoring data that is completed during the subsurface sampling will be used to guide the PPE requirements in excavation and loading activities with the project areas.		
Clear locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and nitrile/leather gloves as necessary. If dust is generated, Envirosearch will ensure personal and fugitive air sampling is scheduled.	Traffic hazards, overhead and underground installations,
Mobilize (with proper equipment/supplies for drilling)		Vehicle accident; injury from drilling equipment.
Borehole Drilling / Soft Dig (Clear upper 3-5' using hand auger or soft dig techniques		Back strain, exposure to dust, hitting an underground utility, repetitive motion. Rig: pinch points, sharp objects/sides on drill rig, and cuts from razor opening sleeves.
Proper clean up and disposal of broken sample container(s).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and nitrile/leather gloves as necessary. A receptacle for the broken glass (something to contain the broken glass - double garbage bag, a box, or bucket.)	Exposure to contaminated soil, dust, broken glass and acid (from sample preservation liquids).
Backfill Borehole & Drum Cuttings	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and nitrile/leather gloves as necessary.	Exposure to public. Traffic hazard or obstruction / inconvenience to station operation. Improper storage or disposal. Back strain.

- *Excavation, Backfilling & Movement of Contaminated Soil*

Sub-Activity	Control Measure / PPE	Potential Hazard
WORKER PPE: LEVEL D, unless air monitoring results indicate otherwise.		
Saw cutting (roadway/concrete)	– Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection and nitrile/leather gloves as necessary. – Maintain dust suppression with water spray/mist as needed. – Traffic control in place and flag person to direct traffic or detour equipment.	– Inhalation of dust/fumes. – Sharp Objects or flying pieces of debris. – Noise. – Vehicle traffic.
Excavation / Backfilling	– Maintain dust suppression with water spray/mist as needed. – PA ONE call for mark outs to reduce chance of encountering an underground utility. – Buddy system to ensure equipment is clear of overheads. – Identify marks or remove debris from work area.	– Inhalation of dust/fumes. – Minimize contact with contaminated soils. – Explosion, fire, electrocution – Equipment operators not able to see onsite workers. – Uneven terrain or trips/falls.
Loading	– Ensure Backup Alarms are operating; – Transporters need HASP training to ensure knowledgeable of worksites within the project areas. – Enter scale area to ensure load is within the weight criteria and drivers are qualified for type of waste being hauled. – Ensure dump truck tarp is in place before leaving loading area.	– Transporters not able to see workers while backing up, leaving truck to enter worksite. – Overloading of dump trucks. – No tarp cover to prevent debris flying onto traffic or workers.

5.3 Hazards - General

General hazards at construction sites may also include the following potential hazard:

- Skin and eye contact with contaminants;
- Ingestion of contaminants;
- Inhalation of dusts impacted with PAHs, metals and PCBs;
- Physical hazards associated with the use of heavy equipment;
- Excavation hazards;
- Tripping hazards;
- Noise exposure;
- Heat stress/cold exposure (depending on weather conditions);
- Flammable hazards;
- Electrical hazards.

5.4 Hazards - Biological

Contact with animals, insects, and plants can cause injury and illness to personnel. Care must be taken to ensure that these types of injuries are avoided. Some examples of biological hazards include:

- Wild animals, such as snakes, raccoons, squirrels, and rats. These animals not only can bite and scratch, but can carry transmittable diseases (e.g., rabies). Avoid the animals whenever possible. If bitten, go to the nearest medical facility.
- Insects such as mosquitoes, ticks, bees, and wasps. Mosquitoes can potentially carry and transmit the West Nile Virus or Eastern Equine Encephalitis (EEE). Ticks can transmit Lyme disease or Rocky Mountain Spotted Fever. Bees and wasps can sting by injecting venom, which causes some individuals to experience anaphylactic shock (an extreme allergic reaction). Written notification needs to be provided to BSI if extreme allergies are present. Whenever you will enter areas that provide a habitat for insects (e.g., grass areas, woods), wear light-colored clothing, long pants and shirt, and spray exposed skin areas with a repellent. Keep away from high grass wherever possible. Keep your eyes and ears open for bee and wasp nests.
- Plants such as poison ivy and poison oak can cause severe rashes on exposed skin. Be careful where you walk, wear long pants, and minimize touching exposed skin with your hands after walking through thickly vegetated areas until after you have thoroughly washed your hands with soap and water.

5.5 Hazards - Other

Personnel, visitors, and subcontractors should also be aware of other hazards typically encountered on a construction project when they come in contact with heavy equipment, wearing PPE within the project area or in certain seasons, traffic detours and uneven surfaces. Personnel within the project area should be aware of the presence of these hazards at all times and take appropriate action to avoid them. The potential other hazards that may be encountered on the project site include and should be addressed under each subcontractor's HASP:

- *Temperature Extremes*

In the event of adverse weather conditions, BSI's Superintendent and SSM will determine if work will continue without potentially risking the safety of all field workers in the project area. Some of the items to be considered prior to determining if work should continue are:

- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds);
- Limited visibility(fog);
- Potential for electrical storms;
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. BSI's Superintendent and SSM will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.
Issues worker, visitors, and other personnel likely will encounter are seasonal temperature. Therefore, worker, visitors, and other personnel should be aware of the following:

- <u>*Hot Temperatures*</u>
  Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE, in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke. If onsite workers exhibit the signs of heat exhaustion or heat stroke, they should seek immediate medical attention.

- <u>*Cold Temperatures*</u>
  Workers may be exposed to the hazard of working in a cold environment. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia, as well as slippery surfaces, brittle equipment, poor judgment, and unauthorized procedural changes. In order to prevent frostbite, hypothermia, trench foot and immersion foot, the workers are responsible for dressing warmly in layers with thick socks, gloves, and appropriate head and face gear. Upon the onset of discomfort due to the cold, onsite workers should take regular five to ten minute breaks to warm up inside

nearby buildings and to drink warm fluids. If a worker exhibits the signs of frostbite, hypothermia, trench foot or immersion foot, they should seek immediate medical attention.

- *Noise*

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. Hearing protection is required and shall be used in designated areas of the site as indicated by BSI Superintendent or Crew Leader. This hazard will be addressed by each subcontractor's corporate HASP.

- *Hand and Power Tools*

In order to complete the various tasks for the project, personnel will utilize hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Proper personal protective equipment shall be worn while utilizing hand and power tools. Ground Fault Circuit Interrupters (GFCIs) are required for all portable electric tools.

- *Slips, Trips, and Falls*

Working in and around the site will pose slip, trip and fall hazards due to equipment, piping, slippery surfaces that may be oil covered, or from surfaces that are wet from rain or ice. Potential adverse health effects include falling to the ground and becoming injured or twisting an ankle. Good housekeeping at the site must be maintained at all times.

- *Fire and Explosion*

Prior to starting all excavation work, a review of appropriate City of Philadelphia maps will be conducted, and the public utility providers will be contacted to identify underground utilities to identify potential hazards. The possibility of encountering fire and explosion hazards exists from under- ground utilities and gases. Therefore, all excavation equipment must be grounded.

- *Material Handling*

Manual lifting of heavy objects may be required. Failure to follow proper lifting techniques can result in back injuries and strains. Back injuries are a serious concern as they are the most common workplace injury, often resulting in lost or restricted work time, and long treatment and recovery periods. Whenever possible, heavy objects must be lifted and moved by mechanical devices rather than by manual effort. The mechanical devices will be appropriate for the lifting or moving task and will be operated only by trained and authorized personnel.

- *Working Near Equipment*

Personnel working in the immediate vicinity of heavy equipment (*e.g.*, excavators, loaders, etc.) may encounter physical hazards resulting from contact with equipment. Field personnel should be aware of the presence of these hazards at all times and take appropriate action to avoid them. Due to the limited ability to communicate when wearing respiratory protection, the risk is increased. Workers must be careful to communicate with heavy equipment operators regarding their location, and should maintain a safe distance from operating equipment at all times. Prior to working around equipment, the site personnel will review appropriate hand signals with the operator(s). <u>Equipment will be equipped with back up alarms.</u>

- *Electrical Safety*

Although not anticipated, personnel may utilize hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Ground Fault Circuit Interrupters (GFCIs) are required for all portable electric tools.

- *Utilities*

Prior to the start of any intrusive work, the location of above-ground and underground utilities and other structures will be completed by the contractor/subcontractor responsible for completing construction activities.

- *Vehicular Traffic*

Portions of site activities (load in and load out) will be conducted in the street so vehicular and pedestrian traffic will be present. Appropriate precautions to protect the on-site workers and civilians should be used including the use of cones and traffic vests as appropriate.

Table 4 below also provides a visual training summary of the potential hazards that may exist and the corresponding activity where the hazard may be encountered.

Table 4
Summary of Other Potential Hazards

Potential Hazard	Earthwork (e.g.. Cutting/Filling)	Dewatering Excavations (if needed)	Equipment Decontamination
Inhalation of volatiles	Low to moderate[1]	low	low to moderate
Skin and eye contact	moderate to high (Fugitive dust)	Moderate (splashing)	moderate to high
Ingestion [4]	low[2]	low[2]	Low to moderate
Inhalation of dust	moderate to high	low	low to moderate
Heat stress [4]	depends on temperature	depends on temperature	depends on temperature
Cold stress [4]	depends on temperature	depends on temperature	depends on temperature
Confined Space Entry[3]	moderate to high[3]	low to moderate[3]	not BSIplicable
Heavy[4] **equipment**	moderate to high[4]	low	low to moderate
Noise [4]	moderate	moderate	moderate
Tripping [4]	moderate	moderate	moderate
PPE	moderate to high	low	moderate
Utilities	moderate	low	low
Other Physical[4] **hazards**	moderate	low	moderate
Biological hazards	low	low	low
Flammable hazards[4]	low	low	low

1: Volatiles have been detected within the subsurface soils above the non-residential MSCs therefore, at the time of soil disturbances a PID will be utilized to determine if other monitoring is required along the perimeter, at the work site and/or of equipment operators; 2: The HASP will emphasize that no food or drinking will be authorized in the project area during intrusive investigations and/or construction activities; 3: Trenching and utility installations will be required in areas where residual may be encountered. Confined space may be required; however, monitoring will have been conducted prior to entry into the space and/or monitoring protocols will be in place prior to entries; 4: HASP addresses these hazards as well as the workers internal company safety plan.

5.6 Confined Space Entry Hazards & Permits

Entry into confined spaces may include below grade utility trenches and/or manholes at a minimum. Since the project entails excavation of soils to a depth of greater than 6’ BSI may need to use trench boxes since the type of soil has the potential for sidewall collapse. Once contaminated soil has been removed, and/or monitoring has deemed the space safe for entry, BSI SSM / Superintendent will allow workers to enter the area.

Workers who may be required to enter a confined space requiring a permit shall be trained in Confined Space Entry in general adherence to OSHA requirements. It is not anticipated that confined space entries will occur during the redevelopment activities.

6.0 PERSONAL PROTECTION

According to the June 2022 SMP, Roux identified onsite activities will include Level D. However, as part of this HASP the following section has been included for awareness training purposes.

The levels of personal protection required for each task are provided below. Required equipment and types of protective clothing materials are listed, as well as an indication of the initial level of protection. PPE must protect workers from the specific hazards they are likely to encounter onsite. Selection of the appropriate PPE must take into consideration:

- Identification of the hazards or suspected hazards;
- Potential exposure routes;
- The performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Based on anticipated site conditions and the proposed work activities to be performed within the project areas, Level D Protection will be used initially. The upgrading/downgrading of the level of protection will be based site monitoring and discussion with BSI's SSM and consultant, if needed. The decision to modify standard PPE will be conveyed to BSI Superintendent and SSM after conferring with the Envirosearch and BPB. The levels of protection are described below.

- *Level D Protection*
  - Safety boots/shoes (toe-protected)
  - Hard hat
  - Long work pants and shirt
  - Gloves
  - Hearing protection (as needed)
  - High visibility outerwear/Reflective traffic vest

- *Level D Protection (Modified)*
  - Safety glasses w/ side shields or chemical splash goggles
  - Safety boots/shoes (toe-protected)
  - Disposable chemical-resistant boot covers
  - Coveralls (poly coated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater)
  - Hard hat
  - Long work pants and shirt
  - Nitrile gloves
  - Hearing protection (as needed)
  - Reflective traffic vest

- *Level C Protection*
  - Half or Full face-piece, air-purifying, cartridge*-equipped, NIOSH-approved respirator [*combo cartridge P100/OV/CL/HC/SD/CD/HS]
  - Outer (nitrile) chemical-resistant glove
  - Chemical-resistant safety boots/shoes (toe-protected)
  - Disposable chemical-resistant boot covers
  - Hard hat
  - Long sleeve work shirt and work pants
  - Coveralls (Tyvek or equivalent will be worn when contact, or anticipated contact with contaminated soils, ground water, and/or non-aqueous phase liquids (NBSIL) if anticipated
  - Hearing protection (as needed)
  - Reflective traffic vest

- *Respirator Fit-Test*

At this time, hazardous materials/wastes are not anticipated to be encountered during the redevelopment activities; therefore, the fit test is not being considered at this time.

- *Respirator Cartridge Change-Out Schedule*

At this time, hazardous materials/wastes are not anticipated to be encountered during the redevelopment activities; therefore, the cartridge change out schedule is not being considered at this time. In the event respirators will be recommended this section of the HASP will be modified by a Certified Industrial Hygienist.

7.0 SITE MONITORING

Atmospheric air monitoring results are used to evaluate and/or identify strategies for controlling/reducing, to the greatest extent practicable, fugitive and/or airborne dust within a project area during construction. With the proximity of residential properties surrounding the subject site, the known existence of soil contamination, and proposed earthmoving and soil placement activities, BSI will evaluate fugitive and/or airborne dust along the project perimeter utilizing an Aeroqual Dust Sentry monitoring system. This system will allow BSI to monitor particulate matter during construction activities, and if necessary, evaluate controls that may be taken to minimize and control dust emissions from project activities. The instrument calibration shall be conducted, as needed, and documented in daily field notes. Calibration checks may be used during the day to confirm instrument accuracy.

This section of the HASP will be revised as necessary to reflect changes in site monitoring conditions or activities warranting additional strategies for controlling/reducing dust in the project area. However, this section will be used as a general operating procedure to address potential dust migration pathways, to monitor for dust produced by site activities, and/or to implement additional monitoring and/or corrective actions as needed.

BSI will evaluate daily the onsite construction activities for visible presence of fugitive and/or airborne dust contamination in making field health and safety decisions. The goal of the site monitoring is to identify strategies for controlling/reducing, to the greatest extent practicable, fugitive and/or airborne dust within the project area during construction.

7.1 Contaminants of Concern (COCs)

The primary COCs, with respect to fugitive dust emissions at the Site, are heavy metals, including lead and arsenic and PAHs. Based on the EDD information provided in the July 2021 RICP, the following parameters were detected in the surface and subsurface soils, and it is assumed these may be encountered during soil disturbances and/or vehicular/equipment traffic.

The table below presents the COCs and the highest concentration detected in the subsurface soils that PennDOT required to be sampled in accordance with the SP5 protocol. The COCs in the surface soils include:

- *Heavy Metals:* Antimony, Cyanide, Mercury, Nickel, Selenium, Lead, Arsenic;
- *VOCs* : Chlorobenzene, dichloromethane, ethylbenzene, styrene, and toluene; and
- *SVOCs*: Anthracene, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Phenol, Pyrene, Benzo a Pyrene, Benzo a Anthracene, Dibenzo ah Anthracene, Benzo b Fluoranthene, Benzo k Fluoranthene, and Benzo b Fluoranthene.

7.2 Previous Site Monitoring

According to the July 2021 Remedial Investigation and Cleanup Plan (RICP), National Grid's consultant monitored the perimeter and breathing zones during the environmental sampling activities. The results of the perimeter and breathing zones air monitoring showed no exceedances of VOC levels or levels of particulate matter during surface and subsurface investigations (RICP, Section 3.1.5).

During the initial disturbances of the surface and subsurface soils in the four AOCs and the restricted area, a photoionization detector (PID) will be used to monitor concentrations of VOCs at personnel breathing-zone height, and fugitive dust emissions will be continually monitored within the project area. It should be noted that hazardous concentrations in the surface and subsurface soils are not anticipated according to the information provided in the RICP and the SMP.

7.3 Potential Sources of Fugitive Dust Emissions

The following project work areas/tasks have been identified as potential sources of fugitive dust emissions. It would be impractical to identify all control measures and standard operating procedures (SOPs) that need to be implemented for every activity that takes place within the project areas. Therefore, the information below summarizes those activities that would have the highest likelihood of generating potential sources dust. At a minimum, dust control techniques will be employed in the following areas:

- Areas of heavy equipment and vehicular traffic;
- Keeping streets clean of tracked soils or excavated fill materials;
- Soil and fill excavation activities;
- Demolition & Cutting Activities
- Exposed excavation faces or disturbed ground surfaces;
- Soil and fill stockpiles;
- Soil and fill loading and unloading operations; and
- Soil backfill placement, grading, and compacting; and
- Site clearing/grubbing.

It should be noted that silica is not addressed as part of the HASP and may also be a COC in the event cutting of block and/or concrete is required. This issue should be addressed as part of each subcontractors corporate HASP. This HASP pertains to the environmental conditions as they present safety concerns to onsite workers.

7.4 Dust Monitoring

BSI will utilize the Aeroqual Dust Sentry monitoring system to monitor particulate matter within the project area during disturbances of surface and subsurface soils. This instrument will be used during work hours and BSI will collect the real time measurements of particulate matter and compare them to the permissible limits designated by the EPA's NAAQS for PM10.

Dust monitoring will be used during prolonged excavations and/or other construction activities. The monitoring will be conducted at an interval designated by BSI SSM and/or consultant's recommendations based on the proposed construction/demolition activities schedule for that day.

If the fugitive emissions are not able to be controlled or reduced through standard dust control measures, BSI's SSM and consultant will determine if work or breathing zone air monitoring is warranted. Based on the past environmental monitoring, no exceedances had been detected during soil disturbances.

7.5 Determination of Background Levels

Background (BKD) levels for VOCs and dust will be established prior to commencement of construction activities for the project due to the close proximity of residential properties, presence of active industrial businesses and the I-95 roadway to the project site.

The potential impact of site work activities on the surrounding community (residential and business) may be a potential concern to be considered. Precautions will be taken to reduce or prevent contamination from leaving the work areas include the following at a minimum:

- Appropriate equipment will be decontaminated before leaving the project area in accordance with the WMP;
- Dust suppression techniques will be used as necessary;
- Perimeter air monitoring for dust will be implemented based upon field conditions during excavation and/or earthmoving activities;
- Speed limit of site equipment to reduce dust generation;
- Have water available (and used as necessary) for sprinkling/wetting to suppress dust;
- Onsite haul trucks will have tarp covers;
- Ensure transport vehicles are not idling;
- Other dust suppression techniques may be used such as wind breaks.

Site workers will be made of aware that all work that involves soil disturbances or otherwise generates dust will be performed utilizing methods to minimize dust generation to the extent practicable. The City of Philadelphia Dust Control Guidance recommends wetting down of the work area to control dust.

7.6 Monitoring Plan

Dust monitoring stations have been set up in 4 locations along the bordering neighborhoods of the property. 2 stations are set up behind the houses on Garden street, one at each end and 2 along Richmond Street, one at each end.

During site work involving soil disturbances and/or other dust generating activities, real time particulate monitoring will be conducted for dust/particulates. A PID will be used to evaluate the VOCs and SVOCs in the immediate work area and at the breathing zone and to screen property line organic vapor emission concentrations. Based upon the initial findings will determine if additional action is needed for monitoring, if any.

Dust at the property lines/perimeters will be evaluated throughout the work day, and if the best management plans limit visible dust no additional monitoring will be recommended. The upwind background level will be established prior to the commencement of soil disturbances, and if the level exceeds the EPA's threshold level for PM10, BSI's SSM and consultant will evaluate the need for additional dust control measures and/or air sampling.

This monitoring will also be implemented for VOCs through the use of the PID screenings. If the work zone levels exceed the background PID by more than 10 ppm over 10 hours, BSI's SSM and consultant will evaluate the need for additional dust control measures and/or air sampling.

VOC and SVOC Monitoring will be conducted with a handheld PID, such as a MiniRAE 2000 (11.7v) or equivalent. This monitoring will occur during intrusive work in the AOCs and restricted area.

7.7 Record Keeping

BSI's SSM will download the daily monitoring records from the instruments and maintain them onsite with the HASP.

8.0 SITE CONTROL

Site control procedures will be implemented **before** the start of each proposed activity within the project areas to evaluate the need for personal protection equipment (PPE), if any. Figures will also be displayed in the work trailers that visually identify the AOCs, and the restricted area will be marked to visually remind site workers of the requirements for this AOC.

8.1 Site Access

Access to the site shall be controlled using one of more of the following methods, and may be modified as needed. The type of site access controls will be determined by BSI project personnel.

- Security fence
- Temporary barricades and/or warning tape
- Sign in/Sign out log
- Identification badges
- Site Access

8.2 Work Zones

Work zones will be established, as needed, to limit the exposure to COCs in the soil (and/or groundwater) by workers, as well as to ensure no cross contamination of non-affected areas. These zones will be created/modified as needed. The exact location and extent of these work zones will be determined as necessary as Act 2 site investigations proceed and new information becomes available. Prior to establishing the zones, Envirosearch's PM, BSI project personnel and Roux will discuss the areas, the potential concerns of each AOC and the need for PPE in each zone, if needed. Following this meeting, site location mapss will be prepared by Envirosearch's PM that depicts the work zones in relation to the RICP AOCs and the work zone designation requirements and protocol(s). These maps will be approved by Roux (BPB's consultant) prior to posting in the work trailers and being included in the HASP.

Potential delineation of work zones is as follows:

- Support Zone (SZ): The Support Zone is basically the area(s), outside the areas the Restricted Area.
- Contamination Reduction Zone (CRZ): The Contamination Reduction Zone is a transition area between the potentially affected areas/materials and assumed non-affected areas/materials. Decontamination of personnel and equipment, if necessary, will be conducted in this area to reduce the probability of contamination transfer to a non-affected area. This zone includes areas surrounding the Restricted Area and entrance areas to the site
- Restricted Zone (EZ): The Restricted Zone (aka Exclusion Zone) is the area where Roux has identified as the Restricted Area in the SMP. The potential for exposure to hazards and contact with restricted materials could occur. The zone will be clearly marked personnel

working within this zone will be expected to follow protective measures as prescribed by the BSI SSM and/or Envirosearch's PM, and in accordance with the SMP.

Separate entrances to this(these) zone(s) may be established, one for personnel and one for heavy equipment. The designation of this type of zone will be determined following the completion of subsurface soil testing and prior to earthmoving.

8.3 Decontamination

During completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination as PPE is intended to minimize accidental contact. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control over spray and runoff and to ensure that unprotected personnel working nearby are not affected.

Heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the site unless it has been thoroughly decontaminated and visually inspected by BSI Superintendent or other designee.

9.0 DUST CONTROL

The goal of the below dust control practices is to prevent dust from entering the ambient air and cause public health concerns. The following methods, at a minimum, and in accordance with the Special Provisions, will be used to prevent conditions conducive to dust generation and suppress dust should it occur:

- Wetting, or use of water sprays and other devices to apply water to the area where dust is being generated, will be used and is a more effective method for dust control. Wetting will be the primary dust control measure, provided wetting is practical and will not damage equipment or create a safety hazard.
- If power tools or other construction equipment is being used and dust is not able to be controlled via wetting, other options may be used concurrently that includes the installation of a barrier or a vacuum system.
- Adjacent paved areas and roads used for construction traffic will be maintained free of tracked soil or fill materials. At minimum, paved traffic areas, driveways, sidewalks, and streets will be cleaned on a daily basis by wet sweeping and/or washing. More frequent cleaning will be provided as necessary. Adjacent paved areas and roads will be left clean at the end of each day.
- Exposed excavations, disturbed ground surfaces, and unpaved traffic areas will be maintained in a moist condition.
- During dry conditions and/or if dust clouds are observed, water will be used before, during and after any demolition, renovation, cutting and/or excavation activities.
- During non-working hours, the Site will be left in a condition that will prevent dust from being generated. At the end of each work day, disturbed areas will be wetted down and security fencing will be installed, as needed, and or inspected to prevent access and additional disturbance.
- Provide temporary cover (e.g. impermeable and/or vegetative covers) and daily maintenance for soil or fill stockpiles, and keep active surfaces wet/moist.
- Before and during the loading and unloading of dusty materials, water will be applied on the materials. If materials are being hauled off-site, tarps will be used on the trucks.
- Wind breaks/barriers, if necessary, will be installed to minimize fugitive dust emissions.
- Cutting and/or other type of blasting is necessary for the project design, and wetting is not sufficient or feasible, then the work area will be enclosed or barrier installed.

A temporary decontamination pad and/or a stabilized construction entrance will be provided at active site entrance/egress locations to keep adjacent paved areas clean. Construction activities will be conducted using methods that minimize dust generation. Dust control procedures employed at the project site will also be in general adherence to the City of Philadelphia’s Air Management protocol as needed.

9.1 Dust Control Awareness Practices

The Contractor will implement dust-monitoring/correction programs, to the extent practicable. Site safety meetings, new employee training, and/or notifications to subcontractors will attempt to reinforce the need for all workers to be cognizant and responsive to conditions or activities that generate visible dust, and/or if they are working in an area that is has Restricted Soils. The area foreman and supervisors will be notified if dust is observed or if conditions exist where dust could be a problem. The initial step of the program is to visually observe the issue.

When operating a vehicle or equipment or completing a task that has the potential to generate dust, the following sequential steps should be used to reduce or eliminate fugitive dust:

1. Reduce the pace of, or cease, dust producing activity until the problem is corrected.
2. Notify the area supervisor of dust conditions and implement dust suppression procedures (e.g. wetting the areas of concern) identified in Section 3.1.
3. Remove accumulated dirt and soil from problematic areas, and/or cover, enclose, or isolate dust-generating areas/surfaces to shield them from wind, sunlight, or heat sources.
4. Increase frequency, volume, and/or coverage of water misting, sprays, and foggers to prevent soil and dirt from drying.
5. Provide additional dust suppression systems and operating personnel during the task duration.
6. Modify operating procedures and methods to eliminate problematic conditions.
7. Increase level of worker awareness and instruct them on implementation of any new or modified operating procedures.
8. Report and document all procedural modifications and results. Perform routine audits of dust suppression methods and work areas for dust sources.
9. In the event that the practices identified above are not sufficient for minimizing visible dust due to abnormally dry conditions, monitoring will be implemented at upwind and downwind locations, or in accordance to the recommendations of CIH / air monitoring consultant.

Site workers will be trained to ensure that all work that involves soil disturbances or otherwise generates dust will be performed utilizing methods to minimize dust generation to the extent practicable, especially in residential areas. The table below provides BMPs when visible dust emissions and/or dry conditions are present.

Table 5 – Best Management Plan (BMP) Actions

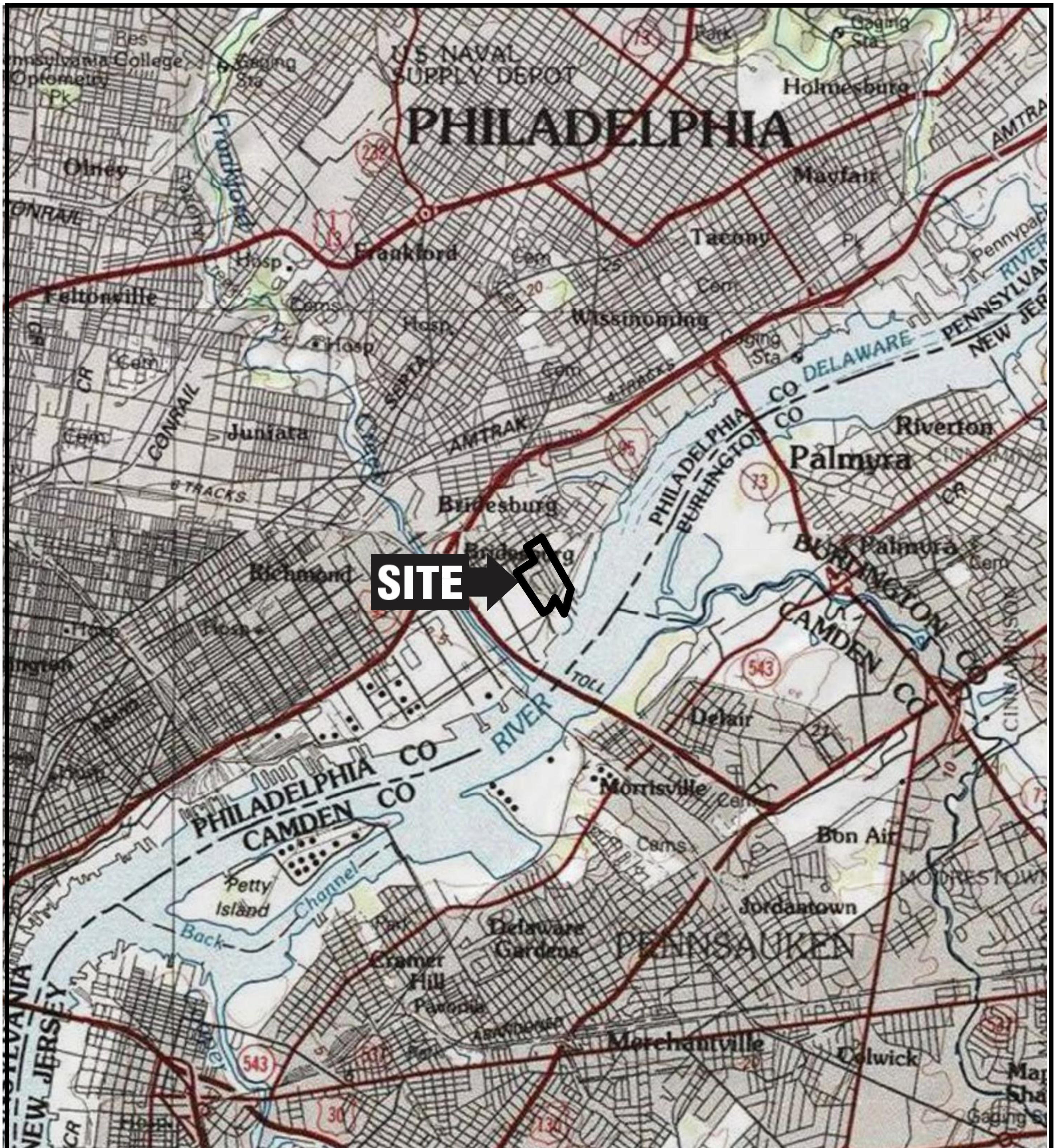
Monitoring Trigger	Proposed Action
Visible dust emissions from site activities	Implement dust controls (e.g., water sprays).
Planned Cutting / Demolition activities	Implement dust controls before, during & after (e.g., water sprays).
Extreme Dry Conditions	Implement dust controls before, during & after (e.g., water sprays).

10.0 RECORD KEEPING

The following is a summary of records that generally will be maintained as part of the HASP for the length of the project:

- Logs of Amendments / Modifications to the HASP
- HASP Awareness Training
- HASP Worker Safety Training
- Incident Reports
- Entry Permits for Confined Spaces
- OSHA Form 300, for recordable injuries
- Work Logs when working in the Restricted Area
- Manifest for Imported Clean Fill
- Work Logs for movement of impacted soils to restricted area
- Dust monitoring daily records

SITE FIGURES
(PREPARED BY ROUX ASSOCIATES, INC.)



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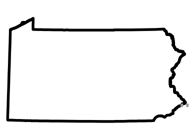

Pennsylvania

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EASTING (X): 39.9967600
NORTHING (Y): -75.0683300

N

5,000 0 5,000'

Title:

SITE LOCATION MAP

BRIDGE POINT BRIDESBURG
4501 RICHMOND STREET, PHILADELPHIA, PA, 19137

Prepared for:

BP Bridesburg, LLC

ROUX

		FIGURE
Compiled by: EJT	Date: 10/23/20	1
Prepared by: EJT	Scale: AS SHOWN	
Project Mgr: MM	Project: 3165.0012J000	
File: F1(AP)		

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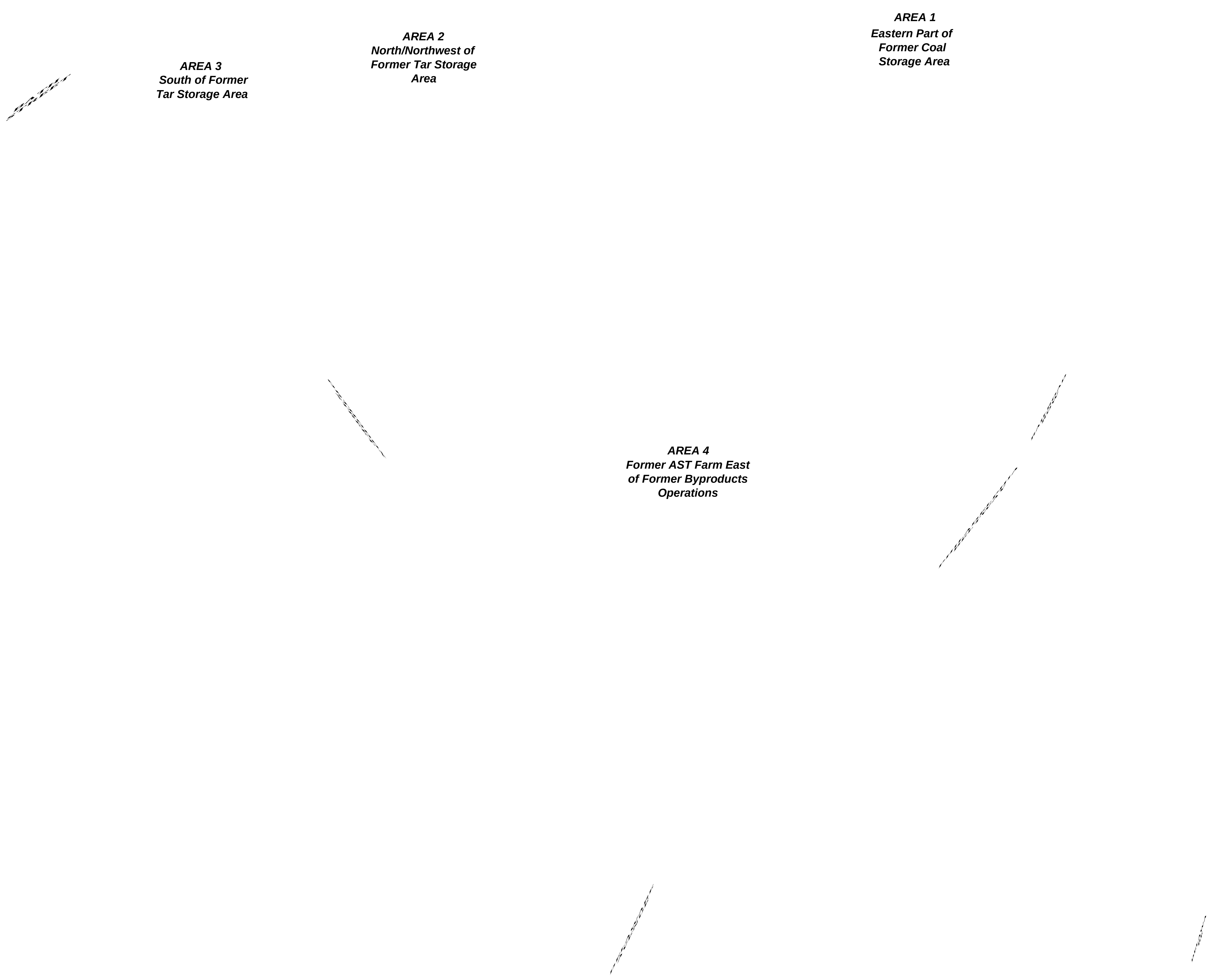


LEGEND

PROPERTY PARCEL
ECRA EXCAVATION
AREA OF INTEREST
RESTRICTED AREA: HISTORICAL TAR / FILL AREAS
FORMER STRUCTURE / OPERATION

REFERENCE

1.) AERIAL PHOTOGRAPH FROM NJDEP 2020 FLYOVER.
2.) SOIL DELINEATION AREAS NATIONAL GRID FORMER PHILADELPHIA COKE PLANT PHILADELPHIA, PENNSYLVANIA RI REPORT BY ARCADIS.
3.) SITE HORIZONTAL DATUM: NAD83 PENNSYLVANIA STATE PLANES, SOUTH ZONE, US FOOT.
4.) BASE MAP AND REMEDIATION AREAS OBTAINED FROM ARCADIS' JULY 2021 REMEDIAL INVESTIGATION REPORT AND CLEANUP PLAN.

Title:

SITE PLAN

BRIDGE POINT BRIDESBURG
4501 RICHMOND STREET
PHILADELPHIA, PHILADELPHIA COUNTY, PENNSYLVANIA

Prepared for:

BP Bridesburg, LLC

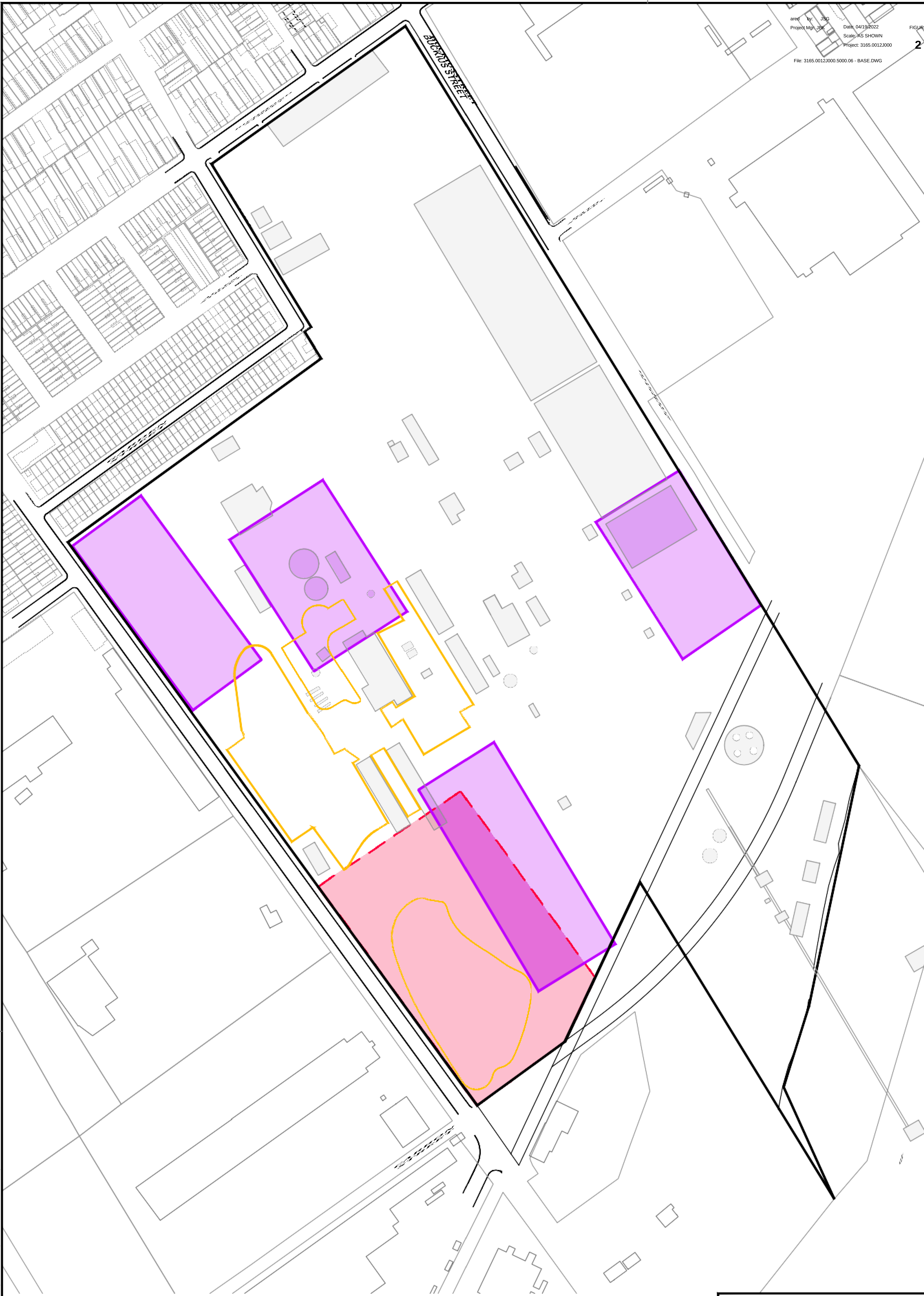
Compiled by: HER

ared by: JSG
Project Mgr: JBK

Date: 04/19/2022
Scale: AS SHOWN
Project: 3165.0012J000

FIGURE
2

File: 3165.0012J000.5000.06 - BASE.DWG



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APPENDIX A

JUNE 2022 SOILS MANAGEMENT PLAN, ROUX ASSOCIATES INC.

Soil Management Plan

Former Philadelphia Coke, Co., Inc.,
4501 Richmond Street
Philadelphia, Pennsylvania

EPA ID: PAD000427906

June 8, 2022

Prepared for:

BP Bridesburg, LLC
One Gatehall Drive, Suite 201
Parsippany, New Jersey 07054

Prepared by:

Roux Associates, Inc.
402 Heron Drive
Logan Township, New Jersey 08085

3165.0012Z000.1002.cov

Table of Contents

Figures

Attachments

1. Introduction

On behalf of BP Bridesburg, LLC (Bridge), Roux Associates, Inc. (Engineer) has prepared this Soil Management Plan (SMP) for the property located at 4501 Richmond Street in Philadelphia, Pennsylvania (Site) as a construction support document associated with the redevelopment of the Site. [1]

Philadelphia Coke, Co., Inc., (PCC) the prior owner of the Site, previously performed extensive soil remediation at specific Hazardous Waste Management Units as part of Resource Conservative and Recovery Act (RCRA) closure activities. Additional remediation work included the removal and disposal of underground storage tanks (USTs) and associated piping, and bioremediation to address contamination in a former fuel blending area. On December 28, 1994, the United States Environmental Protection Agency (USEPA) issued a Certificate of Completion for RCRA. Furthermore, on November 19, 2018, a Notice of Intent to Remediation (NIR) was submitted to the Pennsylvania Department of Environmental Protection (DEP) stating that PCC is seeking a release of liability under the Act 2 Site-Specific Standard. The objective of the Act 2 Site-Specific Standard, and a summary of the previously completed remedial investigation and action activities are documented in Arcadis' July 2021, *Remedial Investigation Report and Cleanup Plan* (provided as **Attachment A**).

The Site is approximately 63 acres in area and is listed in the USEPA Corrective Action Program with EPA ID: PAD000427906. PCC formerly operated at their facility from the mid-1920's through 1989 for manufacturing gas production, metallurgical coke production and fuel oil blending operations. Previous investigation activities completed by PCC determined that Site constituents of concern (COCs) in soil are generally limited to polycyclic aromatic hydrocarbons (PAHs), arsenic, lead and limited polychlorinated biphenyl (PCBs). Visual impacts (e.g., viscous tar, oil-like material, and solidified tar) are limited to the fill layer or the top few feet of the silt and clay layer.

The goal of the SMP is to ensure that all future earth work activities associated with the re-development of the Site are conducted with the ultimate goal for the final development to facilitate a more protective remedy. This SMP has been prepared to provide the selected earth work contractor with direction regarding the management of soils and other environmental issues that result from the presence of any potential contamination that may be encountered during development activities. Specifically, the SMP describes activities to be undertaken during soil cutting and filling activities and describes procedures to be followed in the event that specific unexpected conditions arise.

The best management practices for the anticipated earth work activities are summarized in the following sections. A Site Location Map depicting the Site location and the surrounding area is provided as **Figure 1**.

[1] It is anticipated that future development will consist of two warehouses encompassing a total area of approximately 901,500 square feet.

2. On-Site Soil Management Process

The methods to be implemented whenever soils are being handled at the Site during the re-development phase of work take into account the soil quality at different areas and any restrictions that apply to those areas.[2] Soil/material handling will be managed under three distinct categories: 1.) Non-Restricted Use soils; 2.) Restricted Use soils; and 3.) Unanticipated material. For purposes of on-Site soil/material placement, the Site soils will be divided into two areas: soils from the Non-Restricted Use Area, and soils from the Restricted Use Area. Any unanticipated materials (e.g., USTs,. non-aqueous phase liquids [NAPL], soil deemed insuf f icient for geotechnical purposes, etc.) identif ied during the development phase of work will be temporarily staged, characterized and disposed of, or utilized depending on the material and the generated analytical data, as f urther discussed in Section 2.3.[3] The Non-Restricted Use Area and Restricted Use Area are presented on **Figure 2**.

2.1 Non-Restricted Use Soils

The Non-Restricted Use Area is def ined as all areas of the Site with the exception of the Historical Tar/Fill Area, depicted on **Figure 2**; however, USEPA regulated waste may be encountered within the following areas:

- Area 1 – Eastern Part of Former Coal Storage Area
- Area 2 – North/Northwest of Former Tar Storage Area
- Area 3 – South of Former Tar Storage Area
- Area 4 – Former AST Farm East of Former Byproducts Operations

When earthwork is perf ormed within the limits of Area 1 through Area 4, care will be taken to inspect and evaluate the condition of the f ill material. If the f ill material within Area 1 through Area 4 exhibits any signs of Restricted Use Soils (e.g., through olfactory observation, field screening, laboratory analytical testing, etc.), fill shall be stockpiled for future disposal or utilized within the Restricted Use Area.

As part of f uture development activities, Bridge plans to excavate soils within this area and relocate to diff erent portions of the Site to achieve the desired grading elevations. As presented on **Figure 3**, approximately 66,000 cubic yards of soil will need to be cut, and approximately 183,000 cubic yards of soil will be used as f ill. With the exception of the conditions outlined in the below Restricted Use Soils section, soils within the Non-Restricted Use Area are available to be utilized as fill material throughout the Site.

2.2 Restricted Use Soils

The Restricted Use Area is def ined as the Historical Tar/Fill Area, depicted on **Figure 2**. As part of f uture construction activities, soil encountered within the Restricted Use Area may be moved throughout the Restricted Use Area to allow for redevelopment and to achieve the f inal desired elevations and grades. During the excavation of soils within the Restricted Use Area, care will be taken to segregate the clean surf ace materials f rom the underlying impacted soil to prevent intermingling. In addition, soils excavated f rom the Restricted Soil Area and have evidence of impact (i.e., staining, NAPL, odor, etc.) or are characterized as hazardous material via laboratory analysis will be stockpiled within a designated area within the limits of the Restricted Soil boundary to avoid mixing with other on-Site materials or imported fill. Erosion and Sediment Control (ESC) plans will include location of the designated soil stockpile area, location of final placement of materials from the Restricted Soils Area and applicable erosion control measures.

All soil and non-soil materials (e.g., riprap, DGA, backfill, etc.) imported to the Site to achieve desired final grades will be reviewed by Bridge and Engineer to ensure compliance with the PADEP's Bureau of Waste

[2] For the purposes of this SMP, excavation is defined as any activity disturbing the underlying material beneath the engineering controls.
[3] As further discussed in Section 2.3, un anticipated material will be temporarily staged, characterized, and disposed of or utilized dep en ding on thematerial and the generated an alytical data.

Management's January 16, 2021, *Management of Fill Policy* (PADEP Fill Policy). This includes, but is not limited to soil, soil like material, backfill, stone, road base, Class B recycled material, gravel, etc. The PADEP Fill Policy describes the type of fill that qualifies as clean fill and outlines the frequency at which imported material will be sampled as well as other requirements. Bridge is currently proposing to raise the grade of the Site with clean fill. If it is determined alternative fill will be used to raise the grade of the Site, an addendum to the SMP will be generated that details the plans for sampling, laboratory analysis, quality control/assurance, health, and safety as well as proper documentation of fill that will be brought on Site. In addition, Bridge understands there are limitations and will adhere to said regulations where regulated fill can be placed as it relates to the 100-year f lood plain, surf ace water and waters of the Commonwealth of Pennsylvania.

2.3 Encountering Unanticipated Material

Although extensive investigation work has been completed at the Site, Engineer has developed an alternative material management approach in the event that any unanticipated material is encountered during development work including but not limited to USTs; and NAPL. Note that if unanticipated material is encountered, it will be considered hazardous waste and will be managed as such until sampling data deems it non-hazardous. The protocols and procedures to manage the unanticipated material are further described below.

2.3.1 Staging and Segregation Protocol

In the event material is encountered that requires off-site disposal, the material will be temporarily placed on plastic sheeting (minimum 12-mil thickness) adjacent to the excavation area and kept covered with appropriately anchored tarps when inactive. If impacted material is selected to be disposed off-site, it will be placed directly within off-site haul vehicles, as practical, to reduce double handling of material. Small quantities of waste, along with drums of used personal protective equipment and similar small debris type items, may be stored in labeled Department of Transportation (DOT) Specification containers before on-Site reuse or off-site disposal. Care will be taken to not contaminate other areas of the Site during the staging and loading process.

2.3.2 Sampling Protocol

Once soils are transported to the staging area, Engineer will coordinate with local PADEP approved disposal f acilities to develop the required sampling f requency and analysis protocol to achieve approval for off-site disposal. The sampling plan will include the collection of grab and composite samples and all analyses will be performed using appropriate EPA methods, and within the recommended quality assurance/quality control (QA/QC) parameters. Once a stockpile has been sampled, no additional soil or material will be added to the pile. In addition, soil piles f rom diff erent portions of the Site or stockpiles with different COCs will not be combined, unless previously authorized by the intended soil disposal facility.

In the event that a UST and associated piping are encountered, the tank and piping will be cleaned, and the generated residual waste will be stockpiled and sampled pursuant to the above-described methods.

2.3.3 Off-Site Transportation and Disposal

The following section of the SMP addresses the off-site transportation and disposal of material that is deemed not suitable for development which includes Site preparation, soil loadout, transport vehicle decontamination and the required truck route. All waste disposal activities will be conducted in accordance with the PADEP Waste Transportation Saf ety Act.

2.3.3.1 Waste Loadout

Stockpiled materials will be loaded into trucks for transport to the approved soil disposal facility. Conventional equipment, such as f ront-end loaders and hydraulic excavators, will be used to load the soil piles into the transport vehicles. Transport vehicles will not be loaded in excess of the approved axle rating and care will be taken to prevent the spread of dust and/or contamination of vehicles during load out.

Bridge and Engineer will ensure that the soil trucking company is licensed and permitted in all states through which they will travel with decals/placards appropriate for the waste material removed f rom the Site. This includes having a PADEP Waste Transporter Authorization issued under Act 90. Bridge and Engineer will ensure that the soil trucking company meets the applicable DOT training requirements, and provides a list of vehicles and DOT approved containers which will be available for use on the project, DOT violation history and a list of other projects similar in magnitude to this project with contact names and telephone numbers.

2.3.3.2 Transportation Vehicle Inspection and Decontamination

Transport vehicles shall be inspected by trucking company personnel upon the completion of loadout activities. Tailgate locks and cover tarps will be inspected to ensure that they are secure and will prevent the release of soil, dust or materials during transport. Truck tires and undercarriage members will be inspected for visible accumulations of soil and will be cleaned as necessary.

Transport vehicles that were exposed to visible accumulations of soil on tires and undercarriage members during loadout will undergo dry decontamination procedures. Dry decontamination consists of the use of brooms and other hand tools to remove accumulated soil, from vehicles prior to leaving the work area. Once loadout of the soil has been completed, the roadways shall be cleaned where visible soil has been deposited during transportation.

2.3.3.3 Manifesting

The appropriate documentation, (i.e., manif ests) will accompany each load of soil/material to the intended disposal or recycling f acility. The manif est will provide space for identif ying the nature of the waste being transported, the date and time that the waste leaves the Site, the truck identif ication number, and the estimated weight/volume transported will be provided with each truck. The manifest form will be signed by a Bridge representative before the material leaves the Site; by the truck driver before the truck leaves the Site; and by a representative of the facility when the load is received at the disposal facility. Upon receipt of the material, the disposal facility will be required to send one copy of the manifest, completed with all appropriate signatures and final weight information, to Bridge and Engineer.

Waste removed f rom the Site shall only be transported to f acilities which have been approved by Engineer and Bridge. Waste removed f rom the Site shall only be transported by transportation trucking companies which have received prior approval to the designated disposal/recycling f acility.

In the event of an off-site spill during transportation, the transportation subcontractor will immediately take all necessary action to prevent, abate, or minimize the additional release or threat of release of any soil. Off-site spills of soil shall be collected, stored and disposed of with similar Site materials. Any “clean” materials potentially contaminated by an off-site spill shall be excavated and disposed of with the soils that caused the contamination, or shall be cleaned and restored to previous existing conditions, to the satisf action of local authorities having jurisdiction, Bridge and Engineer.

2.3.3.4 Traffic Management Plan

Prior to the off-site disposal of any material, a Construction Traffic Management Plan (CTMP) will be prepared and will include the following:

- Detail of traffic routes used by construction vehicles on the Site;
- Detail of traffic routes used by construction vehicles from the Site to the disposal facility;
- The number and type of vehicles to be used during the project;
- Speed limits to be observed along routes to and from the Site; and
- Behavioral safety requirements for vehicle drivers to/from the Site and within the Site.

3. Soil Erosion and Sediment Control Measures

Due to the nature and extent of the development work, an ESC plan has been prepared in accordance with state, county and local soil conservation laws and regulations. The ESC plan should, at a minimum, include:

- Narrative description of the project, temporary and permanent ESC procedures, pre- and post-construction stormwater runoff patterns, and Site restoration;
- Calculations, as needed, for stormwater runoff and stability analyses;
- Various Site maps (quadrangle, soils, wetlands (if needed), etc.); and
- Design drawings, including pre- and post-construction elevations, cap locations, ESC controls, limits of disturbance, staging areas, details and required notes.

It is anticipated that stormwater encountered during redevelopment activities will be managed via on-Site ESCs and stored in temporary detention basins and sampled prior to determining where the water will be discharged. Bridge is evaluating the potential for discharge to the Philadelphia Water Department via a groundwater discharge permit. If required, an addendum to the SMP will be completed that details the means and mechanisms on managing stormwater.

Installed ESC measures will be inspected, maintained and replaced (as needed) throughout the duration of the development work. Vegetation is to only be cleared on an as needed basis to ensure that ESC measures remain in place.

4. Fluids Management

With regard to the proposed redevelopment and the potential for adverse impacts to groundwater, the development activities do not call for encountering groundwater with the exception of the potential to do so in the very limited case where utilities are installed. In addition to the limited scenarios where groundwater may be encountered, there is the potential of generating stormwater during precipitation events. [4] If it is determined that a Temporary Groundwater Discharge Permit will be need, the permit will be obtained f rom the Philadelphia Water Department that will allow for the discharge of groundwater and/or stormwater through the City's sewer system. Prior to discharge, the water will be collected and containerized in f rac tanks (or similar). The requirements of the permit will determine if treatment and/or sampling of the f luid is necessary prior to discharge. Otherwise, these liquids will be handled, transported and disposed/recycled in accordance with applicable local, State and Federal regulations.

With regard to impacts to surf ace water, Bridge will be implementing a series of ESCs that will mitigate any impacts to surf ace waters (i.e. Delaware River).

[4] Care will be taken to minimize the amount of water in the area of excavation by employing diversion berms or other approved applicable techniques. Proper controls will be employed to minimize erosion and sediment transport of which details will be provided within the ESC plan.

5. Quality Assurance/Quality Control

All construction activities associated with the redevelopment of the Site will be conducted in a safe and prudent manner so that unreasonable hazards to workers and the public are minimized. Prior to initiating work activities, workers shall be trained to ensure a proper understanding of all aspects of their job including:

- Understanding their role and location at the Site;
- Traffic patterns and heavy equipment operations;
- Recognizing, and eliminating or avoiding hazards;
- Understanding flagger signals and safety colors;
- Knowing communication methods and alarms;
- Knowing how to work next to traffic and heavy equipment in a way that prevents accidents;
- Being as visible as possible; and
- Knowing how to operate equipment and vehicles, and specifically prevent rollovers.

This training will be conducted before an individual is allowed to work in the activity area and whenever operations change in the activity area. Additionally, tailgate safety meetings will be conducted on a weekly basis to specifically discuss the work planned for each day and the means by which to prevent incidents.

6. Health and Safety Requirements

A Site-specific Health and Safety Plan (HASP) will be prepared, which will be consistent with the requirements of Occupational Safety and Health Administration OSHA) (29 CFR 1910 and 1926) and all other federal, state and local authorities. In addition, the Site will be secured during all re-development activities in a manner to limit potential human and ecological exposure to contaminated media.

Dust shall be minimized to the greatest extent possible by implementing best management dust suppression practices by utilizing water trucks, street sweepers, misters, etc. Dust monitoring may be conducted by Engineer to evaluate the potential concern of affecting air quality. Proper measures will be taken to meet regulatory requirements to minimize and control dust during construction activities. Dust control during the excavation process is the main engineering control used to minimize potentially contaminated material from becoming airborne and affecting either the worker or environment.

7. Documentation of Soil Reuse, Staging and Placement

All Restricted Use Soils excavated at the Site will be subject to the below described documentation practices. An ongoing log will be maintained to track the soil origin and end use location. At a minimum the soil tracking log will include the following:

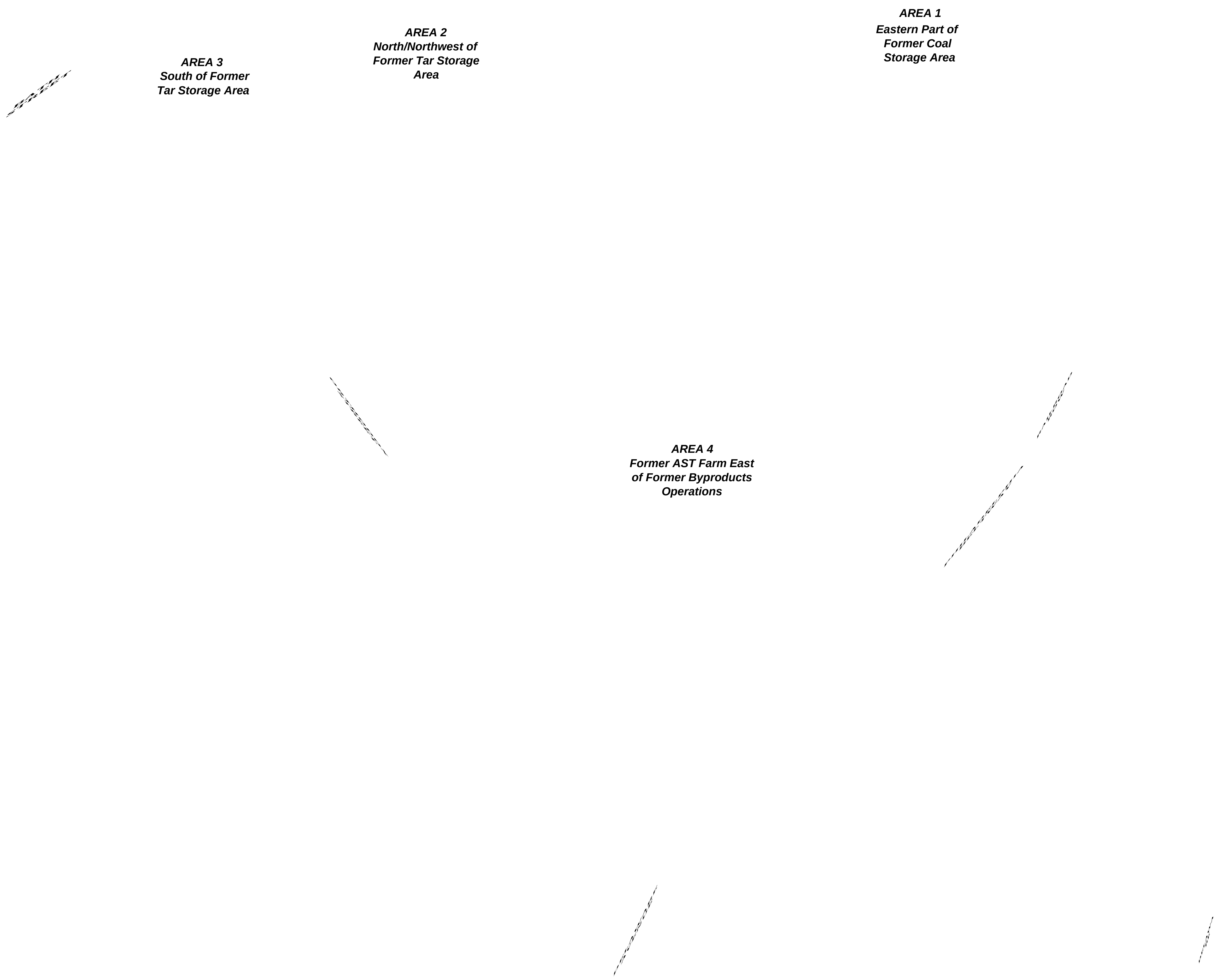
- Unique pile identif iercode;
- Date and location of original excavation;
- Estimated volume;
- Placement depth, thickness, and aerial extent;
- Date of placement; and
- Lab data summarizing sol characterization activities for soil and material warranting offsite disposal (if warranted).

At the completion of the project, a comprehensive report will be prepared that will summarize the soil management activities as well as detail the new enhanced engineering controls.

8. Conclusions

This SMP has been developed to assist in the redevelopment of the Site and to ensure the requirements detailed within Arcadis' July 2021, *Remedial Investigation Report and Cleanup Plan* (provided as **Attachment A**) are adhered to. In addition, and as will be detailed within daily inspection logs, all soils and surf ace cover material that are disturbed and located within the Restricted Use Areas will remain within the Restricted Use Areas and will be repaired at a minimum to the pre-construction elevation (or greater) with material similar (or equally protective) composition.

FIGURES



LEGEND

PROPERTY PARCEL

ECRA EXCAVATION

AREA OF INTEREST

HISTORICAL TAR PLAINS / FILL AREA

FORMER STRUCTURE / OPERATION

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REFERENCE

1.) AERIAL PHOTOGRAPH FROM NJDEP 2020 FLYOVER.

2.) SOIL DELINEATION AREAS NATIONAL GRID FORMER PHILADELPHIA COKE PLANT PHILADELPHIA, PENNSYLVANIA RI REPORT BY ARCADIS.

3.) SITE HORIZONTAL DATUM: NAD83 PENNSYLVANIA STATE PLANES, SOUTH ZONE, US FOOT.

Title:

CUT / FILL PLAN

BRIDGE POINT BRIDESBURG
4501 RICHMOND STREET
PHILADELPHIA, PHILADELPHIA COUNTY, PENNSYLVANIA

Prepared for:

BP Bridesburg, LLC

5.50
6.00
6.50
7.00

Date: 01/05/2021 Scale: AS SHOWN

Project: 3165.0012J000

FIGURE

3

iled by: JBK Prepared by: JSG Project Mgr: JBK

File: 3165.0012J000.5000.06 - BASE.DWG

ATTACHMENT

A. Arcadis' July 2021, Remedial Investigation Report and Cleanup Plan

ATTACHMENT 1

Arcadis' July 2021, Remedial Investigation Report and Cleanup Plan

Philadelphia Coke Co., Inc.

REMEDIAL INVESTIGATION REPORT AND CLEANUP PLAN

Former Philadelphia Coke Plant
Philadelphia, Pennsylvania
PADEP eFACTS Site ID #833593
& Facilities ID #609978
EPA ID #PAD000427906

July 2021

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REMEDIAL INVESTIGATION REPORT AND CLEANUP PI.AN

Former Philadelphia Coke Plant
Philadelphia, Pennsylvania
PADEP eFACTS Site lD #833593 &
Facilities ID #609978
EPA ID #PAD000427906

Daniel P. Sheehan, P.E.
Project Consultant

Mathew Lesley, PG
Principal Geologist

Prepared far:
Philadelphia Coke Co., Inc.

Prepared by:
Arcadis U.S., Inc.
824 Market Street
Suite 820
Wilmington
Delaware 19801
Tel 302 658 1718
Fax 302 658 2068

Our Ref,:
3004026

Date.
July 2021

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CONTENTS

IN-TEXT TABLES

TABLES

IN-TEXT FIGURES

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EXHIBITS

APPENDICES

ELECTRONIC ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
µg/m³	micrograms per cubic meter
AMSL	above mean sea level
ASTM	American Society Testing and Materials
BaA	benz(a)anthracene
BaP	benzo(a)pyrene
BbF	benzo(b)fluoranthene
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
cm/sec	centimeters per second
CFR	Code of Federal Regulations
COCs	constituents of concern
COPEC	constituent of potential ecological concern
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
DRBC	Delaware River Basin Commission
E&SC	Erosion and Sedimentation Control
EPA	United State Environmental Protection Agency
ESBs	ecotoxicological screening benchmarks
ES	ecological screening
ft/day	feet per day
g/cm³	grams per cubic centimeter
GC/FID	gas chromatography with flame ionization detector
GC/TCD	gas chromatography with thermal conductivity detector
GEI	GEI Consultants Inc.
GPS	global positioning system
GW	groundwater
HASP	Health and Safety Plan
HQ	hazard quotient

HSA	hollow-stem auger
HWMU	RCRA Hazardous Waste Management Unit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MSCs	medium-specific concentrations
MTBE	methyl-tert-butyl ether
NAD 83	North American Datum of 1983 State Plane of Pennsylvania-South
NAPL	non-aqueous phase liquid
NAVD 88	North American Vertical Datum of 1988
NTUs	Nephelometric Turbidity Units
NIR	Notice of Intent to Remediate
PFBC	Pennsylvania Fish and Boat Commission
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources (predecessor of PADEP)
PADNR	Pennsylvania Department of Natural Resources
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCC	Philadelphia Coke Company, Inc.
PID	photoionization detector
PIP	Public Involvement Plan
PNDI	Pennsylvania Natural Diversity Inventory
PP	Priority Pollutant
PPE	personal protective equipment
PS&S	Paulus, Sokolowski and Sartor, Engineering, PC
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
QD	Quick Domenico
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
S-GW	soil-to-groundwater MSCs for a non-residential used aquifer with TDS less than or equal to 2,500 ppm

SHS	Statewide Health Standards
SMD	scientific/management decision
SRI	Supplemental Remedial Investigation
SVOCs	semivolatile organic compounds
SWMU	RCRA Solid Waste Management Units
TAL	Target Analyte List
TCE	trichloroethene
TCL	Target Compound List
TDS	total dissolved solids
TGM	PADEP Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil Under Act 2 (PADEP 2019)
TSCA	Toxic Substances Control Act
TPH	Total Petroleum Hydrocarbon
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDOT	United States Department of Transportation
UST	underground storage tank
USFWS	United States Fish and Wildlife Service
VI	vapor intrusion
VOCs	volatile organic compounds
WCC	Woodward-Clyde Consultants

EXECUTIVE SUMMARY

On behalf of Philadelphia Coke, Co., Inc., Arcadis U.S. Inc. (Arcadis) has prepared this Remedial Investigation (RI) Report and Cleanup Plan for the Former Philadelphia Coke Plant location in the Bridesburg Borough of Philadelphia, Pennsylvania (the Site). The Site is located at 4501 Richmond Street between Orthodox Street and Buckius Street and is adjacent to the Delaware River. The Site is approximately 63 acres in size and is currently unoccupied. The Site is overgrown with vegetation and only remnants of the former operating structures, foundations, and concrete pads remain. All former structures at the Site have been demolished to ground level. A mix of residential, industrial, and commercial uses surrounds the Site. Plans are currently being prepared for Site redevelopment and use for commercial warehousing (see Exhibit 1).

Site operations concluded in 1989. Resource Conservation and Recovery Act (RCRA) Closure actions were conducted at the plant in the late 1980s to address source area contamination located at specific RCRA Hazardous Waste Management Units. Extensive soil remediation was performed as part of the RCRA closure with nearly 39,000 tons of soil transported offsite for treatment/disposal. In addition, bioremediation was performed in a former fuel blending area and former underground storage tanks and residual oil in piping removed. Periodic (typically quarterly) groundwater monitoring began in April 1985 to evaluate groundwater conditions at the Site. The Certificate of Completion for RCRA Site Closure was issued by the United States Environmental Protection Agency (EPA) on December 28, 1994 (WCC 1994). Following receipt of the Certificate of Completion, PCC continued to monitor groundwater quarterly, until the Pennsylvania Department of Environmental Protection (PADEP) authorized termination of the groundwater monitoring program in a July 26, 1999 letter. No outstanding closure responsibilities associated with the RCRA Corrective Action remain. The Site has not been occupied since 1991. Other than the Site investigations discussed herein and site investigations conducted for Site redevelopment (under a Site-specific health and safety plan), no other Site activities or operations besides routine mowing and maintenance of the perimeter chain-link fence have been conducted since the RCRA Closure.

RI Activities and Results

The RI was undertaken to assess the nature and extent of residual Site-related environmental impacts, if any, and evaluate the risks posed to human health and the environment by those impacts. The RI was performed in two major phases: (1) the Initial RI activities from 2003 through 2006; and (2) the Supplemental RI activities from 2018 and 2019. When combined, work activities performed for the RI consisted of the following:

- Excavating 197 test pits and collecting soil samples from 145 test pits.
- Installing 179 soil borings and collecting soil samples from 150 soil borings.
- Installing and sampling 33 shallow groundwater monitoring wells, 13 deep groundwater monitoring wells, and 7 hydropunch borings.
- Analyzing approximately 540 soil samples and 112 groundwater samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganics, cyanide, pesticides, and/or polychlorinated biphenyls (PCBs).

- Collecting 21 soil gas samples and one ambient air sample for VOCs (via Method TO-15), Naphthalene (via GC/MS in the full scan mode) methane, and fixed gases (via American Society Testing and Materials Method D-1946).
- Performing sediment probing in the Delaware River and a visual reconnaissance of the shoreline for sheens, tar-like material, elevated photoionization detector readings, or other observable indications of Site-related impacts.

The results of the RI provide adequate coverage across the Site to: (1) identify and delineate residual environmental conditions; (2) support a Risk Assessment Report; (3) develop a Cleanup Plan; and (4) support Site redevelopment.

Based on observations of soil samples recovered from soil borings across the Site, there are three hydrogeological units above weathered metamorphic schist bedrock. Nearest the ground surface is a layer of man-made fill materials that generally meets the description of historic fill as defined in Pennsylvania Department of Environmental Protection's Management of Fill Policy (Document #258-2182-773) dated January 1, 2020. A confining unit of silt and clay material underlies the fill materials and underneath that confining unit is a sand and gravel unit. Groundwater at the Site is separated into a shallow and deep zone by the silt and clay layer. Shallow groundwater is located within the historic fill and mounds in the central/southern portion of the Site and flows radially outward from the mound. The shallow aquifer was formed by the historical placement of fill above native surface soils. Due to the presence and characteristics of the historic fill, it is not suitable for use. Deep groundwater is located within the sand and gravel unit flows eastward toward the Delaware River. Groundwater does not appear to be tidally influenced or affected by the presence of the municipal Upper Delaware Connecting Sewer (reportedly 11-foot-3-inch to 12-foot-3-inch diameter) that bisects the western portion of the Site, other than a limited tidal influence on deep groundwater (generally less than 1 foot) nearest to the Delaware River. The Upper Delaware Collecting Sewer conveys regional storm water deep beneath the Site; however, it does not collect any storm water from the Site itself.

Soil analytical results and visual impacts (e.g., viscous tar, oil-like material, and solidified tar) indicate the presence of localized impacts in the center of the Site and at isolated locations on the remainder of the Site. In general, visual impacts are associated with the former process piping and foundations, except for impacts found in the vicinity of a former aboveground storage tank farm (east of Former Byproducts Building). Visual impacts are limited to the fill layer or the top few feet of the silt and clay layer and were not observed to have penetrated the confining unit. Based on the observed variations between original and revisited sampling locations from the Initial RI to the Supplemental RI, viscous tar and oil-like material appear to be limited to isolated pockets and not reproduceable from the original sampling event (i.e., not as extensive and/or contiguous as the Initial RI indicates). Additionally, groundwater analytical results do not indicate the presence of source material onsite.

Areas of the Site exhibiting elevated concentrations of chemical constituents and visual impacts have been delineated for purposes of cleanup plan development. Laboratory analytical results of soil, groundwater, and soil gas samples are summarized below:

- Surface soil with chemical constituents at concentrations exceeding non-residential direct contact medium-specific concentrations (MSCs) is mostly limited to polycyclic aromatic hydrocarbons (PAHs), arsenic, and lead at concentrations commonly associated with urban/historic fill. PAH concentrations for benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenz(a,h)anthracene were not typical of urban fill at one location (PCTP-66) which was revisited during the Supplemental RI and surrounded by additional sampling locations to delineate the extent of the impacts around this location. Additionally, lead concentrations not typical of urban fill were observed in the Fuel Blending Area and at two locations in the center of the Site. Surface soil impacts (concentrations above MSCs) are encountered throughout the Site given the presence of urban fill.

- Non-residential direct contact MSCs for subsurface soil are not exceeded at any location for the parameters analyzed (i.e., VOCs, SVOCs, inorganics including cyanide, PCBs, and pesticides). VOC and SVOC concentrations that exceed the non-residential soil-to-groundwater MSCs by an order or magnitude or more are typically collocated with visual impacts. Based on exceedances of the non-residential soil-to-groundwater MSCs, arsenic and lead in subsurface soil are the primary inorganic constituents of concern (COCs) for subsurface soil.
- Groundwater impacts are generally limited to areas where viscous tar and oil-like materials were observed. Groundwater monitoring wells installed downgradient of these areas indicate that Site-related groundwater impacts do not extend offsite. Outside of these isolated areas, groundwater is unimpacted by former Site operations; existing groundwater conditions are typical of groundwater in urban/historic fill.
- When compared to applicable non-residential vapor intrusion (VI) standards, soil and groundwater analytical results indicate the potential for soil related VI in future buildings in certain areas onsite in the absence of remediation or mitigation. However, soil gas analytical results did not exceed the sub-slab VI screening values, indicating that the VI potential may be over-predicted by the soil and groundwater analytical results.
- No surface or subsurface soil sample concentrations exceed the applicable non-residential, direct contact or soil-to-groundwater MSCs for pesticides and PCBs. Therefore, further activities will be focused on the VOCs, SVOCs, and inorganic constituents.

Based on the RI results, several PAHs, arsenic, and lead related to urban/historic fill were detected in surface soil throughout the Site. The COCs related to Site operations include: several PAHs and lead in surface soil; several VOCs, SVOCs, and inorganics in subsurface soil; and benzene, several SVOCs, and inorganics in groundwater. Site-related impacts in soil and groundwater have been delineated for purposes of developing a cleanup plan.

From a risk perspective, there are currently no complete exposure pathways for human receptors. Soil exposure is controlled by Site use (i.e., the Site is vacant), Site fencing, vegetation, and the presence of non-permeable surface covers (e.g., old asphalt parking lots). No current exposure pathways are complete for groundwater or soil vapor.

Future use of the Site will be restricted to non-residential by use of an environmental covenant. Potentially complete future exposure pathways could exist via soil, groundwater, and VI. However, groundwater is not used or anticipated to be used for potable purposes at the Site and in the surrounding area. Pathway elimination strategies will be integrated with the Site development plans to mitigate potentially complete future exposure pathways to ensure protection of human health and the environment.

Potentially complete exposure pathways for ecological receptors are direct contact and incidental ingestion of surface soil, and ingestion of contaminated prey. Direct contact to the historic fill is most likely to occur from burrowing mammals or small mammals that may incidentally ingest soil as part of their dietary exposure to prey items in the existing leaf litter. Larger wildlife (e.g., deer) may forage on the vegetation present, but would have limited dietary exposure to surface soil. Similar to the means for addressing human exposure, capping and/or limited removal of COCs as part of a protective cleanup plan will effectively eliminate potential ecological exposure to surface soil at the Site.

Cleanup Plan Summary

Based on the RI results, Philadelphia Coke Co., Inc. proposes to pursue a release of liability under the Act 2 Site-Specific Standard via a “pathway elimination” cleanup approach. Potentially complete future exposure pathways will be eliminated using engineering and institutional controls. The Cleanup Plan has been developed and presents the proposed methods to prevent further migration and eliminate potentially complete future exposure pathways. Although source material (e.g., non-aqueous phase liquid), was not encountered in the RI, the Cleanup Plan also includes provisions for addressing source material if encountered in the future. The remedial strategies presented in the Cleanup Plan will be integrated with Site development plans, once finalized. Conceptual development plans are currently being prepared and include commercial warehouse buildings, parking lots, access roads, driveways, and various landscape features, as shown in Exhibit 1.

The proposed remediation will achieve the Site cleanup objectives to protect human health by mitigating identified future exposure pathways with soils and groundwater impacted by applicable Site COCs. The Cleanup Plan:

- Provides methods to achieve pathway elimination for soils using engineering controls (i.e., capping of soils with structures, roadways, parking lots, and landscaping).
- Provides methods to achieve pathway elimination for vapor intrusion using engineering controls (i.e., use of a vapor barrier specifically designed, manufactured and installed for use in VOC mitigation) within areas of potential VI concern.
- Outlines procedures and plans to allow for safe execution of future Site remediation and/or redevelopment activities.
- Specifies institutional controls to be implemented (i.e., deed notice, restrictions, or other appropriate vehicles).
- Outlines a Post-Remediation Care Plan.

The remedial goals for soil will be to allow historic fill and impacted soils to remain in place or be reused onsite (e.g., as subsurface fill), to the extent possible, while mitigating potentially complete exposure pathways via engineering and institutional controls.

The engineering controls may consist of: (1) caps(s) overlaying areas where potential pathways exist for direct contact exposure; and (2) a VI mitigation system(s) within areas of potential VI concern identified by initial VI screening (as specified within this report) or a building-specific VI risk assessment addressing any potential future development. The proposed cap may include concrete floor slabs/foundations for new buildings; asphalt pavement and/or concrete for driveways, parking areas, and sidewalks; and/or 2-feet of clean soil (e.g., in landscaped areas) to eliminate potential direct contact exposure scenarios. Engineering controls (e.g., vapor barriers) may be used, where appropriate, to mitigate the potential VI pathway for COCs. Although not needed in certain areas of the Site (e.g., the western portion of the Site along Richmond Street), the current redevelopment plans are to install VI mitigation systems for all proposed occupied structures onsite. Alternatively, the Site-Specific Standard may also be pursued through completion of a cumulative VI risk assessment and/or additional soil-gas sampling to demonstrate that VI mitigation is not needed.

An environmental covenant with deed restrictions/notifications will be incorporated as an institutional control. The Site will be restricted to non-residential use to limit potential future receptors, and groundwater use will be prohibited to eliminate potential future groundwater exposure pathways. In addition, institutional controls will stipulate inspection, periodic maintenance/repair activities, and reporting requirements for soil caps and VI mitigation systems, as appropriate.

Additional details of site-specific engineering controls will be provided in the future (via Cleanup Plan Addendum), when site development occurs in the near term. Following implementation of the remedy included in the approved Cleanup Plan, a Final Report will be prepared in accordance with Act 2 requirements to obtain a release of environmental liability for the Site.

1 INTRODUCTION

On behalf of Philadelphia Coke Co., Inc. (PCC), Arcadis U.S. Inc (Arcadis) has prepared this Remedial Investigation (RI) Report and Cleanup Plan for the Former Philadelphia Coke Plant location in the Bridesburg borough of Philadelphia, Pennsylvania (the Site). This RI Report and Cleanup Plan was prepared in accordance with Pennsylvania's Land Recycling Program Technical Guidance Manual updated on January 19, 2019, the Land Recycling and Environmental Remediation Standards Act (Act 2), and its enabling regulations, 25 PA Code, Chapter 250. This report provides:

- A summary of the RI activities performed to delineate the nature and extent of Site-related chemical constituents (constituents of concern [COCs]) at the Site.
- An Ecological Screening to evaluate potential exposure of environmental receptors at the Site.
- An assessment of potentially complete exposure pathways (current and future) associated with the COCs.
- A Cleanup Plan for affected media at the Site to mitigate the potentially complete future exposure pathways based on identified conditions.
- A post-remediation care plan to ensure that no future exposure pathways to remaining COCs at the Site exist.

A Notice of Intent to Remediate (NIR) was submitted to Pennsylvania Department of Environmental Protection (PADEP) on November 19, 2018 (Appendix A). The NIR stated that PCC is seeking a release of liability under the Act 2 Site-Specific Standard.

The objective of the Act 2 Site-Specific Standard is to develop and evaluate detailed site information to provide a protective cleanup standard unique to that site. The Site-Specific Standard is a risk management approach (PADEP 2019a). For the purposes of this Site, the proposed Site-Specific Standard will generally be the "pathway-elimination" approach, which means that potentially completed future exposure pathways will be eliminated using engineering and institutional controls. Engineering controls that may be implemented at the Site include covering impacted soils with asphalt/ concrete paving, building structures and/or clean soil covers to prevent direct contact exposure to Site COCs and installation of barriers or vapor mitigation systems to mitigate potential vapor intrusion (VI) into future buildings constructed on the property. Institutional controls that could be considered include deed restrictions/environmental covenants: (1) prohibiting use of groundwater at the Site; (2) limiting future soil disturbance in areas with engineering controls; (3) limiting future development in specific areas of the Site; and/or (4) requiring a Soil Management Plan that stipulates inspection, periodic maintenance/repair activities, and reporting requirements for engineering controls, as appropriate (PADEP 2019a).

The information presented in this RI Report and Cleanup Plan reflects, in part, the information provided in a March 5, 2019 Kick-Off Meeting and March 8, 2021 Project Update Meeting with PADEP and the United States Environmental Protection Agency (EPA).

Remedial alternatives based on the future development of the Site as an industrial and/or commercial property are presented in the Cleanup Plan. Remedial strategies presented in the Cleanup Plan will be integrated with Site development plans, once finalized by the purchaser/developer of the property.

Conceptual development plans are currently being prepared and include commercial warehouse buildings, parking lots, access roads, driveways, and various landscape features, as shown in Exhibit 1. The Cleanup Plan presents the general approach and typical methods that will be used to mitigate potentially complete exposure pathways in accordance with Act 2. Specific details on engineering and institutional controls to be employed through any potential site development will be prepared and provided to PADEP for review/approval in addenda to the Cleanup Plan.

1.1 Report Organization

The organization of this RI Report and Cleanup Plan is presented below.

Table 1-1: Report Organization

Section		Purpose
Section 1	Introduction	Provides information relevant to the development of this report and the objectives of this report.
Section 2	Site Information	Presents a description of the Site setting, production history, and historical investigations and remediation.
Section 3	Remedial Investigation	Describes the field investigation to evaluate the extent of former Site-related environmental impacts and the findings of that investigation.
Section 4	Fate and Transport Model	Evaluates the extent of constituent migration in groundwater in the absence of any remedial activities.
Section 5	Conceptual Site Model	Evaluates the risks posed to human health and the environment by Site-related impacts. This section summarizes the potential current and future migration and exposure pathways for the identified impacts.
Section 6	Ecological Screening	Evaluates the potential exposure of environmental receptors at the Site.
Section 7	Public Benefits to Remediation and Reuse	Presents a summary of public benefits of the redevelopment and reuse of the property. Industrial and commercial development benefits are evaluated.
Section 8	Remedial Investigation Conclusions	Presents a summary of the RI and the Site-related environmental impacts.

Section		Purpose
Section 9	Cleanup Plan	Presents the proposed cleanup objective and process, project personnel, selected remedial standards, the public participation, the cleanup actions to attain the remedial standards, and the post-remediation activities.
Section 10	Summary and Conclusions	Presents a summary of the proposed cleanup actions to address the impacts.
Section 11	Signatures	Provides a signature of the Site owner's representative.
Section 12	References	Presents a list of the references cited in the RI Report and Cleanup Plan.

1.2 Objectives

The overall objective of this RI Report is to define the nature and extent of residual Site-related environmental impacts, if any, and evaluate the risks posed to human health and the environment by those impacts. The RI identifies the potential human exposure pathways and environmental risks in sufficient detail to support the proposed Site remedial approach and non-residential use redevelopment scenario. The RI objectives were met by filling data gaps from previous investigations and cleanup activities.

The RI results are used to develop a conceptual Cleanup Plan for the property. The Cleanup Plan has been developed to meet the Act 2 Site-Specific Standard. Based on the RI findings, the cleanup objective for the Site is to protect human health by mitigating identified exposure pathways with soil and groundwater impacted by select volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and inorganics in locations where COC concentrations exceed the respective non-residential medium-specific concentrations (MSCs).

Following implementation of the remedial alternatives included in the approved Cleanup Plan, a Final Report will be prepared in accordance with Act 2 requirements to obtain a release of environmental liability for the Site.

2 SITE INFORMATION

This section presents relevant background information used to develop the RI scope. The Site location and history are described below, followed by a summary of previous investigations and remediation activities.

2.1 Location and Description

The Site is located on 4501 Richmond Street between Orthodox Street and Buckius Street in the Bridesburg borough of Philadelphia, Pennsylvania. The Site is bounded to the west by Richmond Street, Lefevre Street, and Garden Street; to the north by Buckius Street; to the south by Orthodox Street; and to the east by the Delaware River[1]. The Site is approximately 63 acres in size and is currently unoccupied. The Site is overgrown with vegetation and only remnants of the former operating structures, foundations, and concrete pads remain. All former structures at the Site have been demolished to ground level, and the Site is currently vacant and unoccupied. The Site is secured by a perimeter chain-link fence that is routinely inspected and repaired, as needed. The Site will remain unoccupied until redevelopment. The Site location is shown on Figure 1.

The Delaware River is the primary hydrologic feature within the region. The river is classified by PADEP as a warm-water fish designated use river/stream. The Delaware River flows north to south to the Atlantic Ocean at the Delaware Bay. Surface flow onsite drains southeast into the Delaware River. A watershed map of the Lower Delaware River Watershed is included as Figure 2.

A large municipal storm sewer identified as the “Upper Delaware Collecting Sewer” (reportedly 11-foot-3-inch to 12-foot-3-inch diameter) extends across the western portion of the Site, from the intersection of Bath Street with Orthodox Street to the south and Buckius Street to the north but does not collect or convey stormwater from the Site. The invert elevation of this sewer was estimated to be at least 29 feet below ground surface (bgs; equivalent to 15.79 feet below mean sea level). An active utility corridor and the inactive Philadelphia Beltway Railroad extend through the eastern portion of the Site.

A mix of residential, industrial, and commercial properties surround the Site. To the west (along Richmond Street) is a mix of commercial enterprises and residential housing. To the south (along Orthodox Street) and to the north (along Buckius Street) are commercial and industrial properties. To the east is the Delaware River.

Ground surface elevations vary throughout the property. The ground surface is lowest near the bulkhead at the Delaware River (at elevations ranging from 5-6.5 feet above mean sea level [AMSL]) and then rises slightly to the west to approximately 8-9 feet AMSL near the utility corridor. West of the utility corridor, the ground surface elevation changes significantly, advancing into the upland areas of the Site in a westerly and northerly direction towards the Site center. The highest ground surface is near former tar holders in the approximate center of the Site, and in the southeast corner of the Site. The ground surface elevations west of the utility corridor range from approximately 10 to 21 feet above AMSL.

[1] For purposes of this report, north (i.e., plant north) is perpendicular to Buckius Street (55 degrees each of the true north shown on the Site figures.

2.2 History

The Site was developed in the mid-1920s to provide manufactured gas to the City of Philadelphia (the City). Facility operations from January 1929 to May 1982 focused on the production of metallurgical coke by the Philadelphia Coke Co., Inc. Principal processes included coal and coke storage, coke production, tar storage, by-product operations, and iron oxide storage. The Site also included an iron oxide waste area and tar plain area. A fuel oil blending facility operated on the eastern 2.5 acres of the Site from approximately 1969 through 1989 by Patterson Oil Co. and Eastern Gas Co.

Coal and Coke Storage Areas were located in the northern portion of the Site. The main Coking Operations Area was in the center of the Site and consisted of the coke ovens, the by-products building, tar storage, and oxide boxes. The facility had two aboveground storage tanks (ASTs) that were used to store product coal tar with estimated capacities of 500,000 and 1,000,000 gallons. Additionally, there was one tank farm with concrete secondary containment for four ASTs and a second tank farm with two fuel oil tanks surrounded with an earthen berm (Woodward-Clyde Consultants [WCC] 1992a). The Main Operations Area is where Resource Conservation and Recovery Act (RCRA) closure activities were implemented and included the Spent Iron Oxide Storage and Tar Plain Areas. The Fuel Blending Area was in the eastern portion of the Site and consisted mainly of aboveground storage and below ground piping. The overall layout of the Former Philadelphia Coke Plant is shown on Figure 3. Historical aerial photographs, Sanborn maps, and other Site plans, including a generalized process flow diagram, are included as Electronic Attachment 1.

The facility carbonized coal in coke ovens. Bituminous coal and limited amounts of anthracite coal were used as raw materials to make metallurgical coke. When combined with limestone and iron ore at high temperatures, metallurgical coke is used to form iron and steel. Metallurgical coke is both fuel and a reactant essential for steelmaking.

During its active years, the facility produced upwards of 220,000 tons of metallurgical coke annually. The facility formerly operated as a large quantity generator of hazardous waste under EPA number PAD000427906. The facility also operated under a National Pollutant Discharge Elimination permit number PAD0011401.

The primary waste materials (residual tar, spent iron oxide, etc.) generated by the coal carbonization process resulted from coal gas cleaning and cooling systems. During the coal carbonization process and subsequent gas cleaning and cooling operations, various heavy hydrocarbons were generated and combined with fine coal or coke solids in the gas stream. This combination then settled in the tar decanters, which principally functioned as tar/water separators. Periodically, the settled mixture in the decanters (decanter tank sludge), as well as waste material in the iron oxide waste storage area, was removed for offsite disposal. The facility manufactured and generated several types of products and wastes. Former Site operations and waste generated is summarized in the Engineer's and Owner's Certification of Closure for Waste Management Units, prepared by WCC in December 1992 (RCRA Closure Report; WCC 1992b) which is included in Electronic Attachment 2.

In the early days of plant operation, discharge to surface water from the Site occurred through a single outfall into the Delaware River (Outfall 001). On March 13, 1951, the Philadelphia Coke Company was issued a discharge permit from the Pennsylvania Department of Health. While no documentation was identified regarding the installation of the oil skimmer leading to Outfall 001, it is assumed that it was installed in the early 1950s. In 1975, a substantial portion of the plant's process water was diverted to the

City's sanitary sewer system on Orthodox St. According to a June 28, 1982 letter, Outfall 001 was plugged following the end of Site operations.

The former Fuel Oil Blending Area supported a process whereby Number 2 and Number 6 fuel oils were brought to the Site by barge and off-loaded. The oil was stored and blended prior to local distribution by tanker truck.

All above-ground structures have been demolished to ground level.

2.3 Historical Investigations and Cleanups

Prior to the RI, various investigations were performed at the Site from the mid-1980s through 2001. The initial investigations were conducted in conjunction with Site closure activities under the federal RCRA program. The results of these investigations are summarized in the RCRA Closure Report (WCC 1992b; Electronic Attachment 2). The RCRA Closure actions conducted at the plant in the late 1980s addressed source area contamination located at specific RCRA Hazardous Waste Management Units. A series of limited investigations of the Fuel Blending Area were also conducted from 1988 to 1993 and in 2001.

As part of these historical investigations, cleanup activities were performed. Approximately 39,000 tons of material were transported for offsite treatment and disposal. A timeline of historical cleanup activities is provided in the table below, and a discussion of these investigations and cleanups is provided in the following paragraphs.

Table 2-1: Historical Cleanups

Year	Cleanup Description
1982-1988	Removed RCRA waste management units
1988	Removed approximately 9,370 tons of soil impacted with decanter tank tar sludge and spent iron oxide
1988-1993	Removed approximately 29,400 tons of soil impacted with coke breeze, paving material, and coal tar
1992-1993	Performed in-situ soil bioremediation in Fuel Blending Area
1991-2001	Removed underground storage tanks (USTs) and residual oil from pipe segments

2.3.1 RCRA Closure Investigation and Remediation

The initial RCRA investigation was conducted in October 1986. The results indicated that coal tar-related base neutral organic compounds were reported above standards in soil and groundwater in the former operational areas.

2.3.1.1 Historical Groundwater Evaluation

Six onsite shallow groundwater monitoring wells (MW-1 through MW-6[2]) and one deep groundwater monitoring well MW-2D were installed in the central portion of the Site as shown on Figure 4. These wells were generally sampled on a quarterly basis for 14 years, from April 1985 through November 1998. After November 1998, the frequency of groundwater monitoring was decreased to annual monitoring events. In a July 26, 1999 letter, PADEP approved the termination of RCRA groundwater monitoring based on the continuous decreasing trend of constituent concentrations.

The monitoring wells were located in the center of the Site and downgradient from the RCRA soil removal areas. Potentiometric surface maps from the 1980s indicate groundwater flow originating near MW-2 (in the Spent Iron Oxide Storage Area in the center of the Site) and flowing radially west to Garden Street, south to Orthodox Street, and east towards the Delaware River. No monitoring wells were installed north of MW-2 to evaluate groundwater flow to Richmond Street or Buckius Street. Historical potentiometric surface maps are provided in Appendix B.

Groundwater analytical results from the sampling events generally indicated the presence of benzene, toluene, ethylbenzene, and SVOCs. In addition, trichloroethene (TCE), 1,1-dichloroethane, and cis-1,2-dichloroethene were periodically detected at elevated levels onsite. VOC and SVOC impacts were primarily observed at MW-1 (located downgradient from the Former Tar Plain, near the existing PCMW-10 cluster) and MW-2. Benzene, toluene, ethylbenzene, xylene, (BTEX) and EPA's 16 priority pollutant polycyclic aromatic hydrocarbons (PAHs) were not detected in monitoring wells MW-3 or MW-4. MW-3 is located in the eastern half of the Site between the Site center and the former Fuel Blending Area, and MW-4 is located on the western property boundary near the Garden Street properties. Some general water quality parameters (i.e., total base neutral extractables and total VOCs) were slightly elevated in MW-3 and MW-4, but those impacts were attributed to fill materials rather than plant-related activities.

During the final year of groundwater monitoring (1998), benzene and naphthalene remained at concentrations greater than the Maximum Contaminant Levels[3] (5 and 20 micrograms per liter [5 µg/L], respectively) in MW-2R (replacement for well MW-2). In 1998, PAH results (including naphthalene results) were lower than the current applicable groundwater MSCs (i.e., PADEP Non-Residential MSCs for Used Aquifers containing Total dissolved solids [TDS] ≤ 2,500 milligrams per liter [mg/L]).

In the July 26, 1999 letter, PADEP indicated that benzene and naphthalene have not migrated to downgradient wells (MW-1 and MW-3) and that these compounds were not found to be at "any appreciable levels" (according to the PADEP) in MW-2D, MW-4, MW-5, or MW-6 since 1994. Therefore, PADEP indicated that groundwater impacts for these compounds were localized and have been since 1994.

In the July 26, 1999 letter, PADEP also indicated that concentrations of the VOC and SVOC constituents have "significantly decreased from 1985 and 1998". Upon termination of the groundwater program, PADEP acknowledged that concentrations of iron, manganese, specific conductance, potassium, sodium, calcium, magnesium, sulfate, and chloride remained elevated. However, PADEP attributed these

[2] Wells identified above as MW-1 through MW-6 were originally identified as W-1 through W-6 in the RCRA closure documentation.
[3] The Maximum Contaminant Levels are from the federal and state Safe Drinking Water Act standards available at the time of the July 26, 1999 letter.

elevated levels as a natural phenomenon (i.e., related to the fill material). In 1999, PADEP concluded that groundwater impacts at the Site were localized, delineated, and stable. PADEP indicated that PCC is no longer subject to any additional groundwater monitoring.

2.3.1.2 RCRA Closure Activities

Closure activities, consisting of excavation and offsite disposal of soil contaminated with decanter tank tar sludge from coking operations (RCRA Waste Code K087), and spent iron oxide (RCRA Waste Code D003) were initiated on July 12, 1988. In total, five RCRA Hazardous Waste Management Units (HWMU) were closed, and 9,370 tons of hazardous waste were removed. Hazardous waste material originated from the tar storage tanks, waste liquor pit, tar plains, tar decanters, and the iron oxide boxes and pile. Hazardous waste removal activities were mostly complete by December 30, 1988.

Following closure of the HWMU, four RCRA Solid Waste Management Units (SWMU) were closed from 1988 to 1992. The SWMUs consisted of a trash pile, clean oxide, wood trays, and process piping throughout the Site. Generated waste consisted of three non-hazardous waste streams: coke breeze, paving material, and coal tar-impacted soil. Approximately 29,400 tons of the coal tar-contaminated soils were removed from the Site and disposed as residual waste at the G.R.O.W.S. landfill facility between February 19 and July 24, 1992. Additionally, approximately 439,800 gallons of groundwater were transported offsite for treatment.

In all closure areas, post-closure sampling demonstrated that the sum of benz(a)anthracene (BaA), benzo(a)pyrene (BaP), benzo(b)fluoranthene (BbF), chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene was less than the 50 milligrams per kilogram (mg/kg) cleanup criteria and none of these constituents were detected at a concentration greater than 15 mg/kg. At the time, these six PAHs were considered to be suspected carcinogens. The results of the post-closure sampling indicated that the cleanup criteria had been achieved.

In 1993, a sixth HWMU was closed. Approximate 20 cubic yards of soil hazardous for benzene were removed from the former seal pot for offsite incineration. The seal pot was in the Former Byproducts Building piping trench. The seal pot was discovered during excavation activities and cleaned in September 1992. Seal pot closure activities were completed on October 19, 1993.

The RCRA excavation areas are shown on Figure 3. The excavation depths were based on visual characterization and varied based on former Site operation locations, as summarized below:

- Decanter Area – excavation depth ranged from 10-13 feet bgs (averaging at 12 feet bgs).
- Oxide Box and Wash Area – excavation depth ranged from 3-10 feet bgs (average 8 feet bgs)
- Tar Plains – excavation depth averaged 11 feet bgs.

The Certificate of Completion for RCRA Site Closure was issued on December 28, 1994 (WCC 1994). No outstanding closure responsibilities associated with the RCRA Corrective Action remain. The Site has not been occupied since the conclusion of the RCRA Site Closure. Other than the Site investigations discussed herein, no other Site activities or operations (besides the routine mowing and maintenance of the perimeter chain-link fence) have been conducted since the RCRA Closure.

2.3.2 Fuel Blending Area Investigation

In 1988, oily residue was observed on surface soils near a former pump house in the Fuel Blending Area. This observation prompted the initiation of a series of limited investigations between 1988 and 1991. Total Petroleum Hydrocarbon (TPH) concentrations ranging from 1,000 to 250,000 mg/kg were reported in various locations within the Fuel Blending Area. The highest concentrations were reported from the unsaturated zone in the fill layer.

Cleanup activities in the Fuel Blending Area were initiated in 1992. These activities included the excavation and disposal of potential fuel oil sources consisting of subsurface piping between the former aboveground tanks and the pump house and oily residues present in the basement of the former pump house. A bioremediation project was conducted for almost two years and reported moderate success in reducing hydrocarbon concentrations in the surface soils (0 to 3 feet bgs), but only limited success with deeper contamination. The project was discontinued in late 1993 and the above-grade facilities were dismantled and removed in early 1998.

In 2001, Miller Environmental Group, Inc. removed oil from the transport pipe that extended from the pier to the fuel oil tanks. No. 2 fuel oil was encountered in the piping and removed for appropriate offsite disposal. During pipe removal, oil was reported floating on the perched groundwater near the western terminus of the pipe segments.

URS Corporation (URS) completed a test pit investigation in 2001 to delineate fuel oil impacts in the Fuel Blending Area observed during the pipe cleaning. A total of 18 test pits were excavated. Based on the observations during the investigation, a relatively thin zone of fuel oil impacts was encountered from 1 and 2 feet above the observed water table to 1 and 2 feet below the water table in the six test pits completed inside the Fuel Oil Blending Area berm. Sheens were observed in an additional five test pits. Impacts were not observed in the test pits completed outside this berm near the Delaware River. The results of the test pit investigation are summarized in a December 13, 2002 URS letter report (Electronic Attachment 3).

2.3.3 Underground Storage Tank Removals

Seven USTs were removed from the Site in July 1991. These USTs were registered with the Pennsylvania Department of Environmental Resources (PADER) at the time of the authorization and assigned Facility Identification No. 51-44990. The UST removals were performed under the oversight of PADER and the City of Philadelphia Department of Licenses and Inspections. According to PADEP Region 1 Office, the UST closures were approved by PADER on June 22, 1992. A description of the USTs removed, including the UST locations and the results of post-excavation soil sampling and analysis, are summarized below.

- Four 1,000-gallon gasoline USTs were removed from the Buckius Street Garage Area (Building 12 on Figure 3, likely in the vicinity of the RI soil boring location PCSB-01). TPH levels reported from the eight post-excavation soil samples ranged from non-detect to 190 mg/kg. A total xylene concentration of 0.019 mg/kg was reported in one of the eight samples. No BTEX were reported in any of the other samples. The excavation was backfilled with clean fill.
- One 1,000-gallon gasoline UST was removed from the Machine Shop Area (Building 12 on Figure 3). TPH levels reported from the three final post-excavation soil samples ranged from non-detect to 180

mg/kg. BTEX concentrations reported in the bottom sample ranged from 0.007 mg/kg (toluene) to 0.037 mg/kg (benzene). BTEX concentrations reported in the wall samples ranged from 0.007 mg/kg (toluene) to 0.18 mg/kg (benzene). Groundwater samples were also collected from seeps entering the excavation at three locations. Benzene was the only BTEX compound detected in the groundwater samples. Benzene was detected at 7 and 8 µg/L. A TPH concentration of 200 µg/L was reported in one sample. The excavation was backfilled with clean fill.

- Two 3,500-gallon diesel USTs were removed from the former scale house area (the scale house could not be located on historical figures). Post-excavation soil sampling indicated that TPH concentrations ranged from not detected to 220 mg/kg. No groundwater was observed in the excavation. The excavation was backfilled with clean fill.

2.4 EPA Environmental Indicator Determinations

In April 2013, EPA completed two Environmental Indicator Determinations concluding that both human exposures and impacted groundwater migration are under control at the Site. The Environmental Indicator process was initiated in response to a notification to PCC Land Company, Inc. (PCC) from EPA Region III on April 18, 2011. The notification included an attached letter dated June 22, 2010 prepared by PADEP requesting information regarding the status of the Site in relation to RCRA Corrective Action. In response to the notification, PCC conducted an August 11, 2011 site walk with PADEP and EPA's representative from Michael Baker International (Baker).

Based on the initial Site walk and file review, Baker prepared a January 2012 Environmental Indicator Inspection Report for the Site. Following the report, EPA issued the following RCRA Environmental Indicator Forms on April 10, 2013:

- CA-725: Current Human Exposures Under Control
- CA-750: Migration of Contaminated GW Under Control

The RCRA Environmental Indicator Forms concluded that both human exposures and impacted groundwater migration are under control at the Site. The RCRA Environmental Indicator Forms are provided as Appendix C. Any further work needed will be performed to satisfy the requirements of PADEP Act 2.

3 REMEDIAL INVESTIGATION

The RI was performed in two major phases. An initial phase of RI activities was performed by Paulus, Sokolowski and Sartor, Engineering, PC (PS&S) from 2003 through 2006 (hereinafter referred to as the Initial RI activities). Additional investigation activities were implemented by Arcadis in 2018 and 2019 (hereinafter referred to as the Supplemental Remedial Investigation [SRI] Activities). Each phase of the RI involved two or more rounds of fieldwork, with the scope of each round developed based on the results of preceding round(s). Between the Initial RI and SRI, the Site was unoccupied, and no activities were performed onsite other than periodic mowing of vegetation or maintenance of the perimeter fence.

The Initial RI activities consisted of sample collection from various media, including surface soil, subsurface soil, groundwater, soil gas, and ambient air to evaluate the nature and extent of impacts at the Site. Initial sampling locations were selected based on a review of available environmental database reports, Sanborn maps, aerial photographs, the RCRA Closure Report (including the associated soil and groundwater data), and other historical documents and figures. Test pit excavations and resulting soil samples were obtained from all areas of the Site, with the sampling locations generally biased towards the former operation areas. Subsequent phases of the Initial RI activities were developed to: (1) further delineate identified COCs; (2) complete characterization of the former operational areas; and (3) establish general Site conditions.

The SRI activities consisted of installing and sampling additional monitoring wells, soil borings, and test pits to: (1) confirm prior results, and that Site conditions had not significantly changed since samples were collected as part of the Initial RI activities; (2) fill identified data gaps from previous investigation and remedial activities and delineate the extent of impacts for purposes of developing a Cleanup Plan; and (3) assess current groundwater conditions.

The RI activities are summarized in Section 3.1 below and the RI findings are presented in Section 3.2.

3.1 Remedial Investigation Activities

The Initial and Supplemental RI activities consisted of the following:

- Excavating 197 test pits to characterize surface and shallow subsurface soil, evaluate subsurface structures, and assess geotechnical conditions. Soil samples from 145 test pits were collected for laboratory analysis.
- Installing 179[4] soil borings to characterize subsurface soils and Site stratigraphy. Soil samples from 150 soil borings were collected for laboratory analysis.
- Installing, developing, and sampling 33 shallow groundwater monitoring wells and 13 deep groundwater monitoring wells to characterize groundwater quality and evaluate groundwater flow.
- Drilling 7 hydropunch borings for a preliminary evaluation of groundwater conditions where visual impacts were observed.

[4] Count includes borings drilled for the monitoring wells installed in 2018 and 2019 because soil was characterized during drilling for the well installations.

- Collecting and analyzing approximately 540 soil samples and 112 groundwater samples for a combination of Target Compound List (TCL) VOCs, TCL SVOCs, Priority Pollutant (PP) metals, Target Analyte List (TAL) inorganics, cyanide, pesticides, and polychlorinated biphenyls (PCBs) to evaluate the nature and extent of environmental impacts in Site media.
- Collecting 21 soil gas samples and one ambient air sample to evaluate the potential for soil VI in future building development.
- Performing sediment probing in the Delaware River and a visual reconnaissance of the shoreline to evaluate nearshore conditions adjacent to the Site.
- Collecting data to support an ecological screening (ES; Section 6).

The test pit, soil boring, monitoring well, hydropunch boring, and soil gas sampling locations are shown on Figure 5. A summary of the laboratory analyses performed on soil samples collected from each soil boring and test pit is presented in Table 1, and a summary of the laboratory analyses performed on groundwater samples collected from each monitoring well and hydropunch location is presented in Table 2.

Sample collection was performed in accordance with PADEP guidelines and Act 2 requirements. The work conducted on the Site was performed in accordance with a site-specific Health and Safety Plan (HASP). The sampling activities, including techniques and analytical testing used to conduct this RI are presented below.

3.1.1 Initial Remedial Investigation Activities (2003-2006)

The Initial RI activities were performed through an iterative process from 2003 through 2006. These activities included the installation of test pits, soil borings, groundwater probes, and monitoring wells and the collection of soil, soil gas, and groundwater samples for laboratory analysis. To obtain data to characterize Site conditions a preliminary test pit and soil sampling program was conducted in March 2003 and additional field investigation activities were conducted from February through March 2005, and July 2005 through March 2006.

During the Initial RI activities, Earth Engineering Incorporated (EEI) also drilled soil borings and excavated test pits to collect soil samples for geotechnical testing. Based upon field observations and/or field instrumentation, select soil samples were also collected during the geotechnical investigation for laboratory analysis for Site-related COCs to aid in the Site characterization.

The components of the Initial RI activities are summarized in the table below.

Table 3-1: Overview of Initial RI Activities

Dates	Consultant	Sample Numbers	RI Activity
March 2003	PS&S	PSSTP-1 to PSSTP-30	Preliminary test pit investigation.
February 2005	EEI and PS&S	PC-B1 to PC-B15	Soil borings for geotechnical testing. Soil samples were collected for laboratory analysis at select locations, based on visible impacts.
February 2005	PS&S	PCTP-01 to PCTP-60	Second test pit investigation.
March 2005	EEI and PS&S	TP-01 to TP-78	Test pits for geotechnical testing. Soil samples were collected for laboratory analysis at select locations, based on visible impacts.
March 2005	PS&S	PCHP-01 to PCHP-07	Hydropunch sampling.
February and March 2005	PS&S	PCSB-01 to PCSB-25	Soil boring investigation.
July and August 2005	PS&S	PCSB-26 to PCSB-60	Additional soil boring investigation.
September 2005	PS&S	PCTP-61 to PCTP-79	Third test pit investigation.
August to October 2005	PS&S	PCMW-01 to PCMW-20S/D	Monitoring well installation.
November 2005 and January/ February 2006	PS&S	PCMW-01 to PCMW-20S/D	Groundwater investigations.
January 2006	PS&S	PCSV-01 to PCSV-22	Soil gas investigation.

The groundwater and soil samples were analyzed by Hampton-Clarke, Veritech Laboratories (Veritech), a PADEP certified laboratory (laboratory certification number #68-463), in accordance with EPA SW-846 methods. Approximately 350 soil samples were collected for laboratory analysis for TCL VOCs, TCL SVOCs, PP Metals, and total cyanide. Approximately 140 of these samples were also analyzed for PCBs and pesticides. A total of 7 groundwater samples from hydropunch borings and 66 groundwater samples from monitoring wells (obtained during two rounds of sampling the 33 monitoring wells) were collected and analyzed for TCL VOCs, TCL SVOCs, PP Metals (total and dissolved), PCBs and pesticides (monitoring well samples only).

Soil gas samples were analyzed by Air Toxics LTD, located in Folsom, California. The laboratory performed analyses via Modified EPA Compendium Method TO-15, plus Naphthalene, using GC/MS in the full scan mode, as well as a Modified American Society Testing and Materials (ASTM) Method D-1946 for methane and fixed gases in air using gas chromatography with flame ionization detector (GC/FID) or gas chromatography with thermal conductivity detector (GC/TCD). Soil gas samples were analyzed in accordance with current methodologies that are consistent with the PADEP Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil Under Act 2 (PADEP 2019; TGM).

Details of the Initial RI fieldwork are provided in the subsections below.

3.1.1.1 Initial Soil Investigation

During the Initial RI activities conducted from 2003 to 2006, surface soil sampling (0 to 2 feet bgs) and a combination of test pits and soil borings to facilitate subsurface soil sampling (>2 feet bgs) were used to evaluate soil conditions. The test pit and soil boring locations are shown on Figure 5. The test pit and soil boring locations where soil samples were collected for laboratory analysis are shown on Figure 6.

Test Pits

The purpose of this test pit program was to:

- Characterize the horizontal and vertical extent of fill across the Site.
- Identify COCs in the various fill areas.
- Identify subsurface utilities that may have been abandoned in-place in former areas of operation.

PS&S conducted a preliminary test pit evaluation in March 2003 during which 30 test pits were excavated in the Former Coke Operations Area and the Fuel Blending Area. The geotechnical investigation involved advancing an additional 78 test pits. Based upon the findings of the initial round, subsequent investigations consisting of characterization and delineation of COCs were implemented. An additional 60 test pits were excavated from February 2005 through March 2005. From August through September 2005, 19 additional test pits were excavated to provide additional Site perimeter characterization data.

Long-reach backhoes were used to excavate test pits to define the depth of the fill areas prior to initiating the boring program. Test pits were located based upon review of Site historical maps, aerial photographs, and previous investigations.

Generally, soil samples were collected from the ground surface (0 to 6 inches) and at the fill and native soil interface (determined based upon visual and physical description). The test pit soil samples were collected using a dedicated polyethylene scoop and placed into laboratory-supplied sample containers. Two soil samples were typically collected from each test pit, although additional samples were collected at some locations based on visual observations.

Soil samples collected from the test pits were handled as follows: (1) screened for volatile organic vapors using a photoionization detector (PID); (2) observed for the presence of staining, discoloration, non-aqueous phase liquid (NAPL), ash, and tar; and (3) logged by a geologist using the Unified Soil Classification System (USCS). The information gathered during the test pit program was documented on test pit logs provided in Appendix D and summarized in Table 3.

Following completion of the test pits and the collection of soil samples, the test pits were backfilled with the excavated material and restored to the original grade. Upon backfilling of the test pits, material that was not retained for laboratory analysis or placed back in the excavation was transferred to a roll-off container and disposed of in accordance with applicable federal, state and local regulations.

Soil Borings

The objectives of the soil boring program were to:

- Supplement the test pit program to further characterize the horizontal and vertical extent of fill material and to investigate the nature and extent of potential impacts to the native soils.
- Characterize the subsurface soils within the Former Coke Operations Area and Fuel Blending Area.
- Characterize Site stratigraphy.
- Identify physical characteristics of the subsurface soils.
- Identify potential physical and Site-related impacts in the Site soils resulting from the former Site operations.

Between February 2005 and October 2005, PS&S advanced a total of 60 soil borings. PCSB-01 to PCSB-25 were advanced in February and March 2005 using a conventional hollow-stem auger (HSA) drill rig and PCSB-26 to PCSB-60 were advanced in July and August 2005 using a GeoProbe direct push rig. Most borings were located within the RCRA Closure Areas, the Former Coke Operation Area, and the Fuel Blending Area. In February and March 2005, the soil borings were advanced through a silt and clay layer and into an underlying sand and gravel layer (between approximately 18 and 50 feet bgs). Three soil borings (PCSB-05, PCSB-13, and PCSB-16) were advanced through the sand and gravel layer and into bedrock. Based on observations from these soil borings, it was concluded that a silt and clay layer was continuous across the Site and acting as a confining unit for subsurface soil impacts. Therefore, soil borings drilled after March 2005 were only advanced into the silt and clay layer (i.e., confining unit). The geotechnical investigation consisted of the advancement of an additional 14 soil borings.

Subsurface soil samples were collected using a decontaminated split-spoon sampler advanced by the conventional HSA drill rig or macro-core liner advanced by the direct-push drill rig. In those instances where the HSA was used to penetrate the sand and gravel layer into the underlying confining unit, steel casing was used to prevent vertical migration of contaminants from the material within the fill layer.

Soil boring locations were selected to supplement the coverage provided by the test pits. The recovered soil samples were handled as follows: (1) screened for volatile organic vapors using a PID; (2) observed for the presence of staining, discoloration, NAPL, ash, and tar; (3) checked for odors; and (4) logged by a geologist using the USCS. The information gathered during the soil boring program was documented on soil boring logs which are contained in Appendix D and summarized in Table 3.

Generally, soil samples were collected from two or more depth intervals from each boring. The depth of the soil samples was based primarily upon field observations (i.e., visual observations, field screening results, etc.) that indicated potential impacts. In general, soil samples were collected at one or more of the above conditions:

- Surficial soils (the upper 0- to 2-foot interval).
- At the bottom of the encountered fill material or at the upper 2-foot interval of the native soils.
- A 6-inch interval (0- to 6-inches) immediately above the water table.

- Immediately above and below the silt and clay confining unit.
- At visually impacted zones and/or elevated PID readings.
- At the completion depth of the boring.

Following completion of the boreholes and the collection of soil samples, the boreholes were grouted to the surface using a cement-bentonite grout. All borings were finished to match pre-disturbance grades. Recovered soil sample material that was not retained for laboratory analysis was placed in a roll-off container and disposed of in accordance with applicable federal, state and local regulations.

3.1.1.2 Initial Groundwater Investigation

During the Initial RI activities, PS&S installed and sampled 20 shallow groundwater monitoring wells and 13 deep groundwater monitoring wells to characterize groundwater quality and evaluate groundwater flow. In addition, seven hydropunch borings were advanced and sampled to evaluate groundwater conditions. The hydropunch borings and monitoring well locations are shown on Figure 7.

Hydropunch Sampling

Following completion of the February and March 2005 test pit and soil boring program, initial groundwater sampling was conducted on March 24 and 25, 2005. A groundwater probe, or hydropunch, was advanced at seven locations in areas where visual impacts were observed during the initial soil investigation. The goal of the hydropunch sampling was to gather groundwater data to identify and generally characterize the constituents present in the shallow groundwater located in the fill above the confining silt and clay layer.

The groundwater samples were collected by driving hydropunch rods to the bottom of the designated sample depth interval and retracting 4 feet of the outer steel casing to expose a decontaminated stainless-steel screen. Actual sample intervals were determined based on observed field conditions (i.e., soil visual observations, soil field screening results, etc.).

The water collected in the sampling rod was poured directly into the laboratory-provided sample containers. The hydropunch rods were decontaminated between each sampling location. Any evidence of odors, sheens, or the presence of NAPL was noted. The observations and results were logged in project field forms. Upon completion of the sampling, each probe hole was left to naturally collapse into itself. All probe holes were restored at grade with the same material that was originally in place.

Monitoring Well Installation

Following completion of the test pit and soil boring phase of the Initial RI activities, a total of 33 monitoring wells were installed from August through October 2005 in accordance with the applicable PADEP Groundwater Monitoring Guidance Manual at the time. The monitoring well locations were located upgradient and downgradient of impacts identified during the soil boring and test pit program and at the property boundaries to serve as "point of compliance" locations. The wells were constructed as either shallow or deep wells based upon their screened depth in relation to the confining unit. The screen interval for shallow groundwater monitoring wells was installed within the fill material above the confining unit, and the screen interval for deep groundwater monitoring wells was installed within the sand and gravel layer below the confining unit.

Of the 33 wells, seven were installed on the riverward portion of the Site and consisted of only shallow wells. The remaining 26 wells were comprised of 13 well clusters, each consisting of a shallow well and a deep well. Shallow wells are generally screened from 1 to 10 feet bgs near the river and from 5 to 15 feet bgs for the remainder of the Site. The deep wells are generally screened below the bottom of the silt and clay layer with a 10-foot screen between 18 and 40 feet bgs, depending on the depth of the silt and clay layer.

The shallow monitoring well construction consisted of 2-inch and 4-inch diameter casings. The 4-inch diameter wells were installed in the riverward portion of the Site. The deep monitoring wells were constructed as double cased wells. Six-inch steel casings were placed approximately 10 feet into the confining clay layer, through the overlying fill material, and grouted in-place. Following a minimum of 24 hours set time, the remaining depth of the boreholes for deep wells was drilled, and the wells were constructed from 2-inch diameter casings. The deep and shallow monitoring well were constructed with polyvinyl chloride (PVC) 20-slot well screens and PVC Schedule 40 casing. Typically, the monitoring well screen length was 10 feet and the casing extended from the top of the screen to grade.

A No. 2-grade sand pack was installed in the annular space from the bottom of the monitoring well screen to approximately one to three feet above the top of the well screen, except for shallow wells where the top of the screen was within one foot of the ground surface. In these shallow wells, the sand pack extends up to the concrete surface seal. A bentonite seal was placed into the annulus above the gravel pack. A bentonite/grout slurry was pumped into the annulus via a tremie pipe, from the top of the bentonite seal to the surface. The monitoring wells were protected and secured with above-grade (“stick-up”) locking steel casings. Well construction details are summarized in Table 4. Monitoring well construction logs are provided in Appendix D.

Following installation, the groundwater monitoring wells were developed by purging with a submersible pump. The development process continued until the turbidity readings were at or below 50 Nephelometric Turbidity Units (NTUs) or a two-hour development period, whichever occurred first. Development water was temporarily containerized onsite in 55-gallon steel drums. After waste characterization, containerized liquids were removed from the Site for proper offsite transportation and disposal.

Soil cuttings generated during the installation of each well were placed into a roll-off container and properly disposed of in accordance with applicable federal, state and local regulations.

Groundwater Sampling

The first round of groundwater sampling from the permanent monitoring wells was conducted approximately two weeks after well development in November 2005. A second round of groundwater sampling was completed in January/February 2006.

The monitoring wells were sampled using a “low-flow” sampling protocol. As part of the protocol, wells were purged at a low pumping rate using a Grundfos Rediflo® submersible pump or peristaltic pump and dedicated tubing. Prior to sample collection, groundwater was circulated through a flow-through cell to record pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential. Following stabilization of the field parameters, groundwater was collected in laboratory-supplied sample containers. In those instances where a peristaltic pump was used to purge the well, the VOC fraction of the sample was obtained using a dedicated bailer. The water level meters, submersible pump, peristaltic pump and flow cell were decontaminated prior to each use. Completed low-flow groundwater monitoring and purge logs are provided as Appendix E.

Water Level Measurements

During the above-identified groundwater sampling events, a complete round of groundwater level measurements was collected from the monitoring wells before sampling. Additional rounds of groundwater level measurements were collected in December 2005 and March 2006. The groundwater level measurement process documented the presence/absence of NAPL and the groundwater depth in each monitoring well. Groundwater depths were measured using a Solinst water level indicator to an accuracy of 0.01 feet. A Solinst oil/water interface probe, cotton string, and disposable bailers were used to determine if any NAPL was present in the monitoring wells. No measurable NAPL was identified during the two rounds of groundwater sampling other than an apparent emulsion at PCMW-05. Groundwater level data is discussed in Section 3.2.2. Water level measurements are presented in Table 5.

Hydraulic Conductivity Testing and Other Soil Physical Parameters

During the RI field program monitoring well installation activities, select soil samples were collected from the three Site strata to obtain the physical characteristics of this material through laboratory testing. Samples were collected in glass containers and Shelby tubes of the fill material, silt and clay layer, and sand and gravel layers. The samples were analyzed in the PS&S geotechnical laboratory for grain size, bulk density, permeability, and porosity. The data for these parameters were used to calculate hydraulic conductivity for each stratum. A copy of the soil physical parameter data is included as Appendix F.

3.1.1.3 Soil Gas Investigation

A total of 21 soil gas samples and one ambient air sample were collected at onsite locations in January 2006. The sampling locations were biased toward areas where visual observations and/or concentrations of VOCs and SVOCs were identified in Site soils and groundwater during the Initial RI activities. The sampling locations were concentrated toward the center, northeast corner, and eastern portions of the Site (see Figure 5 for the sampling locations). Soil gas samples were collected in unsaturated soil (i.e., fill) above the water table. The soil gas sampling locations were biased toward areas where visual impacts and/or elevated VOC or SVOC concentrations were identified in soil and groundwater. However, these locations may not have been ideal for soil gas sample collection because the water table was less than 5 feet bgs and the ground surface was not covered with an impermeable material (e.g., the ground surface at these locations consisted of soil or deteriorated asphalt).

The soil gas samples were obtained using a stainless-steel sampling system that uses driving rods (shaft sections) equipped with a small diameter hollow-tip sampling point (shield point). Teflon tubing was installed to allow extraction of soil gas samples. The shaft sections were driven into the ground to a depth of approximately one foot above the observed groundwater table. Due to the shallow groundwater at the Site, soil gas samples were generally collected at depths less than 5 feet bgs. The probe was then removed, leaving the expendable shield point and tubing in place allowing the collection of the soil gas sample.

The probe hole was sealed with bentonite to prevent intrusion of ambient “surface” air. Prior to the collection of soil gas, a vacuum pump was used to purge the line of ambient air at a rate of 0.1 to 0.2 liters/minute. Continuous or excessive pumping was avoided so that the soil gas would not be diluted with surface air.

Samples were extracted using Summa canisters attached to Teflon sample lines that extend from the shield points. Summa canisters were supplied by Air Toxics Limited (Air Toxics LTD) and evacuated to a vacuum pressure of approximately 30 inches of mercury. The pressure gradient between the vacuum in the canister and the subsurface atmosphere provided the driving force for sample flow and gas collection. The canisters were equipped with flow controllers with an integral vacuum gauge adjusted to provide a nominal one-hour integrated sample collection period (approximately 0.1 liters/minute). A vacuum gauge was used to measure the initial and final vacuum in the canister to document sample integrity. Following sample collection, real-time instrument readings were recorded for the presence of hydrogen sulfide, oxygen, carbon dioxide, and methane.

Soil gas sample integrity was maintained by using experienced field personnel, good sampling techniques, proper sampling equipment, and adequate documentation. Pre- and post-sample vacuum checks conducted in the field and at the laboratory demonstrated that leakage had not occurred before or after sample collection and provided documentation of sample integrity.

A field “replicate” soil gas sample was taken at two locations (one replicate for every 11 samples) to provide an assessment of the compositional consistency of the soil gas samples. One ambient air sample was also taken at a central location (adjacent to PCSV-22) for quality assurance and quality control (QA/QC) purposes.

After sampling was completed, the sample canisters were shipped overnight to Air Toxics LTD, located in Folsom, California for analysis. The laboratory performed analyses via the Modified EPA Compendium Method TO-15, plus Naphthalene, using GC/MS in the full scan mode, as well as a Modified ASTM Method D-1946 for Methane and fixed gases in air using GC/FID or GC/TCD. Analysis of a laboratory blank was performed by the laboratory as an internal QA/QC check.

3.1.2 Supplemental Remedial Investigation Activities (2018-2019)

The SRI Activities were performed in multiple phases from 2018 through 2019 to confirm the results and fill data gaps from the Initial RI work. Activities included additional groundwater and soil investigations, a Delaware River reconnaissance, and sediment probing in the nearshore area adjacent to the Site at low tide. As part of an interim Site review and inspection (performed between the Initial RI and SRI), GEI Consultants Inc. (GEI) performed Site walks on June 21, 2011 and July 12, 2011 to review current Site conditions. For purposes of this report, GEI’s activities are presented together with the SRI Activities in Subsection 3.1.2.4. Most of the supplemental groundwater investigation was performed in 2018, and the supplemental soil investigation and sediment probing were performed in 2019. The components of the SRI Activities are summarized in the table below.

Table 3-2: Overview of SRI Activities

Dates	Sample Numbers	RI Activity
March 2018	MW-5, MW-6, and the 21 available PCMW- wells	Phase 1 groundwater investigation.
May 2018	MW-101 to MW-107, and seven PCMW- wells	Phase 2 groundwater investigation.
August 2018	PCMW-10D, PCMW-15S	Groundwater sampling for free cyanide.
March 2019	MW-107, PCMW-05, PCMW-16D	Groundwater sampling for total metals, dissolved metals, and TDS.
April and May 2019	S-101 through S-162, revisited 28 Initial RI Soil Sampling Locations (suffix “R” added to designate a revisited sampling location)	Phase 1 soil investigation.
April 2019	Not applicable	Delaware River reconnaissance and sediment probing.
September 2019	S-163 to S-173, MW-108 to MW-113, and PCTP-07R	Phase 2 soil investigation. Additional groundwater monitoring well installation.
October 2019	MW-108 to MW-113	Phase 3 groundwater investigation (groundwater sampling).

The groundwater and soil samples were analyzed by SGS North America Incorporated Laboratories of Dayton, New Jersey (SGS), a PADEP certified laboratory in accordance with the EPA SW-846 methods. A total of 186 soil samples were collected and analyzed for a combination of TCL VOCs, TCL SVOCs, TAL inorganics, total or free cyanide, pesticides, and PCBs. A total of 48 groundwater samples were collected and analyzed for a combination of TCL VOCs, TCL SVOCs, TAL inorganics (total and dissolved), total cyanide, pesticides, and PCBs. The laboratory analytical reports are provided in Electronic Attachment 4.

In addition, three groundwater samples were analyzed for free cyanide by TestAmerica, located in Amherst New York. The laboratory performed analyses via EPA SW-846 Method 9016.

3.1.2.1 Supplemental Groundwater Investigation

The supplemental groundwater investigation was performed to:

- Evaluate potential changes to groundwater conditions, if any, since the Initial RI activities and provide additional data to fully characterize the onsite extent of any impacts in Site groundwater (both shallow and deep groundwater zones).
- Help further refine the focus of the soil investigation (e.g., soil sampling targeted where groundwater impacts were observed).

- Fill data gaps that have been identified based on comparison of the Initial RI Activity data to the updated PADEP MSCs.

During the SRI, not all groundwater monitoring wells previously installed as part of the Initial RI or earlier investigations could be found or repaired for use in groundwater sampling. However, the existing wells that were found and the additional wells installed as part of the SRI provide sufficient coverage for evaluating groundwater flow patterns and water quality across the Site.

The first phase (Phase 1) of the SRI groundwater investigation fieldwork was performed between February 26, 2018 and March 23, 2018, and included land surveying, monitoring well integrity surveys, monitoring well redevelopment, water-level gauging, groundwater sampling and analysis, and a storm sewer reconnaissance.

The second phase (Phase 2) was conducted between May 8 and 31, 2018 to fill data gaps from Phase 1, including: (1) where certain previously-installed monitoring wells could not be located and sampled (the wells are considered lost or destroyed); and (2) where there were no previously-installed wells to evaluate conditions (e.g., downgradient from a former soil removal area and in certain areas where Initial RI soil investigation data suggested that residuals may remain).

The third phase (Phase 3) of the SRI groundwater investigation was performed on October 3 and 4, 2019 to evaluate groundwater conditions at: (1) locations where the SRI soil investigation identified a combination of visual impacts (e.g., coal tar-like material) and COCs at concentrations an order of magnitude or higher than potentially applicable PADEP MSCs; and (2) at the Site property boundaries and areas downgradient of Site-related impacts.

Monitoring Well Integrity Surveys and Redevelopment

Arcadis conducted well integrity surveys on February 26 and 27, 2018 to assess the condition of the existing groundwater monitoring wells at the Site (as those wells were installed more than 12 years earlier). Arcadis located 23 of the 33 stickup monitoring wells (wells identified by the prefix “PCMW-”), plus two of the nine monitoring wells that were of “unknown construction” (wells identified with the ID “MW-”). Based on the well integrity surveys, 23 of the 25 identified wells were found to be intact and usable for the groundwater investigation. Monitoring wells PCMW-7 and PCMW-12S were both found, but inspections with a downhole camera revealed that the well screens were damaged and blocked by roots and not usable for groundwater sampling. During Phase 2 investigation activities, the roots in monitoring wells PCMW-7 and PCMW-12S could not be cleared with available drilling equipment without irreparably damaging the wells. The monitoring well integrity survey forms are included in Appendix G.

The locations of the monitoring wells at the Site, with color-coding identifying those that were or were not found, are shown on Figure 7. As indicated by the figure, the usable existing wells in combination with the newly installed wells provided suitable coverage to evaluate the groundwater conditions across the Site.

Arcadis redeveloped existing monitoring wells on February 28, 2018 and March 5, 2018. This included monitoring wells where soft sediment was identified in the bottom of the well and where the measured depth of the well was less than the reported installation depth. Fine sands and silts were observed entering certain wells during redevelopment. The surging portion of the redevelopment process was discontinued at these wells to limit the potential for additional sediment accumulation in the wells.

Monitoring Well Installation

Arcadis installed monitoring wells MW-101 through MW-107 as part of the Phase 2 supplemental groundwater investigation and monitoring wells MW-108 through MW-113 as part of the Phase 3 supplemental groundwater investigation. These newly installed monitoring wells are in the shallow groundwater (water table) aquifer and screened within the fill material above the confining unit.

Phase 2 groundwater wells were installed from May 14 to 16, 2018 to provide coverage in the following areas of the Site:

- Where impacts were previously identified but the corresponding monitoring wells could not be located during the Phase 1 RI groundwater investigation.
- Downgradient from areas where Initial RI soil investigation data suggests that residuals may remain (e.g., soil containing NAPL and/or elevated concentrations of PAHs).
- Downgradient from a former soil removal area and near or along part of the property boundary where groundwater quality had not previously been evaluated.

Monitoring wells installed during the SRI to replace initial RI monitoring wells are identified in the table below.

Table 3-3: Replacement Wells

Initial RI Monitoring Well	Replacement Well	Notes on Location
PCMW-14S	MW-101	Slightly downgradient of PCMW-14S.
PCMW-13S	MW-103	Upgradient of PCMW-13S. Approximately hallway between PCMW-13S and PCMW-14S.
PCMW-16S	MW-105	In immediate vicinity of PCMW-16S.
PCMW-02	MW-106	In immediate vicinity of PCMW-02.

Phase 3 groundwater wells were installed on September 24 and 25, 2019 to provide coverage in and downgradient from areas where Site-related impacts were identified in soil and groundwater conditions were unknown.

The soil boring for MW-101 was advanced using conventional HSA drilling method, and soil samples from the boring were collected using a 2-foot-long, 2-inch-outside-diameter, split spoon sampling device. Based on the soil conditions observed at MW-101, Arcadis determined that using direct-push techniques would achieve good soil recovery and increase investigation efficiency. Therefore, soil borings for the remainder of the monitoring wells were advanced using the direct-push method and associated soil samples were continuously collected using a 5-foot macro-core liner. After the direct-push borings were completed, the borings were over-drilled using the HSA drilling method to enable installation of monitoring wells. This change was accomplished "on-the-fly" (without delay) using a drilling rig equipped with tooling for both methods. Monitoring well installation and boring logs are included in Appendix D.

The new groundwater monitoring wells were constructed using 2-inch-diameter Schedule 40 PVC pipe with a 0.010-inch slotted screen. The top of the screen was positioned approximately 1 foot above the water table, with the filter pack extending 1 foot above the top of the screen, a 1-foot thick bentonite seal above the filter pack, and at least 4 feet of solid PVC pipe extending below the ground surface. Screen lengths varied depending on the thickness of saturated shallow soil above the confining unit. The wells were protected at the surface using a 4-inch steel "stick-up" casing with a locking cap. The protective casings extend approximately 2.2 to 2.5 feet above ground surface and were set in concrete. Monitoring well construction details are presented in Table 4.

Soil Sampling

Soil samples recovered from the monitoring well borings were handled as follows: (1) screened for volatile organic vapors using a PID; (2) inspected for the presence of staining, odor, discoloration, NAPL, ash, and tar; and (3) characterized by a geologist (i.e., via soil classification by the USCS). The information gathered during the soil boring program was documented on soil boring logs which are contained in Appendix D and summarized in Table 3. Soil samples were collected from the borings during installation of MW-102, MW-103, MW-108, and MW-111 for laboratory analysis for the following reasons:

- MW-102 – A sample was collected to characterize a white plaster-like material that was encountered in the soil sample.
- MW-103 – Soil samples were collected at the water table and at the interface of the fill and silt and clay layer to evaluate soil conditions near sampling location PCTP-75 (adjacent to Buckius Street) where soil from 10-12 feet bgs was previously characterized (during Initial RI) as having an oil-like material and found to contain high concentrations of naphthalene.
- MW-108 and MW-111 – Soil samples were collected where the presence of coal tar-like material was observed and at the first interval without visual impacts or odors.

Soil samples were analyzed for TCL VOCs, TCL SVOCs, and TAL inorganics (including cyanide). The soil samples from MW-102 and MW-103 were also characterized for PCBs and pesticides.

Groundwater Sampling

Arcadis collected groundwater samples using low-flow methods on the following dates and at the following locations:

- *March 19 to 23, 2018* – groundwater samples were collected from the 23 monitoring wells that were found to be intact and usable during well surveying.
- *May 29 to 31, 2018* – groundwater samples were collected from monitoring wells MW-101 through MW-107, PCMW-04, PCMW-05, PCMW-06, PCMW-08S, PCMW-09S, PCMW-16D, and PCMW-19S.
- *July 27, 2018* – groundwater samples were collected from PCMW-10D and PCM-15S.
- *March 28, 2019* – groundwater samples were collected from MW-107, PCMW-05, and PCMW-16D.
- *October 4, 2019* – groundwater samples were collected from MW-108 through MW-113.

Field parameters (pH, conductivity, dissolved oxygen, temperature, turbidity, and oxidation-reduction potential) were monitored every five minutes during purging. After turbidity levels decreased to below the

50 NTU goal (where possible) and parameters stabilized, groundwater samples were collected for laboratory analysis. Groundwater sampling logs are included in Appendix E.

The groundwater samples collected in March 2018, May 2018, March 2019, and October 2019 were submitted to SGS Accutest of Dayton, New Jersey where they were analyzed as follows:

- Each groundwater sample was analyzed for TAL inorganic constituents, including total cyanide, except the May 30, 2018 groundwater sample collected from PCMW-16D.
- Each 2019 groundwater sample was analyzed for dissolved inorganics.
- March 2018, May 2018, and October 2019 groundwater samples were analyzed for TCL VOCs and TCL SVOCs.
- Each 2018 groundwater sample was analyzed for PCBs and pesticides.
- Select 2019 samples were analyzed for TDS.

The May 30, 2018 groundwater sample from PCMW-16D and the July 27, 2018 groundwater samples from PCMW-10D and PCMW-15S were submitted to Test America of Amherst, New York where they were analyzed for free cyanide. The free cyanide analysis was performed to evaluate the fraction of free cyanide present in the total cyanide concentration previously identified in samples from the respective wells. A sampling summary identifying each monitoring well and the corresponding sampling dates and laboratory analyses is presented in Table 2.

Water Level Measurements

Arcadis collected three synoptic rounds of groundwater level measurements on the following dates: (1) March 19, 2018 from 8:30 to 10:00 am, finishing approximately at low tide; (2) May 29, 2018 from approximately 9:00 to 11:00 am finishing approximately one hour after low tide; and (3) October 3, 2019 from 9:00 am to 1:00 pm finishing at low tide. Groundwater level measurements referenced to the North American Vertical Datum of 1988 (NAVD 88) are presented in Table 5. Groundwater potentiometric surface maps developed for the shallow and deep zones (for the above dates) are shown on Figures 8 through 12.

The groundwater flow patterns are consistent with those observed during the Initial RI activities. As indicated by Figures 8 through 10, shallow groundwater mounds in the central/southern portion of the Site and flows radially outward from the mound in all directions. As indicated by Figures 11 and 12, groundwater flow in the deep zone is eastward, toward the Delaware River.

3.1.2.2 Storm Sewer Reconnaissance

Existing site mapping shows a large City storm sewer identified as the “Upper Delaware Collecting Sewer” (reportedly 11-foot-3-inch to 12-foot-3-inch diameter) extending across the western portion of the Site, from the intersection of Bath Street with Orthodox Street to the south and Buckius Street to the north. The Upper Delaware Collecting Sewer conveys regional storm water deep beneath the Site. The sewer does not collect any storm water from the Site. The depth and construction of this sewer and the potential interaction (if any) between the sewer and shallow groundwater (whether groundwater may be infiltrating into the sewer, or the sewer may be leaking) were unknown prior to conducting the Phase 1 groundwater investigation.

Arcadis identified a manhole in the western portion of the Site (MH-4) within the approximate alignment of this sewer as shown on site mapping. The manhole location is approximately 175 feet south of the intersection of LeFevre Street and Garden Street, as shown on Figure 7. Arcadis observed a wire extending down in the manhole. Aboveground, the wire appeared to extend from MH-4 toward a nearby power pole with an elevated control box. The power pole is labelled, “Philadelphia Water Department, CSO Site, H07”. Downhole camera photos of MH-4 are shown below.

Figure 3-1: Downhole Photos of MH-4

Water was observed in the manhole at a depth of 26.5 bgs (equivalent to negative 13.29 feet NAVD 88). Groundwater elevations beneath the Site within the vicinity of the Upper Delaware Collecting Sewer range from approximately positive 6 to 8 feet NAVD 88, which is approximately 19 feet above the water level in the sewer. Based on this large head difference and as indicated in the existing shallow zone potentiometric surface maps, the Upper Delaware Collecting Sewer appears to have little or no influence on groundwater flow patterns at the Site. Accordingly, any groundwater collected by the sewer would be negligible.

3.1.2.3 Supplemental Soil Investigation

The supplemental soil investigation was performed to:

- Confirm that soil conditions have not changed since the Initial RI data were collected (i.e., that the existing data continue to be representative) and that Initial RI analytical data are still usable for developing the conceptual site model (CSM) and site cleanup plan.
- Delineate known impacted areas to assist in defining the limits of potential cleanup activities.

- Evaluate the elevation of the silt and clay confining unit to further assess the migration potential of any dense non-aqueous phase liquid (DNAPL) in the shallow/water table aquifer.
- Investigate soil conditions along the property boundary to evaluate the potential for offsite migration of site-related constituents or DNAPL.

The first phase (Phase 1) of the soil investigation fieldwork was performed between March 25 and May 3, 2019, and included land surveying, subsurface utility clearance, soil borings, and test pit installation.

The second phase (Phase 2) was conducted between September 19 and 25, 2019 to fill data gaps from Phase 1, where: (1) soil exhibited a combination of visual impacts (e.g., coal tar-like material) and COCs at concentrations an order of magnitude or higher than potentially applicable PADEP MSCs; and (2) data for nearby locations were insufficient to evaluate extent of the impacted soil requiring removal/in-situ treatment.

Soil samples were collected from soil borings or test pits, depending on the purpose of each sampling location, and submitted for laboratory analysis. Soil borings were used more frequently to achieve sampling depths to the confining unit. Test pits were used in locations where subsurface structures were expected and where a broader evaluation of shallow subsurface soil was desired.

Soil Borings

Arcadis advanced a total of 80 soil borings during Phase 1 and a total of 12 soil borings during Phase 2. These numbers are in addition to the soil borings drilled to install monitoring wells MW-101 through MW-113. To confirm Initial RI soil analytical results, approximately 10% of the Initial RI soil sampling locations were revisited and sampled. In total, 25 soil borings revisited previous soil sampling areas, 21 of which were originally test pit sampling locations. Revisited sampling locations were selected to: (1) provide spatial coverage across the site; and (2) represent a range of conditions (e.g., highest concentrations, medium concentrations, and lowest concentrations, with approximately equal focus on each concentration range). Revisited sampling locations were also selected to provide site-wide information on the elevation of the confining silt and clay layer.

Soil borings were drilled into the silt and clay layer using direct-push methods. Soil samples were continuously collected from the borings using a 4-foot-long, 1.5-inch-inside-diameter macro-core sampling device. Recovered soil samples were visually characterized (for color, texture, and moisture content) and were screened using a PID. The presence of visible impacts (e.g., tar-like material, sheens) and obvious odors encountered in the soil were documented. The information gathered during the soil boring program was documented on soil boring logs which are contained in Appendix D and summarized in Table 3.

One or more soil samples were collected from 86 of the soil borings drilled for laboratory analysis. Selection of soil samples for laboratory analysis was primarily based on visual observations and data from nearby Initial RI sampling locations. The proposed sample depths were generally selected for laboratory analysis following one of the scenarios below:

- *Scenario 1* – For revisited sampling locations, samples were collected at approximately the same depth intervals as the Initial RI samples. As needed, additional samples were collected from these locations based on visual observations and at the discretion of the onsite geologist overseeing the work (e.g., if the geologist observed visual impacts, obvious odors, or elevated PID readings not previously documented at the sampling location).

- *Scenario 2* – For sampling locations where visible staining, tar-like material, obvious odors, or elevated PID readings were identified, one sample was collected from the “worst-case” sampling interval and a second sample was collected from the first apparent “clean” interval underlying the impacted materials.

- *Scenario 3* – For perimeter sampling locations where no visible staining, NAPL, obvious odors, or elevated PID readings were identified, one surface soil sample (0-0.5 feet bgs) and one shallow subsurface soil sample (0.5-2 feet bgs) were collected for laboratory analysis.

- *Scenario 4* – If the scenarios above did not apply, two samples were collected from depths selected based on nearby Initial RI sampling locations and identified data gaps.

Soil samples were not collected from below the water table (as identified by saturated soil in the soil boring) for the Phase 2 soil investigation.

Soil samples collected for laboratory analysis were generally analyzed for TCL VOCs, TCL SVOCs, and TAL inorganics including cyanide, except as indicated:

- Samples from S-101 through S-104 were only analyzed for TCL VOCs and SVOCs.
- Samples from S-138 through S-140 were only analyzed for PCBs.

Surface soil samples from PCSB-30R, PCSB-41R, and PCTP-73R and revisited sampling locations from the Initial RI’s PSSTP- series were also analyzed for PCBs and pesticides. A summary of the laboratory analyzes performed in soil from each soil boring is presented in Table 1.

Test Pits

Arcadis excavated nine test pits during Phase 1 of the supplemental soil investigation. No test pits were excavated during Phase 2. To confirm Initial RI soil analytical results, three of the test pits were excavated at revisited sampling locations, one of which was originally a soil boring location.

Test pits were excavated using a rubber-tire backhoe. Soil excavated from each 2-foot depth interval was visually characterized (for color, texture, and moisture content) and screened using a PID. The presence of visible impacts and obvious odors encountered in the soil was documented. The information gathered during the test pit excavations is documented on the logs included in Appendix D and summarized in Table 3.

One or more soil samples were collected from eight test pits for laboratory analysis. Selection of soil samples for laboratory analysis was primarily based on visual observations and data from nearby Initial RI sampling locations and in general, followed the same sampling scenarios as the soil borings.

Soil samples collected for laboratory analysis were generally analyzed for TCL VOCs, TCL SVOCs, and TAL inorganics including cyanide, except one of two soil samples from S-142 (i.e., from 6-6.5 feet bgs) was only analyzed for cyanide because of the potential presence of purifier waste. An underlying sample from S-142 (7-8 feet bgs) was analyzed for TCL VOCs, TCL SVOCs, and TAL inorganics including cyanide. Additionally, soil samples from PCSB-26R and PCTP-66R were analyzed for PCBs and pesticides. A summary of the laboratory analyzes performed in soil from each soil boring is presented in Table 1.

3.1.2.4 Delaware River Reconnaissance and Sediment Probing

To evaluate potential impacts from the Site to the Delaware River, Arcadis performed reconnaissance activities along the shoreline adjacent to the Site. Initial evaluations of the shoreline were performed on March 25 and April 8, 2019. Additional evaluations of the shoreline were performed on May 3 and November 12, 2019. During these site visits, the shoreline was assessed for sheens, tar-like material, elevated PID readings, or other observable indications of Site-related impacts, and the current shoreline conditions were photo-documented during the low tide.

The shoreline was found to contain a rubble-armored seawall (i.e., riprap-like material), two dilapidated piers, and a narrow sandy/gravel area. Additionally, a shopping cart, three submerged vehicles, and other trash were observed along the shoreline. From reconnaissance conducted along the tidal shoreline habitat at low tide, no visible impacts (e.g., sheens) to sediment were observed.

Arcadis evaluated potential habitat for the northern red-bellied cooter during a November 12, 2019 site visit. The northern red-bellied cooter had been identified by the Pennsylvania Fish and Boat Commission (PFBC) as a threatened species in the area of the Site. Arcadis did not encounter prime habitat for the red-bellied cooter or any rare plant or wildlife communities. Observations indicated limited basking habitat areas along the near-shoreline tidal areas.

Arcadis visually assessed and surveyed Outfall 001 south of the southernmost pier and a potential transfer pipe on north side of northern pier. GEI had also assessed Outfall 001 during its Site walks and found no impacts. Outfall 001 is constructed of concrete and approximately two feet in diameter. At low tide the pipe is fully exposed, except where it is silted in with surrounding sand, gravel, and debris. The potential transfer pipe is constructed from steel and approximately 8 to 12 inches in diameter. This pipe is level with the top of the pier and is not expected to be submerged at any point of the tidal schedule. No discharges were observed during Arcadis' or GEI's Site visits. A photograph of Outfall 001 at low tide is shown as Figure 3-2. No site-related environmental impacts were observed at Outfall 001.

Figure 3-2: Outfall 001

Sediment probing was performed on the shoreline adjacent to the Site on May 3, 2019 during low tide. Probing was done from south of the northernmost pier to the southern property boundary and extended approximately 20 feet from the shore into the Site. Probing was performed approximately every 2 feet in this area to evaluate the presence of any sheens, seeps, or other indications of Site-related impacts. The sediment was soft and silty. A metal rod was commonly advanced 3 to 4 feet in the sediment and at some locations up to 5 feet into the sediment. No oil-like sheens, elevated PID readings, or noticeable odors were observed. Volatile organics were not detected (i.e., PID readings were 0.0 parts per million [ppm]) at these film locations. Based on the probing observations, sediment was not further evaluated.

3.1.3 Fish and Wildlife Evaluation

Arcadis performed a fish and wildlife evaluation to support the development of the Ecological Screening (Section 6). The evaluation generally consisted of the following three parts:

- An onsite wetland delineation.
- A formal review of the Site from Pennsylvania Department of Natural Resources (PADNR) in conjunction with United States Fish and Wildlife Service (USFWS) in response to a request from Arcadis in the form or a Pennsylvania Natural Diversity Inventory (PNDI) receipt submitted on October 3, 2019.
- An onsite habitat delineation.

Findings of the fish and wildlife evaluation are provided in Section 6.1.

3.1.4 Decontamination

Sampling equipment was decontaminated before implementing sampling, probing, and drilling activities and between boring locations. Excavation and drilling equipment, including augers and split spoon samplers, were decontaminated using a steam cleaner or hot water pressure washer over a temporary decontamination pad or 55-gallon drum. Non-dedicated sampling equipment was decontaminated between each use by steam cleaning and/or thoroughly washing with alconox and water, using a brush to remove particulate matter or surface film, followed by a thorough rinsing with tap water. Liquids generated from the decontamination process were pumped into 55-gallon steel drums and disposed of in accordance with federal, state and local regulations.

3.1.5 Air Monitoring

During the Initial RI, a PID, quad gas meter and dust monitor (data RAM) were used to monitor volatile organic vapors, hazardous vapors and soil particulates, respectively, in the breathing zone during ground intrusive activities. During field activities that used the HSA drilling method or during test pit excavation activities, calibrated air monitoring instruments were also employed to monitor for potential releases of VOCs and dust at upwind and downwind air monitoring stations. The monitoring instruments were calibrated on at least a daily basis. Equipment calibration was documented in the project field forms and instrument calibration logs. The results of the perimeter air monitoring showed no exceedances of VOC levels or levels of particulate matter with a diameter less than 10 microns as a result of the ground intrusive activities.

Based on the observations during the Initial RI activities, monitoring during the SRI was conducted only in the worker breathing zone for volatile organic vapors using a PID. Perimeter air monitoring was not performed during the SRI. No elevated PID readings were observed in the work breathing zone.

3.1.6 Surveying

During the Initial RI activities, the locations, measuring point and surface elevations of test pits, new monitoring wells, soil probes/borings, and groundwater probes were either surveyed by a licensed surveyor or documented using a field global positioning system (GPS) unit and placed on a georeferenced base map. Top of casing and associated ground surface elevations were surveyed. These data were used in determining groundwater elevations.

Arcadis's survey subcontractor, Paul James Olszewski, PLS, PLLC (PJ Olszewski), established three semi-permanent survey control points at the Site relative horizontally to the North American Datum of 1983 State Plane of Pennsylvania-South (NAD 83) State Plane of Pennsylvania-South and vertically to NAVD 88. Each semi-permanent survey monument was tied into at least three planimetric features. Using the semi-permanent survey control points, PJ Olszewski resurveyed the located monitoring wells that remained from the Initial RI. The top of outer casing, top of inner casing, and ground surface elevations for each groundwater monitoring well were surveyed relative to NAVD 88. PJ Olszewski also surveyed the horizontal location and rim elevation of the Upper Delaware Collecting Sewer manhole MH-4 and subsurface piping and structures encountered at the Site. The horizontal location and ground surface elevation of each soil sampling location were also surveyed relative to NAD 83 and NAVD 88. The groundwater monitoring well, soil boring, test pit, MH-4, and subsurface pipe coordinates and elevations are presented in Table 6.

Before implementing the supplemental soil investigation, PJ Olszewski laser-scanned four preliminary soil delineation areas and associated building foundation areas. Laser technology measures distance with laser "time of flight" and then verifies the space with "wave technology" to generate a point cloud of data that is subsequently overlain by high-definition black and white photographs. The combination of the technologies and smart software tools allows for survey quality measurements of an entire area. The scanned areas were selected based on review of the Initial RI activities. Laser scanning technologies provided detailed survey ("point cloud" data) of the primary areas of interest at the Site in areas where the most significant impacts were suspected to be present. The survey and site photographs were used to evaluate/select SRI sampling locations based on surface condition, vegetation density, and proximity to remaining site features.

Arcadis used a handheld Trimble Geo 7X GPS to survey water and wetlands boundaries. A handheld Trimble R1 GPS was used to survey other points of ecological interest, Outfall 001, and the potential intake pipe.

3.1.7 Data Management and Quality Control

The data quality objective was to obtain valid data to be used to determine the nature, extent and sources of COCs at the Site. For the SRI, the QA/QC samples were collected in accordance with the most recent version of National Grid's generic Field Sampling Plan/Quality Assurance Project Plan. In addition, Arcadis performed a Tier 2 validation for each sample delivery group. Findings of the validation process are documented in the Data Usability Summary Reports included in Appendix H.

To document data quality in the soil and groundwater analyses, several types of QA/QC measures were implemented. QA/QC samples were collected (field blanks, matrix spikes and matrix spike duplicates) at a rate of 1 per 20 environmental samples (soil and groundwater). Trip blanks accompanied shipments of water samples that required volatile organic analysis. Samples for organic analyses were spiked with surrogate and/or internal standard compounds in order to determine the integrity/reliability of the sample results.

To determine the comparability of the sample results, matrix spikes and matrix spike duplicates were analyzed. In addition, specific laboratory QA/QC measures were taken during analysis (i.e., calibrations, blanks, control samples, spiked blanks, etc.), as required by the analytical methods.

3.1.8 Waste Management

All investigation-derived waste was contained onsite for waste characterization before offsite disposal. Soil cuttings, personal protective equipment (PPE), and spent disposable sampling materials were segregated by waste type and placed in United States Department of Transportation- (USDOT-) approved 55-gallon steel drums. Decontamination water, purged groundwater, and drilling water was stored in 55-gallon drums.

During the SRI Activities, a total of 13 drums of non-hazardous liquids (consisting of purge, decontamination, and well-development water), 5 drums of non-hazardous solids (consisting of drill cuttings, decontamination pad materials, and probe liners), and 4 drums of lead-hazardous soil mixture (EPA waste code D008) were generated. Drums were managed and removed from the Site under the direction of National Grid’s Waste Management subcontractor, Capital Environmental.

3.2 Remedial Investigation Findings

This section presents the findings of the RI activities described in Section 3.1. Visual impacts, PID headspace readings, and laboratory analytical results are used together to form a “weight of evidence” to evaluate Site-related impacts and cleanup requirements. A discussion of regional geology in the vicinity of the Site is presented below, followed by a discussion of the Site geology and hydrogeology, distribution of visual impacts, and sampling results for soil, groundwater, and soil vapor.

3.2.1 Physical Setting and Geology

The Site is situated on the westernmost margin of the Atlantic Coastal Plain Physiographic Province. The Coastal Plain is a narrow strip of land in southeastern Pennsylvania. The entire area is about 45 miles long and up to five miles wide and runs parallel to the Delaware River. Most of the Coastal Plain deposits are sand, gravel, silt and clay, which drape over crystalline igneous and metamorphic rocks. The Coastal Plain deposits range in thickness from a thin film at edge of the Coastal Plain to over 6,000 feet beneath the mouth of Delaware Bay (PADEP 2001).

The Site is within the Lower Delaware River Watershed (Hydrologic Unit Code 02040202), which encompasses approximately 1,151 square miles. The watershed is primarily characterized as urban, industrial, and agricultural lands. The region is characterized by sands and gravels storing large quantities of water with extensive streams and wetlands present. Precipitation is primarily adsorbed through direct infiltration processes into surface soils or absorbed through root uptake by vegetation. As mentioned in Section 2.1, vegetation cover exists throughout a large portion of the Site, and limits potential for dust generation or migration to downgradient areas.

According to the Soil Survey of Bucks and Philadelphia Counties (USDA 1975), soil in the vicinity of the Site is characterized as Urban Land. Areas characterized as Urban Land are often so disturbed by construction that identification is not practical. Native soils are typically displaced by fill material during construction activities. Subsurface investigations confirm the presence of substantial fill materials above native soils at the Site. Fill materials consist of cinders, metal, glass, brick, concrete rubble, coal, ash, and cinders comingled with varying amounts of sand and gravel. The fill material at the Site generally meets the definition of historic fill described in Pennsylvania Department of Environmental Protection's Management of Fill Policy (Document #258-2182-773) dated January 1, 2020. The fill material at the Site ranges in thickness from approximately 10- to 20-feet and is thickest in the northeast portion of the Site. In general, the fill thickness decreases from north to southeast, where it pinches out near the Delaware River. The regional geography near the Site is shown on Figure 13.

An organic-rich silt and clay layer underlies the fill material beneath the entire Site. The silt and clay layer was the original land surface prior to filling and development of the area and was likely deposited in a flood-plain/marshy area of the Delaware River. The silt and clay ranges in thickness from approximately 5- to 45- feet and is thickest in the eastern portion of the Site, near the Delaware River. This confining unit was determined to be the separation between the shallow and deep groundwater at the Site and for practicable purposes prevents the movement of groundwater between the shallow and deep groundwater zones at the Site.

Fine-to-coarse sand and gravel of the Pennsauken Formation is observed beneath the silt and clay. Only two Site borings (PCSB-05 and PCSB-16) penetrated the sand and gravel unit, and the thickness of the sand and gravel at these locations was approximately 40 and 60 feet bgs, respectively. Weathered metamorphic schist (saprolite) of the Wissahickon Formation was observed at PCSB-05 and PCSB-16 at approximately 70 and 85 feet bgs, respectively. A cross-section location map and two geologic cross-sections are provided on Figures 14 through 16.

3.2.2 Hydrogeology

Regional groundwater generally flows from the northwest to the southeast, toward the Delaware River. Groundwater elevation data at the Site was measured on October 31, 2005, December 30, 2005, January 30, 2006, March 14, 2006, March 19, 2018, May 29, 2018, and October 3, 2019. The March 14, 2006 data include groundwater elevation data collected during both high and low tides in the Delaware River to assess tidal influence on the shallow and deep groundwater at the Site. The monitoring conducted to date does not indicate a tidal influence on the Site other than at select deep monitoring well locations where levels change by generally less than 1 foot between low and high tides. The groundwater measurements are presented in Table 5. Groundwater contour maps for the shallow and deep groundwater are shown on Figures 8 through 12.

Three hydrostratigraphic units exist at the site: the fill, silt and clay, and sand and gravel. Hydrostratigraphic units are defined based on formations that have similar hydraulic properties. The water table is encountered in the urban/historic fill unit across the site at depths of approximately 2- to 12- feet bgs. Based on regional groundwater information, this shallow groundwater zone is a perched aquifer that was created by the placement of fill over the native silt and clay layer. Composition of this aquifer is expected to be heavily influenced by the urban/historic fill, and therefore, the groundwater is not suitable for use. As shown on Figures 8, 9, and 10, groundwater in the fill is mounded in the central/southern portion of the Site and flows radially outward from the mound. The horizontal hydraulic gradient in the fill is approximately 0.005 to 0.01, depending on location. It appears that flow in the fill is largely controlled by the topography of the underlying silt and clay. That is, where the silt and clay unit has a higher topographic relief, the water table is also higher in elevation. A small amount of groundwater is expected to leak downward and into the silt and clay unit, as demonstrated by a downward hydraulic gradient that exists between the fill and sand and gravel of approximately 0.27. The hydraulic conductivity of the fill ranges from approximately 1.47×10^{-4} to 2.93×10^{-3} centimeters per second (cm/sec)[5].

Groundwater flow within the silt and clay is expected to be minimal due to its low permeability. The hydraulic conductivity of the silt and clay is calculated to be approximately 8.76×10^{-8} to 1.38×10^{-7} cm/sec. Flow within this unit is both horizontal and downward into the sand and gravel.

The potentiometric surface within the sand and gravel of the deep aquifer zone is observed at approximately 9- to 17-feet bgs. The deep aquifer is the primary groundwater aquifer for the Philadelphia region. Groundwater elevations in the sand and gravel do not appear to vary as much as those in the fill, likely because of hydraulic connection with the Delaware River. As indicated by Figures 11 and 12, groundwater in the sand and gravel flows eastward, toward the Delaware River. The horizontal hydraulic gradient in the sand and gravel is approximately 0.002. The sand and gravel is the most permeable hydrostratigraphic unit beneath the site and has a hydraulic conductivity of 2.73×10^{-3} to 1.79×10^{-1} cm/sec.

3.2.2.1 Local Wells and Groundwater Use Around the Site

Per the Philadelphia Water Department Records, residents around the Site consume city water. However, according to the Pennsylvania Groundwater Information System (accessed via the internet on October 13, 2020), there are a total of 65 groundwater wells within a ½-radius around the Site boundaries. Groundwater wells within a ½-mile radius around the Site boundaries are shown on Figure 13 and local well details are presented in Appendix I. Per well type, the number of local wells around the Site are as follows:

- 55 Unused/Abandoned/Destroyed Wells
- 6 Groundwater Monitoring Wells
- 1 Unknown Withdrawal Well
- 1 "Domestic Withdrawal Well"
- 2 Other Withdrawal Wells

A total of 38 of the 65 wells around the Site are directly related to the environmental investigation and cleanup efforts at the former Rohm and Haas Chemical Company Facility (Pennsylvania Facility ID 742771 and NIR number 61614). This facility is approximately 1/3 mile north of the Site. Three monitoring wells, the two "other withdrawal wells", and the one "unknown withdrawal well" appear to be directly related to the former Rohm and Haas Chemical Company environmental investigation and cleanup.

The one "domestic well" located near the Site is also listed as a monitoring well. This well is located on 3099 Orthodox Street immediately south of the Site at a facility with an active environmental cleanup (Facility ID 609536). This well appears to be related to a former diesel spill from a UST (Pennsylvania Notification of Contamination Form number 33352). For this reason, it is likely that the well is only used for monitoring.

[5] Hydraulic conductivity values were calculated based on slug test data reported by WCC (WCC 1986) and laboratory soil testing results reported by PSS.

The cluster of wells on the south side of Orthodox Street (immediately south of the Site) appear to be related to an environmental cleanup effort for USF Holland Inc (Pennsylvania Facility IDs 608210/832196 and NIR number 69661).

In conclusion, groundwater around the Site is not used for potable purposes and groundwater wells installed around the Site are generally only used for environmental investigations and clean-ups.

3.2.3 Visual Observations / Headspace Readings

Soil samples collected from soil borings and test pits underwent visual inspection and field screening with a PID. The observed Site-related impacts were characterized by degree of impact. For purposes of characterizing visual observations in the soil, three categories are used to describe the observed impacts as follows (ordered from most impacted to least impacted):

- *Viscous tar or oil-like material* – Viscous or tacky substance that is in a liquid or partially liquid phase. Viscous tar or oil-like material was sometimes observed throughout the soil sample and in the pore space around soil granules. The magnitude of the observed tar was also described (e.g., coated, stringers or blebs).
- *Solidified tar or tar-like material* – Residual tar or similar material that is in a semi-solid to solid phase.
- *Sheen* – Soil and/or groundwater exhibiting an iridescent or rainbow petroleum-like sheen.

Based on the three categories above, 118 of the 377 test pits and soil borings exhibit visual impacts from former Site operations. Visible staining was observed in soil from an additional 15 sampling locations, and soil from three of these locations had bluish-green staining commonly associated with potential purifier waste. However, cyanide analytical results did not indicate the presence of purifier wastes (cyanide concentrations ranged from 0.11 to 20 mg/kg at locations with bluish-green staining, and these values are each below applicable MSCs). Pockets of viscous tar or oil-like material were observed in 20 test pits and soil borings. Solidified tar or tar-like material was observed in 43 test pits and soil borings. Sheens were observed in soil from 77 test pits and soil borings. Odors were noticed at approximately 135 test pits and soil borings. Field observations are summarized in Table 3. Photographs of soil sampling intervals collected from the SRI are included as Electronic Attachment 5.

The Site-related visual impacts were predominately encountered within the central portion of the Site surrounding the Former Coke Operations Area and structures (i.e., former tar storage area, former by-products building and former oxide boxes). Isolated areas of visual soil impacts were encountered at locations on the remainder of the Site. The observed visual impacts in the central portion of the Site were generally associated with the former process piping and foundations, except for impacts found near the former AST farms, east of Former Byproducts Building (later in this RI Report referred to as Area 4). Table 3 summarizes the impacts encountered at the soil boring and test pit locations and identifies the general area of the site where each boring/test pit was completed. Additionally, the extent of Site-related visual impacts and the designated color scheme representing the three categories above (e.g., viscous tar or oil-like material, solidified tar or tar-like material, and sheen) are shown on Figure 17.

Occurrences of viscous tar or oil-like material are limited to the central portion of the Site surrounding the Former Coke Operation Area, except at the following locations: PCSB-01, PCTP-66, PCTP-75, PSSTR-04R, and S-151. The quantity of viscous tar or oil-like material was not well documented during the Initial RI. For the SRI, viscous tar was generally only observed as stringers or blebs, except at sampling locations PCTP-17R, S-160, and S-161 where lenses of coal-tar like material were encountered in available pore space. Sampling locations with viscous tar or oil-like material have been revisited, and viscous tar or oil-like material in surrounding soil has been delineated. Viscous tar or oil-like material in the center of the Site have also been delineated.

Visual impacts are limited to the fill layer or the top two feet of the silt and clay layer, except at soil boring location PCTP-17R near the Former Tar Holders where visual impacts were observed 8 feet into the silt and clay layer. Based on observations at PCSB-09 (located approximately 30 feet northeast of PCTP-17R), the silt and clay layer is approximately 25 feet thick at PCTP-17R. Both PCSB-09 and PCTP-17R are shown on cross-section A-A' (Figure 15). If visual impacts were encountered in a soil boring, the soil boring was advanced to at least the first "clean" interval where no visual impacts or odors were observed. No impacts were observed penetrating the confining silt and clay layer. Within the fill layer, the depths of the visual impacts ranged from surface soils to the bottom of the layer (up to 22 feet bgs) depending on location. Odors were noted at depths up to 26 feet bgs.

For the revisited sampling locations, the visual observations from the SRI Activities are generally consistent with or indicate lesser degree of impacts than those originally documented during the Initial RI activities. In total, seven sampling locations where PS&S observed viscous tar or oil-like material were revisited, and Arcadis only confirmed the presence of this material at one location (PCTP-17). In addition, Arcadis encountered viscous tar or oil-like material at a revisited sampling location (PSSTP-04R) where PS&S did not observe this impact during the Initial RI Activity. The variation between locations where viscous tar and oil-like material were observed during the Initial RI and SRI indicate that viscous tar and oil-like material is not as extensive and/or contiguous as the Initial RI indicates. Therefore, locations with viscous tar and oil-like material are likely limited in size and were not reproduceable.

Generally consistent observations of solidified tar, staining, and sheens were observed between original and revisited sampling locations. For the revisited sampling locations, the reported top of clay surface depths (when encountered) were generally within 1 to 3 feet of that reported for the original boring, except for PCTP-10 and PCTP-32 where the clay surface depths are reported with an 8-foot and 10.5-foot difference, respectively (neither of these locations exhibit viscous tar or oil-like material). In addition, the reported groundwater depths at each soil sampling location were generally reported within 1 to 4 feet from Initial RI and SRI activities. The difference in observations from the Initial RI and SRI Activities is potentially due to a combination of factors, including the potential difference in sampling method (test pits vs. soil borings), survey discrepancies[6], changes in location because of access issues (e.g., because of vegetation or terrain), difference in precipitation and infiltration at the time of sampling, and interpretation of conditions by different onsite geologists. To help distinguish between the SRI and the Initial RI sample locations, the SRI sample locations are shaded in gray on Table 3, and the SRI data for a revisited sampling location is presented immediately after the Initial RI data.

PID headspace readings greater than zero ppm are also presented in Table 3. Figure 17 also indicates locations where PID headspace readings are greater than or equal to 100 ppm. Although there is no regulatory screening value for PID readings, the observations are used in conjunction with visual impacts

[6] A horizontal datum was not referenced during the Initial RI activities. When revisiting the sampling locations, Arcadis used the horizontal coordinates available in PS&S notes and from their existing Geographic Information System map.

to gather a “weight of evidence” of Site-related impacts to inform the Site cleanup and redevelopment plan. Additional information about the PID readings is provided below.

A total of 12 sampling locations with visual impacts also had volatile organic vapors at concentrations greater than 100 ppm. However, PID headspace readings greater than 100 ppm were also encountered at 13 sampling locations where no visual impacts were observed. The highest PID readings were encountered at PCSB-01R which is in the northeast-most corner of the Site. At this location, the PID identified volatile organic vapors greater than 15,000 ppm (instrument maximum) from 16 to 17 feet bgs. The elevated PID readings immediately dropped to 23.1 ppm at the next interval. The initial interval with an elevated PID reading at PCSB-01R was from 14 to 15 feet bgs at 111.8 ppm. Initial RI PID Readings from PCSB-01 peaked at 1,050 ppm from 14.5 to 15 feet bgs. The second highest PID reading was observed at SRI boring location S-144 (458.9 ppm from 14 to 15 feet bgs) which is a step-out delineation boring beyond PSCB-01R, and the third highest PID reading was observed at PCSB-45 (349.2 ppm) which is in the Fuel Blending Area where URS encountered fuel oil impacts in 2001.

3.2.4 Soil Quality Evaluation

This section summarizes the quality of surface and subsurface soil at the Site based on the analytical results for the soil samples collected during the RI.

Approximately 540 soil samples were collected from the 150 soil borings and 145 test pits completed as part of the RI activities. Up to five soil samples were collected from a soil boring or test pit. As described in Section 3.1, soil samples were submitted for laboratory analysis for a combination of VOCs, SVOCs, inorganics including cyanide, pesticides, and PCBs.

For the purposes of evaluating the soil analytical results, the results have been compared to the following PADEP Statewide Heath Standards (SHS) established in Title 25 of the Pennsylvania Code Chapter 250, Administration of the Land Recycling Program:

1. The non-residential direct contact MSC for surface soil (if appliable).
2. The non-residential direct contact MSC for subsurface soil (if appliable).
3. The soil-to-groundwater MSCs for a non-residential used aquifer with TDS less than or equal to 2,500 ppm. The higher of the 100 X groundwater MSC or generic value is used. However, groundwater is not used for potable purposes at the Site and in the surrounding area.

These SHS are potentially applicable to the Site given the anticipated current and future site use. The property is currently zoned as industrial, and as indicated in the Cleanup Plan, the property will be deed restricted to non-residential use only. Please note, that the soil results are compared to VI screening values in Section 3.2.6.

A separate evaluation of the applicability of the Toxic Substances Control Act (TSCA) PCB regulations to PCBs identified in soil at the Site was submitted to the EPA on May 12, 2021, and EPA’s response is provided in a July 8, 2021 letter to Arcadis (refer to Appendix J for copies of the evaluation and EPA’s response). As indicated by EPA’s response, EPA agrees that PCBs identified in soil samples collected at the Site, except in the southeast corner (Historic Tar Plains/Fill Area), are related to pre-April 1978 release(s) and are therefore not regulated under TSCA. PCBs in soil will be addressed in accordance with the Cleanup Plan contained in Section 9 of this document and a self-implementing cleanup plan for the TSCA-regulated soils in the southeast corner that will be submitted to EPA in accordance with 40

CFR 761.61. The cleanup method to be used for the southeast corner (PCB-containing soils) will be the same as that used for other areas of the Site (i.e., capping and deed restriction).

To make the soil analytical results more manageable, the attached data tables (Tables 7 through 13) separate the soil analytical results into surface soils, unsaturated subsurface soils, and saturated subsurface soils. A soil sample was considered saturated if its elevation was below the higher of either: (1) the groundwater elevation encountered in the soil boring and test pit; or (2) the groundwater surface elevation from the highest potentiometric surface map (January 30, 2006 for Initial RI samples and March 2018 for SRI samples). Therefore, the saturated soil dataset also includes soil samples collected from the anticipated capillary fringe area. Surface soil analytical results for detected constituents are presented in Tables 7 and 8, and sampling locations with results exceeding the non-residential direct contact MSCs are highlighted on Figure 18. Subsurface soil analytical results for detected constituents are presented in Tables 9 through 12. Table 13 presents a statistical summary table for the soil analytical data.

Additionally, detail figures are provided for four areas of the Site where the sampling density is high (delineation areas) as follows:

- ***Area 1:*** *Eastern Part of Former Coal Storage Area*. Sampling locations PCTP-75 and PSSTP-04 where revisited and environmental impacts around these locations were delineated. Additionally, Arcadis installed four new monitoring wells in this area (MW-103, MW-108, MW-109, and MW-110).
- ***Area 2:*** *North/Northwest of Former Tar Storage Area*. Environmental impacts in soil around the Former Tar Storage Area have been delineated. Additionally, sampling locations PCTP-12 and PCTP-17 were revisited.
- ***Area 3:*** *South of Former Tar Storage Area*. Sampling locations PCTP-66 and TP-15 were revisited and environmental impacts around these locations were delineated.
- ***Area 4:*** *Former AST Farm East of Former Byproducts Operations*. Environmental impacts in soil near the former AST farm have been delineated. Sampling location TP-63 was revisits. Additionally, Arcadis installed three new monitoring wells in this area (MW-111 through MW-113).

The four above-identified areas are shown in Figure 19, and sampling locations with visual impacts in those areas are highlighted on Figures 20 through 23.

For the PSSTP- test pit series, please note that the sample IDs with the …A and …B suffix originate from the same sampling location and just represent different depth intervals (e.g., PSSTP-01A was a surface or shallow soil sample and PSSTP-01B was a subsurface sample collected from test pit sampling location PSSTP-01).

During the Initial RI activities, PS&S labelled the blind duplicate samples with “fake” sample IDs. Arcadis could not identify a key or table linking the duplicate samples with their associated parent samples. However, it appears that, in general, PS&S labelled the duplicate samples with a “2” in front of the parent sample ID (e.g., the parent for PCTP-260 (0.5) is PCTP-60 (0.5)). However, in some cases, the sample depth does not match that of the parent sample. In these cases, the blind duplicate data are not presented with a parent sample, the duplicate is not associated with a sample location in this RI Report’s figures, and the duplicate is counted as a separate sample but not a separate sampling location when presenting statistics[7]. Duplicate sample IDs without parent samples are limited to only the following: PCTP-214 (7.5), PCTP-236 (7), and TP-278 (9).

3.2.4.1 Surface Soil Analytical Results

A total of 104 surface soil samples from 102 sampling locations[8] were collected and analyzed for VOCs, SVOCs, and inorganics. In addition, 93 samples were also collected for pesticides analysis, and 101 samples were collected for PCB analysis. For sampling locations S-138 through S-140, soil samples were only analyzed for PCBs (two samples from each boring for a total of six samples). Surface soil samples were generally collected throughout the Site, but with a higher density of samples from the Fuel Blending Area. Pesticides and PCBs were not detected in surface soil at concentrations greater than non-residential direct contact or soil-to-groundwater MSCs. Therefore, the discussion of surface soil analytical results below focuses on VOC, SVOCs, and inorganics. The locations of surface soils and associated MSC exceedances are shown on Figure 18.

Surface Soil Analytical Results for VOCs

No VOCs were detected in surface soil at concentrations greater than the non-residential direct contact MSCs. Other than benzene, no VOCs were detected in surface soil above the non-residential soil-to-groundwater MSC. Benzene was detected at a concentration greater than the 0.5 mg/kg soil-to-groundwater MSC at only three locations (PCTP-66 [0.5 feet bgs], PSSTP-22 [1-2 feet bgs], and S-113B [1-3 feet bgs]). The highest benzene concentration identified in surface soil was 29 mg/kg in the sample from PCTP-66 located in the southwest corner of the Site. As part of the SRI Activities, PCTP-66 was revisited and surrounded by delineation sampling locations. Benzene was not detected in the surface soil sample from PCTP-66R or surface soil samples from the four delineation sampling locations (S-119 through S-122). Benzene concentrations at the other two locations (PCTP-22A in the center of the Site and S-113B in Area 2) were both below 1 mg/kg. VOCs in soil around both locations have been delineated.

Surface Soil Analytical Results for SVOCs

SVOCs were not detected at concentrations greater than the non-residential direct contact MSCs or the non-residential soil-to-groundwater MSCs in surface soil samples from 84 of 102 sampling locations. At the remaining 18 sampling locations, several PAHs common in urban/historic fill were generally detected at concentrations slightly higher than non-residential direct contact MSCs. Of these 18 sampling locations, 9 sampling locations contained PAH concentrations exceeding the non-residential soil-to-groundwater MSCs.

BaP concentrations exceeding direct contact MSCs were encountered at each of the 18 surface soil sampling locations where MSC exceedances were identified. At 10 of the 18 locations, there were no other SVOCs besides BaP exceeding the MSCs. At 5 of those 18 locations, BbF was the only other SVOC besides BaP exceeding the MSCs.

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[7] During statistical discussions in this RI Report, duplicate samples with identified parents are counted as one sample.
[8] Location count does not include sampling locations S-138 through S-140 where soil samples were only analyzed for PCBs.

Multiple PAHs were identified at concentrations exceeding MSCs in surface soil collected from sampling locations PCTP-66 (0.5 feet bgs), PCTP-68 (0.5 feet bgs), and S-163 (0.5-2 feet bgs). BaA, BaP, BbF, dibenz(a,h)anthracene, and indeno(1,2,3-cd) pyrene were identified as COCs. The highest PAH concentrations were identified at location PCTP-66 in the southwest corner of the Site. As indicated above, PCTP-66 was revisited during the SRI. BaA, BaP, BbF, and dibenz(a,h)anthracene were detected in the surface soil sample collected from PCTP-66 at concentrations up to two orders of magnitude greater than non-residential direct contact MSCs. PAHs in soil around PCTP-66 were delineated during the SRI. Solidified tar was found on a cobble at PCTP-66R. Only BaP and BbF were detected at concentrations exceeding MSCs in the surface soil sample collected from PCTP-66R. Additionally, No SVOC were detected at concentrations exceeding MSCs from the delineation soil samples around PCTP-66.

PAH concentrations from PCTP-68 and S-163 are an order of magnitude less than those detected in PCTP-66. PCTP-68 is located in the center of the Site, and S-163 is located in Area 2. PAHs in soil around both locations have been delineated.

Surface Soil Analytical Results for Inorganics

Inorganic constituents were not detected at concentrations greater than non-residential direct contact MSCs in surface soil from 81 of 102 sampling locations. Arsenic and lead were the most frequently detected inorganic constituents encountered at concentrations greater than MSCs in surface soil. Arsenic MSC exceedances in surface soil appear to be randomly distributed across the Site. Lead MSC exceedances in surface soil are mostly located in the Fuel Blending Area and at select locations in the center of the Site. Arsenic and lead impacts do not appear to be collocated with one another.

Arsenic concentrations in surface soil exceed the 61 mg/kg non-residential direct contact MSC at 13 sampling locations and the 29 mg/kg soil-to-groundwater MSC at 22 sampling locations. The highest arsenic concentrations are 170 mg/kg at PSSTP-30A, 120 mg/kg at PCTP-70, and 105 mg/kg at S-120. Outside these locations, arsenic concentrations are 100 mg/kg or less.

Lead concentrations in surface soil exceed the 1,000 mg/kg non-residential direct contact MSC at 12 sampling locations and the 450 mg/kg soil-to-groundwater MSC at 30 sampling locations. The highest lead concentrations were identified in surface soil samples collected from the Fuel Blending Area. The highest lead concentrations are 14,000 mg/kg at PCSB-36 (0.5 feet bgs), 6,200 mg/kg at PCSB-55 (0.5 feet bgs), and 5,400 mg/kg at PCSB-44 (0.5 feet bgs). Outside of the Fuel Blending Area, lead concentrations exceeding non-residential direct contact MSCs were only identified at two sampling locations: PCTP-78 (just west of the utility corridor at 1,100 mg/kg) and PSSTP-22 (near the middle of the Site at 1,130 mg/kg). Although lead concentrations may exceed the soil-to-groundwater MSCs, lead was not detected in any filtered groundwater samples at concentrations greater than the 5 µg/L residential and non-residential MSC.

Mercury is the only other inorganic that exceeds the 10 mg/kg soil-to-groundwater MSC. Mercury only exceeds the soil-to-groundwater MSC in surface soil collected from PCSB-06 (17 mg/kg), which is located in the Fuel Blending Area. Mercury was not identified in any groundwater samples at concentrations greater than the 2 µg/L residential and non-residential groundwater MSC.

3.2.4.2 Subsurface Soil Analytical Results

In total, subsurface soil samples from 285 sampling locations were analyzed for a combination of VOCs, SVOCs, inorganic constituents, pesticides, and PCBs. The sample count includes 39 sampling locations where both saturated and unsaturated soil samples were collected.

In the unsaturated zone, 77 subsurface soil samples from 75 sampling locations were collected and analyzed for VOCs, SVOCs, and inorganics. Of those 77 samples, 17 samples were also analyzed for pesticides and PCBs.

In the saturated zone, 354 subsurface soil samples from 249 sampling locations were collected and analyzed for VOCs and SVOCs. Of those 354 samples, 349 samples were also analyzed for metals, and 59 samples were analyzed for pesticides and PCBs.

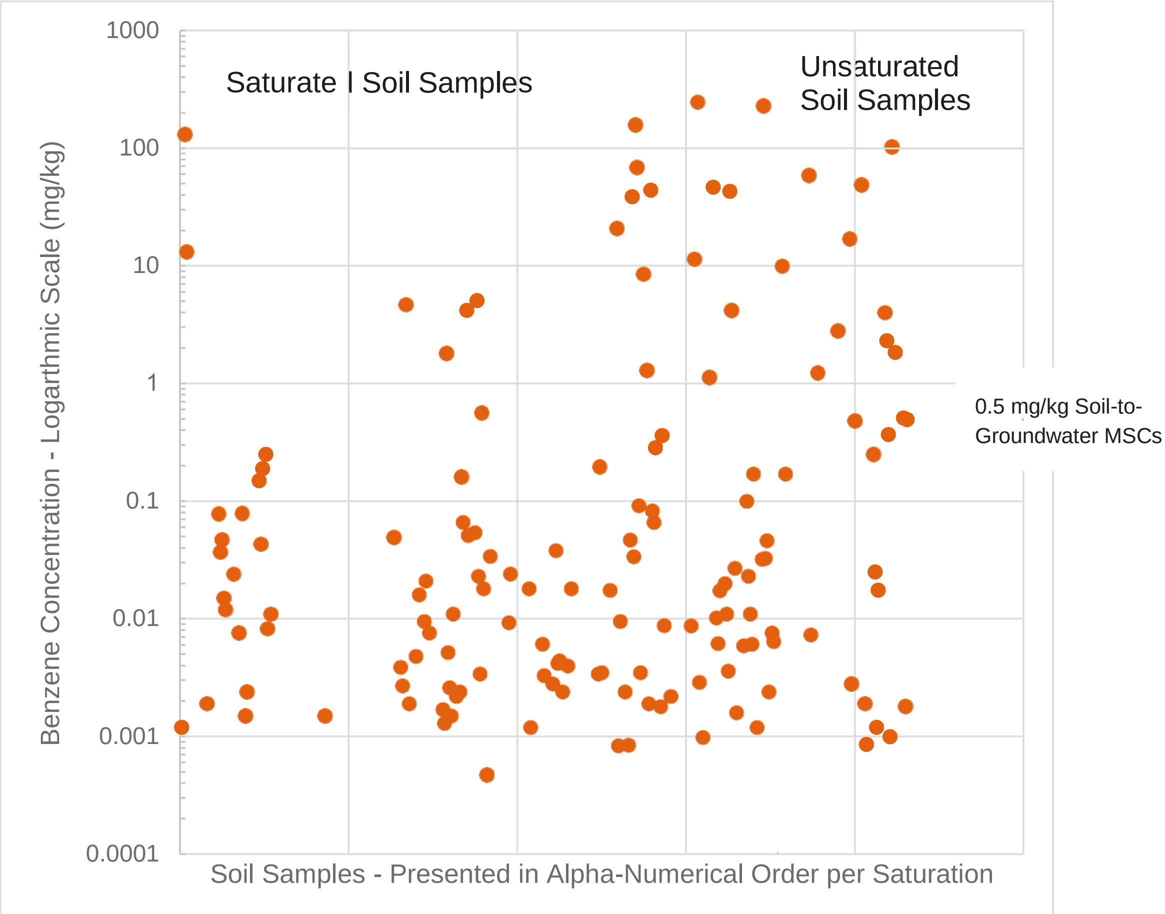
No constituents were detected at concentrations exceeding the non-residential direct contact MSCs for subsurface soil. Similar to surface soil samples, pesticides and PCBs were not detected at concentrations exceeding the non-residential soil-to-groundwater MSCs. Therefore, the discussion of subsurface impacts below focuses on VOCs, SVOCs, and inorganic results exceeding non-residential soil-to-groundwater MSCs.

Subsurface Soil Analytical Results for VOCs

VOCs were not detected at concentrations greater than the non-residential soil-to-groundwater MSCs in subsurface soil samples from 254 of 285 sampling locations. From the remaining 31 subsurface soil sampling locations, several VOCs were detected at concentrations greater than the soil-to-groundwater MSCs in 11 unsaturated and 23 saturated soil samples (three sampling locations contained both unsaturated and saturated soil samples with VOCs exceeding the MSCs). Benzene was the only VOC detected in unsaturated soil at concentrations greater than the corresponding MSC. In saturated soil, benzene was detected at a concentration exceeding the MSC at each location that exhibited a VOC exceedance, except S-122 (Area 3B) and TP-33 (Former Coke Operations Area) where dichloromethane was the only VOC detected at a concentration greater than MSCs.

In general, subsurface soil sampling locations with higher concentrations of benzene also had higher concentrations of other VOCs. The highest benzene concentrations were detected in saturated soil in Area 4 (Former AST Farm East of Former Byproducts Operations): 247 mg/kg at S-155 (10-12 feet bgs), 230 mg/kg at TP-63 (8 feet bgs), and 157 mg/kg at S-125 (7 to 9 feet bgs). The highest benzene concentration in unsaturated soil is 103 mg/kg at S-161 from 5 to 7 feet bgs (also in Area 4). The distribution of benzene concentrations in unsaturated and saturated subsurface soil is shown on Figure 3-3 below. TP-63 had the most VOCs detected at concentrations greater than MSCs and S-155 had the second most VOCs detected at concentrations greater than MSCs. Viscous tar or oil-like material was observed at both locations (blebs at S-155; the quantity of viscous tar at TP-63 was not documented). TP-63 and S-155 are both located within Area 4. The viscous tar or oil-like material in Areas 4 has been delineated as part of the SRI Activities.

Figure 3-3: Distribution of Benzene Concentrations in Subsurface Soil Samples



Note: Data are presented in logarithmic scale on y-axis. Each sample where benzene was detected is represented by an orange dot. As illustrated above, most data are below the S-GW MSC for benzene of 0.5 mg/kg.

Chlorobenzene, dichloromethane, ethylbenzene, styrene, and toluene exceedances in saturated subsurface soil are collocated with benzene, except as noted above. Locations where each of these VOCs was found to exceed the corresponding soil-to-groundwater MSCs are summarized below:

- Chlorobenzene concentrations exceeded the 10 mg/kg MSC in subsurface soil samples from three sampling locations (S-125 [47.5 and 19 mg/kg], S-155 [40.7 mg/kg], and TP-63 [53 mg/kg]).
- Dichloromethane concentrations exceeded the 0.5 mg/kg MSC in subsurface soil samples from five sampling locations (PCTP-42 [0.91 mg/kg], PCTP-46 [1.2 mg/kg], S-122 [0.829 mg/kg], TP-15 [1.8 mg/kg], and TP-33 [3.2 mg/kg]).
- Ethylbenzene concentrations exceeded the 70 mg/kg MSC in subsurface soil samples from three sampling locations (PCTP-42 [180 mg/kg], S-155 [76 mg/kg], and TP-63 [140 mg/kg]).
- Styrene concentrations exceeded the 24 mg/kg MSC in subsurface soil samples from two sampling locations (MW-111 [29.5 mg/kg] and TP-63 [47 mg/kg]).

- The toluene concentration exceeded the 100 mg/kg MSC in the subsurface soil sample from one sampling location (TP-63 [140 mg/kg]).

No other VOCs were detected in subsurface soil at the Site at concentrations exceeding the non-residential soil-to-groundwater MSCs. Chlorobenzene, dichloromethane, ethylbenzene, styrene, and toluene were not detected in any groundwater samples at concentrations greater than applicable residential and non-residential groundwater MSCs.

Subsurface Soil Analytical Results for SVOCs

SVOCs were not detected at concentrations greater than the non-residential soil-to-groundwater MSCs in subsurface soil samples from 238 of 285 sampling locations. From the remaining 47 subsurface soil sampling locations, SVOCs were detected at concentrations greater than the soil-to-groundwater MSCs in 15 unsaturated and 35 saturated soil samples. Naphthalene was detected in subsurface soil at a concentration exceeding the MSC at each sampling location that exhibited an SVOC MSC exceedance, except locations PCTP-22 and TP-16 where BaP was the only SVOC detected at a concentration greater than the MSC.

In general, locations with higher naphthalene concentrations also had higher concentrations of other SVOCs. To evaluate the variability and magnitude of SVOC results, it is helpful to compare the total PAH concentrations[9]. Sampling locations exhibiting the highest total PAH concentrations are within the four delineation areas (Areas 1 through 4). Additionally, the SRI sampling results indicate that PAH concentrations at these locations are at least an order of magnitude less than the Initial RI results. Viscous tar or oil-like material was commonly observed at locations with elevated PAH concentrations.

Subsurface Soil Analytical Results for Inorganics

Inorganic constituents were not detected in subsurface soil samples from 174 of 281 sampling locations at concentrations greater than non-residential soil-to-groundwater MSCs. Similar to surface soil analytical results, arsenic and lead were the inorganic constituents most frequently detected in subsurface soil at concentrations greater than MSCs. In addition, antimony, cyanide, mercury, nickel, and selenium were detected at select sampling locations (three or fewer separate sampling locations for each constituent) at concentrations greater than the non-residential MSCs. Arsenic concentrations greater than MSCs in subsurface soil are distributed across the Site. Lead concentrations greater than MSCs in subsurface soil are mostly located in the Fuel Blending Area and at select locations elsewhere onsite. Arsenic and lead impacts do not appear to be collocated with one another. Antimony, cyanide, mercury, nickel, and selenium were detected at concentrations greater than MSCs at subsurface sampling locations where lead was generally also detected at concentrations greater than the MSC, but these constituents are not collocated among themselves.

Arsenic concentrations exceed the 29 mg/kg soil-to-groundwater MSC at 76 sampling locations (8 unsaturated samples and 70 saturated samples). The highest detected arsenic concentrations are 170 mg/kg at S-105 from 2 to 4 feet bgs (unsaturated), 140 mg/kg at PCSB-30 at 2 feet bgs (unsaturated), and 140 mg/kg at PCTP-19 at feet bgs (saturated). The distribution of arsenic concentrations in

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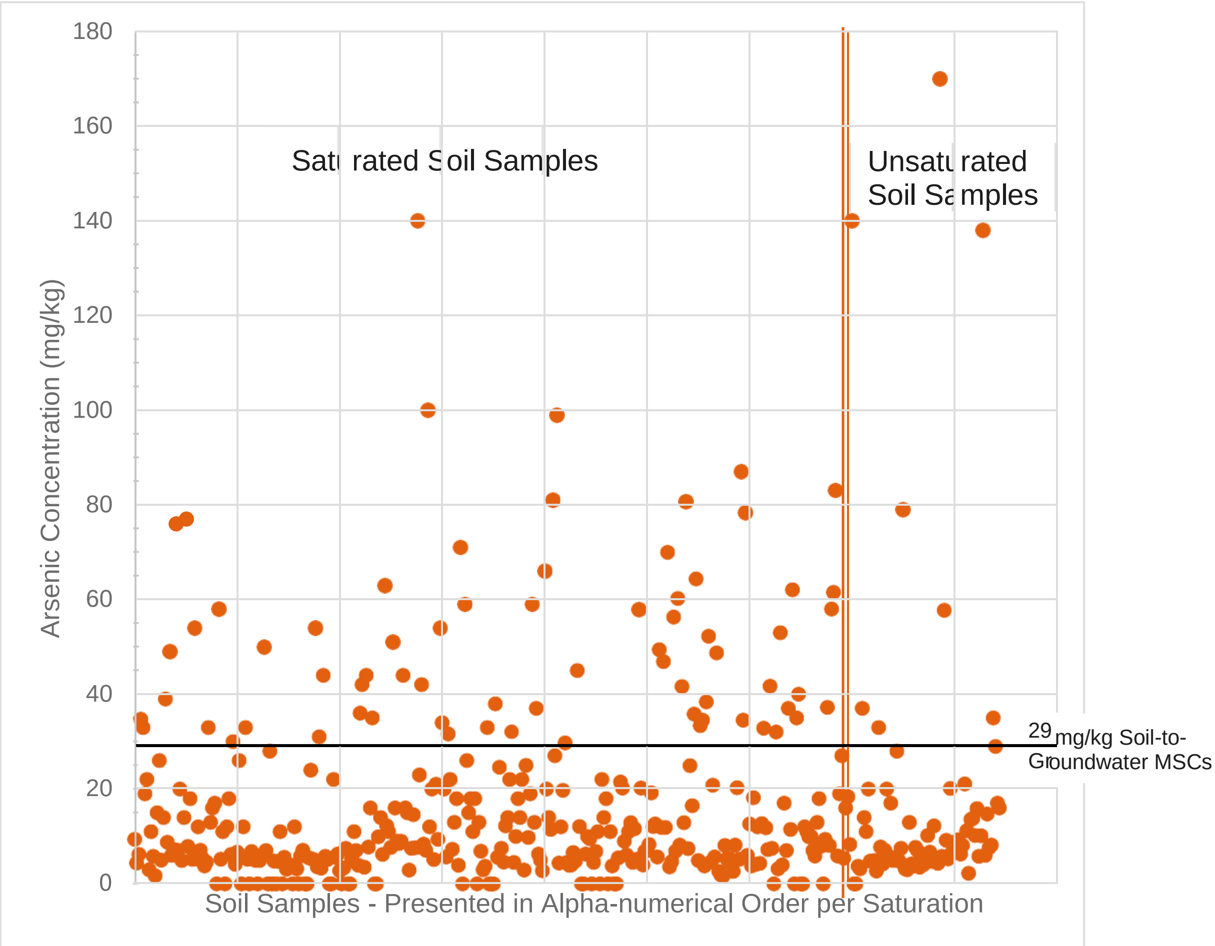
[9] For purposes of this RI Report, total PAH is considered the sum of EPA 16 priority pollutant PAHs and 2-methylnaphthalene.

subsurface soil is shown on Figure 3-4 below. Arsenic impacts appear to be randomly distributed across the Site.

Figure 3-4: Distribution of Arsenic Concentrations in Subsurface Soil Samples



Note: Each sample is represented by an orange dot. As illustrated above, most data are below the S-GW MSC for arsenic of 29 mg/kg.

Lead concentrations exceed the 450 mg/kg soil-to-groundwater MSC at 58 sampling locations (14 unsaturated samples and 45 saturated samples). The highest detected lead concentrations are 62,000 mg/kg at PCTP-28 at 7 feet bgs (saturated), 26,000 mg/kg at PCSB-08 at 10.5 feet bgs (saturated), and 9,600 mg/kg at TP-44 at 4 feet bgs (unsaturated). PCTP-28 and PCSB-08 are located in the center of the Site. TP-44 is located in the Fuel Blending Area. Sampling locations PCTP-28 and TP-44 were revisited during the SRI. Lead concentrations at PCTP-28R did not exceed the soil-to-groundwater MSC. Lead concentrations at TP-44R exceeded the soil-to-groundwater MSC at one of three sampling intervals (2,840 mg/kg at 5-7 feet bgs). As discussed in Section 3.2.5, lead was not detected in any filtered groundwater samples at concentrations greater than the 5 µg/L residential and non-residential MSC.

Antimony, cyanide, mercury, nickel, and selenium exceedances are summarized below:

- Antimony concentrations exceeded the 27 mg/kg MSC in subsurface soil samples from three sampling locations (PCTP-09 [92 mg/kg], PCTP-12 [33 mg/kg], and PCTP-41[34 mg/kg]).
- Cyanide concentrations exceeded the 200 mg/kg MSC in subsurface soil samples from three sampling locations (PCTP-12 [340 mg/kg], PCTP-17 [670 mg/kg], and TP-64 [789 mg/kg]). No other inorganic constituents were detected in subsurface soil from TP-64 at concentrations greater than MSCs.
- The mercury concentration exceeded the 10 mg/kg MSC at one location (31 mg/kg at PCTP-68).
- The nickel concentration exceeded the 650 mg/kg MSC at one location (2,480 mg/kg at PSSTP-04R).
- The selenium concentration exceeded the 26 mg/kg MSC at one location (29 mg/kg at PCSB-30).

No other inorganic constituents were detected in subsurface soil at the Site at concentrations greater than the non-residential soil-to-groundwater MSCs. Cyanide (free), mercury, and selenium were not identified in any groundwater samples at concentrations greater than the applicable residential and non-residential MSC.

3.2.4.3 Comparison of Initial RI and SRI Results for Revisited Sampling Locations

Similar to the outcome of the visual characterization comparison between the Initial RI and SRI soil samples (which showed fewer visual impacts in SRI soil samples), laboratory analytical results show that most of the revisited sampling locations had lower concentrations than those identified at the original sampling locations, sometimes by an order of magnitude or more. Therefore, the Initial RI data may be biased (i.e., potentially focusing on small blebs or pockets of impacted material and not representing overall conditions at the sampling location). Considered alone, the Initial RI data likely over-predicts the magnitude of Site-related impacts as the impacts were often not reproduced in the revisited sampling locations. However, the site-wide distributions of soil impacts are generally consistent between the Initial RI and SRI results, and the overall site model is unchanged by the SRI data.

The differences in concentrations from the Initial RI and SRI Activities are potentially due to a combination of factors, including survey discrepancies, location adjustments because of access issues (e.g., due to vegetation or terrain), natural attenuation/degradation processes, and selection of soil samples by different onsite geologists (different bias). Additionally, Initial RI concentrations may be higher than SRI concentrations because the majority of the initial RI subsurface soil samples were collected from test pits instead of borings, and test pits may expose more potentially impacted soil for sample selection.

3.2.4.4 Soil Investigation Conclusion

In total, 104 surface and more than 430 subsurface samples were collected for laboratory analysis to characterize the nature and extent of Site-related impacts. The number and density of samples is more than sufficient to complete delineation of the Site COCs and advance the project into cleanup.

No surface or subsurface samples exceed the non-residential direct contact or soil-to-groundwater MSCs for pesticides and PCBs. Therefore, cleanup activities will be focused on areas where the VOC, SVOC, and inorganic concentrations exceed MSCs.

Constituents in surface soil exceeding non-residential direct contact MSCs are limited to select SVOCs, arsenic, and lead. The SVOC and arsenic concentrations found in surface soil are typical of urban/historic fill, except SVOC results at surface soil sampling location PCTP-66 which was resampled during the SRI. SVOC impacts in surface soil around PCTP-66 have been delineated. SVOC impacts in surface soil at PCTP-66 are collocated with solidified tar or tar-like material. Surface soil containing lead concentrations greater than non-residential direct contact MSCs are in the Fuel Blending Area and at two locations in the center of the Site. COCs in surface soil are listed in Table 3-4 below.

Table 3-4: Soil Constituents in Surface Soil Exceeding Non-Residential Direct Contact MSCs

Analyte	CAS Number	Direct Contact Exceedance Frequency
Semi-Volatile Organic Compounds		
Benz(a)anthracene	56-55-3	3/104
Benzo(a)pyrene	50-32-8	18/104
Benzo(b)fluoranthene	205-99-2	8/104
Benzo(k)fluoranthene	207-08-9	2/104
Chrysene	218-01-9	1/104
Dibenz(a,h)anthracene	53-70-3	3/104
Indeno(1,2,3-cd)pyrene	193-39-5	3/104
Naphthalene	91-20-3	2/104
Metals		
Arsenic	7440-38-2	13/104
Lead	7439-92-1	12/104

No constituents were identified in subsurface soil at concentrations exceeding non-residential direct contact MSCs for subsurface soil. The subsurface soil sampling locations exhibiting the highest VOC and SVOC concentration also have the highest benzene and naphthalene concentrations. The highest VOC concentrations in subsurface soil are in Area 4 and the highest SVOC concentrations in subsurface soil are in the four delineation areas (Areas 1 through 4). Elevated VOC and SVOC concentrations are typically collocated with visual impacts (e.g., pockets of viscous tar, oil-like material, and solidified tar). VOC and SVOC concentrations have been delineated. Similar to surface soil findings, arsenic and lead are the primary inorganic COCs in subsurface soil. Additionally, groundwater is characterized throughout the Site (as discussed in Section 3.2.5), and many of the constituents detected in soil at concentrations greater than the S-GW MSC were not detected in groundwater samples at concentrations greater than applicable residential and non-residential groundwater MSCs. This includes the following constituents: chlorobenzene, dichloromethane, ethylbenzene, styrene, toluene, 1,1-biphenyl, 2-methylnaphthalene, 4-methylphenol, anthracene, fluoranthene, fluorene, phenanthrene, phenol, pyrene, cyanide, lead, mercury, and selenium. The COCs in surface and subsurface soil are identified in Table 3-5 below.

Table 3-5: Soil Constituents Exceeding Non-Residential Soil-to-Groundwater MSCs

Analyte	CAS Number	S-GW Exceedance Frequency	Concentration in GW Above Applicable GW MSCs (discussed in Section 3.2.5)
Volatile Organic Compounds			
Benzene	**71-43-2**	**36/530**	**Yes**
Chlorobenzene	108-90-7	4/530	No
Dichloromethane	75-09-2	5/530	No
Ethylbenzene	100-41-4	3/529	No
Styrene (Monomer)	100-42-5	2/470	No
Toluene	108-88-3	1/532	No
Semi-Volatile Organic Compounds			
1,1-Biphenyl	92-52-4	4/168	No
2-Methylnaphthalene	91-57-6	4/535	No
4-Methylphenol	106-44-5	1/296	No
Anthracene	120-12-7	15/535	No
Benz(a)anthracene	**56-55-3**	**12/535**	**Yes**
Benzo(a)pyrene	**50-32-8**	**39/535**	**Yes**
Benzo(b)fluoranthene	**205-99-2**	**22/535**	**Yes**
Benzo(g,h,i)perylene	**191-24-2**	**13/535**	**Yes**
Benzo(k)fluoranthene	**207-08-9**	**6/535**	**Yes**
Carbazole	**86-74-8**	**18/535**	**Yes**
Chrysene	**218-01-9**	**18/535**	**Yes**
Dibenz(a,h)anthracene	**53-70-3**	**2/535**	**Yes**
Dibenzofuran	**132-64-9**	**16/535**	**Yes**
Fluoranthene	206-44-0	8/535	No
Fluorene	86-73-7	4/535	No
Naphthalene	**91-20-3**	**54/535**	**Yes**
Phenanthrene	85-01-8	4/535	No
Phenol	108-95-2	2/535	No
Pyrene	129-00-0	6/535	No
Metals			
Antimony	**7440-36-0**	**3/527**	**Yes**
Arsenic	**7440-38-2**	**101/527**	**Yes**
Cyanide	57-12-5	3/333	No
Lead	7439-92-1	89/527	No
Mercury	7439-97-6	2/525	No
Nickel	**7440-02-0**	**1/527**	**Yes**
Selenium	7782-49-2	1/527	No

Notes: S-GW indicates the soil-to-groundwater MSCs for a non-residential used aquifer with TDS less than or equal to 2,500 ppm; GW = groundwater.

3.2.5 Groundwater Quality Evaluation

This section summarizes the groundwater quality at the Site based on analytical results of groundwater samples collected from monitoring wells and hydropunch sampling locations during the RI.

During the Initial RI activities, groundwater samples were collected from 33 monitoring wells and 7 hydropunch locations. The 33 monitoring wells were sampled in November 2005 and January/February 2006 for VOCs, SVOCs, total metals, dissolved metals, pesticides, and PCBs, except PCMW-08S which was only sampled in November 2005. Groundwater samples collected from the hydropunch locations were analyzed for VOCs, SVOCs, and total metals.

During the monitoring well integrity survey performed as part of the SRI Activities, Arcadis located 23 of the 33 Initial RI monitoring wells (wells identified by the prefix "PCMW-") as shown on Initial RI site maps, plus two of the nine pre-2003 monitoring wells (wells identified with the ID "MW-"). As listed in Table 3-3 (Subsection 3.1.2.1), Arcadis installed four monitoring wells to replace Initial RI monitoring wells that could not be located in 2018. Arcadis also installed nine additional monitoring wells in areas where groundwater was not sufficiently characterized by the Initial RI monitoring well network, including Areas 1 and 4 where the most impacted soils were observed.

During the SRI Activities, Arcadis sampled groundwater from 23 existing wells (including two wells of unknown construction) and 13 new SRI monitoring wells for a combination of VOCs, SVOCs, total inorganics, dissolved inorganics, total cyanide, free cyanide, TDS, pesticides, and PCBs.

The groundwater analytical results have been compared to the PADEP Non-Residential MSCs for Used Aquifers containing TDS ≤ 2,500 mg/L. These MSCs are applicable to the Site given the anticipated current and future site use for commercial or industrial purposes. Groundwater is not used for potable purposes at the Site and in the surrounding area. For documentation purposes, the groundwater analytical results are also compared in this Section to the PADEP Residential MSCs for Used Aquifers containing TDS ≤ 2,500 mg/L. Please note that the groundwater results are compared to VI screening values in Section 3.2.6.

Groundwater analytical results for hydropunch locations are presented in Table 14. Groundwater analytical results for monitoring wells are presented in Tables 15 through 17. A statistical summary of groundwater analytical data for samples collected from the monitoring wells is presented in Table 18. Additionally, groundwater analytical results exceeding the above-identified MSCs are shown in Figures 24 and 25.

During the Initial RI activities, PS&S labelled the blind duplicate samples with "fake" sample IDs. Arcadis could not identify a key or table linking the duplicate samples with their associated parent samples. However, it appears that, in general, PS&S labelled the duplicate samples with a "2" in front of the parent sample ID (e.g., the parent for PCMW-214D (11/9/05) is PCMW-14D (11/9/05)). However, in some cases, the duplicate ID does not indicate if the sample was collected from the deep or shallow well in the cluster. In these cases, the blind duplicate data are not included in the discussion below. Duplicate sample IDs without parent samples are limited to only the following: PCMW-211 (2/2/2006) and PCMW-212 (2/1/2006). However, results for these duplicate samples are included in the statistics in Table 18.

3.2.5.1 Hydropunch Groundwater Sampling Results

In general, hydropunch samplers were advanced in the areas where soil impacts were observed in the Initial RI. The analytical results for groundwater samples collected from hydropunch locations are summarized below:

- VOCs and SVOCs were not detected in any of the hydropunch groundwater samples at concentrations exceeding the MSCs, except the sample from PCHP-03 which is located in the center of the Site. At PCHP-03, benzene was detected at a concentration of 290 µg/L vs the 5 µg/L on-residential MSC and select PAHs were detected at concentrations up to 6.3 µg/L (BaA at 6 µg/L, BaP at 4.6 µg/L, BbF at 6.3 µg/L, benzo(g,h,i) perylene at 2.18 µg/L, benzo(k)fluoranthene at 1.8 µg/L, and chrysene at 5.1 µg/L vs. non-residential MSCs of 4.9, 0.2, 1.2, 0.26, 0.55, and 1.9 µg/L, respectively). No other VOCs or SVOCs were detected above MSCs in the hydropunch groundwater samples. Groundwater impacts around PCHP-03 have been delineated by PCHP -01, PCHP-06, PCHP-07, PCMW-14S/MW-101 and PCMW-15S.
- Amenable cyanide was not detected in any of the hydropunch groundwater samples at concentrations exceeding the MSCs.
- Metals were detected at concentrations exceeding the MSCs in unfiltered groundwater samples collected from 6 of the 7 hydropunch locations. Elevated metal concentrations are likely the result of the sample collection method. Hydropunch samples are not collected using standard low-flow methods through a developed monitoring well and typically have very high turbidity biasing metal results to be high due to entrained solids.

3.2.5.2 Shallow Groundwater Sampling Results

A total of 35 monitoring wells are screened in the shallow groundwater zone located within the historic fill unit, including 20 wells installed during the Initial RI activities, 13 wells installed during the SRI activities, and two wells installed sometime before 2003 (i.e., those two wells were found and sampled in 2018). Except for the observation of emulsified petroleum in PCMW-05 during the Initial RI, NAPL was not encountered in any shallow groundwater monitoring wells. This emulsion was not observed during the SRI. During both the Initial RI and SRI, pesticides and PCBs were not detected at concentrations greater than the applicable MSCs (residential or non-residential MSCs for used aquifers with TDS ≤2,500 mg/L). Therefore, the discussion of shallow groundwater analytical results below focuses on VOC, SVOCs, and inorganics. The shallow groundwater analytical results are summarized below.

Shallow Groundwater Sampling Results for VOCs

When combining the Initial RI and SRI data, VOCs were not detected at concentrations greater than the MSCs in 28 of the 35 shallow groundwater monitoring wells. SRI groundwater analytical results indicate that groundwater quality has improved onsite since the Initial RI investigation, demonstrated by the decreasing benzene concentrations. VOCs were detected above MSCs at the following locations:

- *PCMW-10S, PCMW-14S, PCMW-15S, & PCMW-17S* – During the Initial RI, benzene was detected in groundwater at concentrations greater than the 5 µg/L non-residential and residential MSCs in each of these four monitoring wells. However, benzene was not detected above the 5 µg/L MSCs in groundwater collected from these wells (or MW-14S replacement well MW-101) during the SRI.

- *MW-107* - Methyl-tert-butyl ether (MTBE) was detected in the May 30, 2018 groundwater sample from this well at a concentration of 20.7 µg/L which is slightly greater than the 20 µg/L residential and non-residential MSC. MTBE was not evaluated in groundwater samples collected during the Initial RI groundwater samples and is not considered to be related to Site operations.
- *MW-111* – Based on the SRI results, the highest benzene concentration (686 µg/L) was detected in a groundwater sample collected from this well on October 4, 2019. Benzene was not detected above laboratory detection limits in groundwater downgradient from MW-111 (i.e., MW-112 or MW-113 to the east of MW-111) during the same event. Therefore, benzene groundwater impacts are limited to the vicinity of MW-111.
- *MW-5* –TCE was detected in the March 19, 2018 groundwater sample from this well at a concentration of 6.1 µg/L which is slightly higher than the 5 µg/L residential and non-residential MSC. TCE was not identified in the Initial RI groundwater samples collected from any of the wells at the Site. TCE was not detected elsewhere on-site during the March 2018 event.

Shallow Groundwater Sampling Results for SVOCs

SVOCs were not detected in 30 of the 35 shallow groundwater monitoring wells at concentrations greater than the MSCs. SVOCs were detected above MSCs at the following locations:

- *MW-102* – Bis(2-ethylhexyl) phthalate was detected in the May 31, 2018 groundwater sample from this well at a concentration of 11.3 µg/L which is greater than the 6 µg/L residential and non-residential MSC. However, since bis (2-ethylhexyl) phthalate was not detected in the duplicate sample collected from this well, the detection is potentially indicative of laboratory contamination. Groundwater samples were not collected from this well on any other date.
- *MW-107* – Multiple low-level PAHs were detected in the May 30, 2018 groundwater sample from this well at concentrations slightly greater than one or both groundwater MSCs. Low-level PAHs are typically associated with urban/historic fill such as the fill observed onsite. BbF was identified in this well at the highest concentration of any PAHs exceeding MSCs (1.7 µg/L vs. 1.2 µg/L non-residential MSC). BaP and benzo(g,h,i)perylene were also detected above the non-residential MSCs (1.2 and 0.95 µg/L vs. MSCs of 0.2 and 0.26 µg/L, respectively). Groundwater samples were not collected from this well on any other date.
- *MW-111* – The highest PAH concentrations in groundwater were detected in the October 4, 2019 groundwater sample collected from this well. The two PAHs with the highest concentrations at this well were naphthalene (973 µg/L vs. 100 µg/L non-residential MSC) and carbazole (189 µg/L vs. 170 µg/L non-residential MSC). PAHs were not detected above MSCs in groundwater downgradient from MW-111 (i.e., MW-112 or MW-113 to the east of MW-111).
- *PCMW-16S* – Multiple low-level PAHs were detected in the February 1, 2006 groundwater sample from PCMW-16S at concentrations slightly greater than one or both groundwater MSCs. PAHs were not detected at concentrations greater than MSCs in the replacement monitoring well for PCMW-16S (MW-105) sampled on May 30, 2018.
- *PCMW-17S* – On February 3, 2006, carbazole was detected in groundwater from this well at a concentration of 51 µg/L which is greater than the 37 µg/L residential MSCs but less than the 170

µg/L non-residential MSC). During the most recent sampling event (March 2018), carbazole was not detected above laboratory limits in the groundwater sample from PCMW-17S.

Shallow Groundwater Sampling Results for Inorganics

Inorganics that are commonly present in urban/historic fill or considered naturally occurring minerals were detected in the groundwater samples from across the Site at concentrations exceeding the MSCs[10]. Some of the samples collected were turbid and contained suspended particulates that are the likely source of the elevated metals concentrations. For this reason, groundwater samples collected from 27 of the 35 shallow groundwater monitoring wells (18 wells during the Initial RI only, 7 wells during the SRI only, and 2 wells during both the Initial RI and SRI) were also filtered in the laboratory and analyzed for dissolved inorganic constituents. After groundwater sample filtration, only six inorganic constituents (antimony, arsenic, manganese, and nickel) were identified in the shallow groundwater at concentrations greater than MSCs. The total and dissolved laboratory analytical results for constituents exceeding MSCs are summarized below:

- Antimony was detected at concentrations slightly exceeding the 6 µg/L residential/non-residential MSC in three unfiltered and one filtered groundwater samples collected from the shallow groundwater monitoring wells. This includes unfiltered groundwater samples from PCMW-07 (6.4 µg/L on November 3, 2005), PCMW-08S (9.9 µg/L on March 22, 2018), and PCMW-13S (6.4 µg/L on November 9, 2005) and a filtered groundwater sample from PCMW-11S (7.8 µg/L on November 7, 2005). As indicated above, each groundwater sample containing antimony exceeding the MSC was collected from a separate groundwater monitoring well.
- Arsenic, a common groundwater constituent in urban/historic fill, was detected at concentrations greater than the 10 µg/L MSC in unfiltered groundwater samples collected from 9 of the 35 shallow groundwater monitoring wells (concentrations ranging from 12 to 160 µg/L). Dissolved arsenic was only detected at concentrations greater than MSCs in filtered groundwater collected from the two monitoring wells exhibiting the highest concentration of total arsenic, including PCMW-08S (21 µg/L on November 3, 2005) and PCMW-19S (11 µg/L on November 14, 2005).
- Total cyanide was identified at concentrations exceeding the 200 µg/L residential/non-residential MSC for free cyanide in SRI groundwater samples collected from three shallow groundwater monitoring wells, including MW-104 (670 µg/L on May 30, 2018), MW-113 (an estimated 380 µg/L October 4, 2019), and PCMW-15S (an estimated 210 µg/L March 20, 2018). There is no MSC for total cyanide. Initial RI groundwater samples were not analyzed for total cyanide. A July 27, 2018 groundwater sample from PCMW-15S was analyzed for free cyanide, and the free cyanide concentration was 9.0 µg/L which is two orders of magnitude below the 200 µg/L MSC, indicating that only a small fraction of total cyanide is free (i.e., bioavailable).
- Lead was identified at concentrations exceeding the 5 µg/L residential/non-residential MSC in groundwater samples from 21 of the 35 shallow monitoring wells. Lead concentrations were generally consistent between Initial RI samples and SRI samples. Lead was not detected in the filtered groundwater samples at concentrations greater than the MSC, indicating that lead impacts are related to turbidity.

[10] Note that there is no difference between residential and non-residential MSCs for the detected inorganics.

- Nickel was detected at concentrations exceeding the 100 µg/L residential/non-residential MSC in groundwater samples (unfiltered or filtered) from only one well (PCMW-05, which is in the former Fuel Blending Area). Nickel was identified in three of four unfiltered samples from PCMW-05 (250 µg/L on January 1, 2006, 450 µg/L on March 23, 2018, and 524 µg/L on May 30, 2018) and one filtered sample from PCMW-05 (210 µg/L on January 31, 2006). This indicates that nickel impacts in groundwater are isolated.

Additionally, naturally occurring mineral constituents, manganese and zinc, were detected in groundwater at concentrations greater than MSCs. Manganese was detected at concentrations most frequently above the MSCs (in 25 of 28 monitoring wells sampled for total manganese and 8 of 9 wells sampled for dissolved manganese[11]). Zinc was detected at concentrations greater than MSCs in one of the 30 monitoring wells sampled for zinc (PCMW-05), but dissolved zinc was not detected above MSCs.

3.2.5.3 Deep Groundwater Sampling Results

A total of 13 monitoring wells were installed below the silt and clay confining unit and screened in the deep groundwater zone (wells PCMW-08D through PCMW-20D). NAPL was not encountered in any deep groundwater monitoring wells. Similar to the groundwater analytical results for the shallow monitoring wells, pesticides and PCBs were not detected at concentrations greater than the residential or non-residential MSCs in any of the groundwater samples from the deep monitoring wells. Therefore, the discussion of deep groundwater analytical results below focuses on VOCs, SVOCs, and inorganics.

Deep Groundwater Sampling Results for VOCs

VOCs were not detected in 12 of 13 deep groundwater monitoring wells at concentrations greater than the MSCs. Tetrachloroethene was the only VOC identified in the deep groundwater samples at a concentration greater than its corresponding residential/non-residential MSC (5 µg/L) and only during the initial RI. Tetrachloroethene was detected in the November 8, 2005 groundwater sample from PCMW-11D at a concentration of 37 µg/L. Tetrachloroethene was detected at a concentration of 4 µg/L when well PCMW-11D was resampled in 2006. PCMW-11D could not be located for resampling during the SRI. Tetrachloroethene was not identified above 5 µg/L in any of the other deep groundwater samples. Based on Site history and soil analytical results, tetrachloroethene is not a Site-related constituent.

Deep Groundwater Sampling Results for SVOCs

SVOCs were not detected in 11 of 13 deep groundwater monitoring wells at concentrations greater than the MSCs. SVOCs were detected above MSCs at the following locations:

- *PCMW-09D* – BaA, BaP, BbF, and chrysene were detected in the January 31, 2006 groundwater sample from this well at concentrations slightly greater than the corresponding residential and/or non-residential groundwater MSCs. Of these four PAHs, BbF was detected at the highest concentration at 2.5 µg/L (the corresponding non-residential MSC is 1.2 µg/L). PCMW-09D could not be located for resampling during the SRI.

- *PCMW-16D* – 2,4-Dinitroluene was detected in the March 19, 2018 groundwater sample from this well at a concentration of 13.3 µg/L, which is greater than the 2.4 µg/L residential and slightly in

[11] Initial RI groundwater samples were not analyzed for manganese which is why the count of sampled wells differs from the previous discussion.

excess of the 11 µg/L non-residential MSCs. This constituent was not detected in any of the other SRI groundwater samples. Initial RI groundwater samples were not analyzed for 2,4-dinitrolouene. The presence of 2,4-dinitroluene in groundwater appears to be isolated to this area near the intersection of Orthodox Street and Casper Street. The deep zone potentiometric surface map in the vicinity of PCMW-16D indicates that groundwater is flowing primarily parallel to Orthodox Street with a component of groundwater flow directed easterly to the Site from offsite. Therefore, it is not likely that the groundwater impacts from PCMW-16D are Site-related but are likely due to background conditions. Additionally, 2,4-dinitroluene is not related to former Site operations.

Deep Groundwater Sampling Results for Inorganics

Similar to the analytical results for groundwater samples collected from the shallow monitoring wells, inorganics that are commonly present in urban fill or considered naturally occurring minerals were detected at concentrations exceeding the MSCs in groundwater samples collected from the deep wells across the Site. Some of the samples collected were turbid and contained suspended particulates that are the likely source of the elevated metals. For this reason, samples from the deep groundwater monitoring wells were also filtered in the laboratory and analyzed for dissolved inorganic constituents. After groundwater sample filtration, only arsenic and manganese were identified in the deep groundwater at concentrations greater than MSCs. Therefore, beryllium, lead, and cyanide in the deep groundwater zone appear to be attributed to suspended particulates. The total and dissolved laboratory analytical results for inorganic constituents exceeding MSCs are summarized below:

- Arsenic was detected at concentrations greater than the 10 µg/L MSC in unfiltered groundwater samples collected from 6 of 13 deep groundwater monitoring wells. Dissolved arsenic was only detected at concentrations greater than the 10 µg/L MSC in one filtered groundwater sample (i.e., the November 14, 2005 sample from PCMW-20D at a concentration of 11 µg/L).
- Beryllium and lead were detected at concentrations greater than their corresponding MSCs (4 µg/L and 5 µg/L, respectively) in the January 31, 2006 groundwater sample from PCMW-09D (concentrations of 5.1 µg/L and 170 µg/L, respectively). Neither constituent was detected in the November 7, 2005 groundwater sample collected from PCMW-09D or the filtered groundwater samples from any of the deep groundwater monitoring wells.
- Total cyanide was identified at a concentration exceeding the 200 µg/L residential/non-residential MSC for free cyanide in groundwater from only one deep monitoring well (350 µg/L in the March 22, 2018 groundwater sample collected from PCMW-10D). There is no MSC for total cyanide. Initial RI groundwater samples were not analyzed for total cyanide. A July 27, 2018 groundwater sample from PCMW-10D was analyzed for free cyanide, and the free cyanide concentration was 4.1 µg/L. Additionally, free cyanide was detected in the May 30, 2018 groundwater sample from PCMW-16D at an estimated concentration of 9.1 µg/L (18 µg/L in the duplicate sample from the well).
- Manganese, a naturally occurring mineral constituent, was detected at concentrations greater than the 300 µg/L MSC in groundwater samples collected from 8 of the 13 monitoring wells. Dissolved manganese was only detected at a concentration greater than MSCs in the March 28, 2019 filtered groundwater sample from PCMW-16D (3,130 µg/L).

3.2.5.4 Groundwater Investigation Conclusions

In addition to the extensive groundwater investigation performed from April 1985 through November 1998, the RI groundwater investigation provides sufficient data for evaluating groundwater quality across the Site. Groundwater analytical results indicate that groundwater quality at the Site is relatively unimpacted by former site operations and that source material is not present onsite. Select VOCs and SVOCs were identified in groundwater samples from 12 of 50 monitoring wells at concentrations exceeding applicable MSCs. However, the results indicate that VOCs and SVOCs were: (1) detected at concentrations within an order of magnitude of MSCs in the most-recent monitoring event in all but one location (MW-111); and (2) detected at much lower concentrations during the SRI then the Initial RI at the same well or a replacement well. The extent of VOCs and SVOCs in shallow groundwater downgradient from MW-111 is delineated by the samples from downgradient monitoring wells (MW-112 and MW-113, both located east of MW-111). Based on groundwater data from point-of-compliance wells, COCs are not migrating offsite at concentrations above residential MSCs.

Inorganic constituents were identified at concentrations exceeding applicable groundwater MSCs. However, these constituents are commonly present in urban/historic fill or considered naturally occurring minerals and are not necessarily attributed to former Site operations. Additionally, most inorganic constituents were not detected at concentrations above the corresponding MSC in groundwater samples that were filtered in the laboratory to evaluate dissolved concentrations of inorganics.

When reviewing the groundwater and soil analytical data together, the groundwater analytical results in Areas 1 and 2 indicate that residual soil impacts are not affecting the groundwater as follows:

- ***Area 1:*** *Eastern Part of Former Coal Storage Area*. SVOCs were not detected at concentrations greater than either the residential or non-residential MSCs in groundwater samples from any monitoring well in this area (MW-103, MW-108, MW-109, and MW-110).
- ***Area 2:*** *North/Northwest of Former Tar Storage Area*. SVOCs were not detected at concentrations greater than either the residential or non-residential MSCs in groundwater samples from any monitoring wells in this area (MW-101, PCMW-11S/D, PCMW-14S/D, and PCMW-17S/D) during the SRI.

Additionally, lead was not detected in any filtered groundwater samples at concentrations greater than the 5 µg/L MSCs indicating that lead concentrations in soil are not impacting groundwater.

The COCs in deep and shallow groundwater are identified in Table 3-6 below.

Table 3-6: Groundwater Constituents Exceeding Residential and Non-Residential MSCs

Analyte	CAS Number	Residential MSC Exceedance Frequency	Non-Residential MSC Exceedance Frequency
Volatile Organic Compounds			
Benzene	71-43-2	8/103	8/103
Methyl-tert-butylether	1634-04-4	1/36	1/36
Tetrachloroethene	127-18-4	1/103	1/103

Analyte	CAS Number	Residential MSC Exceedance Frequency	Non-Residential MSC Exceedance Frequency
Trichloroethene	79-01-6	1/103	1/103
Semi-Volatile Organic Compounds			
Benz(a)anthracene	56-55-3	4/103	0/103
Benzo(a)pyrene	50-32-8	4/103	4/103
Benzo(b)fluoranthene	205-99-2	4/103	4/103
Benzo(g,h,i)perylene	191-24-2	3/103	3/103
Benzo(k)fluoranthene	207-08-9	3/103	2/103
bis(2-Ethylhexyl)phthalate	117-81-7	1/103	1/103
Carbazole	86-74-8	2/103	1/103
Chrysene	218-01-9	3/103	3/103
Dibenz(a,h)anthracene	53-70-3	1/103	0/103
Dibenzofuran	132-64-9	1/103	0/103
Indeno(1,2,3-cd)pyrene	193-39-5	3/103	0/103
Naphthalene	91-20-3	1/103	1/103
Metals (Dissolved)			
Antimony	7440-36-0	1/76	1/76
Arsenic	7440-38-2	3/76	3/76
Manganese	7439-96-5	8/9	8/9
Nickel	7440-02-0	1/76	1/76
Vanadium	7440-62-2	1/9	0/9

3.2.6 Soil Gas Quality

This section summarizes the quality of soil gas at the Site based on comparison of soil gas analytical results and existing soil and groundwater data to the screening values presented in the TGM.

3.2.6.1 Soil Gas Results

During the Initial RI activities, soil gas samples were collected from 21 locations to evaluate the potential for VI in future building development (see Figure 26). Due to the shallow water table, 20 of the 21 soil gas samples were collected from depths less than the desired depth of 5 feet bgs. The cover material at most of the soil gas sampling locations consisted of gravel or deteriorated asphalt pavement (not impervious surfaces). The soil gas sample data set is limited for use in VI evaluation in that only one round of soil gas data was collected (the TGM specifies two rounds) and the data were collected from shallower intervals than prescribed (i.e., intervals less than 5 feet below pervious surfaces can result in atmospheric air being introduced into the samples). Therefore, when paired with soil and groundwater data, the soil gas data are used herein as a semi-quantitative screening tool to aid in identifying areas that could potentially exhibit vapor intrusion concerns.

In response to the above circumstances, the soil gas analytical results were conservatively compared to residential and non-residential sub-slab soil gas SHS VI screening values (SV_{SS}) instead of near-source soil gas SHS VI screening values (SV_{NS}) for qualitative screening assessment purposes. The SV_{SS} screening values are much lower than the SV_{NS} screening values. As presented in Table 19, no VOCs were detected above the non-residential SV_{SS} in any of the soil gas samples. At sampling location PCSV-11, 1,4-dioxane was detected at a concentration of 440 micrograms per cubic meter (µg/m^3) which exceeds the 120 µg/m^3 residential SVss. No other constituents exceed the residential SVss in any of the soil gas samples. More information on soil gas quality compared to residential standards is provided in Subsection 3.2.6.4.

3.2.6.2 Soil Analytical Results Compared to Vapor Intrusion Standards

The existing unsaturated soil analytical results were compared to the residential and non-residential VI standards from the TGM to evaluate the potential for VI concerns for future development. The soil analytical results compared to VI screening values are presented in Table 20.

From a total of 152 sampling locations where unsaturated soil samples were collected for laboratory analysis, soil analytical results exceed the non-residential VI screening values at 24 sampling locations and soil analytical results exceed the residential VI screening values at 26 sampling locations (two additional sampling locations compared to the non-residential standards). Benzene and naphthalene are the constituents that most frequently exceed the residential and non-residential VI screening values. Toluene, 1,1-biphenyl, and 2-methylnaphthalene also exceed the residential and non-residential VI screening values at select locations but were identified at the same locations where benzene and/or naphthalene exceedances were observed. Dichloromethane exceeds only the residential VI screening levels at three locations, and at two of these locations, dichloromethane was the only constituent exceeding VI screening values. Most of the exceedances are within one of the four delineation areas (Areas 1 through 4), the Fuel Blending Area, or in the Site center near the Former Coke Operations Area. Soil sampling locations where constituents have been identified in vadose zone soil at concentrations greater than non-residential VI screening values are shown on Figure 27.

3.2.6.3 Groundwater Analytical Results Compared to Vapor Intrusion Standards

Groundwater samples collected from monitoring wells screened in the shallow groundwater zone were compared to applicable VI standards. At monitoring wells where groundwater was never observed to be within 5 feet of the ground surface, Arcadis compared the existing groundwater analytical results to the residential and non-residential VI standards. Per the TGM, Arcadis used the PADEP residential MSCs for Used Aquifers containing TDS ≤ 2,500 mg/L as the VI screening value for any wells where groundwater was at one point observed within 5 feet of the ground surface. Groundwater has been observed within 5 feet of the ground surface in 20 of 33 shallow monitoring wells. For the shallow groundwater zone, the groundwater analytical results compared to VI screening values are presented in Table 21.

Groundwater analytical results exceed the applicable non-residential VI screening values at 5 of 33 shallow monitoring wells (i.e., the same wells where groundwater was found to be impacted with constituents at concentrations exceeding MSCs for groundwater, as described in Subsection 3.2.5). Groundwater analytical results exceed the applicable residential VI screening values at 6 of 33 shallow monitoring wells (i.e., one additional monitoring well compared to the VI exceedance of the non-residential standard). Based on the SRI groundwater analytical results, potential VI concerns associated with groundwater appear to be limited to only three monitoring well locations (MW-5, MW-107, and MW-111). VOC and SVOC concentrations in groundwater samples collected from MW-5 and MW-107 are generally consistent with or only slightly greater than VI screening values in groundwater samples collected from MW-5 and MW-107. Based on the groundwater analytical results for wells located downgradient of MW-111 (i.e., MW-112 and MW-113), potential vapor concerns from groundwater impacts are isolated to the immediately vicinity of MW-111 (Area 4). Groundwater monitoring wells where constituents have been identified at concentrations greater than VI screening values are shown on Figure 28.

3.2.6.4 Off-site Soil Vapor Evaluation

To evaluate the potential for VI concerns off-site, the soil-gas, soil, and groundwater analytical data were compared to the applicable residential VI screening values, as introduced in the previous subsections. Based on available data, there are no potential VI concerns for the residential properties adjacent to the Site.

When comparing the analytical data to residential VI standards, one soil-gas sampling location, two additional soil sampling locations, and one additional groundwater monitoring well are added to areas of potential VI concern that had been identified based on comparison to non-residential VI standards. Where applicable residential VI screening values are exceeded, proximity distances were used to evaluate the potential for VI concerns off-site in accordance with the TGM. Proximity distances of 30 feet for petroleum constituents and 100 feet for non-petroleum constituents are specified in the TGM.

Most sampling locations or monitoring wells where constituents were identified at concentrations exceeding applicable VI standards are near the center of the Site and would not affect off-site properties. However, 100-foot proximity distances around sampling locations PCTP-66 and S-156 extend offsite for non-petroleum constituents, but the proximity distances do not extend below off-site buildings. These locations are not adjacent to, or across the street from, residential properties. Sampling location PCTP-66 is across the street from a commercial/industrial property where clothing is sold and printed with custom prints. Sampling location S-156 is across the street from a car impoundment lot that appears to be loose gravel. The proximity distances for sampling locations and monitoring wells where constituents exceed the residential VI screening values are shown on Figure 29. In conclusion, there are no potential VI concerns off-site from conditions on-Site.

3.2.6.5 Soil Vapor Constituents of Concern

When compared to applicable non-residential VI standards, soil and groundwater analytical results indicate the potential for soil VI in future buildings in certain limited areas onsite in the absence of remediation or mitigation. Benzene is the constituent most frequently detected above non-residential VI standards in both soil and groundwater samples, and benzene is the only constituent detected at concentrations greater than an order of magnitude above the non-residential VI standards in both soil and groundwater[12]. However, soil gas sampling results did not exceed any of the sub-slab VI screening values

[12] Naphthalene is also detected at concentrations an order of magnitude above the non-residential VI standards in soil, but naphthalene concentrations in soil gas are limited by the 73.2 mg/kg soil saturation level (at an assumed soil/groundwater temperature of 62.6°F), and therefore, soil naphthalene concentrations have limited VI potential.

indicating that the VI potential is likely over predicted by the soil and groundwater analytical results. The COCs potentially causing IV concerns are identified in Table 3-7 below.

Table 3-7: Groundwater Constituents Exceeding Residential and Non-Residential MSCs

Analyte	CAS Number	VI Screening Values for Soil Exceedance Frequency	VI Screening Values for GW Exceedance Frequency
Volatile Organic Compounds			
Benzene	71-43-2	20/175	5/103
Methyl-tert-butyl ether	1634-04-4	0/53	1/36
Toluene	108-88-3	3/177	0/103
Trichloroethene	79-01-6	0/136	1/103
Semi-Volatile Organic Compounds			
1,1-Biphenyl	92-52-4	3/54	0/36
2-Methylnaphthalene	91-57-6	1/179	0/103
Naphthalene	91-20-3	19/179	0/103

Note: GW = groundwater.

4 FATE AND TRANSPORT MODEL

Fate and transport modeling was conducted upon completion of the groundwater sampling to assess the groundwater conditions at the Site and at the property boundaries. The purpose of the groundwater fate and transport modeling was to evaluate: (1) the extent of constituent migration in groundwater in the absence of any remedial activities (i.e., baseline conditions); and (2) the potential to either achieve equilibrium/stabilization or a reduction of constituent concentrations. Model development, analysis, and documentation were performed in accordance with the guidelines provided in Pennsylvania's Land Recycling Program Technical Guidance Manual updated on January 19, 2019. Results of the fate and transport simulations are used to estimate the movement of the constituents over time, and to assess the potential for impacts due to constituent mass migration and discharge to adjacent surface waters.

This Section documents the modeling effort, provides an evaluation of model applicability, and reports the results of the fate and transport simulations.

4.1 Study Objectives

The objective is to develop a fate and transport model for the Site that can be used as a basis for predicting the current and potential future extent of groundwater concentrations for select VOCs and SVOCs at Site boundaries above MSCs. Results of the fate and transport simulations are used to estimate the movement of the constituents over time and assess the potential for impacts due to constituent mass migration and discharge to the Delaware River.

At monitoring well MW-107, the closest well to the Delaware River within the flow path toward the river, the SVOCs that exceed groundwater MSCs were also compared to the following surface water criteria:

1. Delaware River Basin Commission (DRBC) Surface Water Criteria (recorded from Tables 3 through 7 of the Administrative Manual - Part III Water Quality Regulations with Amendments through December 4, 2013: 18 CFR Part 410 for the DRBC).
2. PADEP Surface Water Criteria for Fish and Aquatic life from 25 Pa. Code § 93.8c Table 5.
3. PADEP Surface Water Criteria for Human Health from 25 Pa. Code § 93.8c Table 5.

Although 25 PA Code § 93.9e defines the portion of the Delaware River adjacent to the Site (Tidal Portions from River-Mile 108.3 to Big Timber Creek) for warm water fish (maintenance only) and migratory fish (passage only), the human health criteria were used as the edge criterion when modeling to be conservative. This portion of the Delaware River is also DRBC Water Quality Zone 3.

4.2 Hydrogeologic Setting

As discussed in Section 3.2.2, three hydrostratigraphic units exist at the Site: the fill, silt and clay, and sand and gravel, and groundwater at the Site is separated into a shallow and deep zone by the silt and clay layer.

The shallow groundwater is encountered in the urban/historic fill unit across the Site at depths of approximately 2- to 12- feet bgs. Based on regional groundwater information, this shallow groundwater zone is a perched aquifer that was created by the placement of fill over the native silt and clay layer. As shown on Figures 8, 9, and 10, groundwater in the fill is mounded in the central/southern portion of the

Site and flows radially outward from the mound. The hydraulic conductivity of the fill ranges from approximately $1.47x10^{-4}$ to $2.93x10^{-3}$ centimeters per second (cm/sec)[13].

The deep aquifer zone is observed at approximately 9- to 17-feet bgs in the sand and gravel unit. As indicated by Figures 11 and 12, groundwater in the sand and gravel flows eastward, toward the Delaware River. The sand and gravel is the most permeable hydrostratigraphic unit beneath the Site and has a hydraulic conductivity of $2.73x10^{-3}$ to $1.79x10^{-1}$ cm/sec.

4.2.1 Hydraulic and Hydrologic Boundaries

The Site is in the Lower Delaware River Watershed and borders the Delaware River to the southeast. Frankfort Creek and the Tookany/Tacony-Frankford watershed is approximately 2,000 feet southwest of the Site (from Site boundary). The Bridesburg Channel (which aerials indicate was the historical course of Frankford Creek), is north of the Site. Both Frankford Creek and the Bridesburg Channel drain to the Delaware River. The shallow groundwater, which mounds in the center of the Site and flows radially outward, is expected to drain to the Delaware River via Frankford Creek, Bridesburg Channel, or other local drainage features between the Site and these water bodies.

As indicated in Subsection 3.2.2.1, a groundwater use survey was conducted in the vicinity of the Site to confirm that no known or suspected users of groundwater exist in the regulatory-required survey area. A total of 65 wells were located within a ½-mile radius of the Site. All the wells surrounding the Site are, or are suspected to be, unused, abandoned, or only used for environmental investigations and clean-ups. A total of 4 wells surrounding the Site are listed as withdrawal wells. The withdrawal wells appear to be related to the environmental investigation and cleanup efforts at the former Rohm and Haas Chemical Company Facility (Pennsylvania Facility ID 742771 and NIR number 61614). This facility is approximately 1/3 mile north of the Site.

4.3 Constituents and Monitoring Wells Selected for Modeling

As discussed in Section 3.2.5, groundwater quality at the Site is relatively unimpacted by former Site operations and source material is not present onsite. Only the SRI groundwater data was considered for fate and transport analysis because the Initial RI data is more than 12 years old, and the SRI groundwater data indicates that VOCs and SVOCs were detected at much lower concentrations during the SRI then the Initial RI at the same wells (or installed replacement wells). Additionally, fate and transport analysis was only performed on groundwater impacts identified in point-of-compliance monitoring wells, defined herein as the most downgradient well in that area of the Site.

During the SRI, select VOCs and SVOCs were identified in groundwater samples from three point-of-compliance monitoring wells at concentrations exceeding applicable MSCs (MW-5, MW-102, and MW-107). The point-of-compliance monitoring wells are screened in the fill layer and sample the shallow groundwater zone. The constituents that exceed MSCs and were considered for Fate and Transport analysis at these monitoring wells are listed on Table 4-1 below:

[13] Hydraulic conductivity values were calculated based on slug test data reported by WCC (WCC 1986) and laboratory soil testing results reported by PSS.

Table 4-1: Groundwater Constituents Considered for Modeling

Monitoring Well	Date	Constituent	Concentration (µg/L)	MSC (µg/L)	Modelled (Y/N)
MW-5	3/19/18	Trichloroethene	6.1	5	Y
MW-102	5/31/18	Bis(2-ethylhexyl)phthalate	<2.4 [11.3]	6	Y
MW-107	5/30/18	Methyl-tert-butyl ether	20.7	20	N
MW-107	5/30/18	Benzo(a)pyrene	1.2	0.2	Y
MW-107	5/30/18	Benzo(b)fluoranthene	1.7	1.2	Y
MW-107	5/30/18	Benzo(g,h,i)perylene	0.95	0.26	N

Notes: MSCs are the soil-to-groundwater MSCs for a non-residential used aquifer with TDS less than or equal to 2,500 ppm. Bis(2-ethylhexyl)phthalate) was not detected above the 2.4 µg/L laboratory detection limit in the parent sample from MW-102, but the constituent was detected at 11.3 µg/L in the duplicate sample collected from the same location.

TCE, bis(2-ethylhexyl)phthalate, BaP, and BbF were selected for modeling. Methyl-tert-butyl ether and benzo(g,h,i)perylene were not modeled because surface water criteria has not been established for these constituents. BaP and BbF concentrations at MW-107 exceed the surface water criteria as indicated in Table 4-2 below:

Table 4-2: MW-107 Groundwater Constituents Exceeding MSCs Surface Water Criteria

Constituent	PADEP Human Health Surface Water Criteria	DRBC Water Quality Criteria		MW-107
		Marine Objective - Fish Ingestion Only	Max	5/30/18
Methyl-tert-butyl ether	- -	- -	- -	20.7
Benzo(a)pyrene	0.0001	0.018	0.2	**1.2**
Benzo(b)fluoranthene	0.001	0.18	- -	**1.7**
Benzo(g,h,i)perylene	- -	- -	- -	0.95 J

Notes: The bolded values indicate that the constituent's concentration at MW-107 exceeds the criteria. All concentrations reported in µg/L. "- -" indicates constituent not listed in guidance document.

4.4 Analytical Models

Domenico analysis was used to model the groundwater impacts for the constituents listed in Table 4-1 (Domenico 1987). The Domenico Model was chosen per Pennsylvania's Land Recycling Program Technical Guidance Manual because there is little variation in conditions over the model domain, with a simple plume geometry and conceptual model. The spreadsheets used were downloaded from the PADEP website following link: https://www.dep.pa.gov/Business/Land/LandRecycling/Standards-Guidance-Procedures/Guidance-Technical-Tools/Pages/Fate-and-Transport-Analysis-Tool.aspx

Both spreadsheets are based on the following equation:

$$C(x,y,z,t)=\left(\frac{C_o}{8}\right)\exp\left\{\frac{x}{2\alpha_x}\left[1-\left(1+\frac{4\lambda\alpha_x}{v}\right)^{\frac{1}{2}}\right]\right\}erfc\left\{\left[x-vt\left(\sqrt{1+4\lambda\alpha_x/v}\right)\right]/2\sqrt{\alpha_x vt}\right\}$$
$$\left\{erf\left[\left(y+Y/2\right)/2\sqrt{\alpha_y x}\right]-erf\left[\left(y-Y/2\right)/2\sqrt{\alpha_y x}\right]\right\}\left\{erf\left[\left(z+Z/2\right)2\sqrt{\alpha_z x}\right]-erf\left[\left(z-Z/2\right)/2\sqrt{\alpha_z x}\right]\right\}$$

where:

C(x,y,z,t) = the concentration of the constituent at location x, y, z from the source at time t.

$\mathbf{C_o}$ = source concentration – the highest concentration of the constituent in the groundwater at the source (derived from site-specific data).

$\boldsymbol{\alpha_x}$ = longitudinal dispersivity (well- / location- specific data).

$\boldsymbol{\alpha_y}$ = transverse dispersivity (well- / location- specific data).

$\boldsymbol{\alpha_z}$ = vertical dispersivity (default value of 0.001 foot).

K = hydraulic conductivity (calibrated data).

i = hydraulic gradient (well- / location- specific data).

$\mathbf{f_{oc}}$ = fraction of organic carbon expressed as a decimal (default value of 0.005).

$\mathbf{p_b}$ = bulk density (laboratory soil testing results).

$\mathbf{n_e}$ = effective porosity (calibrated data).

$\mathbf{K_{OC}}$ = the organic carbon partition coefficient (default value from Table 5 in PA Code Title 25, Chapter 250).

R = retardation factory (calculated as $1+((K_{OC}*f_{oc}*p_b)/n_e)$.

v = constituent velocity (calculated as v_s/R).

$\mathbf{v_s}$ = seepage velocity (calculated as $v_s = Ki/n_e$).

λ = first order decay constant (default value from Table 5 in PA Code Title 25, Chapter 250).

Y = width of source area (well- / location- specific data).

Z = depth of source area (well- / location- specific data).

x,y,z = spatial coordinates in the horizontal, transverse and vertical directions.

t = time since the plume started moving.

Groundwater impacts originating from MW-5 and MW-102 were modeled using PADEP's Quick Domenico (QD) spreadsheet to evaluate groundwater concentrations of the selected constituents at the property boundary. Groundwater impacts originating from MW-107 were modeled using PADEP's SWLoad5B spreadsheet to estimate the mass loading of the selected constituents from groundwater to the Delaware River.

The results were loosely calibrated to available data from the MW-111 to MW-112 monitoring well pair.

4.4.1 Quick-Domenico Model

The QD application spreadsheet calculates the concentration anywhere in a plume of impacts at any time after a continuous, source becomes active. The QD model is intended for dissolved organic constituents whose fate and transport can be described or influenced by first order decay and reaction with organic carbon in the soil. The model assumes a constant source of a user-defined width which contributes impacts to the groundwater system, which has a defined constant flow velocity and direction, dispersion, linear isotherm adsorption (retardation), and first-order decay. All parameters are assumed constant in space and time. The QD mode also calculates the concentrations in a two-dimensional 5x10 grid whose length and width are set by the user.

4.4.1.1 Quick-Domenico Model Limitations

The major limitation of the QD model is that steady, uniform, one dimensional groundwater flow is assumed. The QD model is limited so that it should not be utilized for sites where flow and transport parameters vary significantly in direction or magnitude over the model domain. The QD model is intended for use in unconsolidated aquifers with reasonably uniform physical and hydrogeologic properties. The QD model does not simulate the transformation of parent compounds into daughter compounds, nor does it consider reactions between compounds. The mounding groundwater flow at this Site is simplified by isolating constituent concentrations (as supported by available groundwater data) to portions of the water table where flow is uniform and one dimensional.

4.4.2 SWLoad

The SWLoad spreadsheet uses a rearrangement of the Domenico equation to calculate concentrations at different points in the cross section of a plume at a distance from a continuous finite source. The concentrations are then added and multiplied by the groundwater flux and can be used to estimate the mass loading of a particular constituent from diffuse groundwater flow to a stream or surface water body. SWLoad assumes that the calculated loading is discharged to the subject stream.

SWLoad is intended to provide an estimate of the mass loading and is intended as screening tool. Therefore, if the mass loading is within the neighborhood of 30-50% of the level that would violate a stream standard, more rigorous in-stream sampling, monitoring and modelling efforts should be considered.

4.4.2.1 SWLoad Model Limitations

SWLoad has the same limitations as the QD model and is primarily intended for use in unconsolidated (soil) aquifers with reasonably uniform physical and hydrogeologic properties.

4.5 Groundwater Flow Model Construction and Parameters

As indicated in Section 4.4 model parameters were selected based on a combination of literature values, site-specific data, and calibration. Parameters obtained using the QD model were also used for SWLoad.

4.5.1 Literature Values

The chemical specific values (i.e., first order decay constant [λ] and the organic carbon partition coefficient [K_{OC}]) were those provided in Table 5a of PA Code Title 25, Chapter 250. Additionally, the default value of 0.5% organic carbon was used.

4.5.2 Laboratory Soil Testing Results

Site-specific parameters were estimated via laboratory soil testing performed on soil samples collected from the borings drilled to install monitoring wells PCMW-14D and PCMW-16D. Laboratory soil samples were collected from each hydrostratigraphic unit. Soil samples were not collected from the monitoring wells selected for modelling (MW-5, MW-102, or MW-107). Therefore, physical parameters of soil samples collected from monitoring wells PCMW-14D and PCMW-16D were used as starting points for calibrating the model. Parameters relevant to modelling provided by laboratory soil testing are hydraulic conductivity, porosity, and soil bulk density. For the fill unit, laboratory soil tests provided the following value range for each of these parameters:

- Hydraulic Conductivity (K): 0.417 to 8.31 feet per day (ft/day: 1.47×10^{-4} to 2.93×10^{-3} cm/sec).
- Porosity (n_e): 0.519 to 0.529.
- Density (p_b): 1.19 to 1.29 grams per cubic centimeter (g/cm^3).

The results of the laboratory soil testing are included in Appendix F. As a note, hydraulic conductivity, porosity, and bulk density are used to calculate constituent velocity used in the Domenico equation. Therefore, infinite combinations of these parameters could result in the same velocity and, thus, the same results.

4.5.3 Well- / Location- Specific Data

Many of the parameters in the Domenico equation are based on well location or the site-specific conditions in the vicinity of that well. These parameters include the hydraulic gradient, dispersivity, and source dimensions. As noted on the QD information sheet, longitudinal dispersivity (αx) is derived by dividing the distance from the source to the point of concern (property boundary) by 10 and the transverse dispersivity (αy) is calculated by dividing longitudinal dispersivity by 10. Vertical dispersivity selected was 0.001 feet, as suggested as a conservative value in the SWLoad Instructions. Source dimensions were roughly selected based on soil data. The hydraulic gradients used in the QD model were estimated using the groundwater contour maps (Figures 8 through 10) and averaging the approximate hydraulic gradient for each event. Well- and location- specific physical parameters selected for modeling are provided in Table 4-3 below.

Table 4-3: Well- / Location- Specific Parameters

Monitoring Well	Hydraulic Gradient (ft/ft)	Dispersivity (feet)		Source Width (feet)	Source Depth (feet)
		ax	ay		
Calibration Pair					
MW-111 to MW-112	0.0101	20.4	2.4	200	10
Modeled Wells					
MW-5	0.00855	13.8	1.38	200	10

Monitoring Well	Hydraulic Gradient (ft/ft)	Dispersivity (feet)		Source Width (feet)	Source Depth (feet)
		ax	ay		
MW-102	0.00506	30	3	200	10
MW-107	0.00294	7	0.7	160	10

4.5.4 Calibration

During the SRI, monitoring wells cluster MW-108 through MW-110 and cluster MW-111 through MW-113 were installed to investigate groundwater concentrations at and downgradient from potential source areas. Downgradient wells, MW-109, MW-110, MW-112, and MW-113, indicate that groundwater is not migrating offsite from the source areas at concentrations exceeding MSCs. Furthermore, most VOC and PAH constituents were not detected in groundwater at these downgradient monitoring wells above laboratory detection limits.

Benzene in well cluster MW-111 through MW-113 was selected for calibration. This well cluster is approximately 1,260 feet from MW-5, 1,240 feet from MW-102, and 600 feet from MW-107. Groundwater direction at the calibration well cluster is most similar to the groundwater direction at MW-102.

Benzene was detected in groundwater from MW-111 at a concentration of 686 µg/L, and benzene was not detected above the 0.5 µg/L laboratory detection limit in groundwater from the downgradient wells (i.e., MW-112, MW-113). For calibration purposes, a benzene concentration half the laboratory detection limit (0.25 µg/L) was modeled at downgradient wells.

For calibration, a time of 37 years was used because the groundwater data was collected in 2019 which is approximately 37 years since Site closure in 1982. The lowest laboratory values for porosity (0.519) and bulk soil density (1.19 g/cm^3) were used as a conservative measure to provide the fastest constituent velocity. A 0.005 organic carbon fraction was used as recommended in the SWLoad Construction Manual (PADEP 2008). Additionally, the October 3, 2019 shallow groundwater potentiometric surface is different than the previous shallow groundwater potentiometric surfaces in this immediate area. Therefore, the model was calibrated twice: first using the March 19, 2018 shallow groundwater flow direction; and second using the October 3, 2019 shallow groundwater flow direction. Benzene isoconcentration maps modelled based on both flow directions are shown on Figures 30 and 31.

Hydraulic conductivity was the only parameter further calibrated. The hydraulic conductivity for the March 19, 2018 groundwater model was 1.185 ft/day, and the hydraulic conductivity for the October 3, 2019 groundwater model was 1.317 ft/day. Both calibrated values for hydraulic conductivity fall within the 0.417 to 8.31 ft/day range established by laboratory soil testing. The 1.317 ft/day hydraulic conductivity was used for modelling at MW-5, MW-102, and MW-107.

4.6 Predictive Simulations

The QD model was adjusted to determine concentrations at the point of compliance (property line) in 5, 10, 15 and 30-year durations. The SWLoad model assumes a near infinite time (when concentrations at boundary locations would be the highest for a constant source). Copies of the results of the QD and SWLoad models are included as Appendix K. For some models, please note that the constituent concentration was inputted as µg/L opposed to the default mg/L to provide a cleaner presentation of the results (i.e., to limit the use of scientific notation for results much less than 0). Unit changes are noted in PDF edits for the model. The modeling results are presented below:

- *TCE at MW-5* – The 30-year (highest) modeled concentration for TCE is 1 µg/L at the Site boundary. Modelling indicates that the constituent would not leave the Site in groundwater at concentrations greater than the 5 µg/L MSC.
- *Bis(2-ethylhexyl)phthalate at MW-102* – The modeled concentration for bis(2-ethylhexyl)phthalate is 0 µg/L at the Site boundary for each of the timeframes modelled. Modelling indicates that the constituent would not leave the Site in groundwater.
- *Benzo(a)pyrene and benzo(b)fluoranthene at MW-107* – The modeled concentrations for both these constituents indicate that groundwater conditions at the Site boundary would not exceed surface water criteria. The estimated concentrations are many orders of magnitude less than the conservative PADEP Surface Water Criteria for Human Health. At the Site boundary, the predicted concentrations for both these constituents are rounded to zero in the model causing a #DIV/0! error in the spreadsheet when outputting the mass loading estimate.

When combined with the groundwater data at point-of-compliance wells, fate and transport modeling results indicate that COCs are not currently, and are not predicted in the future, to migrate offsite in groundwater. Therefore, PCC proposes to prepare an Act 2 Final Report for groundwater upon approval of this RI Report and Cleanup Plan.

5 CONCEPTUAL SITE MODEL

This section presents the CSM which has been prepared in accordance with the PA Code Title 25, Chapter 250.404 and follows EPA (1989) guidance. The CSM outlines potential source areas, release and transport mechanisms, environmental media that currently show or may show the presence of COCs in the future, possible exposure pathways to potentially exposed human populations, and potential exposure routes. It considers current Site conditions and surrounding land use, as well as the most likely future conditions upon redevelopment for future commercial or industrial land use.

The primary exposure source is onsite soil that contains COCs common in urban/historic fill and/or residual COCs from former Site-related activities. Figure 32 contains a graphic illustration of the CSM for the Site. As shown in the figure, the primary exposure source is onsite soil. Table 22 includes information on pathway elimination for both current and future Site receptors.

A complete exposure pathway is composed of the following four elements (EPA 1989):

- A source and mechanism of COC release.
- Retention or transport media.
- A potential contact point with an affected medium.
- An exposure route (i.e., ingestion, dermal contact, inhalation) at the potential contact point.

If any of the elements are or will be missing, the exposure pathway is incomplete, and there is no potential for exposure or health risk. This is the premise behind “pathway elimination” cleanup strategy. Exposure pathways are depicted as potentially complete where it has not been confirmed that any of the elements of an exposure pathway are missing.

5.1 Current Exposure Pathways

The Site is currently vacant; therefore, based on the current use of the Site there are no potential human receptor populations that may contact COCs onsite. In the event that the Site is redeveloped, and buildings are constructed, there are potentially complete future VI pathways.

5.1.1 Current Soil Pathways

The Site is currently vacant and access to the impacted areas of soil on-site is currently restricted by a chain-link fence that encloses the entire Site. In addition, most of the Site is either densely vegetated (woodlands and mowed grass) or covered by impervious surfaces such as pavement or remaining building structures or features such as concrete pads or footings, which limit the ability of surface soils to be eroded or mobilized and encountered by human receptors.

Outdoor maintenance workers mow herbaceous vegetation at the Site a few times a year and mow to a grass height of 6 inches or higher. Subsurface utility work is not anticipated because subsurface utilities were disconnected as part of Site demolition activities, except for the Upper Delaware Collecting Sewer which extends beneath the Site and can be accessed from a manhole near the western end of the Site. Additionally, any Site workers must follow the HASP and use PPE that will mitigate soil exposure pathways. Site worker (both outdoor worker and utility worker) exposure to soils are eliminated by the presence of vegetation and impervious surfaces, as well as the adherence of safe work practices as prescribed in the HASP. Therefore, there are no potential receptors for on-site soil dermal contact or ingestion and this pathway is incomplete.

5.1.2 Current Groundwater Pathways

Drinking water in Philadelphia is solely sourced from the Delaware and Schuylkill Rivers. Groundwater is not used for drinking water in Philadelphia. As shown in Figure 13 and presented in Appendix I, there are no active groundwater wells at the Site or in the immediate Site area. Therefore, the current exposure pathway for groundwater as potable water or industrial water is incomplete. In the future, as part of the Site redevelopment, institutional controls will be established that prohibit groundwater use.

There are no groundwater seeps at the Site, so there is no pathway to groundwater exposure unless intrusive work is performed below the water table. There is only one active manhole which provides access to the Upper Delaware Collecting Sewer. All other utilities were disconnected during previous Site demolition/decommissioning activities. The Upper Delaware Collecting Sewer does not collect any storm water from the Site. No installation, maintenance, or repair of underground utilities is anticipated under current conditions.

5.1.3 Current Vapor Intrusion Pathways

There are no buildings currently onsite; therefore, the current VI pathways via onsite groundwater and soil are incomplete.

5.2 Future Exposure Pathways

The following hypothetical potential human receptor populations were identified and the potential for their exposure was evaluated under the future exposure scenario:

- Construction workers
- Utility workers who may install or maintain utilities on the Site
- Outdoor workers
- Building occupants and indoor workers
- Residents, if Site use is not restricted
- Recreational users
- Trespassers

Biota may be exposed to COCs in surface soil (top 2 feet) via direct contact, ingestion, inhalation, and food-web transfer. Potential risks from inhalation or dermal exposures are typically not quantified for wildlife because of the lack of acceptable methodology to quantify exposure.

5.2.1 Future Soil Pathways

Future exposure pathways via direct contact with soils for incidental ingestion, dermal contact and/or inhalation of fugitive dusts or COCs volatilized from soils would be complete in scenarios where the

Cleanup Plan is not implemented. Future soil exposure pathways would include the following individuals who may encounter COCs in surface and subsurface soil via incidental ingestion, dermal contact, and the inhalation of VOCs and/or particulates in windblown soil:

- Residents.
- Recreational users.
- Building occupants and indoor workers.
- Construction and utility workers.
- Outdoor workers (such as lawn maintenance personnel).
- Trespassers.

5.2.2 Future Groundwater Exposure Pathways

The depth to groundwater ranges from approximately 2 to 15 feet bgs across the Site, except at one isolated location, PCMW-12S, where groundwater (likely perched) was observed at a depth of 0.78 feet bgs. Therefore, similar to future soil exposure pathways, future exposure pathways via direct contact with groundwater for incidental ingestion, dermal contact, and/or inhalation of COCs volatilized from groundwater may potentially exist for future residents, construction workers, and utility workers. There is a complete exposure pathway for utility workers and residents who may be exposed to COCs in shallow groundwater, via dermal contact and inhalation of VOCs while performing utilities installation or maintenance on the Site or using groundwater (without restrictions or treatment) for drinking water. Volatile constituents in groundwater may volatilize into utility trenches. Construction workers are potential candidates for exposure to COCs in groundwater, if excavation dewatering is performed during Site redevelopment. If fill material were to be placed in areas of the Site with a shallow groundwater table prior to building construction, this may limit excavation below the water table (e.g., for installation of utilities).

As previously discussed, groundwater is not used as potable water in Philadelphia. However, a potential future pathway is conservatively evaluated because an official Non-Use aquifer determination has not been made for the immediate area of the Site or Philadelphia. Since there is no official non-use aquifer determination for portion of the city around the Site, this pathway hypothetically could be considered potentially complete in the future in the absence of an environmental covenant restricting groundwater use for the following receptors:

- Indoor workers via ingestion, dermal contact, or inhalation if potable wells are installed in the absence of an environmental covenant restricting groundwater use onsite.
- Hypothetical future onsite residents via ingestion, dermal contact, and inhalation of groundwater in the absence of a deed restriction restricting the property to industrial/commercial use.

5.2.3 Future Vapor Intrusion Pathway

Based on the results of the RI Activities discussed in Section 3, in potential VI source areas (i.e., Areas 1 through 4, and select locations in the center of the Site and in the northern portion of the Fuel Blending Area), there could be complete exposure pathways for indoor workers via VI exposure from soil and groundwater if future buildings are constructed onsite without some mitigation, although these risks may be over-predicted (see Section 3.2.6). In these areas, the VOC concentrations identified in vadose zone soil and groundwater at the Site may have the potential to cause VI concerns. Therefore, future buildings will be evaluated prior to construction to determine if a VI risk assessment and/or VI mitigation system is necessary. The results of a VI risk assessment and/or additional soil gas characterization may demonstrate or eliminate the need to install a VI mitigation system in certain areas. Alternatively, a VI mitigation system (e.g., vapor barrier) may be installed to address the potential VI pathway in lieu of performing a risk assessment. Implementation of institutional controls will provide assurance that the VI pathway is eliminated in future Site development.

6 ECOLOGICAL SCREENING

The ES evaluates potential exposure of environmental receptors at the Site. It focuses on potentially complete exposure pathways for terrestrial receptors that may be impacted by constituents of potential ecological concern (COPECs). The ES evaluates environmental conditions at the Site in accordance with the PADEP Ecological Screening Process presented in the PADEP Land Recycling Program Technical Guidance Manual (PADEP 2019a). The procedure follows EPA interim final guidance on *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997). This procedure uses eight discrete steps, with a decision option after Step 2 or Step 7 to determine whether a substantial impact has resulted from regulated substances. The information provided in this ES includes Step 1 (Fundamental Concepts) and Step 2 (Preliminary Exposure Estimate and Risk Estimate). The ES supports the use of pathway elimination as part of the scientific/management decision (SMD) concluded after Step 2. No further ecological evaluation is recommended beyond Step 2 as explained below. Under the future CSM, capping soils impacted by COPECs during site redevelopment would effectively eliminate potential ecological exposure at the Site. The requirements for Step 1 are provided in the section below, and the following section presents the findings of Step 2.

6.1 Step 1 – Fundamental Concepts

Step 1 describes the fundamental components of the Site and the environmental setting. To support Step1, a Site visit was conducted, online ecological databases were reviewed, and appropriate regulatory agencies were consulted (via the Pennsylvania Natural Diversity Inventory receipt). Step 1 evaluates the site environmental settings and potential species and habitats of concern. The CSM is developed as part of Step 1.

6.1.1 Site Environmental Setting – Vegetation and Wetland Communities

The Site environmental setting, including Site location, history, geomorphology, hydrogeology, and characterization are provided in Sections 2 and 3 of this report. The supplemental information below is provided to support the ES. It describes the vegetation and wetland communities in more detail.

Signs of observable impacts to environmentally sensitive natural areas or species were not present during the Site reconnaissance. No indication of stressed vegetation, seeps, free-product discharges, or short-term effects on biota were observed.

The vegetative communities that exist within the project area consist mostly of early successional grasslands which are dominated by invasive species, with intermittent hardwood forest mix scattered throughout the Site. Dominant vegetation within the project area includes mugwort (*Artemisia vulgaris*), orchard grass (*Dactylis glomerate*), big bluestem (*Andropogon gerardii*), eastern cottonwood (*Populus deltoides*), common reed (*Phragmites australis*), stickywilly (*Galium apartine*), and poison ivy (*Toxicodendron radicans*). A listing of vegetative species observed throughout the plant communities found at the Site is provided in Table 23.

A wetland delineation was performed at the Site on May 1, 2019. Wetlands and waters of the U.S. were identified in the field using the 1987 “U.S. Army Corps of Engineers Wetland Delineation Manual” (USACE Manual) and the associated regional supplement for the Atlantic and Gulf Coastal Plain Region

(USACE 2010). Areas within the defined project limits exhibiting wetland characteristics were flagged in the field with sequentially numbered survey tape or pin flags. The flag locations were surveyed with a handheld Trimble Geo 7X GPS. The hydrology, soils, and vegetation conditions were documented.

Six isolated wetland complexes were identified at the Site. These wetland features receive hydrology primarily from surface water flows due to their low topographic position within the landscape. Surface hydrology onsite is controlled by fill material historically placed onsite resulting in a shallow impermeable layer ranging from approximately 8 to 14 inches below the surface. Four of the wetlands are present on the western portion of the Site within a mosaic of upland and palustrine forested and emergent wetlands. A fifth palustrine emergent wetland exists as an isolated depression within the upland topography and located in the eastern portion of the Site. A sixth wetland is located within a man-made ditch associated with a retired rail line on the eastern portion of the Site. A figure showing the location of wetlands and adjacent uplands is provided in Figure 33.

6.1.2 Potential Species and Habitats of Concern

As introduced in Section 3.1.3, an evaluation of the potential occurrence of threatened, endangered, and/or special concern species or resources onsite was initiated through consultation with PADNR and USFWS.

The PNDI search was submitted online through the PADNR which identified the Delaware River Shoreline as a Natural Heritage Area. This habitat indicated potential species of concern "…are only found in specific areas where tidal habitat remains protected and in a few of the more naturally managed park areas." A formal review for the Site was provided by PADNR on October 2, 2019. From review of PNDI records, the PFBC[14] indicated one threatened species of turtle (northern red-bellied cooter, *Pseudemys rubriventris*) may potentially utilize habitats occurring at the Site. No other species of concern were indicated by PADNR agencies or USFWS. After review of the additional site information, PFBC concluded in their October 30, 2019 response letter that the current Site conditions pose no adverse impacts to the species of concern. The PADNR and PFBC consultation correspondence is provided in Appendix L.

On November 12, 2019, Arcadis performed a cover-type and habitat evaluation, searching for potential northern red-bellied cooter habitat. Observations were documented in a field book and accompanied by a photograph log (Appendix M). Site observations indicated limited basking habitat areas along the near-shoreline tidal areas. Based on the nature of the historic fill found throughout the surface layer of the upland portions of the Site, suitable nesting habitat of sandy and silty loam soils is not present. Per these observations, there is little to no potential for species or habitats of concern to be impacted by existing conditions found at the Site. Following Site development, species or habitats of concern will be further protected from remaining environmental residuals at the Site.

6.1.3 Ecological Conceptual Site Model

The CSM identifies exposure pathways and potential receptor populations that may be exposed to COPECs in environmental media. Potential ecological receptors can be exposed directly or indirectly (i.e., through the food web) to COPECs if a complete exposure pathway exists. A complete exposure pathway

[14] The PFBC has jurisdiction for aquatic species in Pennsylvania.

includes the following elements: (1) constituent source; (2) release mechanism to the environment; (3) transport medium; (4) receptor contact at the exposure point; and (5) exposure route. If an element is missing, the exposure pathway is considered incomplete and is generally excluded from evaluation. Important features that need to be considered when evaluating whether an exposure pathway is complete include the COPEC concentrations in different media and their respective locations, the physical and chemical properties of the COPECs, and the locations of environmentally sensitive areas.

The CSM identifies ecological receptors and potential exposure pathways (e.g., ingestion of constituents in soil or food, direct contact with impacted media). For wildlife (i.e., birds and mammals), oral exposures are predominantly considered. Potential risks from substances via inhalation or dermal exposures are typically not quantified for wildlife because of the lack of acceptable methodology to quantify exposure.

Preliminary ecological exposure pathways were evaluated during the Site visits. No visible seeps and/or springs were observed within the upland portion of the Site. No significant surface water drainages are present. No significant surface erosion patterns in surface soils are present. Therefore, shallow groundwater, surface water, and subsurface soil (defined as greater than 2 feet bgs) are not considered complete exposure pathways and are not part of the CSM, leaving surface soil as the only potential pathway. Additionally, an evaluation of COPECs that may have migrated from upland source areas to sediment were not evaluated as part of the CSM because probing revealed no observable impacts to the sediment. As shown in the CSM diagram (Figure 34), only terrestrial habitats were evaluated per existing complete or potentially complete exposure pathways from surface soils.

Under future conditions, it is expected that sources of environmental contaminants will be isolated or removed during redevelopment, thereby mitigating potential ecological exposure pathways.

6.1.3.1 Ecological Receptors

Limited wildlife species (i.e., ecological receptors) were observed onsite. Based on the disturbed nature of the habitat and industrial setting surrounding the Site, the primary wildlife species that may utilize the Site include those common species adapted to fragmented habitats found in urban landscapes (e.g., common grackle, crow, deer mice, house finch, meadow voles, mourning dove, rabbits, raccoons, robins, squirrels, and woodchucks). Species observed during the Site visits are summarized in Table 24. The following ecological receptor groups are identified for evaluating potential exposure within the current CSM:

- Plants
- Soil invertebrates
- Wildlife (e.g., American robin, meadow vole, short-tailed shrew, red fox, red-tailed hawk)

6.1.3.2 Ecological Exposure Pathways

Potential exposure routes associated with surface soil, as defined as the top 2 feet within the PADEP Ecological Screening Process, include direct contact, ingestion, inhalation, and food-web transfer. The COPECs identified in soil each possess varying degrees of potential for exposure depending on chemical-specific parameters. The following complete or potentially complete exposure pathways were identified:

- Direct contact with COPECs in soil is a potentially complete exposure pathway for wildlife and a complete exposure pathway for terrestrial plants and soil invertebrates. However, soil chemistry and nature of historical fill components may limit the potential bioavailability for some COPECs. Wildlife may have direct exposure to soil while burrowing and/or preening; however, fur or feathers greatly reduces the potential exposure.
- Incidental ingestion of COPECs in soil is a potentially complete exposure pathway for soil invertebrates and a complete exposure pathway for wildlife. Soil-bound COPECs may be ingested during foraging or grooming activities.
- For COPECs in soil that are potentially bioaccumulative, food-web transfer is a potentially complete exposure pathway. These COPECs can accumulate in soil invertebrates and plants, potentially allowing constituents to accumulate in lower trophic level organisms. In turn, mammalian and avian wildlife could consume these COPECs in their diet.

Under the future CSM, exposure routes associated with impacted surface soil would be addressed during the remedial design process and subsequent redevelopment phase, thereby eliminating the current exposure pathways.

6.2 Step 2 – Preliminary Exposure Estimate and Risk Assessment

Step 2 is the Preliminary Exposure Estimate and Risk Estimate. Under Step 2, surface soil data are compared to ecotoxicological screening benchmarks (ESBs) to evaluate the exposure and risk to ecological receptors.

Surface soil data are compared to ESBs to evaluate the exposure and risk to ecological receptors. The ecological screening process identified a total of 62 potential COPECs, including 17 metals (including cyanide), 6 pesticides, 9 VOCs, 26 SVOCs (primarily PAHs and phenol), and PCBs. The initial COPEC screening of available surface soil data collected at the Site is provided in Appendix N.

A risk characterization was conducted by comparing COPEC EPCs to conservative ESBs. The derived value is identified as a hazard quotient (HQ). An HQ less than or equal to 1 indicates the potential for adverse effects to ecological receptors is absent or minimal and additional evaluation is likely not necessary. An HQ greater than 1 indicates a potential for adverse effects to ecological receptors may exist and that additional evaluation of potential risks may be necessary. Using the ESBs derived for plants, soil invertebrates, and wildlife the highest HQs for COPECs were found for metals (aluminium, chromium, cyanide, iron, lead, mercury, and zinc), individual PAHs (anthracene, benzo(a) pyrene, fluoranthene, phenanthrene, and pyrene), and total PCB Aroclors. For each COPEC identified, the HQ values is provided in Appendix N.

6.3 Conclusions

Under the PADEP ES Process framework, a SMD is made to determine if:

1. The ES should be continued to develop a site-specific clean-up goal, or to reduce uncertainty in the evaluation of risk and impact.
2. The preliminary screening is adequate to determine that no substantial risk exists.

3. There is substantial impact and remediation can eliminate or reduce exposure to an acceptable level.

The results of the ES indicate potentially complete exposure pathways for ecological receptors exposed to COPECs in surface soil. However, through pathway elimination as provided in the Cleanup Plan, future ecological exposure would effectively be eliminated. Therefore, no further ecological evaluation is recommended or required to reach this remedial decision.

7 PUBLIC BENEFITS TO REMEDIATION AND REUSE

The Site is ideal for a variety of commercial or industrial uses and Site development will benefit the public in various ways. The Site is currently being considered for commercial warehousing (see preliminary plans in Exhibit 1). The primary economic and health benefits gained by Site redevelopment are directly related to returning the property to a functional use. Site development will generate the following benefits to the Bridesburg area:

- Increased employment opportunities for the Bridesburg borough and the surrounding communities. Per a September 2019 US Bureau of Labor Statistics Report, Philadelphia County has the highest unemployment rate in the Philadelphia-Camden-Wilmington Metropolitan Area.
- Increased revenues to the Bridesburg borough. The Site is in a Federally Qualified Opportunity Zone. Opportunity Zones are a community investment tool established by Congress in the Tax Cuts and Jobs Act of 2017 to encourage long-term investments in low-income urban and rural communities nationwide.

8 REMEDIAL INVESTIGATION CONCLUSIONS

The RI was undertaken to assess the nature and extent of Site-related environmental impacts remaining after the extensive soil remediation performed as part of the RCRA closure from 1982 to 1994. The RI evaluates the risks posed to human health and the environment by those remaining impacts that will be addressed in the Cleanup Plan.

The Initial RI activities were performed by PS&S from 2003 through 2006. Based on a review of the Initial RI results, Arcadis performed a supplemental investigation in 2018 and 2019 to: (1) confirm that Site soil conditions have not significantly changed since samples were collected as part of the Initial RI activities; (2) fill identified data gaps from previous investigation and remedial actions for purposes of developing a Cleanup Plan; and (3) assess current groundwater conditions. The Site is unoccupied, and no Site use or redevelopment activities were performed between the Initial RI and the SRI. When combined, work activities performed for the RI consisted of the following:

- Excavating 197 test pits and collecting soil samples from 145 test pits.
- Installing 179 soil borings and collecting soil samples from 150 soil borings.
- Installing and sampling 33 shallow groundwater monitoring wells, 13 deep groundwater monitoring wells, and 7 hydropunch borings.
- Analyzing approximately 540 soil samples and 112 groundwater samples for a combination of TCL VOCs, TCL SVOCs, PP metals, TAL inorganics, cyanide, pesticides, and PCBs.
- Collecting 21 soil gas samples and one ambient air.
- Performing sediment probing in the Delaware River and a visual reconnaissance of the shoreline for sheens, tar-like material, elevated photoionization detector readings, or other observable indications of Site-related impacts.

The RI results provide adequate data coverage across the Site to: (1) identify and delineate the environmental conditions; (2) support a CSM; (3) develop a cleanup plan; and (4) support Site redevelopment. Based on the RI results, site-related impacts are relatively limited to the center of the Site and at isolated locations on the remainder of the Site.

Based on observations of soil samples recovered from soil borings across the Site, there are three hydrogeological units above weathered metamorphic schist bedrock. Nearest the ground surface is a layer of man-made fill materials that generally meets the description of historic fill as defined in PADEP's Management of Fill Policy (Document #258-2182-773) dated January 1, 2020. The fill layer is where most soil samples were collected and where most groundwater wells are screened. A confining unit of silt and clay material underlies the fill materials and underneath that confining unit is a sand and gravel unit. Groundwater at the Site is separated into a shallow and deep zone by the silt and clay layer. The shallow aquifer was formed by the historical placement of fill above native surface soils. Due to the presence and characteristics of the historic fill, it is not suitable for use.

Based on the RI results, no COCs have been identified in subsurface soil at the Site at concentrations exceeding non-residential direct contact MSCs. Several PAHs and lead were detected throughout the Site in surface soil at concentrations typical of urban/historic fill and, at select locations, at concentrations exceeding the non-residential direct contact MSCs. Additionally, soil containing viscous tar, oil-like material, and solidified tar was observed at isolated and limited locations at the Site. Visually impacted material was generally collocated with select VOCs, SVOCs, and inorganics at concentrations greater than non-residential soil-to-groundwater MSCs. These limited areas have been delineated, and groundwater monitoring wells were installed and sampled within and downgradient of them to assess the potential impact to groundwater from soil.

Outside of these isolated areas, shallow groundwater is relatively unimpacted by former Site operations. In the shallow aquifer, existing groundwater conditions are typical of groundwater in urban/historic fill. Groundwater impacts were generally not observed in point-of-compliance wells downgradient from impacted areas, and fate and transport modelling indicates that the limited residual groundwater impacts are not migrating offsite. Deep groundwater (the primary Philadelphia region aquifer) is shown to be unimpacted by former Site operations.

Taken together, the RI soil and groundwater analytical results indicate the presence of stable, residual impacts limited to defined areas within the boundaries of the Site. Based on these RI findings, PCC will prepare an Act 2 Final Report for groundwater upon PADEP's approval of the RICP.

VOCs were not detected above the screening values for non-residential, sub-slab, soil gas samples collected during the Initial RI. Additionally, a comparison of existing unsaturated soil and groundwater data to residential VI standards from the TGM indicate there are no potential VI concerns for the residential properties adjacent to the Site. However, the existing unsaturated soil and groundwater results indicate the potential for VI in future Site buildings.

The COCs for the Site are listed in Table 8-1 below.

Table 8-1: COC For Each Environmental Medium

Analyte	CAS Number	Surface Soil COC (Yes/No)	Subsurface Soil COC (Yes/No)	GW COC (Yes/No)	VI COC (Yes/No/na)
Volatile Organic Compounds					
Benzene	71-43-2	No	**Yes**	**Yes**	**Yes**
Chlorobenzene	108-90-7	No	**Yes**	No	No
Dichloromethane	75-09-2	No	**Yes**	No	No
Ethylbenzene	100-41-4	No	**Yes**	No	No
Methyl-tert-butylether	1634-04-4	No	No	**Yes**	**Yes**
Styrene (Monomer)	100-42-5	No	**Yes**	No	No
Tetrachloroethene	127-18-4	No	No	**Yes**	No
Toluene	108-88-3	No	**Yes**	No	**Yes**
Trichloroethene	79-01-6	No	No	**Yes**	**Yes**
Semi-Volatile Organic Compounds					
1,1-Biphenyl	92-52-4	No	**Yes**	No	**Yes**
2-Methylnaphthalene	91-57-6	No	**Yes**	No	**Yes**
4-Methylphenol	106-44-5	No	**Yes**	No	No
Anthracene	120-12-7	No	**Yes**	No	No
Benz(a)anthracene	56-55-3	**Yes**	**Yes**	**Yes**	na
Benzo(a)pyrene	50-32-8	**Yes**	**Yes**	**Yes**	na

Analyte	CAS Number	Surface Soil COC (Yes/No)	Subsurface Soil COC (Yes/No)	GW COC (Yes/No)	VI COC (Yes/No/na)
Benzo(b)fluoranthene	205-99-2	**Yes**	**Yes**	**Yes**	na
Benzo(g,h,i)perylene	191-24-2	No	**Yes**	**Yes**	na
Benzo(k)fluoranthene	207-08-9	**Yes**	**Yes**	**Yes**	na
bis(2-Ethylhexyl)phthalate	117-81-7	No	No	**Yes**	na
Carbazole	86-74-8	No	**Yes**	**Yes**	na
Chrysene	218-01-9	**Yes**	**Yes**	**Yes**	na
Dibenz(a,h)anthracene	53-70-3	**Yes**	**Yes**	**Yes**	na
Dibenzofuran	132-64-9	No	**Yes**	**Yes**	na
Fluoranthene	206-44-0	No	**Yes**	No	na
Fluorene	86-73-7	No	**Yes**	No	na
Indeno(1,2,3-cd)pyrene	193-39-5	**Yes**	No	**Yes**	na
Naphthalene	91-20-3	**Yes**	**Yes**	**Yes**	**Yes**
Phenanthrene	85-01-8	No	**Yes**	No	na
Phenol	108-95-2	No	**Yes**	No	na
Pyrene	129-00-0	No	**Yes**	No	na
Inorganics					
Antimony	7440-36-0	No	**Yes**	**Yes**	na
Arsenic	7440-38-2	**Yes**	**Yes**	**Yes**	na
Cyanide	57-12-5	No	**Yes**	No	na
Lead	7439-92-1	**Yes**	**Yes**	No	na
Manganese	7439-96-5	No	No	**Yes**	na
Mercury	7439-97-6	No	**Yes**	No	na
Nickel	7440-02-0	No	**Yes**	**Yes**	na
Selenium	7782-49-2	No	**Yes**	No	na
Vanadium	7440-62-2	No	No	**Yes**	na

Notes: na = not applicable analyte does not readily volatilize; GW = groundwater; the inorganics shown for groundwater are based on dissolved-phase analytical results.

Currently, there is no complete exposure pathway to impacted soil and groundwater. Future exposure pathways via direct contact with Site soil or groundwater for incidental ingestion, direct dermal contact and/or inhalation of windblown particulates (fugitive dusts) or volatilized COCs will potentially be complete if no controls are implemented.

Based on the concentrations of select COCs in unsaturated soil and groundwater, there is potential for a complete VI exposure pathway when buildings are constructed onsite in the future. The potentially complete exposure pathway would be for indoor occupants, residents, and workers via VI from soil and groundwater if future buildings are constructed onsite in the absence of engineering and institutional controls.

The findings of the RI provide the basis for performing a “pathway elimination” cleanup approach.

9 CLEANUP PLAN

The NIR was submitted to PADEP stating that PCC is seeking a release of liability under the Act 2 Site-Specific Standard (Appendix A). Current potentially complete exposure pathways and hypothetical future exposure pathways (without engineering and institutional controls) are presented in Section 5 and summarized in Table 9-1 below:

Table 9-1: Summary of Current and Hypothetical Future Exposure Pathways

Current and/or Future Exposure Pathway	Potential Current Receptors	Potential Future Receptors without Remedy
Incidental Soil and GW Ingestion, Dermal Contact, and Inhalation of VOCs and Particulates	1. Utility/Construction Worker 2. Outdoor Worker	1. Resident 2. Recreational User 3. Building Occupant 4. Utility/Construction Worker 5. Outdoor Worker 6. Trespasser
Potable Water Ingestion and Use	None	1.Resident 2.Building Occupant 3.Indoor Worker
Soil Vapor Intrusion	None	1. Resident 2. Building Occupant 3. Indoor Worker

Based on the characterization data for soils and groundwater presented in Section 3 and review of migration pathways and potential receptors, the remedial action objective for the Site is to protect human health by eliminating identified exposure pathways with soils and groundwater impacted by VOCs, SVOCs, and inorganics. The Cleanup Plan:

- Provides methods to achieve pathway elimination for impacted soils using engineering controls (e.g., capping of soils with structures, roadways, parking lots, and landscaping).
- Outlines procedures and plans to allow for safe execution of proposed Site redevelopment activities.
- Specifies institutional controls to be implemented (i.e., Environmental Covenants, restrictions, or other appropriate vehicles).
- Outlines a Post-Remediation Care Plan.

The proposed Site-Specific Standard for this Site generally consists of "pathway-elimination," which means that potentially complete future exposure pathways will be mitigated using engineering and/or institutional controls. Details of site-specific engineering controls will be updated in the future if and as Site development occurs. Engineering controls proposed in this Cleanup Plan include:

1. Covering impacted soils with asphalt/concrete pavement, building structures, and/or a 2-foot clean soil cover (for areas that contain surface soil exceeding the non-residential direct-contact standards) to prevent direct contact exposure and/or to mitigate potential migration of constituents from soil-to-groundwater.

2. Employing VI mitigation measures for future buildings constructed onsite if and where needed. An initial screening of areas with potential VI concerns is provided as Figure 35. Additional soil gas characterization and/or a cumulative risk assessment may demonstrate that mitigation measures are not needed.

Proposed institutional controls are a deed restriction/environmental covenant that: (1) prohibits use of groundwater at the Site; (2) restricts the Site to non-residential use; and (3) requires a Post-Remediation Care Plan that stipulates inspection, periodic maintenance/repair activities, and reporting requirements for engineering controls, as appropriate. These restrictions will be embodied in a recorded and enforceable Environmental Covenant.

This Cleanup Plan may be implemented in conjunction with Site redevelopment. Surface elements of redevelopment, such as paving, building foundations and slabs may be used to form an integral part of the planned final cap for the Site and eliminate potential exposure pathways. The Cleanup Plan may be implemented using an iterative process that results in elimination of potential exposure pathways as any potential redevelopment is conducted; however, the general remedial scheme will be implemented even in the absence of redevelopment.

9.1 List of Contacts

Table 9-2: Site Contacts

Name/Affiliation	Address	Contact Information
PADEP		
Ms. Sarah Pantelidou PADEP Case Manager	2 East Main Street Norristown, PA 19401	T: 484 250-5778
PCC – Property Owner / Remediator		
Brian M. Stearns, P.E. Site Investigation and Remediation	300 Erie Boulevard Syracuse, New York 13202	T: 315 428-5731 brian.stearns@nationalgrid.com
Michael E. Guerin Director, Property Strategy & Transactions	40 Sylvan Road 1st Floor East Waltham, MA 02451	T: 781 907-1741 michael.guerin@nationalgrid.com
Arcadis U.S., Inc. – Project Consultant		
Daniel P. Sheehan, P.E. Principle in Charge	824 N Market Street, STE 820, Wilmington, Delaware 19801-4939	T: 302 884-6919 daniel.sheehan@arcadis.com

9.2 Site Maps

The following figures are referenced as part of the Cleanup Plan:

- Figure 1: Site Location Map
- Figure 17: Soil Boring Observations

- Figure 18: Surface Soil Analytical Results
- Figure 19: Soil Delineation Areas
- Figure 24: Groundwater Analytical Results – VOCs and SVOCs Exceeding MSCs
- Figure 25: Groundwater Analytical Results – Dissolved Inorganics Exceeding MSCs
- Figure 27: Soil Sampling Locations Exhibiting Potential Vapor Intrusion Concerns in Vadose Zone
- Figure 28: Groundwater Monitoring Wells Exhibiting Potential Vapor Intrusion Concerns
- Figure 35: Site Locations with Potential Vapor Intrusion Concerns

A comprehensive list of report figures is included in the table of contents, and figures are referred to throughout the text.

9.3 Remedial Goals

Based on the analysis of remedial alternatives presented herein, the remedial goals for soil will be to allow historic fill and impacted soils to remain in place with capping (e.g., asphalt/concrete pavement, building structures, clean soil cover, etc.), to the extent practicable, and provide new cover/capping to the disturbed soil across the Site, where needed to meet the Site-Specific Standard, as discussed below.

9.4 Remedial Alternatives

The technical guidance recommends the identification of remediation alternatives, and an evaluation of the effectiveness of the selected remedy to achieve the Site-Specific Standards, based on the factors set forth in Section 304(j) of Act 2. The evaluation should consider: 1) the long-term risks and effectiveness; 2) the ability of the remedy(ies) to reduce the toxicity, mobility or volume of regulated substance; 3) the short-term risks and effectiveness; 4) the ease or difficulty of implementation; 5) the cost of the remedial measure; and 6) the incremental health and economic benefits of the remedy.

9.4.1 Selection of Remedial Alternatives

General response actions are broad categories of remedial technologies that can potentially be used to meet remedial action objectives. The general response actions typically include:

- Institutional Controls
- Containment
- Treatment
- Removal and Disposal

Institutional controls and containment processes reduce the risk of exposure, but do not remove or destroy the COCs.

Containment technology options are those that control the release or minimize the potential for contact. Examples of containment approaches include surface capping, vertical barriers, and horizontal barriers.

Treatment technology options are those that reduce the mobility, toxicity, or volume of the source of impacts. Treatment can employ physical, chemical, or biological methods and can be applied in-situ (in place) or ex-situ (following removal from the source location).

Removal and disposal options remove impacted media from an area of concern and relocate it to a more secure area. An example of a removal and disposal option is excavation of impacted soil and disposal in a permitted landfill.

9.4.2 Evaluation of Remedial Alternatives

The selection of an acceptable remedial alternative requires the establishment of comparison criteria that address the major factors required for successful remedial action. Additionally, a mechanism to rank the various factors is also important.

The criteria used to evaluate the retained remedial alternatives are those described in Section 304(j) of Act 2, summarized as follows:

- "Long-term Risks and Effectiveness" – The magnitude of residual risk following implementation of the alternatives are evaluated. The type, degree and duration of post-remediation care, potential for exposure, and adequacy and reliability of controls are also considered.
- "Reduction of Toxicity, Mobility or Volume" – This criterion addresses hazardous constituents, treated contaminants and residuals remaining after the remedial alternative is implemented. The degree of reduction in toxicity, mobility and volume is evaluated.
- “Short-Term Risks and Effectiveness" – During implementation, potential short-term impacts to onsite workers, adjacent residents, and the environment are considered.
- "Implementability" – Ability to construct, operate, monitor, maintain and obtain regulatory approvals for an alternative are considered. The evaluation also includes availability of technologies, equipment, trained personnel and offsite disposal services.
- "Cost" – Capital, operation and maintenance costs are estimated and evaluated. In generating these calculations, Arcadis has assumed that some construction requirements are applicable to all remedies associated with the potential reuse of the property for development. Therefore, costs such as sediment and erosion control for each remedy would be essentially equal.
- "Incremental Health and Economic Benefits" – The long-term economic benefits are evaluated for each of the potential remedies.

The selected soil remedy, groundwater, and soil vapor remedies are summarized in the Sections 9.6 through 9.8.

9.5 Community Participation

The selected remedial alternative will be adjusted, as appropriate, based on community feedback. A Public Involvement Plan (PIP) has been prepared for the Site that defines procedures for community engagement and the communication of findings from ongoing Site remediation in accordance with the latest updates to Act 2 and the TGM. The PIP establishes the framework for educating interested parties about past and ongoing Site environmental remediation efforts and enables communication between the public, PCC, the site developers, PADEP, EPA, Philadelphia Department of Public Health, and other Philadelphia Departments and elected officials. The PIP:

- Provides public access to project documents at convenient locations.

- Designates a central point of contact to address questions from the community.
- Identifies a location for public hearings and meetings near the Site.

The PIP is available to the public at the Frankford Library, Councilman Bobby Henon's Office, and online at: http://www.4501richmondstreet.com/.

9.6 Selected Soil Remedy

The following COCs have been reported as detected in surface soil at concentrations above the non-residential direct contact MSCs in surface soil:

- SVOCs: BaA, BaP, BbF, benzo(k)flouranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene.
- Metals: arsenic and lead.

The sampling locations where constituents have been detected in surface soil at concentrations greater than the non-residential direct contact MSCs in surface soil are shown in Figure 18. No constituents have been identified in subsurface soil at concentrations above the non-residential direct contact MSCs for subsurface soil. The subsurface soil COCs are presented in Table 9-3 (constituents that exceeded the soil-to-groundwater MSCs in soil samples. The number of exceedances of each constituent is also presented vs. the total number of soil samples collected. In general, visual impacts and elevated PID readings were also observed at the same soil sampling locations that contained the highest concentrations of constituents. Figure 17 shows sampling locations where visual impacts or elevated PID readings were observed.

Table 9-3: Subsurface Soil COCs

Analyte	CAS Number	S-GW Exceedance Frequency
Volatile Organic Compounds		
Benzene	71-43-2	36/530
Chlorobenzene	108-90-7	4/530
Dichloromethane	75-09-2	5/530
Ethylbenzene	100-41-4	3/529
Styrene (Monomer)	100-42-5	2/470
Toluene	108-88-3	1/532
Semi-Volatile Organic Compounds		
1,1-Biphenyl	92-52-4	4/168
2-Methylnaphthalene	91-57-6	4/535
4-Methylphenol	106-44-5	1/296
Anthracene	120-12-7	15/535
Benz(a)anthracene	56-55-3	12/535
Benzo(a)pyrene	50-32-8	39/535
Benzo(b)fluoranthene	205-99-2	22/535

Analyte	CAS Number	S-GW Exceedance Frequency
Benzo(g,h,i)perylene	191-24-2	13/535
Benzo(k)fluoranthene	207-08-9	6/535
Carbazole	86-74-8	18/535
Chrysene	218-01-9	18/535
Dibenz(a,h)anthracene	53-70-3	2/535
Dibenzofuran	132-64-9	16/535
Fluoranthene	206-44-0	8/535
Fluorene	86-73-7	4/535
Naphthalene	91-20-3	54/535
Phenanthrene	85-01-8	4/535
Phenol	108-95-2	2/535
Pyrene	129-00-0	6/535
Metals		
Antimony	7440-36-0	3/527
Arsenic	7440-38-2	101/527
Cyanide	57-12-5	3/333
Lead	7439-92-1	89/527
Mercury	7439-97-6	2/525
Nickel	7440-02-0	1/527
Selenium	7782-49-2	1/527

Note: S-GW indicates the soil-to-groundwater MSCs for a non-residential used aquifer with TDS less than or equal to 2,500 ppm

Due to the relatively low levels of COCs identified at the Site and the scattered and often isolated locations across the Site, the selected remedial alternative will be capping and/or covering of the impacted areas.

This selected remedy will:

- Significantly reduce the risk of exposure following installation of the remedy.
- Minimize the type and duration of post remediation care required.
- Significantly reduce the potential exposure to human and ecological receptors.
- Be accomplished in a reasonable period of time at a realistic cost.

While the proposed remedy does not reduce the toxicity or volume of impacted soils, the mobility of the impacted soils is significantly reduced by the proposed capping system. In addition, as noted above, the concentrations of these COCs are generally low and often isolated.

Site characteristics that may affect the implementation or effectiveness of the remedial action are as follows:

- The location of the impacted soils will dictate the mechanism for soils capping. The identified impacted soils are generally at depths less than 15 ft bgs.

- The locations of impacted soil areas will be marked prior to implementation of remedial activities in that area. Additional care will be taken if these areas need to be excavated and the disposition of excavated materials from these areas will be documented.

The short-term risks are minimal to construction workers and will be further reduced by onsite monitoring of the soil removal as discussed in Subsection 9.5.1. The short-term effectiveness of the remedy has been proven in numerous applications of a cap as a remedial alternative. The ease of implementation of the remedy has been proven in many prior instances. Commercially available equipment will be used along with established construction practices. The incremental health and economic benefits gained by implementation of the selected remedy include returning the property to a functional use with associated benefits to the community.

An Erosion and Sedimentation Control Plan (E&SC documents) will be prepared; remedial activities will not proceed without approved E&SC documents.

9.6.1 Detailed Description of Remedial Action for Soil

The selected remedial action for soils with reported detections above the non-residential MSCs will be capping of the impacted soil areas with either concrete, asphalt, or two feet of clean fill. Any soil which needs to be excavated from impacted areas associated with grading, utility, or foundation installation, will be relocated and will be capped as appropriate. If excavated soils are visually impacted, they will be moved to other areas of the Site that will be capped and/or removed and disposed of at a facility permitted to accept the material. During implementation of the remedial work (and any Site redevelopment if applicable) specific environmental controls, decontamination, health and safety requirements, and soil management, handling, and disposal requirements will need to be followed. Work conducted on the Site will be in accordance with the procedures defined in a site-specific HASP. The proposed remedial actions and associated construction requirements are summarized below.

Prior to starting any excavation at the Site, the planned excavation activities will be reviewed to evaluate if the proposed excavation will occur in areas known to contain impacts and/or areas that have the potential to contain impacts. The proposed ground-intrusive activities will be monitored if the excavation likely will encounter, or holds the potential to encounter, impacted soil. Additionally, the Site will be surveyed and staked/marked to identify areas (Areas 1 through 4 shown on Figure 19) and sampling locations where viscous tar or tar-like material was previously observed. Soil screening will be performed for visual impacts, odors, or elevated PID readings during excavations into known or potentially impacted material.

9.6.1.1 Earthwork and Soil Management

Site grading or excavation activities within marked areas will be documented to identify the relocation of any impacted soils. Soil onsite can be reused as fill in areas that will be covered as part of site redevelopment. Fill material removed from the Site, including historic fill, will be managed in accordance with PADEP's Management of Fill Policy (Document #258-2182-773). Soil impacted with tar- and oil-like material remaining onsite may be left in place unless encountered during the installation of utilities, drainage features, and/or foundations. Impacted soil that is excavated will be managed in accordance with the PADEP Guidelines for E&SC. At a minimum, the E&SC measures will include silt fencing and/or hay bales that will be installed in appropriate locations in and around the remedial work area to minimize surface soil in the disturbed areas from potentially being transported, via wind and/or surface water, to areas outside of the limits of disturbance. If staged, impacted soil will be placed on plastic sheeting (minimum 6 mil thickness) adjacent to the excavation area and kept covered with appropriately anchored tarps when inactive. Small quantities of waste, along with drums of used PPE and similar small debris type items, may be stored in labeled USDOT Specification containers before onsite reuse or offsite disposal.

If soil saturated with viscous tar or oil-like material is encountered and not suitable from a geotechnical perspective for use as subsurface fill, it will be:

- Characterized in accordance with the disposal facility's requirements.
- Transported by a permitted waste hauler contracted to transport waste materials to the certified waste disposal facility in accordance with appropriate local, State, and Federal regulations.
- Documented in a waste manifest containing a summary of transport tonnage and disposal destination. The waste manifest will be maintained onsite and submitted to the PADEP in the Final Report.

For any materials disposed offsite, disposal quantities and associated documentation will be reported to the PADEP in the Final Report. This documentation will include waste profiles, test results, facility acceptance letters, manifests, bills of lading, and facility receipts.

9.6.1.2 Soil Capping System

When constructing the soil cap, surface soil sampling locations that contain COCs at concentrations greater than direct contact MSCs will be surveyed and marked, as appropriate. The capping of impacted soil areas, either by asphalt/concrete paving, building slabs, or soil cover will be documented. The soil cap will extend across areas of the Site where: (1) COCs are in surface soil at concentrations greater than the non-residential direct contact MSCs (see Figure 18); and (2) excavated soil impacted by COCs is reused onsite (unless laboratory analytical data demonstrates that COCs do not exceed non-residential direct-contact MSCs for surface soil). Final cap across the Site will be constructed in accordance with the PADEP draft guidance entitled, "The Use of Caps as Activity and Use Limitations" and consist of:

- Two feet of clean fill, including landscaping topsoil, in the greenspace and other landscaped areas underlain by a geotextile fabric to serve as a visual distinction between the clean fill cap and the existing impacted soil; or
- Site paving, building foundations and floor slabs.

A Post-Remediation Care Plan (institutional control) will be developed for long-term care and maintenance of the final cap(s).

9.7 Selected Groundwater Remedy

The following have been reported as detected in groundwater at concentrations above the PADEP non-residential MSCs for Used Aquifers containing TDS ≤ 2,500 mg/L:

- VOCs: benzene, MTBE, tetrachloroethene, TCE

- SVOCs: 2,4-dinitrotoluene, BaP, BbF, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, and chrysene.
- Total Metals: antimony, arsenic, beryllium, lead, manganese, nickel, and zinc.
- Dissolved Metals: antimony, arsenic, manganese, and nickel.

VOCs and SVOCs detected in groundwater at concentrations greater than MSCs are shown in Figure 24, and dissolved inorganics detected in groundwater at concentrations greater than MSCs are shown in Figure 25. In general, SRI groundwater data indicates that groundwater conditions are improving across the Site, especially in regard to VOCs and SVOCs in replacement wells, and groundwater impacts are isolated and limited in extent.

Due to the relatively low levels of COCs identified at the Site and groundwater data from point-of-compliance wells showing that impacted groundwater is not migrating offsite, an Environmental Covenant prohibiting onsite groundwater use for any purpose is the selected remedy. The EC will also restrict Site use to non-residential use. Such a restriction will ensure that exposure to groundwater from beneath the Site does not occur. With groundwater use prohibited, there will be no future complete exposure pathway to groundwater at the Site. Appropriate institutional controls are proposed to effectively mitigate the complete exposure pathways listed in Section 5.

This selected remedy will:

- Significantly reduce the risk of exposure following establishment of the institutional controls.
- Minimize the type and duration of post-remediation care required.
- Significantly reduce the potential exposure to human and ecological receptors.
- Be accomplished in a reasonable period of time at a reasonable cost.

Construction or utility workers may encounter shallow groundwater during utility excavations for installation, maintenance, or repair of underground utilities. Volatile constituents in groundwater may volatilize into the utility trench. If future excavation were to be required to the depth of the perched water or groundwater table, the procedures listed in Section 9.5.1 will be followed to limit construction worker exposure from groundwater impacts.

Upon approval of this RI Report and Cleanup Plan, an Act 2 Final Report for groundwater will be prepared, and once the Final Report is approved, all onsite monitoring wells will be abandoned and decommissioned in accordance with applicable requirements.

9.8 Soil Vapor Remedy

VOCs were not detected at concentrations above the non-residential sub-slab screening values in subsurface soil gas samples collected during the Initial RI. As discussed in Section 3.2.6, soil and groundwater analytical results likely overpredict VI potential because the soil gas sampling results did not exceed any of the sub-slab VI screening values. However, a comparison of existing unsaturated soil and groundwater data to non-residential VI standards from the TGM indicates the potential for soil VI if buildings are constructed in the future. The following constituents have been detected in soil and/or groundwater samples at concentrations above non-residential VI standards: benzene, MTBE, TCE, toluene, 1,1-biphenyl, 2-methylnaphthalene, and naphthalene. A detailed analysis of the VI COCs is included in the VI Evaluation provided as 3.2.6.

Unsaturated soil sampling locations where COCs have been identified at concentrations exceeding the non-residential VI standards are shown in Figure 27 and groundwater sampling locations where COCs have been identified at concentrations exceeding the non-residential VI standards (or for groundwater within 5 feet of the ground surface, the non-residential MSCs for Used Aquifers containing TDS ≤ 2,500 mg/L) are shown on Figure 28. In summary, based on the TGM VI guidance, the locations where VI is a potential concern at the Site are shown on Figure 35.

For buildings installed in locations where VI is a potential concern, the selected soil vapor remedy will be pathway elimination via the installation of a vapor barrier designed and manufactured for use in VOC mitigation. Alternatively, the results of a VI risk assessment and/or additional soil gas characterization may eliminate the need to install a VI mitigation system in certain areas. To achieve pathway elimination, the vapor barrier material will be chemically resistant and have demonstrated low permeability for the VOCs present. Additionally, the EC will prohibit construction of basements in areas of potential VI concern.

The two proposed buildings shown in Exhibit 1 (i.e., a 148,611 square-foot building located in the northern portion of the Site and a 740,701 square-foot building located in the central portion of the Site) were evaluated for VI potential. Based on the areas of potential VI concern, as shown on Figure 35, VI mitigation will be installed for the larger building consisting of a vapor barrier that is chemically resistant to and demonstrated low permeability for benzene. The vapor barrier will be installed and tested pursuant to the manufacturer's recommendations. The selected vapor barrier remedy will:

- Significantly reduce the risk of potential exposure to human receptors in the proposed future building.
- Be accomplished in a reasonable period of time at a reasonable cost.

While not needed from a vapor risk protection perspective, to be pro-active and conservative, a passive sub-slab ventilation system will be installed in general accordance with American National Standards Institute's 2018 Standard Soil Gas Control System in New Construction Buildings (ANSI/AARST CC-1000) as an additional protective measure.

9.9 Post-Remediation Care Plan

9.9.1 Soil

If engineering or institutional controls are needed to maintain a standard, a post-remediation care plan must be documented in the Final Report. Remedial measures are anticipated to incorporate capping of residual soil impacts.

If an engineering control (i.e., capping) will be incorporated over those areas where residual impacted soil remains following remedial activities/potential redevelopment, a post-remediation care plan will be outlined in the Final Report and listed in the environmental covenant.

Accordingly, the following provisions would be required to assure continued function of the engineering controls:

- Inspecting the engineered caps on a periodic basis.

- Maintaining the engineered cap and repairing any identified deterioration of the cap units regularly, as encountered.
- Documenting and recording where and when the inspection and maintenance is being conducted.
- Reporting inspection/maintenance results to the PADEP as provided in the environmental covenant (to be developed).

Inspection records, documentation associated with any necessary modifications/repairs and copies of notification letters will be maintained by the property owner.

As a component of the Final Report, an environmental covenant will be developed that requires the identification, and long-term inspection and maintenance of those areas where a cap must be maintained, if any.

9.9.2 Groundwater

A site-wide deed restriction prohibiting groundwater use will be incorporated into an Environmental Covenant and recorded with the Philadelphia County Recorder of Deeds.

9.9.3 Vapor Intrusion

The EC will require that a vapor barrier will be installed, tested and maintained in accordance with the manufacturer's specifications. Alternatively, the requirements for a VI mitigation system may be eliminated if the results of a cumulative risk assessment demonstrate that a VI mitigation system is not needed. If the risk assessment identifies an unacceptable VI risk, the Environmental Covenant will require the installation and maintenance of a VI mitigation system for any future inhabited structures within areas of potential VI concern.

9.10 Final Report

Following completion of remediation/development activities at the Site, an Act 2 Final Report will be prepared for submittal to PADEP. The Final Report will be signed and sealed by a PADEP Professional Geologist or Professional Engineer licensed in Pennsylvania. The report will contain the following:

- A discussion of the remedial activities performed.
- Proof of submissions and notifications of the Final Report.
- All necessary fees.
- Chronological summary of the remediation work performed.
- A list identifying the quantity of materials removed from the Site, and transport bills of lading and/or manifests generated.
- A discussion of any deviations from this Cleanup Plan.
- Relevant permits issued.
- Analytical data generated.

- A Post-Remediation Care Plan.
- Contact information.
- Documentation of the field remedial/redevelopment activities.
- As-built drawings.

Upon approval of the Final Report, an Environmental Covenant that defines the long-term maintenance requirements for any onsite engineering controls and documents the institutional controls requirements that will be needed for remaining soil and groundwater impacts will be recorded. Groundwater monitoring wells will be abandoned, as appropriate following PADEP approval of the Final Report for groundwater, in accordance with applicable regulatory requirements.

10 CLEANUP PLAN SUMMARY

The RI was undertaken to assess the nature and extent of Site-related environmental impacts and evaluate the risks posed to human health and the environment by those impacts. The RI results provide adequate data coverage across the Site to: (1) identify and delineate the environmental conditions; (2) support an CSM; (3) develop a cleanup plan; and (4) support Site redevelopment. Based on the RI results, site-related impacts are relatively limited to the center of the Site and at isolated locations on the remainder of the Site.

Currently, there is no complete exposure pathway to impacted soil and groundwater. Future exposure pathways via direct contact with Site soil or groundwater for incidental ingestion, direct dermal contact and/or inhalation of windblown particulates (fugitive dusts) or volatilized COCs will potentially be complete if no controls were to be implemented. Additionally, there is potential for a complete VI exposure pathway when buildings are constructed onsite in the future.

The future exposure pathways can be mitigated via “pathway-elimination” pursuant to an Act 2 Site-Specific Standard. The Site-Specific Standard is a risk management approach. Potentially complete future exposure pathways will be eliminated using engineering and/or institutional controls. Engineering controls proposed for the Site to prevent direct contact exposure include capping impacted soils with asphalt pavement, concrete, building structures and/or clean soil. The Engineering control proposed to prevent potential VI into future buildings on the property includes installing a vapor barrier specifically designed and manufactured for use in VOC mitigation below buildings constructed in areas of potential VI concern unless a VI risk assessment demonstrates that such a control is not needed. Proposed institutional controls include use of deed restriction/environmental covenant prohibiting use of groundwater at the Site. The future exposure pathways and how the proposed remedy eliminates these pathways is summarized in Table 10-1 below.

Table 10-1: Summary of Pathway-Elimination Remedy

Current and/or Future Exposure Pathway	Potential Current Receptors	Potential Future Receptors without Remedy	Proposed Remedy	Potential Future Receptors with Remedy
Incidental Soil and GW Ingestion, Dermal Contact, and Inhalation of VOCs and Particulates	1. Utility/ Construction Worker 2. Outdoor Worker	1. Resident 2. Recreational User 3. Building Occupant 4. Utility/Construction Worker 5. Outdoor Worker 6. Trespasser	• Soil Cap(s) • Institutional Controls	Utility/Construction Workers (i.e., during ground-intrusive activities. Managed in accordance with a HASP)
Potable Water Ingestion and Use	None	1. Resident 2. Building Occupant 3. Indoor Worker	• GW Use Restrictions	None
Soil Vapor Intrusion	None	1. Resident 2. Building Occupant 3. Indoor Worker	• Vapor Barrier Specific for Site COCs • VI Risk Assessment	None

Note: GW = groundwater

The future use of the property will be restricted to non-residential purposes. The remedial goals for soil will be to allow historic fill and impacted soils to remain in place or be reused onsite underneath a cap (e.g., asphalt/concrete pavement, building structures, clean soil cover, etc.), to the extent practicable, and provide cover/capping to the disturbed soil across the Site.

The Cleanup Plan has been developed and details the proposed methods to prevent further migration and eliminate potentially complete exposure pathways.

11 SIGNATURES

Mr. Michael E. Guerin, Philadelphia Coke Co., Inc., 40 Sylvan Road, 1st Floor East
Waltham, MA 02451

Relationship to the Site: Authorized Representative for current Site Owner

Signature:

Michael Guerin
Philadelphia Coke Co., Inc. / National Grid USA

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EXHIBIT 1

Site Redevelopment Plan

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

LOCATION MAP
SCALE: 1" = 1,000'

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DATE:	2/1/2021
CAD I.D.:	PP203056-SPP-2

PROJECT:

ZONING PLAN

FOR
BRIDGE ACQUISITIONS, LLC

PROPOSED DEVELOPMENT

4501 RICHMOND STREET
PHILADELPHIA, PA 19137

1515 MARKET STREET, SUITE 920
PHILADELPHIA, PA 19102
Phone: (267) 402-3400
Fax: (267) 402-3401
www.BohlerEngineering.com

C. BROWN

REFERENCES AND CONTACT INFORMATION

1. THIS PLAN REFERENCES:
   ALTA/NSPS LAND TITLE SURVEY
   PREPARED BY: CONTROL POINT ASSOCIATES, INC.
   1600 MANOR DRIVE, SUITE 210
   CHALFONT, PA 18914
   PREPARED FOR: BP BRIDESBURG, LLC
   FILE NO.: 02-200079-00

   DATED: 11-19-2020
   LAST REVISED: 12-11-2020

   PROPOSED FACILITIES SITE PLAN
   PREPARED BY: CORNERSTONE ARCHITECTS, LTD
   PREPARED FOR: 4501 RICHMOND STREET
   DATED: 2-17-2021

2. OWNER:
   EASTERN ENTERPRISES
   9 RIVERSIDE RD
   WESTON, MA 02493

3. APPLICANT:
   BRIDGE DEVELOPMENT PARTNERS, LLC
   ONE GATEHALL DRIVE, SUITE 201

   PARSIPPANY, NJ 07054
   ATTN: JIM MARSHALL
   EMAIL: JMARSHALL@BRIDGEDEV.COM
   PHONE: (267)-346-0556

GENERAL NOTES

1. SITE DATA:
   4501 RICHMOND STREET
   PHILADELPHIA, PA 19137
   AREA (U.S.S.) = 2,884,248.9 S.F. (66.21 AC)
2. ZONING DATA:
   EXISTING ZONING: RMX-2 (RESIDENTIAL MIXED-USE)

   PROPOSED ZONING: ICMX (INDUSTRIAL MIXED-USE) & I-2 (INDUSTRIAL) & SP-PO-A (PARKS AND OPEN SPACE)

   PREVIOUS USE: OPEN SPACE
   PROPOSED USE: RETAIL & WAREHOUSE DISTRIBUTION
3. BOHLER ENGINEERING BUSINESS PRIVILEGE NUMBER IS 650139
4. PWD #: FY21-RICH-6344-01
5. ALL IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE CITY OF PHILADELPHIA AND PHILADELPHIA WATER AND SEWER DEPARTMENT, AND ZONING REQUIREMENTS IN THE PHILADELPHIA CODE.
6. ELEVATIONS ARE BASED ON CITY OF PHILADELPHIA DATUM. LOT DIMENSIONS & EASEMENT DIMENSIONS ARE BASED ON PHILADELPHIA DISTRICT STANDARDS UNLESS OTHERWISE NOTED.
7. WATERSHED DISTRICT: DELWARE DIRECT WATERSHED NON-CONTRIBUTING, FLOOD MANAGEMENT DISTRICT C.
8. PLAN PREPARED AS PER INSTRUCTIONS OF THE OWNER.
9. STORMWATER SHALL DISCHARGE DIRECTLY TO THE DELAWARE RIVER.
10. ALL PLANTINGS SHALL BE IN ACCORDANCE WITH P.C.P.C. GUIDELINES.
11. ALL CURB RADII SHALL BE 5.0 FEET UNLESS OTHERWISE NOTED.
12. ELEVATIONS OF PROPOSED CONCRETE CURB TO BE DETERMINED BY THE CITY SURVEY DISTRICT. FACE OF CURB TO MATCH EXISTING CURB/EDGE OF PAVEMENT.

LEGEND

PROPOSED
RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE

LEGEND

ZONING

EXISTING ZONING: RMX-2 (RESIDENTIAL MIXED-USE)

PROPOSED ZONING: ICMX (INDUSTRIAL MIXED-USE), I-2 (INDUSTRIAL), SP-PO-A (OPEN SPACE & PARK)
EXISTING USE: OPEN SPACE
PROPOSED USE: WAREHOUSE AND DISTRIBUTION FACILITIES

SITE CALCULATION

SITE AREA:	2,896,321 SF (66.50 AC)
ICMX-2 DISTRICT:	488,499.54 SF (11.21 AC)
I-2 DISTRICT:	2,019,365.62 SF (46.37 AC)
SP-PO-A DISTRICT:	388,455.98 SF (8.92 AC)

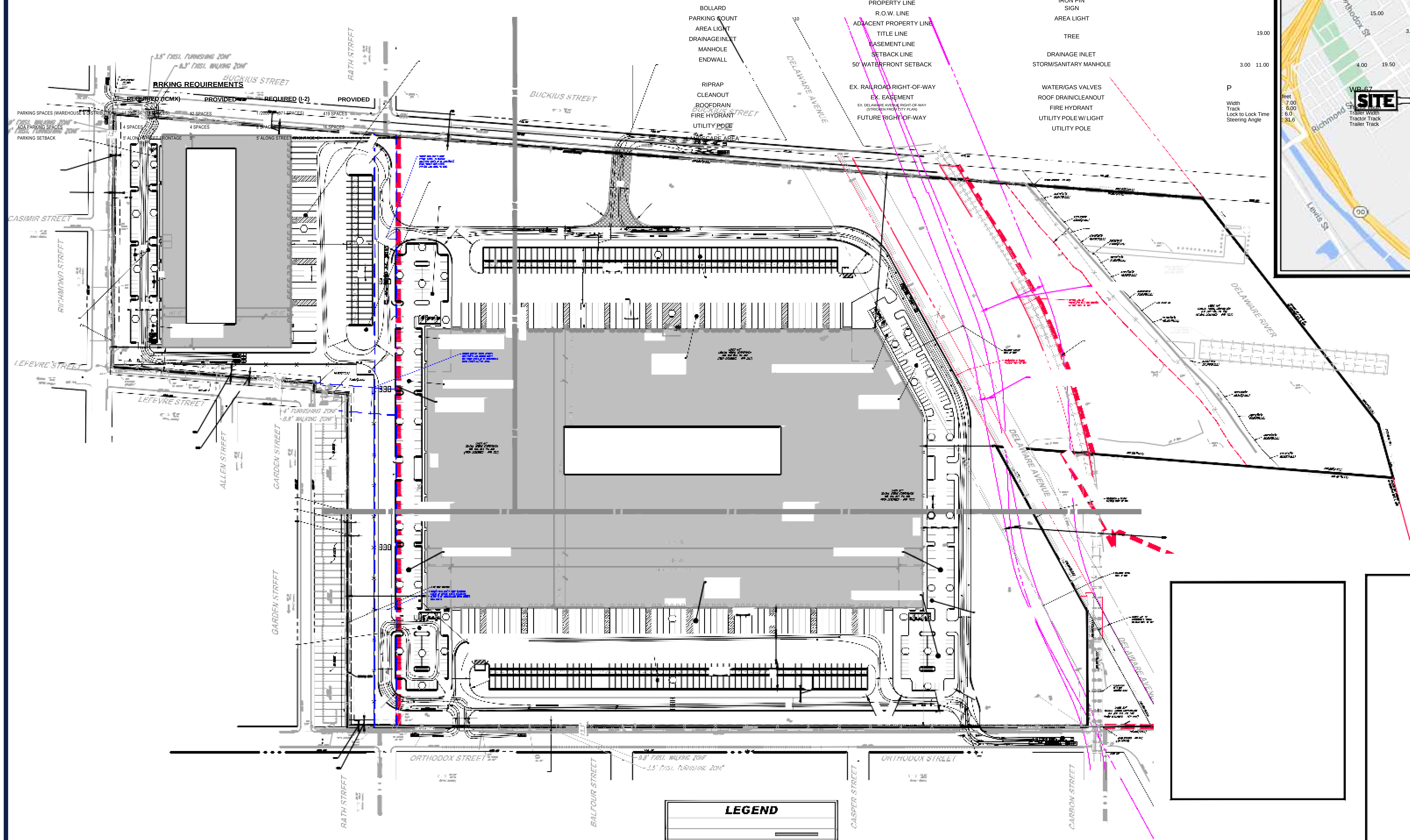
ZONING DISTRICT REQUIREMENTS

	REQUIRED (ICMX)	EXISTING	PROPOSED	REQUIRED (I-2)	EXISTING	PROPOSED
MAX. OCCUPIED AREA	100%	N/A	30.42%	100%	N/A	36.68%
MIN. YARD SETBACKS						
FRONT	0"	N/A	17.6'	0"	N/A	276.9'

SIDE YARD (EA)	8"	6"	66'	8'	5	8	N/A	172.2' WATERFRONT		LANDSCAPE BUFFER	15' >15'
	N/A		REAR		1		SETBACK	50'	N/A		15' >15'
	N/A	N/A						N/A	50'		15'
				2				N/A	50'	MAX. BUILDING HEIGHT	60'

	N/A	60'	60'	N/A	60'	
MAX. FLOOR AREA RATIO	500%	N/A	30.42%	500%	N/A	36.68%

* WHERE A LOT ABUTS A RESIDENTIAL DISTRIC, FRONT YARDS, SIDE YARDS, AND REAR YARDS SHALL BE PROVIDED ON THE LOT ON THE SIDES ABUTTING THE RESIDENTIAL DISTRICT. THE MINIMUM REQUIREMENTS FOR THOSE YARDS SHALL BE EITHER THOSE FOR THE INDUSTRIAL DISTRICT OR THOSE FOR THE RESIDENTIAL DISTRICT ON THE ABUTTING SIDE, WHICHEVER IS LARGER



GUIDE RAIL
TREELINE
ACCESSIBLE SYMBOL
CROSSWALK
SIDEWALK
SIGN
BOLLARD
PARKING COUNT
AREA LIGHT
DRAINAGE INLET
MANHOLE
ENDWALL
RIPRAP
CLEANOUT
ROOF DRAIN
FIRE HYDRANT
UTILITY POLE
LANDSCAPE AREA

EXISTING
RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
PROPERTY LINE
R.O.W. LINE
ADJACENT PROPERTY LINE
TITLE LINE
EASEMENT LINE
SETBACK LINE
50' WATERFRONT SETBACK
EX. RAILROAD RIGHT-OF-WAY
EX. EASEMENT
FUTURE RIGHT-OF-WAY

LEGEND

EXISTING
CONCRETE MONUMENT/ IRON PIN
SIGN
AREA LIGHT
TREE
DRAINAGE INLET
STORM/SANITARY MANHOLE
WATER/GAS VALVES
ROOF DRAIN/CLEANOUT
FIRE HYDRANT
UTILITY POLE W/ LIGHT
UTILITY POLE

13. DEVELOPMENT TO BE SERVICED BY PUBLIC WATER AND SEWER IN ACCORDANCE WITH CITY OF PHILADELPHIA REQUIREMENTS.
14. BY GRAPHIC PLOTTING ONLY, THIS PROPERTY IS LOCATED IN FLOOD HAZARD ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) & FLOOD HAZARD ZONE AE (WITH BFE OR DEPTH).
15. TRASH PICK-UP WILL BE VIA A PRIVATE HAULER.

WB-67
feet
Tractor Width : 8.00
Trailer Width : 8.50
Tractor Track : 8.00
Trailer Track : 8.50
Lock to Lock Time : 6.0
Steering Angle : 28.4
Articulating Angle : 75.0

P
feet
Width : 7.00
Track : 6.00
Lock to Lock Time : 6.0
Steering Angle : 31.6

120 60 30 0 120
1"= 120'

LEGEND

LEGEND

LEGEND

PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317
DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05041400

SHEET TITLE:
OVERALL ZONING PLAN

SHEET NUMBER:
1A

ORG. DATE - 2/1/2021

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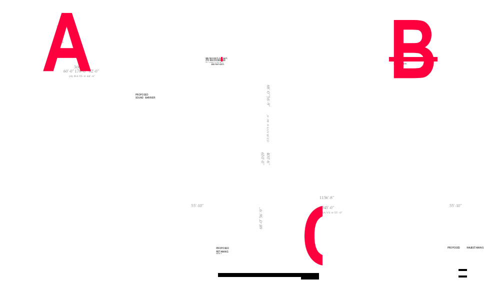

KEY MAP
SCALE: 1" = 500'

LEGEND
PROPOSED

RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
ACCESSIBLE SYMBOL
CROSSWALK
SIDEWALK
SIGN
BOLLARD
PARKING COUNT 10
AREA LIGHT
DRAINAGE INLET
MANHOLE
ENDWALL
RIPRAP
CLEANOUT
ROOFDRAIN
FIRE HYDRANT
UTILITY POLE
LANDSCAPE AREA

LEGEND
EXISTING

RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
PROPERTY LINE
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50' WATERFRONT SETBACK
EX. RAILROAD RIGHT-OF-WAY
EX. EASEMENT
EX. DELAWARE AVENUE RIGHT-OF-WAY (STRICKEN FROM CITY PLAN)
FUTURE RIGHT-OF-WAY

LEGEND
EXISTING

CONCRETE MONUMENT/ IRON PIN
SIGN
AREA LIGHT
TREE
DRAINAGE INLET

SITE CIVIL AND CONSULTING ENGINEERING
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DRAWN BY:	GB
CHECKED BY:	KM
DATE:	2/1/2021
CAD I.D.:	PP203056-SPP-2

PROJECT:

ZONING PLAN

FOR
BRIDGE ACQUISITIONS, LLC

PROPOSED DEVELOPMENT

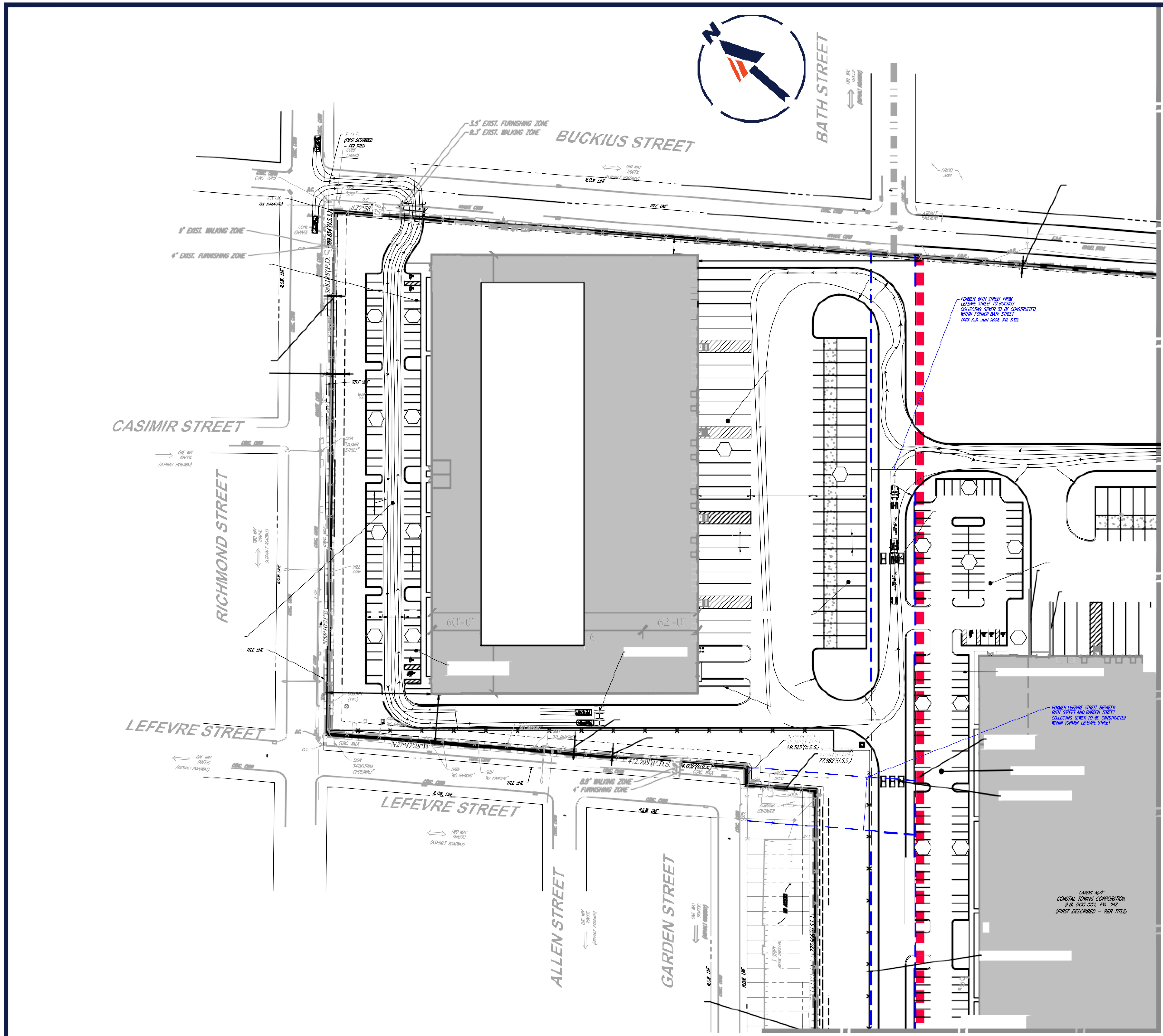
4501 RICHMOND STREET
PHILADELPHIA, PA 19137

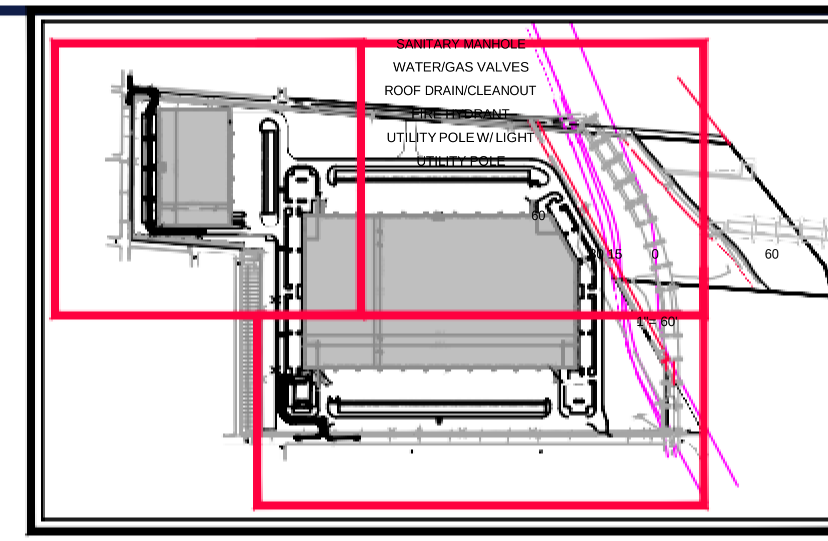
1515 MARKET STREET, SUITE 920
PHILADELPHIA, PA 19102
Phone: (267) 402-3400
Fax: (267) 402-3401
www.BohlerEngineering.com

C. BROWN

PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317
DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05041400

SHEET TITLE:





LEGEND

LEGEND

LEGEND

BOHLER

ZONING PLAN

SHEET NUMBER:

1B

DATE - 2/1/2021

BOHLER

LEGEND

PROPOSED

RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
ACCESSIBLE SYMBOL
CROSSWALK
SIDEWALK
SIGN
BOLLARD
PARKING COUNT 10
AREA LIGHT
DRAINAGE INLET
MANHOLE
ENDWALL
RIPRAP
CLEANOUT
ROOF DRAIN
FIRE HYDRANT
UTILITY POLE
LANDSCAPE AREA

LEGEND

EXISTING

RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
PROPERTY LINE
R.O.W. LINE
ADJACENT PROPERTY LINE
TITLE LINE
EASEMENT LINE
SETBACK LINE
50' WATERFRONT SETBACK
EX. RAILROAD RIGHT-OF-WAY
EX. EASEMENT
EX. DELAWARE AVENUE RIGHT-OF-WAY (STRICKEN FROM CITY PLAN)
FUTURE RIGHT-OF-WAY

LEGEND

EXISTING

CONCRETE MONUMENT/ IRON PIN
SIGN
AREA LIGHT
TREE
DRAINAGE INLET
STORM/SANITARY MANHOLE
WATER/GAS VALVES
ROOF DRAIN/CLEANOUT
FIRE HYDRANT
UTILITY POLE W/ LIGHT
UTILITY POLE

A B C

KEY MAP
SCALE: 1" = 500'

DELAWARE AVENUE
(150' WIDE R.O.W.) (NOT LEGALLY OPEN) (18'-14'-18') (STRICKEN FROM CITY PLAN)

BUCKIUS STREET
(60' WIDE R.O.W.) (LEGALLY OPEN (13'-34'-13')) (ON CITY PLAN)

UCTED STREET
EXTENSION

251'
7 TRAILER AY SPACES
25
70'
60'
8
SPEED CUSHION (TYP.)
12
18
12
54 SPACE PARKING FIELD
PROPOSED SOUND BARRIER WALL (TO BE DESIGNED BY STRUCTURAL ENGINEER)
PROPOSED RETAINING WALL
ORAGE SPACES
4
ELECTRIC VEHICLE CHARGING SPACES
MATCH LINE
MATCH LINE
16
16
PROPOSED SOUND BARRIER WALL (TO BE DESIGNED BY STRUCTURAL ENGINEER)
N57°35'37"E 19.469'(P.D.S.)
N27°47'28"W 77.764'(P.D.S.)
PROPOSED DISTRICT BOUNDARY LINE
64 SPACE PARKING FIELD
SPEED CUSHION (TYP.)
16
16
OPOSED ICMX DISTRICT
OPOSED I-2 DISTRICT

MAP 80 N 20
PARCEL 306
OPA 88-5914840

59
14' (TYP.)
59 TRAILER STORAGE SPACES
13' (TYP.)
52
1044.7'
MAP 80 N 20
PARCEL 306
OPA 88-5914840
52 TRAILER BAY SPACES
68'-0"
56'-9"
(12) BAYS @ 44'-6"

PROPOSED DISTRIBUTION FACILITY
BUILDING FOOTPRINT= 740,701 SF
REQ. AUTOMOBILE PARKING (WAREHOUSE) = 371 SPACES
PROVIDED AUTOMOBILE PARKING = 419 SPACES
PROVIDED TRAILER STORAGE PARKING = 122 SPACES

PROP. TRASH ENCLOSURE
PROPOSED RETAINING WALL
10
14
ELECTRIC VEHICLE CHARGING SPACES
14
13
73 SPACE PARKING FIELD

PROVIDED TRAILER BAY PARKING = 113 SPACES

P.O.B.
ZONED I-3
2540.490'(P.D.S.)
50' WATERFRONT SETBACK
PROPOSED SP-PO-A DISTRICT
PROPOSED I-2 DISTRICT
FUTURE 150' DELAWARE AVENUE RIGHT-OF-WAY
PROPOSED DISTRICT BOUNDARY LINE
FUTURE 33' REQUIRED RIGHT-OF-WAY LINE (PHILADELPHIA BELT LINE RAILROAD)

SITE CIVIL AND CONSULTING ENGINEERING
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CAD I.D.:	PP203056-SPP-2

PROJECT:

ZONING PLAN

FOR
BRIDGE ACQUISITIONS, LLC

PROPOSED DEVELOPMENT

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PHILADELPHIA, PA 19137

1515 MARKET STREET, SUITE 920
PHILADELPHIA, PA 19102
Phone: (267) 402-3400
Fax: (267) 402-3401
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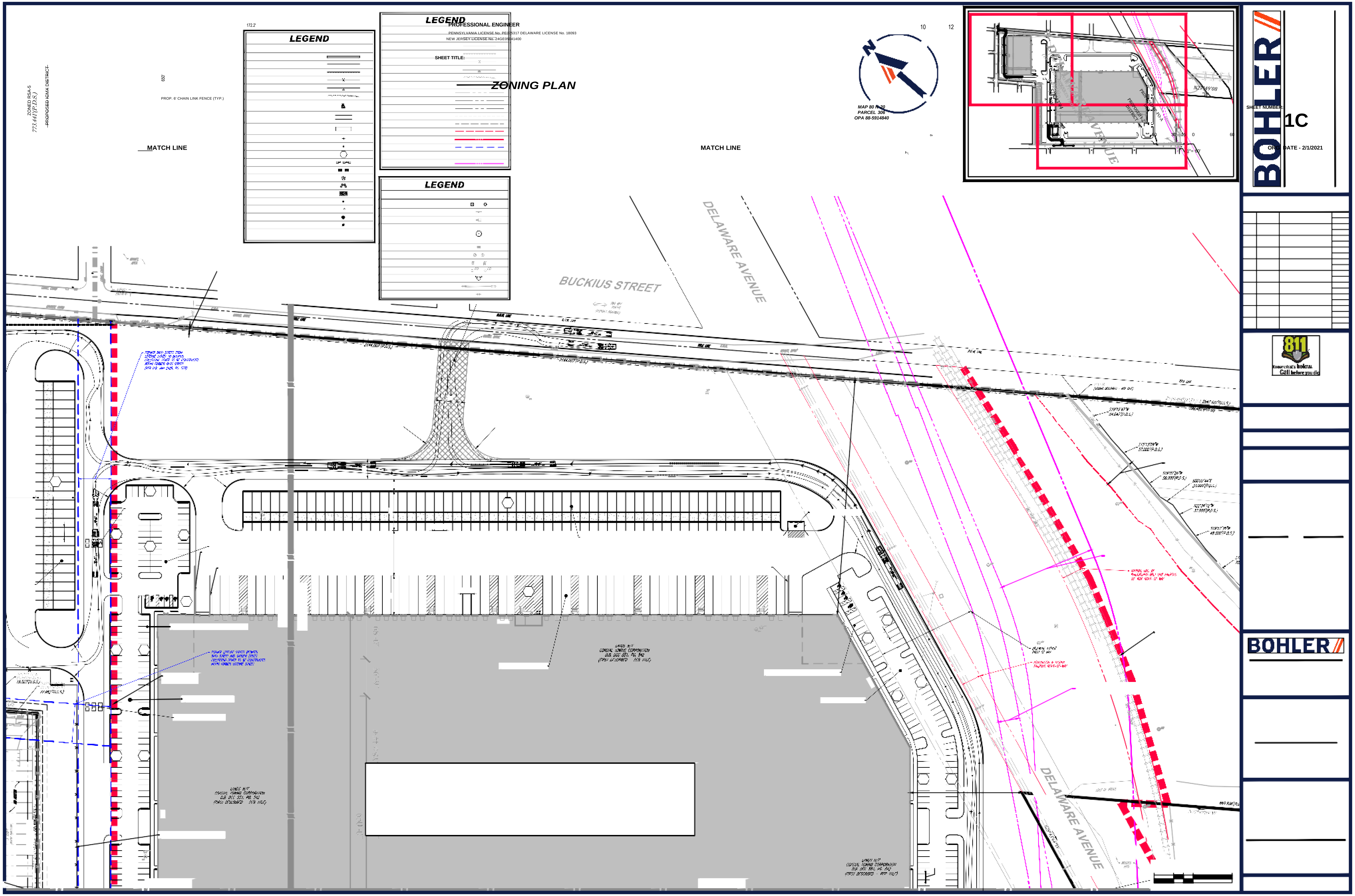

LEGEND
LEGEND
LEGEND
PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317 DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05341400
SHEET TITLE:
ZONING PLAN
SHEET NUMBER:
1C
ORG. DATE - 2/1/2021
MATCH LINE
MATCH LINE
PROP. 6' CHAIN LINK FENCE (TYP.)
ZONED RSA-5
PROPOSED ICMX DISTRICT
MAP 80 N 20
PARCEL 306
OPA 88-5914840
BUCKIUS STREET
DELAWARE AVENUE
DELAWARE AVENUE
BOHLER
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LEGEND
PROPOSED
RETAINING WALL
CONCRETE CURB
FLUSH CURB
FENCE
GUIDE RAIL
TREELINE
ACCESSIBLE SYMBOL
CROSSWALK
SIDEWALK
SIGN
BOLLARD
PARKING COUNT 10
AREA LIGHT
DRAINAGE INLET
MANHOLE
ENDWALL
RIPRAP
CLEANOUT
ROOFDRAIN
FIRE HYDRANT
UTILITY POLE
LANDSCAPE AREA

LEGEND
EXISTING
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R.O.W. LINE
ADJACENT PROPERTY LINE
TITLE LINE
EASEMENT LINE
SETBACK LINE
50' WATERFRONT SETBACK
EX. RAILROAD RIGHT-OF-WAY
EX. EASEMENT
EX. DELAWARE AVENUE RIGHT-OF-WAY (STRICKEN FROM CITY PLAN)
FUTURE RIGHT-OF-WAY

LEGEND
EXISTING
CONCRETE MONUMENT/ IRON PIN
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AREA LIGHT
TREE
DRAINAGE INLET
STORM/SANITARY MANHOLE
WATER/GAS VALVES
ROOF DRAIN/CLEANOUT
FIRE HYDRANT
UTILITY POLE W/ LIGHT
UTILITY POLE

A B C

KEY MAP
SCALE: 1" = 500'

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

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PROVIDED AUTOMOBILE PARKING = 419 SPACES
PROVIDED TRAILER STORAGE PARKING = 122 SPACES
PROVIDED TRAILER BAY PARKING = 113 SPACES

ZONED RSA-5
PROPOSED ICMX DISTRICT
PROPOSED IC
PROPOSED I
773.441'(P.D.S.)
PROP. 6' CHAIN LINK FENCE (TYP.)
650'-0"
400'-6"
MAP 80 N 20
PARCEL 306
OPA 88-5914840
DELAWARE AVENUE
PROPOSED SP-PO-A DISTRICT
PROPOSED I-2 DISTRICT
N27°49'08"W

MATCH LINE
MATCH LINE
MATCH LINE
MATCH LINE

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SPEED CUSHION (TYP.)
1156'-8"
FUTURE 33' REQUIRED RIGHT-OF-WAY LINE (PHILADELPHIA BELT LINE RAILROAD
64 SPACE PARKING FIELD
64 SPACE PARKING FIELD
55'-10"
56'-9"
1045'-0"
(19) BAYS @ 55'-0"
55'-10"
438.167'(P.D.S.)

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61 TRAILER BAY SPACES
68'-0"
ELECTRIC VEHICLE CHARGING SPACES
ELECTRIC VEHICLE CHARGING SPACES
183.9'
66'
1157.6'
61
13' (TYP.)
4
4

ZONING PLAN

FOR
BRIDGE ACQUISITIONS, LLC

PROPOSED DEVELOPMENT
4501 RICHMOND STREET
PHILADELPHIA, PA 19137

PROPOSED RETAINING WALL
PROPOSED SOUND BARRIER WALL (TO BE DESIGNED BY STRUCTURAL ENGINEER)
50 SPACE PARKING FIELD
PROP. TRASH ENCLOSURE
63 TRAILER STORAGE SPACES
50 SPACE PARKING FIELD
PROPOSED RETAINING WALL
268.566'(P.D.S.)
DELAWARE
14' (TYP.)
63
8
8
6' CHAIN LINK FENCE (TYP.)
36' CURB CUT
5' PARKING BUFFER
SPEED CUSHION (TYP.)
PROPOSED CURB CUT
MAP 80 N 24
PARCEL 15
OPA 88-5914840
238.313'(P.D.S.)
N57°35'37"E
S57°35'37"W
N32°24'23"W
1721.000'(P.D.S.)
N32°24'23"W 15.044

1515 MARKET STREET, SUITE 920
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Phone: (267) 402-3400
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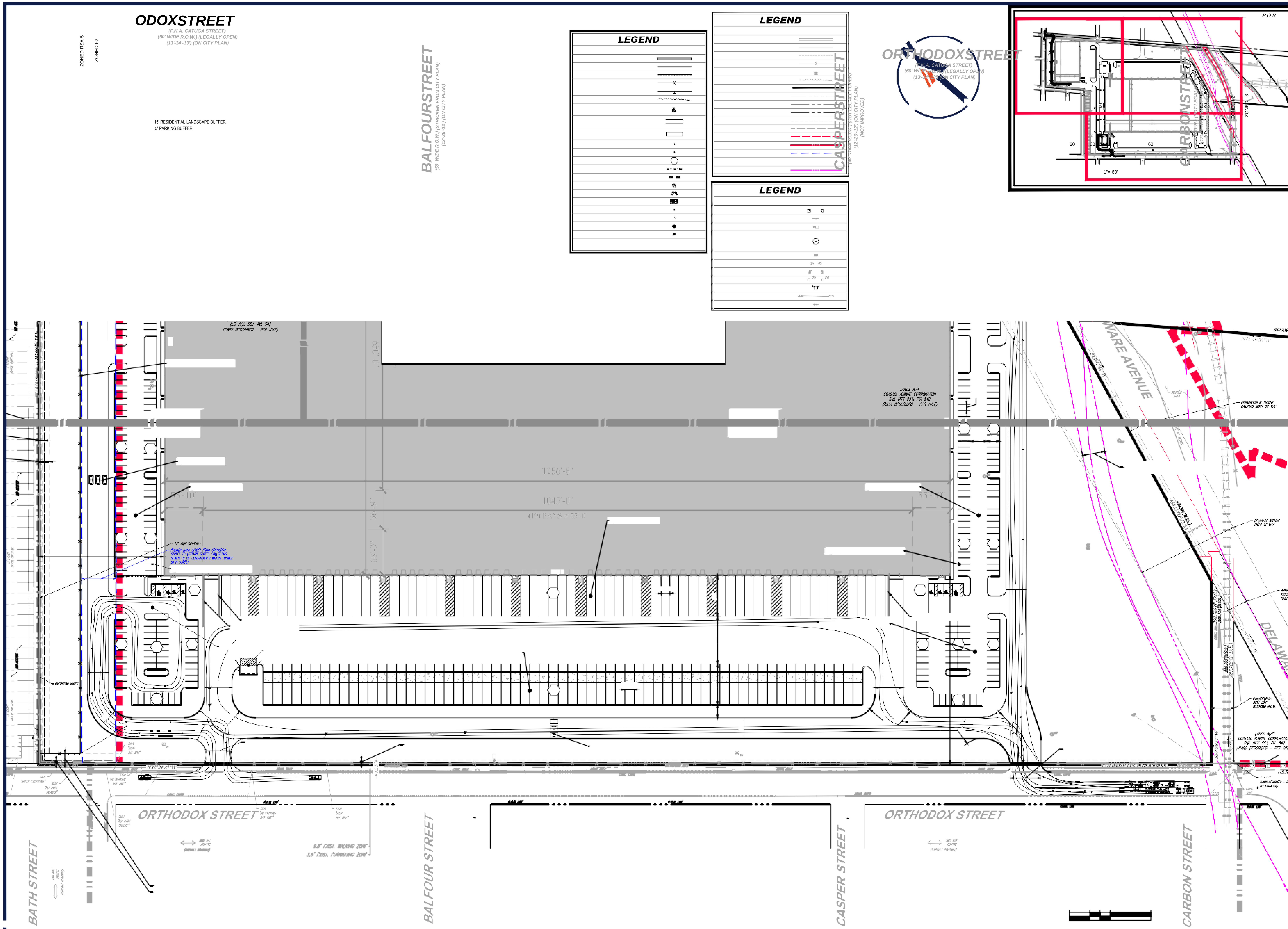
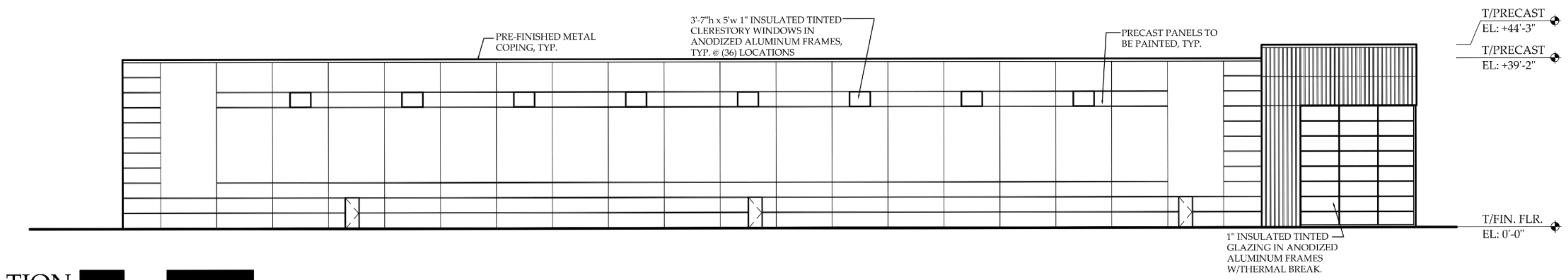


PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317
DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05041400

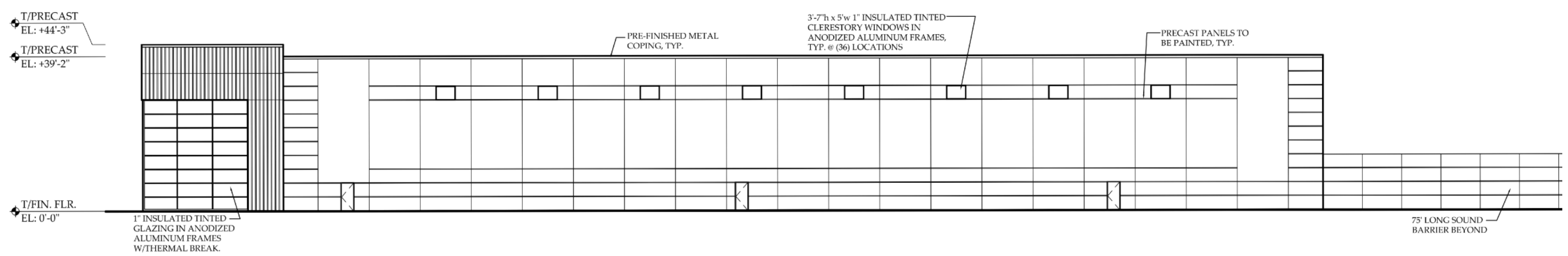
SHEET TITLE:
ZONING PLAN

SHEET NUMBER:
1D

ORG. DATE - 2/1/2021

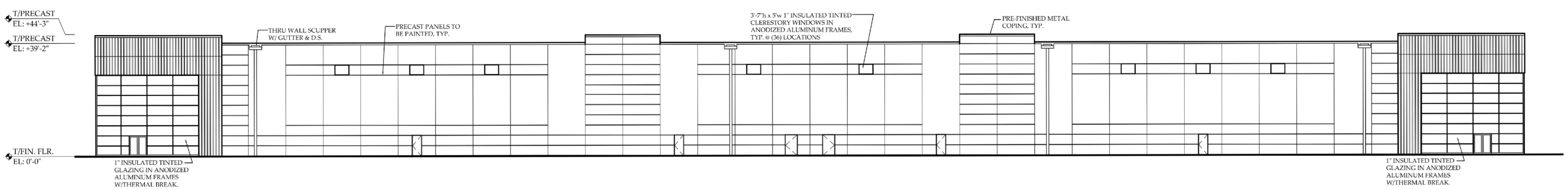


EAST ELEVATION:

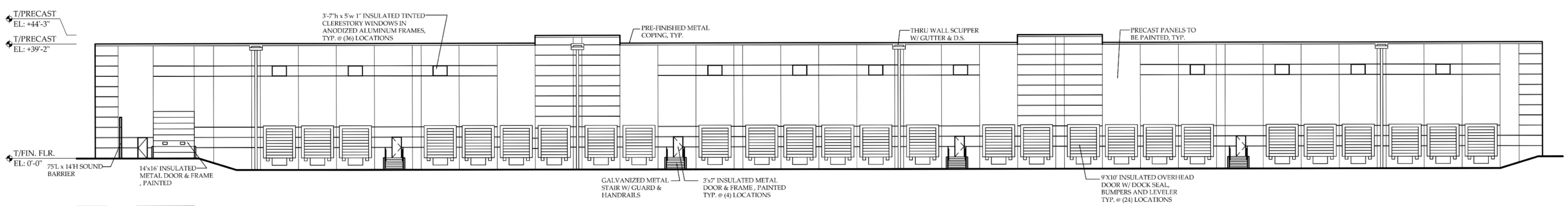


WEST ELEVATION:

LOCATION MAP
SCALE: 1" = 1,000'



NORTH ELEVATION:



SOUTH ELEVATION:

BOHLER//
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PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317
DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05041400

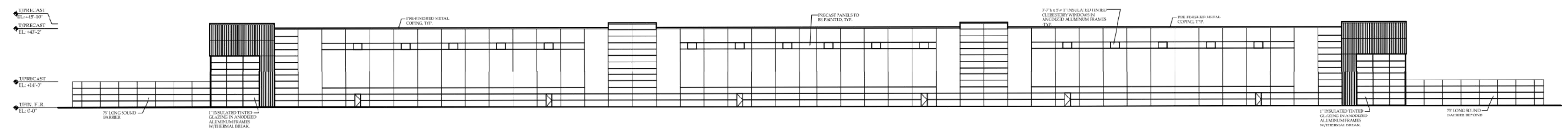
SHEET TITLE:

ELEVATION PLANS

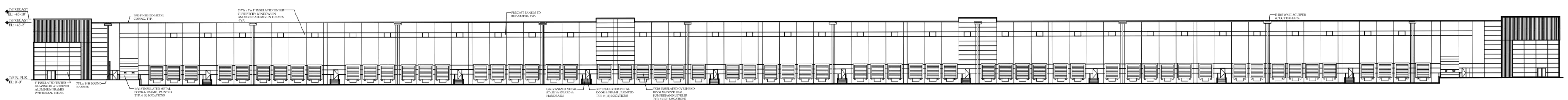
SHEET NUMBER:

2A

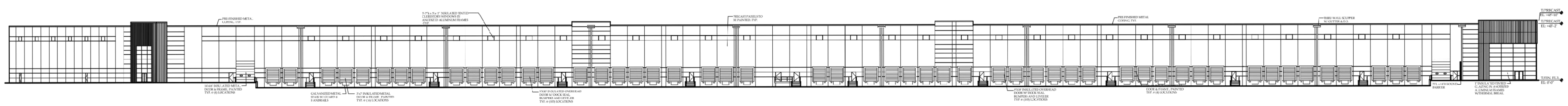
LOCATION MAP
SCALE: 1" = 1,000'



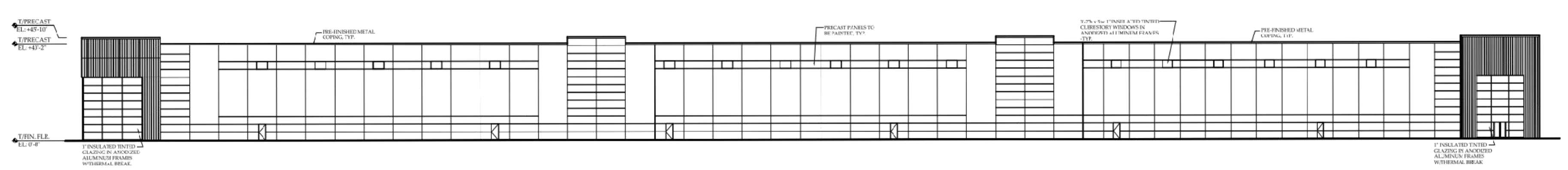
NORTH ELEVATION:
0 15 30 60 FEET



WEST ELEVATION:
0 15 30 60 FEET



EAST ELEVATION:
0 15 30 60 FEET



SOUTH ELEVATION:
0 10 20 40 FEET

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
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REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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PROJECT No.:	PP203056
DRAWN BY:	GB
CHECKED BY:	KM
DATE:	2/1/2021
CAD I.D.:	PP203056-SPP-2

PROJECT:

ZONING PLAN

FOR
BRIDGE ACQUISITIONS, LLC

PROPOSED DEVELOPMENT

4501 RICHMOND STREET
PHILADELPHIA, PA 19137

BOHLER

1515 MARKET STREET, SUITE 920
PHILADELPHIA, PA 19102
Phone: (267) 402-3400
Fax: (267) 402-3401
www.BohlerEngineering.com

C. BROWN

PROFESSIONAL ENGINEER
PENNSYLVANIA LICENSE No. PE075317
DELAWARE LICENSE No. 18093
NEW JERSEY LICENSE No. 24GE05041400

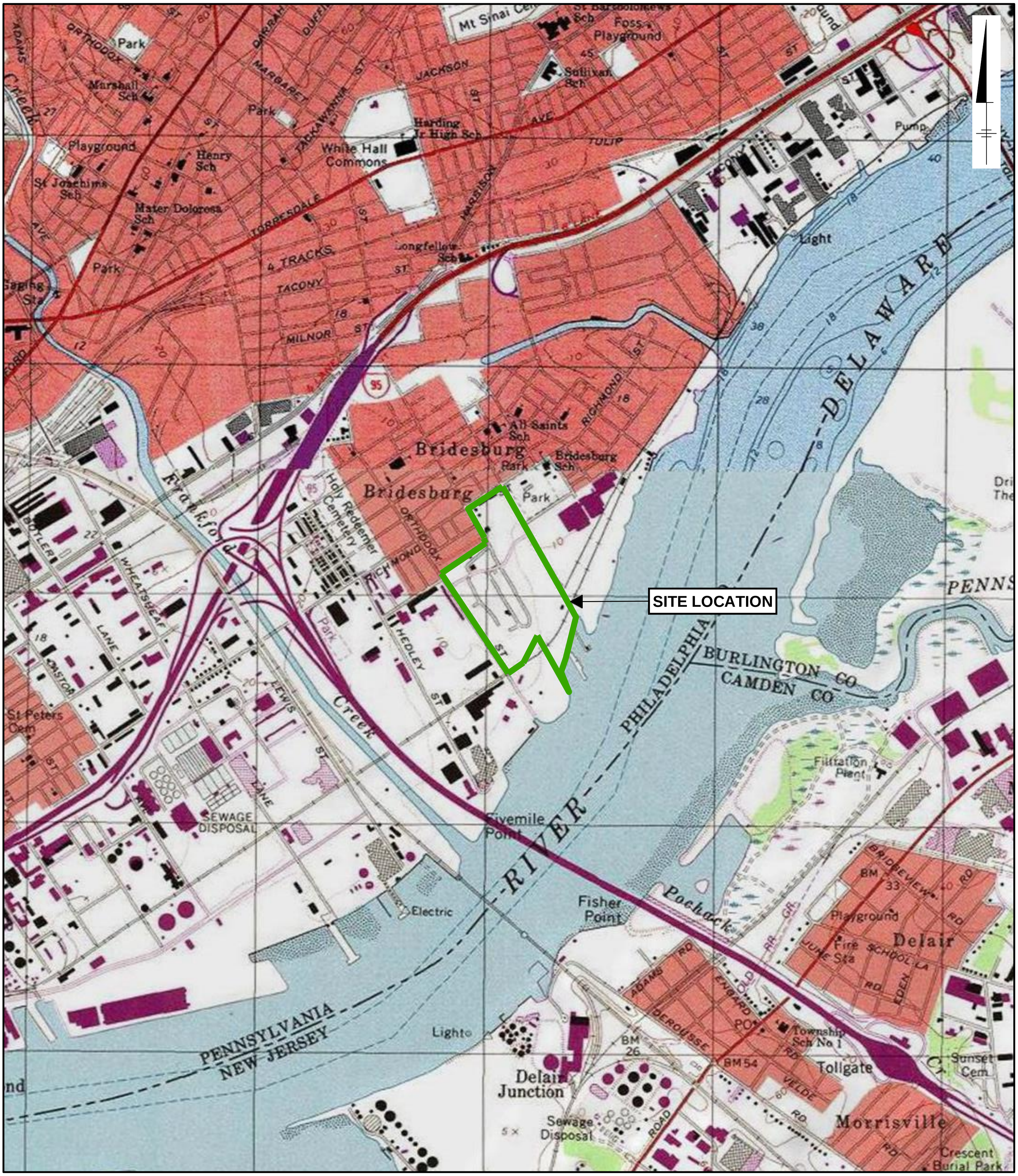
SHEET TITLE:

ELEVATION PLANS

SHEET NUMBER:

2B

FIGURES



NOTE:

1. USGS TOPOGRAPHIC MAP PROVIDED BY ESRI.

0 2,000 4,000 Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

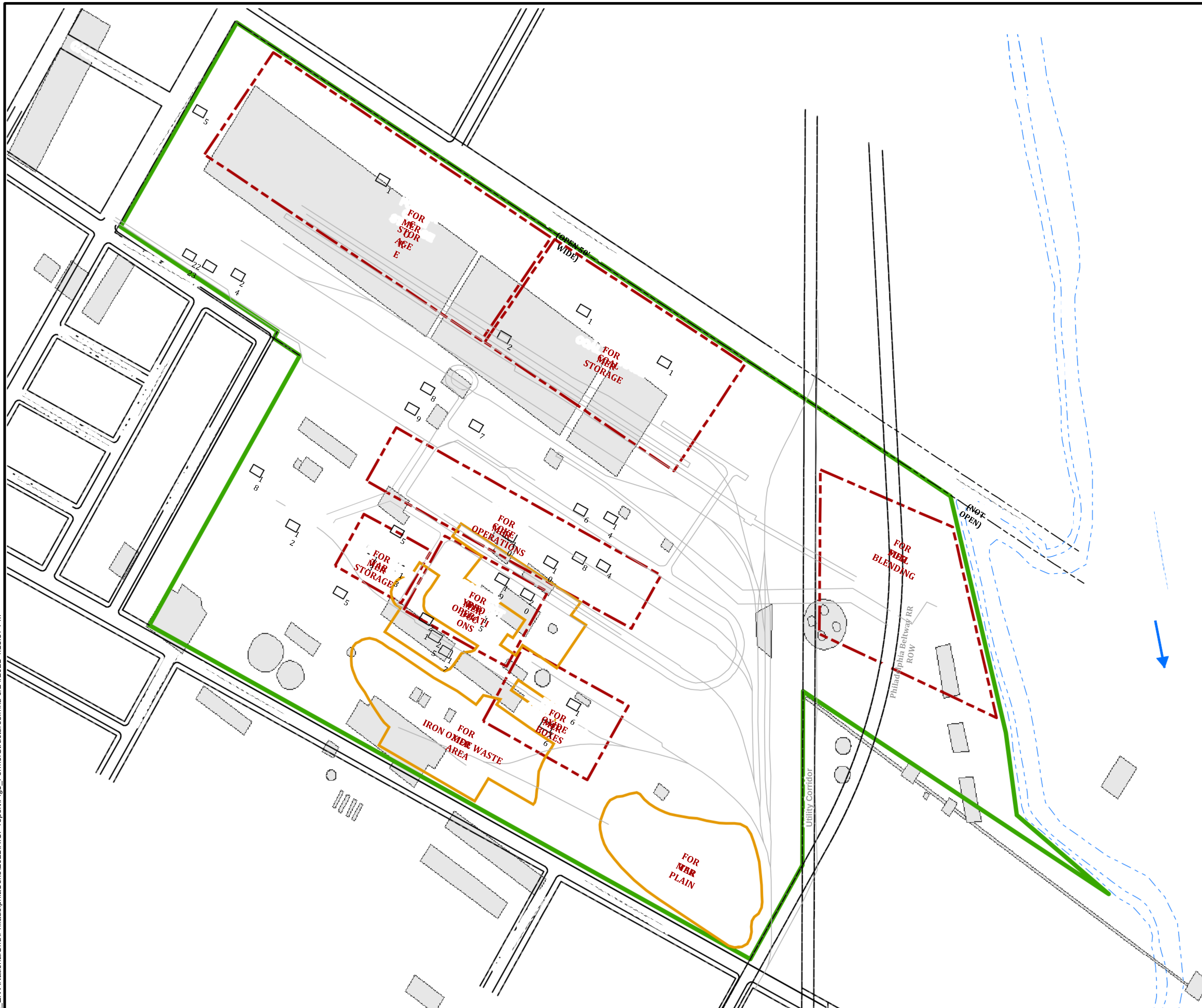
FIGURE 1

NOTE:
1. 2016 AERIAL IMAGE ACCESSED VIA ARC GIS ONLINE
2. HUC IS DEFINED AS HYDROLOGIC UNIT CODE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

FIGURE 2. LOWER DELAWARE RIVER WATERSHED

ARCADIS Design & Consultancy for natural and built assets



LEGEND:

- FORMER SITE OPERATION AREA
- RCRA EXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY
- SHORELINE

FORMER STRUCTURES:

1 - COKE AND COAL STORAGE (NO STRUCTURES)
2 - CONVEYOR
3 - FUEL BLENDING AREA
4 - STACKS
5 - CONCRETE FOUNDATION
6 - BOILER HOUSE / PRODUCER BUILDING
7 - SHEET METAL BUILDING
8 - DUST COLLECTOR
9 - ELECTRIC SUBSTATION
10 - COKE OVENS
11 - QUENCHING STATION
12 - MACHINE SHOP
13 - TAR STORAGE TANK / HOLDER FOUNDATION
14 - TAR STORAGE TANK / HOLDER FOUNDATION
15 - BY-PRODUCTS BUILDING
16 - OXIDE BOXES
17 - TANKS
18 - FIELD OFFICES
19 - TAR DECANTERS
20 - DECANTER SLUDGE LAGOON
21 - WASTE LIQUOR PIT
22 - LAB
24 - CHANGE HOUSE
25 - ABSORBER TANK

NOTE:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.

0 250 500 Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

FORMER STRUCTURES

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FIGURE
3

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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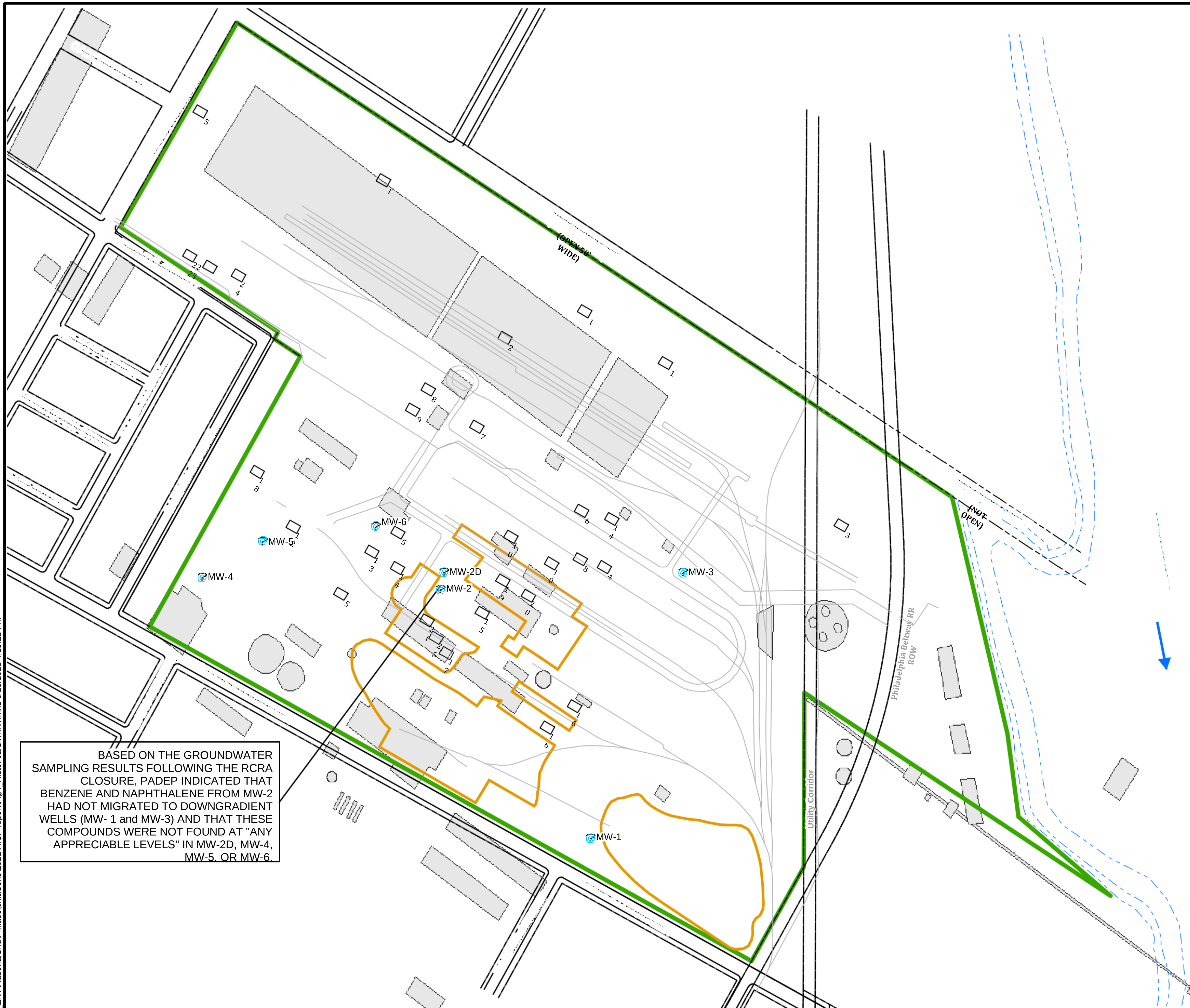


LEGEND:

- (MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
- RCRA EXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY
- SHORELINE

FORMER STRUCTURES:

1 - COKE AND COAL STORAGE (NO STRUCTURES)
2 - CONVEYOR
3 - FUEL BLENDING AREA
4 - STACKS
5 - CONCRETE FOUNDATION
6 - BOILER HOUSE / PRODUCER BUILDING
7 - SHEET METAL BUILDING
8 - DUST COLLECTOR
9 - ELECTRIC SUBSTATION
10 - COKE OVENS
11 - QUENCHING STATION
12 - MACHINE SHOP
13 - TAR STORAGE TANK / HOLDER FOUNDATION
14 - TAR STORAGE TANK / HOLDER FOUNDATION
15 - BY-PRODUCTS BUILDING
16 - OXIDE BOXES
17 - TANKS
18 - FIELD OFFICES
19 - TAR DECANTERS
20 - DECANTER SLUDGE LAGOON
21 - WASTE LIQUOR PIT
22 - LAB
24 - CHANGE HOUSE
25 - ABSORBER TANK

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. IN A JULY 26, 1999 LETTER, PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) CONCLUDED THAT VOLATILE ORGANIC COMPOUND AND SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER SIGNIFICANTLY DECREASED FROM 1985 TO 1998 AND HAVE BEEN LOCALIZED SINCE 1994. THE CONCLUSION WAS BASED ON 14 YEARS OF GROUNDWATER SAMPLING FROM APRIL 1985 TO NOVEMBER 1998 AT MONITORING WELLS MW-1 THROUGH MW-6. DURING THIS TIME PERIOD, GROUNDWATER SAMPLES WERE GENERALLY COLLECTED ON A QUARTERLY BASIS (FOUR TIMES A YEAR).

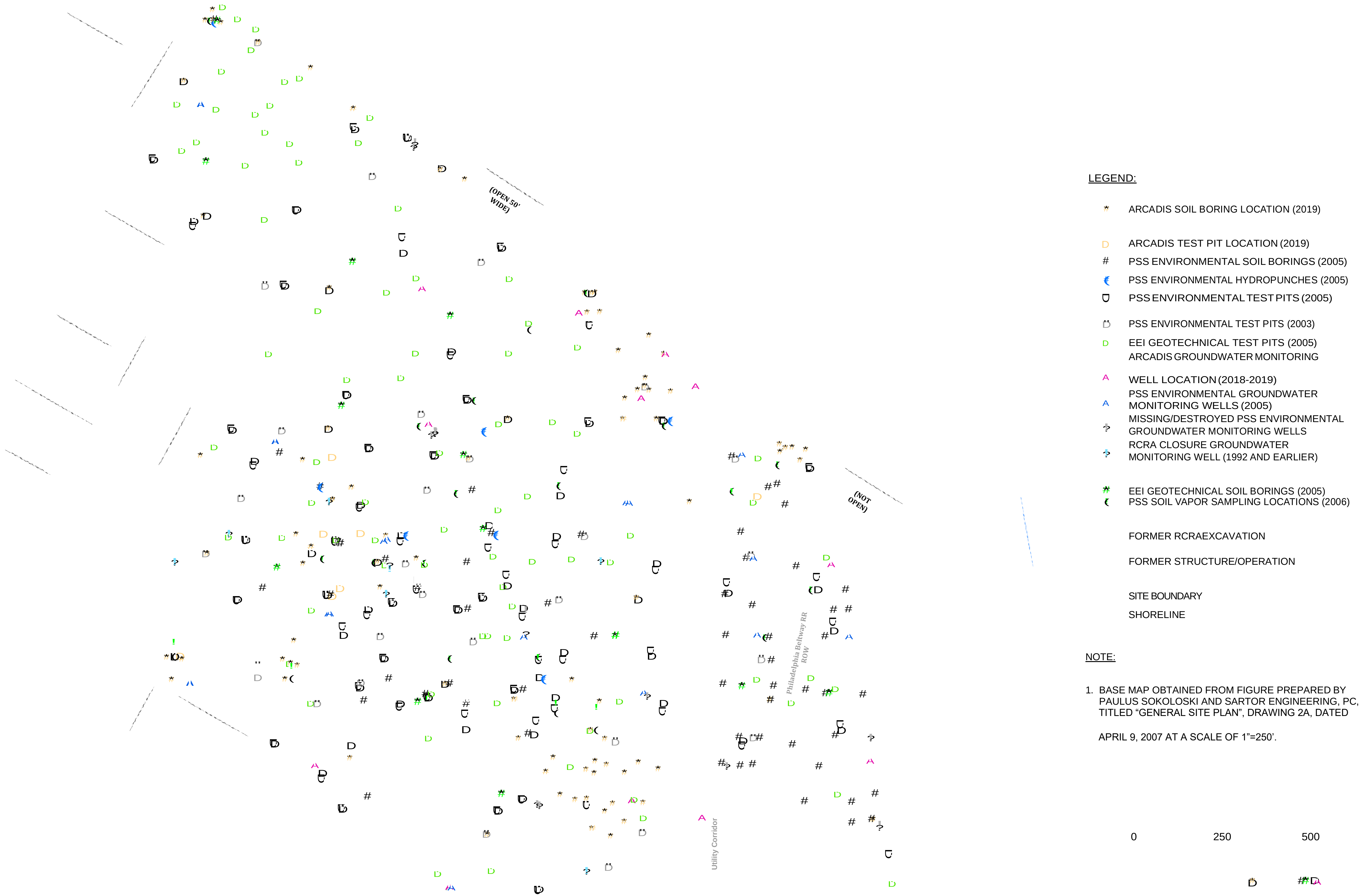
0 250 500 Feet
GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

HISTORICAL GROUNDWATER MONITORING WELLS

ARCADIS Design & Consultancy for natural and built assets

FIGURE 4



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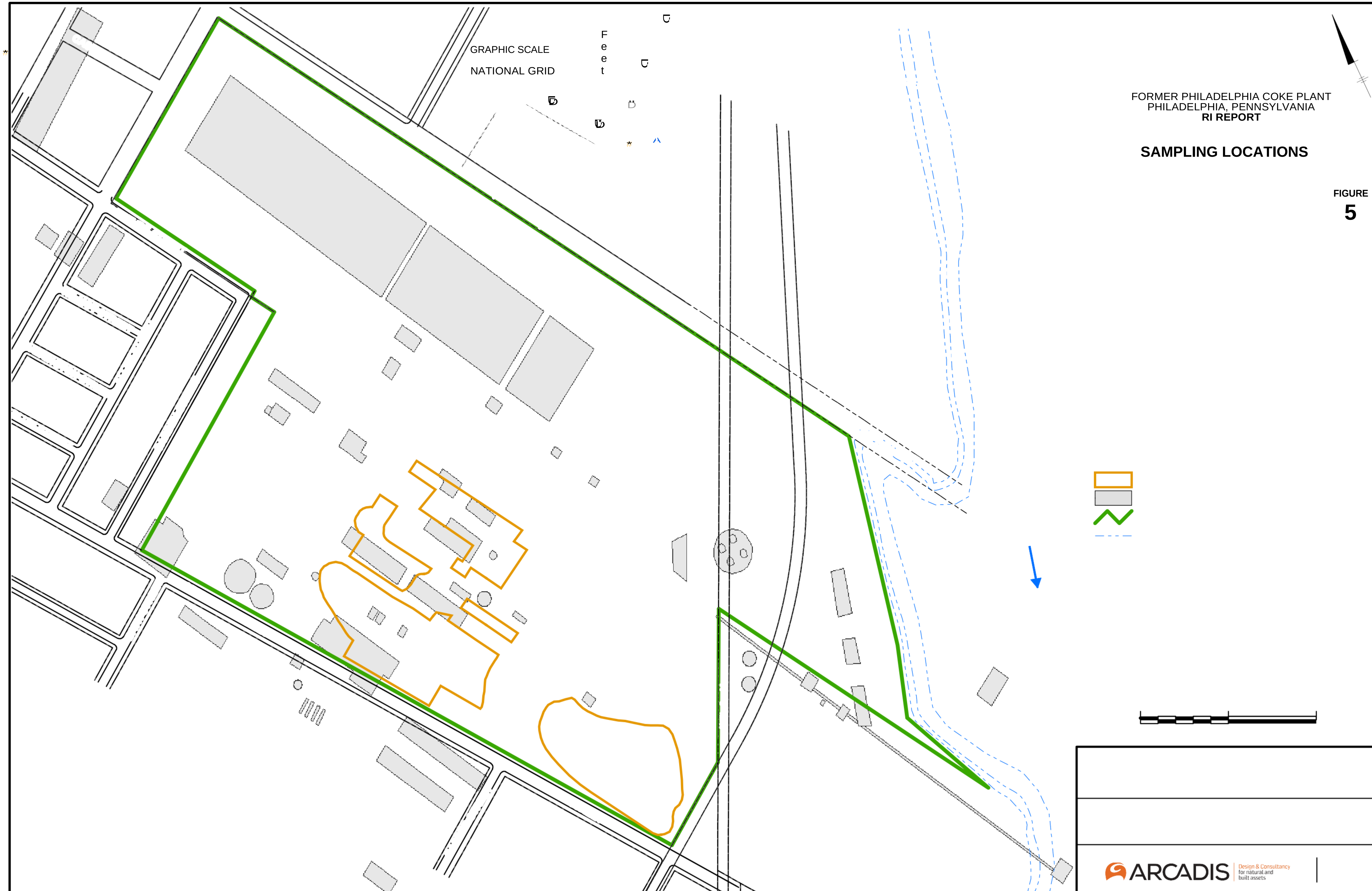
GRAPHIC SCALE
NATIONAL GRID
Feet
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT
SAMPLING LOCATIONS
FIGURE
5
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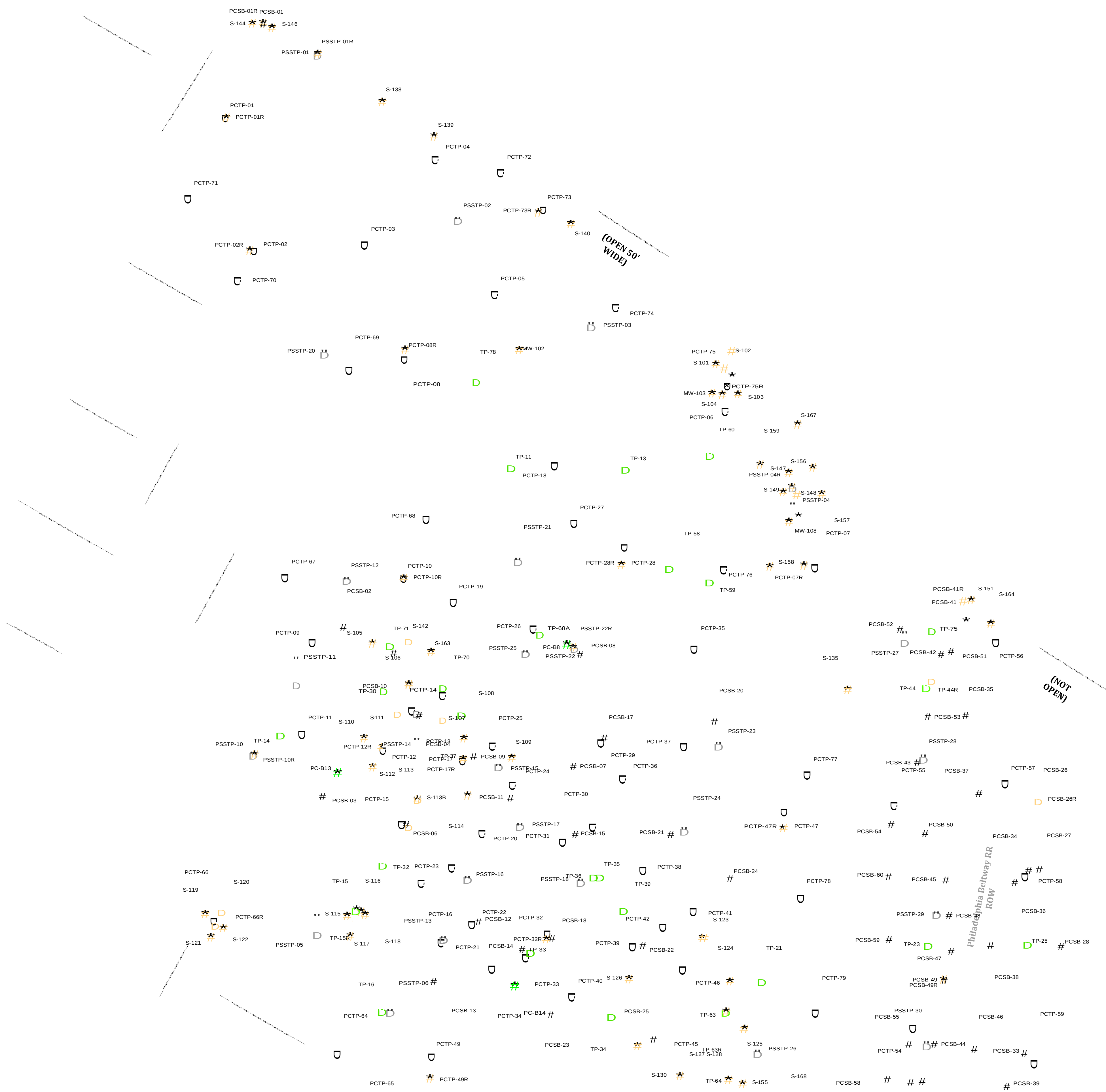

LEGEND:

(S-101) 2019 SOIL BORING LOCATION (2019)

(S-120) 2019 TEST PIT LOCATION (2019)

(PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(TP-46) EEI GEOTECHNICAL TEST PITS (2005)

(PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)

FORMER RCRAEXCAVATION

FORMER STRUCTURE/OPERATION

SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. FIGURE ONLY SHOWS SAMPLE LOCATIONS WHERE SOIL SAMPLES WERE COLLECTED FOR

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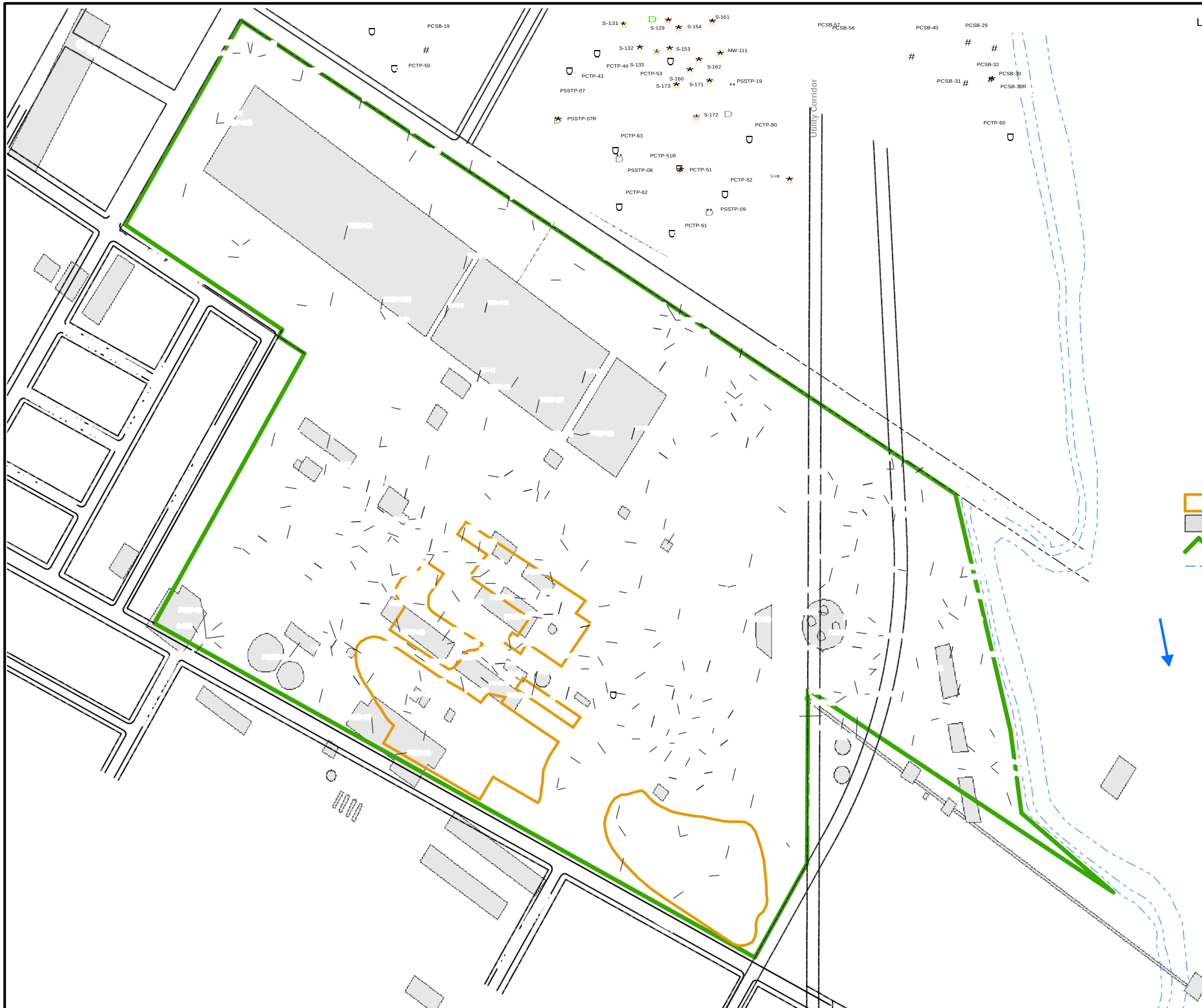

LABORATORY ANALYSIS.

0 250 500
Feet
GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SOIL SAMPLING LOCATIONS WITH CHEMICAL ANALYTICAL RESULTS

FIGURE
6

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LEGEND:

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(PCHP-03) PSS GROUNDWATER HYDROPUNCH (2005)

(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

FORMER RCRA EXCAVATION

APPROXIMATE SITE BOUNDARY

SHORELINE

NOTE:

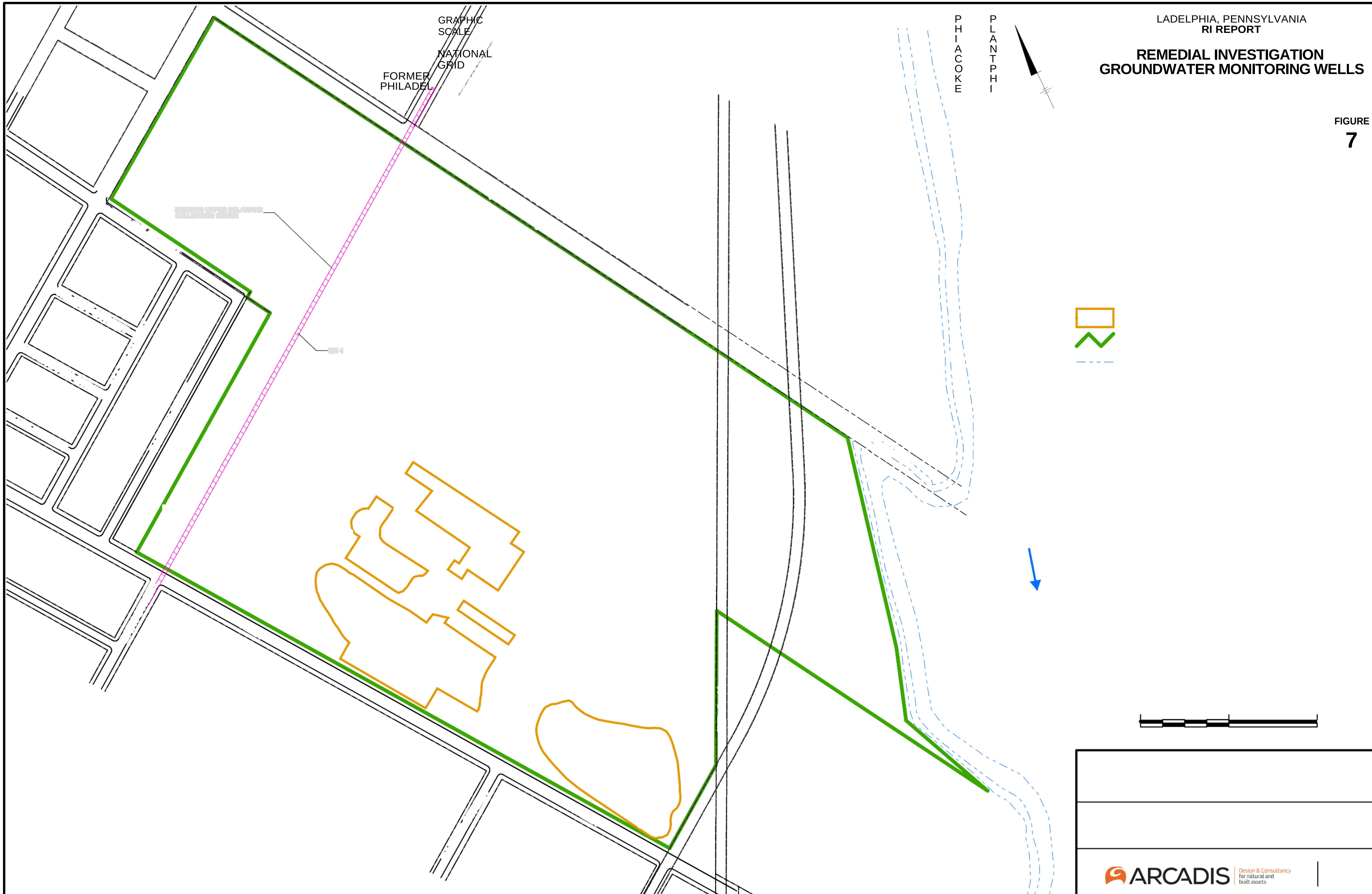
1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

0 250 500
Feet

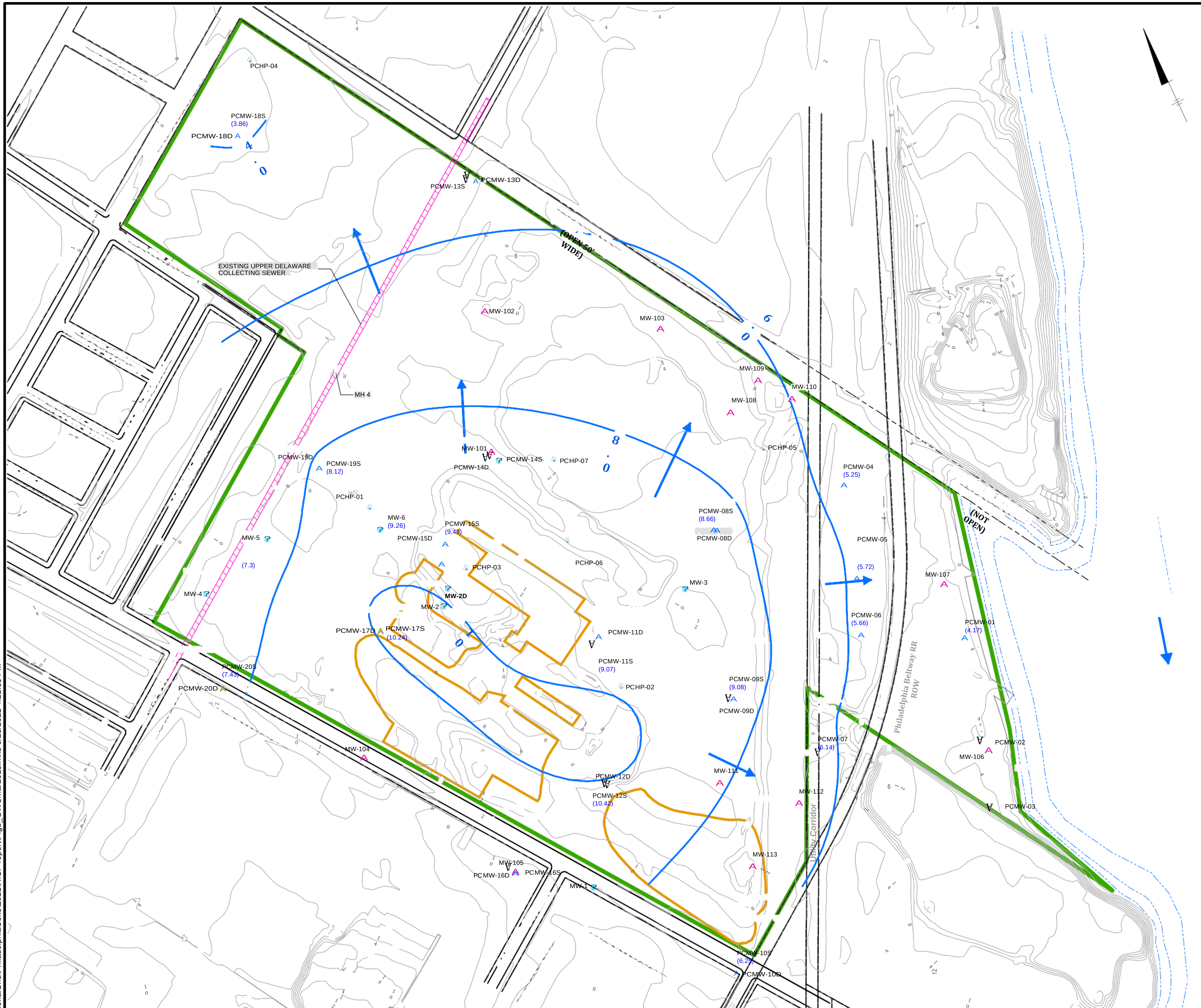
LADELPHIA, PENNSYLVANIA
RI REPORT

REMEDIAL INVESTIGATION
GROUNDWATER MONITORING WELLS

FIGURE
7



ARCADIS Design & Consultancy for natural and built assets



LEGEND:

- INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- (9.07) GROUNDWATER ELEVATION - SHALLOW ZONE (FEET ABOVE MEAN SEA LEVEL, NAVD 88)
- (MW-101) GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- (PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)
- (PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
- (PCHP-03) PSS GROUNDWATER HYDROPUNCH (2005)
- (MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
- GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT. (PHILADELPHIAVERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)
- FORMER RCRA EXCAVATION
- APPROXIMATE SITE BOUNDARY
- SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. WATER LEVEL ELEVATIONS ARE FROM MARCH 19, 2018 APPROXIMATELY AN HOUR BEFORE LOW TIDE THROUGH THE DURATION OF LOW TIDE.
3. PCMW-07 AND PCMW-12S ARE OBSTRUCTED BY

   OVERGROWN ROOTS IMMEDIATELY BELOW THE WATER TABLE. HOWEVER, WATER ELEVATIONS WERE STILL OBTAINED FROM BOTH WELLS.
4. MONITORING WELLS MW-101 THROUGH MW-113 WERE NOT YET INSTALLED DURING THE MARCH 2018 WATER LEVEL GAUGING EVENT.

0 250 500
Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

ARCADIS

GROUNDWATER POTENTIOMETRIC SURFACE MAP SHALLOW ZONE MARCH 19, 2018

FIGURE

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
T:_ENV\NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig8_GWCMar2018.mxd 6/25/2021 4:21:35 PM

LEGEND:

- INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- (9.07) GROUNDWATER ELEVATION - SHALLOW ZONE (FEET ABOVE MEAN SEA LEVEL, NAVD 88)
- (MW-101) ARCADIS GROUNDWATER MONITORING WELLLOCATION (2018-2019)
- (PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)
- (PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
- (PCHP-03) PSS GROUNDWATER HYDROPUNCH (2005)
- (MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
- GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT. (PHILADELPHIAVERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)
- FORMER RCRA EXCAVATION
- APPROXIMATE SITE BOUNDARY
- SHORELINE

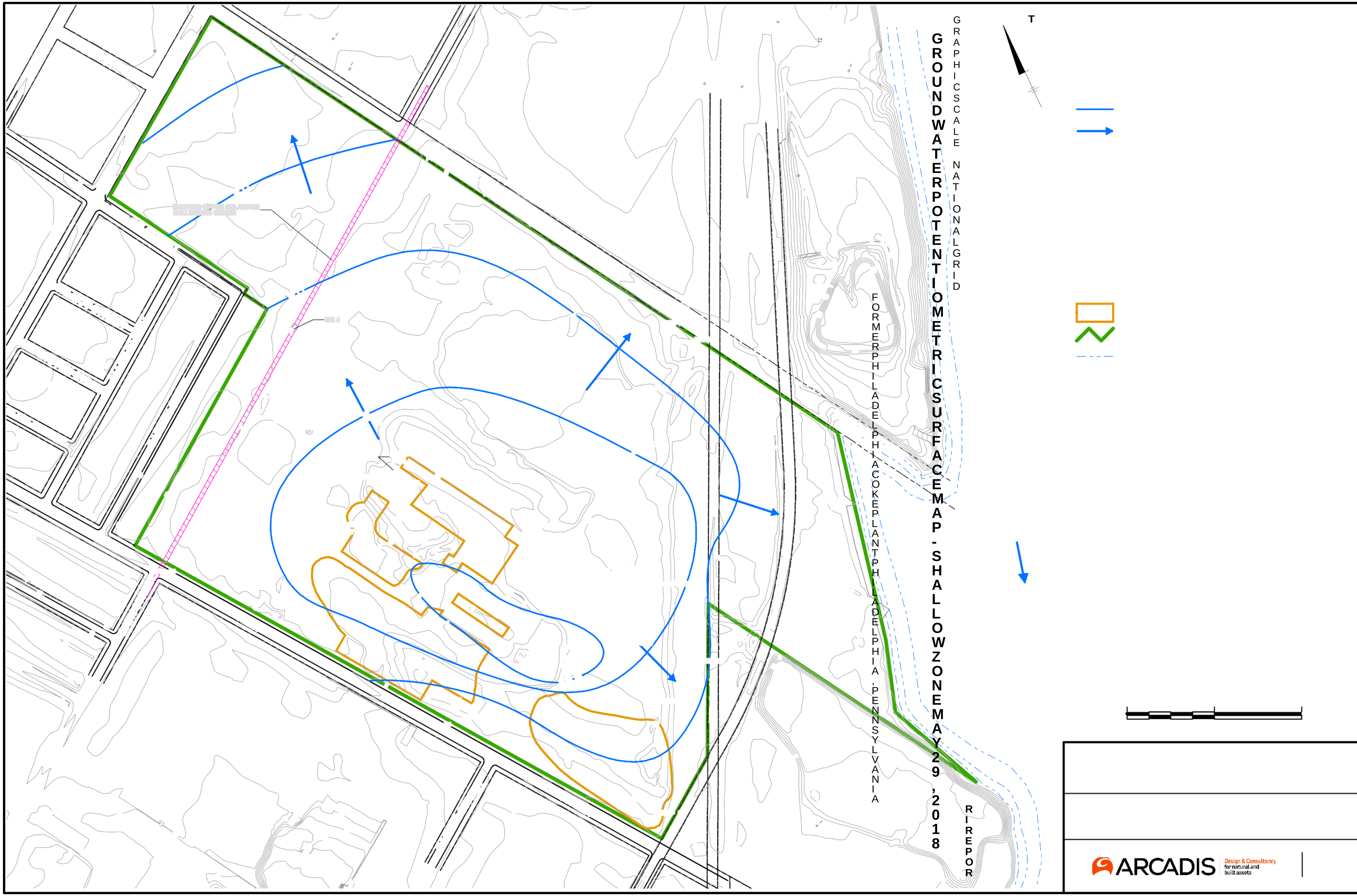
NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. WATER LEVEL ELEVATIONS ARE FROM MAY 29, 2018 APPROXIMATELY AT LOW TIDE TO AN HOUR AFTER LOW TIDE.
3. NM = NOT MEASURED
4. PCMW-12S IS OBSTRUCTED BY OVERGROWN ROOTS IMMEDIATELY BELOW THE WATER TABLE. HOWEVER, WATER ELEVATION WAS STILL OBTAINED FROM THE WELL.
5. MONITORING WELLS MW-108 THROUGH MW-113 WERE NOT YET INSTALLED DURING THE 2018 WATER LEVEL GAUGING EVENTS.

0 250 500
Feet

oup: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
illy Coke (B0036790.0000.00001)
alGrid\PhiladelphiaCoke\2021\RICP report\Fig9_HistoricalGWCMar2018.mxd 6/25/2021 4:23:04 PM

PCMW-10D


GROUNDWATER POTENTIOMETRIC SURFACE MAP - SHALLOW ZONE MAY 29, 2018
FORMER PHILADELPHIA COKE PLANT PHILADELPHIA, PENNSYLVANIA
RI REPOR R
GRAPHIC SCALE
NATIONAL GRID
T
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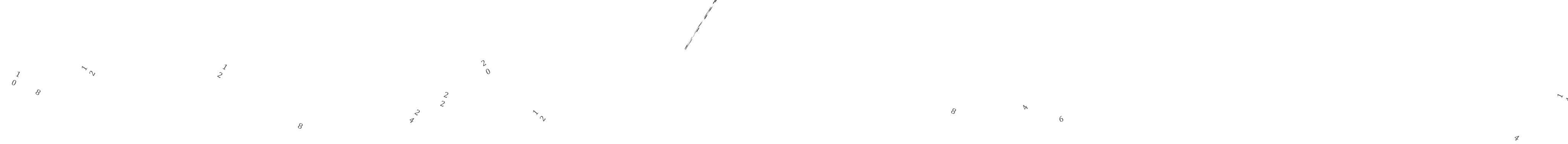
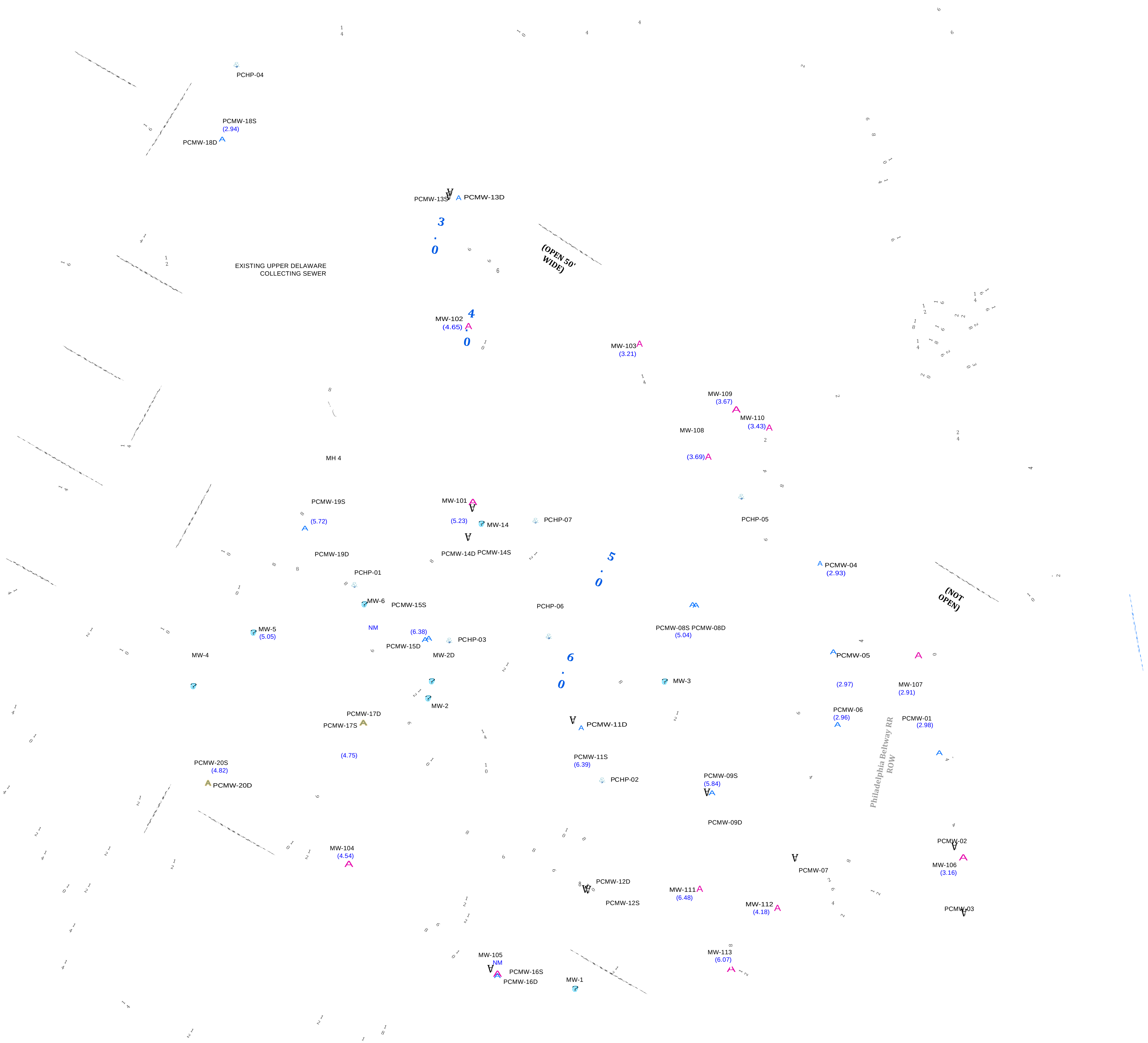


FIGURE
9



LEGEND:

INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)

APPROXIMATE GROUNDWATER FLOW DIRECTION

(2.98) GROUNDWATER ELEVATION - SHALLOW ZONE (FEET ABOVE MEAN SEA LEVEL NAVD 88)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(PCHP-03) PSS GROUNDWATER HYDROPUNCH (2005)

(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT. (PHILADELPHIA VERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)

FORMER RCRA EXCAVATION

APPROXIMATE SITE BOUNDARY

SHORELINE

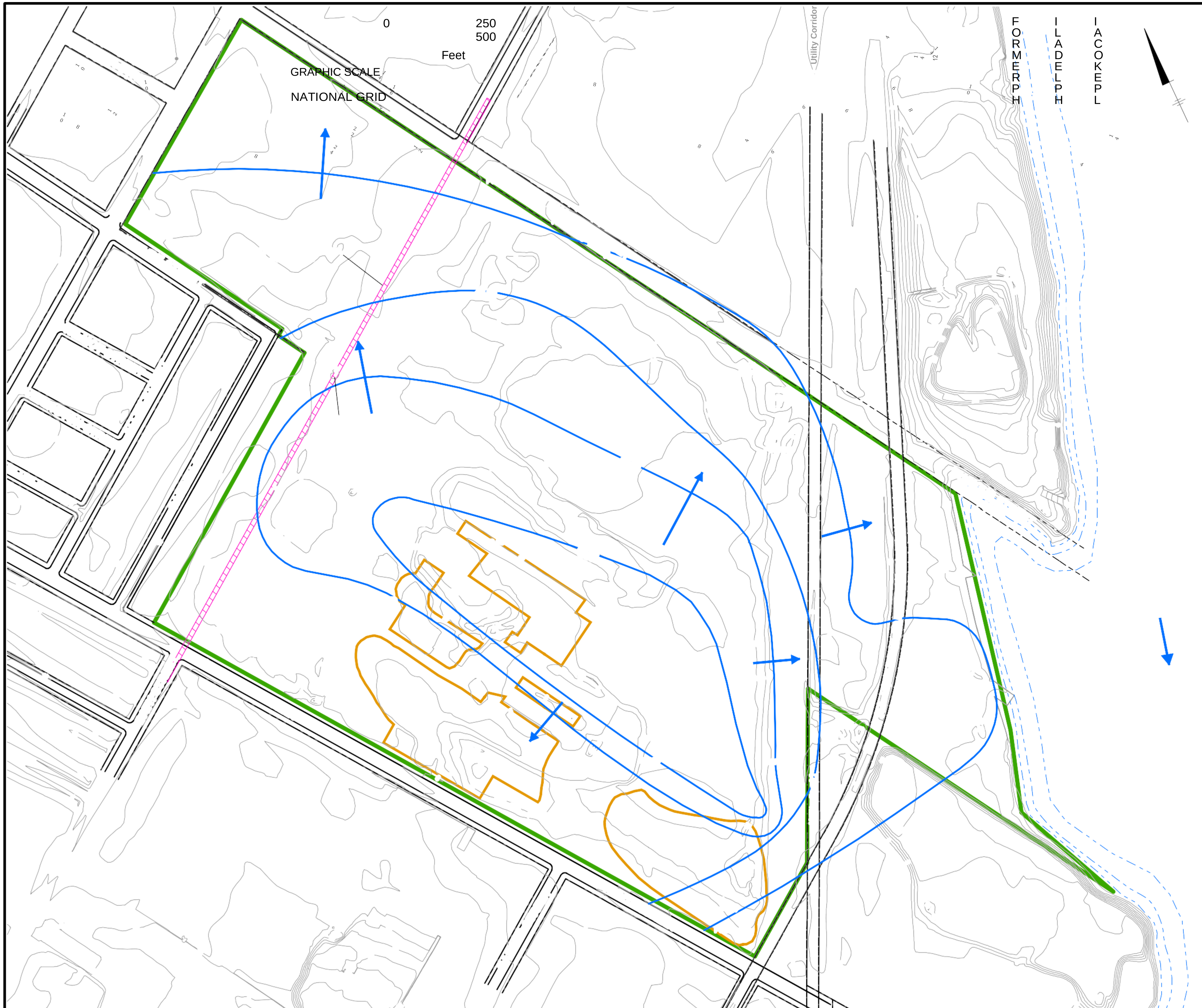
NOTE:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC,

   TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. WATER LEVEL ELEVATIONS ARE FROM OCTOBER 3, 2019 APPROXIMATELY 2 HOURS BEFORE LOW TIDE THROUGH THE DURATION OF LOW TIDE.

3. NM = NOT MEASURED.



ANT PHILADELPHIA, PENNSYLVANIA
RI REPORT

GROUNDWATER POTENTIOMETRIC SURFACE MAP - SHALLOW ZONE
OCTOBER 3, 2019

FIGURE
10

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LEGEND:

INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)

APPROXIMATE GROUNDWATER FLOW DIRECTION

(9.07) GROUNDWATER ELEVATION - DEEP ZONE (FEET ABOVE MEAN SEA LEVEL, NAVD 88)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(PCHP-03) PSS GROUNDWATER HYDROPUNCH (2005)

(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT. (PHILADELPHIA VERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)

FORMER RCRA EXCAVATION

APPROXIMATE SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.
2. WATER LEVEL ELEVATIONS ARE FROM MAY 29, 2018 APPROXIMATELY AT LOW TIDE TO AN HOUR AFTER LOW TIDE.

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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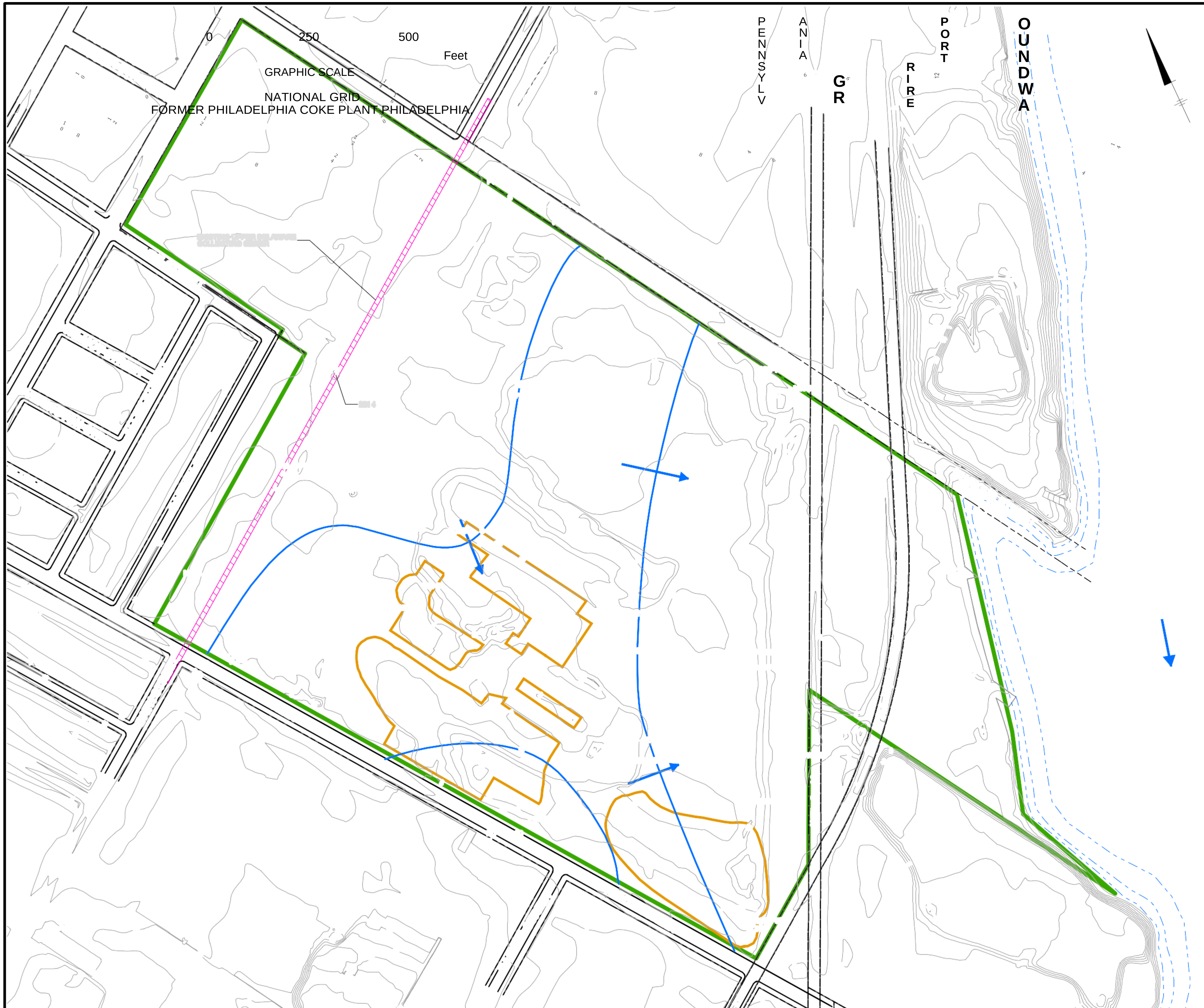
TER POTENTIOMETRIC SURFACE
MAP - DEEP ZONE
MAY 29, 2018
FIGURE
11


0
250
500
Feet
GRAPHIC SCALE
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT PHILADELPHIA
PENNSYLV
ANIA
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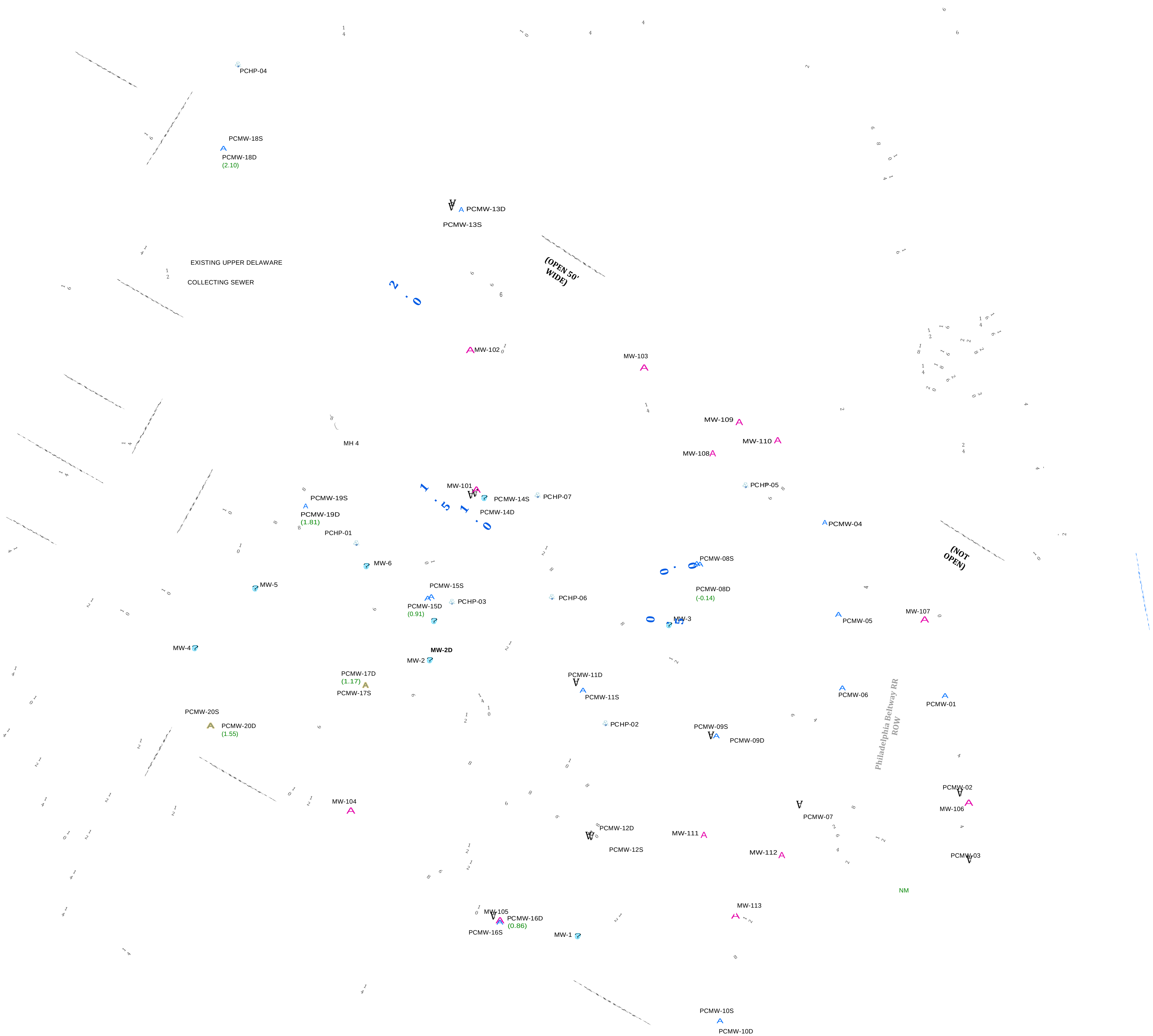


LEGEND:

INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)

APPROXIMATE GROUNDWATER FLOW

(0.91) GROUNDWATER ELEVATION - DEEP ZONE (FEET ABOVE MEAN SEA LEVEL NAVD 88)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSSGROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(PCHP-03) PSS GROUNDWATER HYDROPUNCH

(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

GROUND SURFACE ELEVATION CONTOURS FROM DATA Clearinghouse Philadelphia Contours 2ft. (Philadelphia Vertical Datum, 2004 - City of Philadelphia)

FORMER RCRA EXCAVATION

APPROXIMATE SITE BOUNDARY

SHORELINE

NOTES:

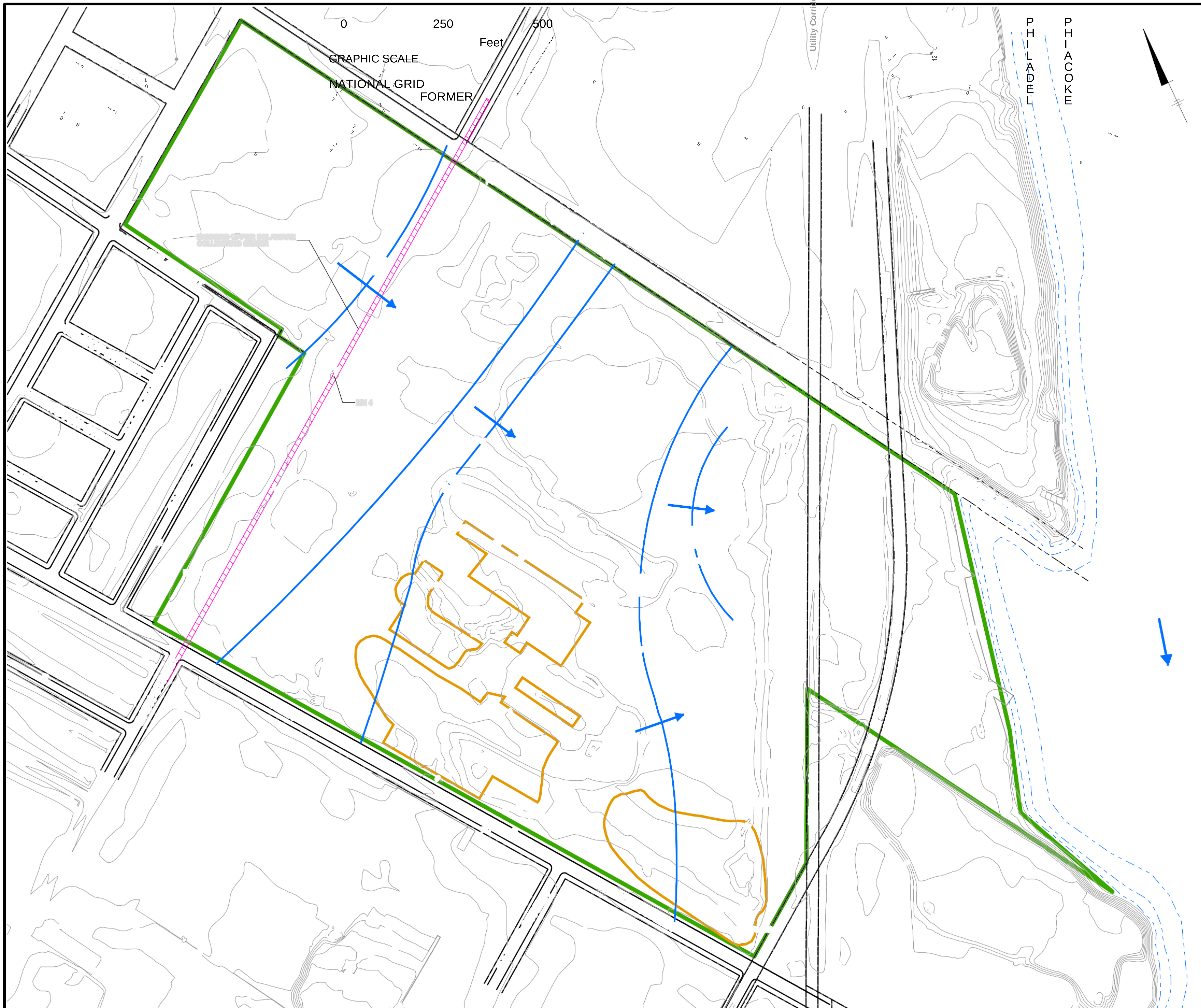
1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. WATER LEVEL ELEVATIONS ARE FROM OCTOBER 3, 2019 APPROXIMATELY 2 HOURS BEFORE LOW TIDE THROUGH THE DURATION OF LOW TIDE.
3. NM = NOT MEASURED.

Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
Grid Philly Coke (B0036790.0000.00001)
NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig12_GWCdeepOct2019.mxd 6/25/2021 4:25:55 PM

PLANT PHILADELPHIA, PENNSYLVANIA
RI REPORT

GROUNDWATER POTENTIOMETRIC SURFACE MAP - DEEP ZONE OCTOBER 3, 2019

FIGURE
12



LEGEND:

PUMPING WELL SEARCH RESULTS

- OTHER WITHDRAWAL WELL LOCATION
- MONITORING WELL LOCATION
- DOMESTIC WITHDRAWAL WELL LOCATION
- UNKNOWN WITHDRAWAL WELL LOCATION
- UNUSED/ABANDONED/DESTROYED WELL LOCATION
- SITE BOUNDARY
- 1/2-MILE RADIUS OF SITE

GEOLOGIC UNIT

- QT - FILL DEPOSITS, HOLOCENE MARSH/ALLUVIAL DEPOSITS, AND TRENTON GRAVEL (PLEISTOCENE) FORMATION
- XW - WISSAHICKON FORMATION

NOTES:

1. GEOLOGIC DATA - THE U.S. DEPARTMENT OF AGRICULTURE (USDA), 2005, (ACCESSED VIA WEB ON MARCH 28, 2012).
2. WELL DATA - PA TOPOGRAPHIC & GEOLOGIC SURVEY DATABASE (ACCESSED VIA WEB ON OCTOBER 13, 2020).
3. PER THE PHILADELPHIA WATER DEPARTMENT RECORDS, RESIDENTS AROUND THE SITE CONSUME CITY WATER. ACCORDING TO THE PENNSYLVANIA GROUNDWATER INFORMATION SYSTEM WEBSITE, THE ONE DOMESTIC WELL LOCATED NEAR THE SITE IS ALSO LISTED FOR MONITORING. THE ONE DOMESTIC WELL IS LOCATED ON A PROPERTY WHERE THERE IS A HISTORICAL DIESEL RELEASE. THEREFORE, IT IS LIKELY THAT THIS WELL WAS USED FOR AND/OR CONTINUES TO BE USED FOR MONITORING PURPOSES ONLY. MORE INFORMATION IS AVAILABLE IN SUBSECTION 3.2.2.1 OF THE REMEDIAL INVESTIGATION REPORT.
4. WELLS OUTSIDE THE 1/2-MILE RADIUS OF THE SITE ARE NOT SHOWN.

0 900 1,800
Feet

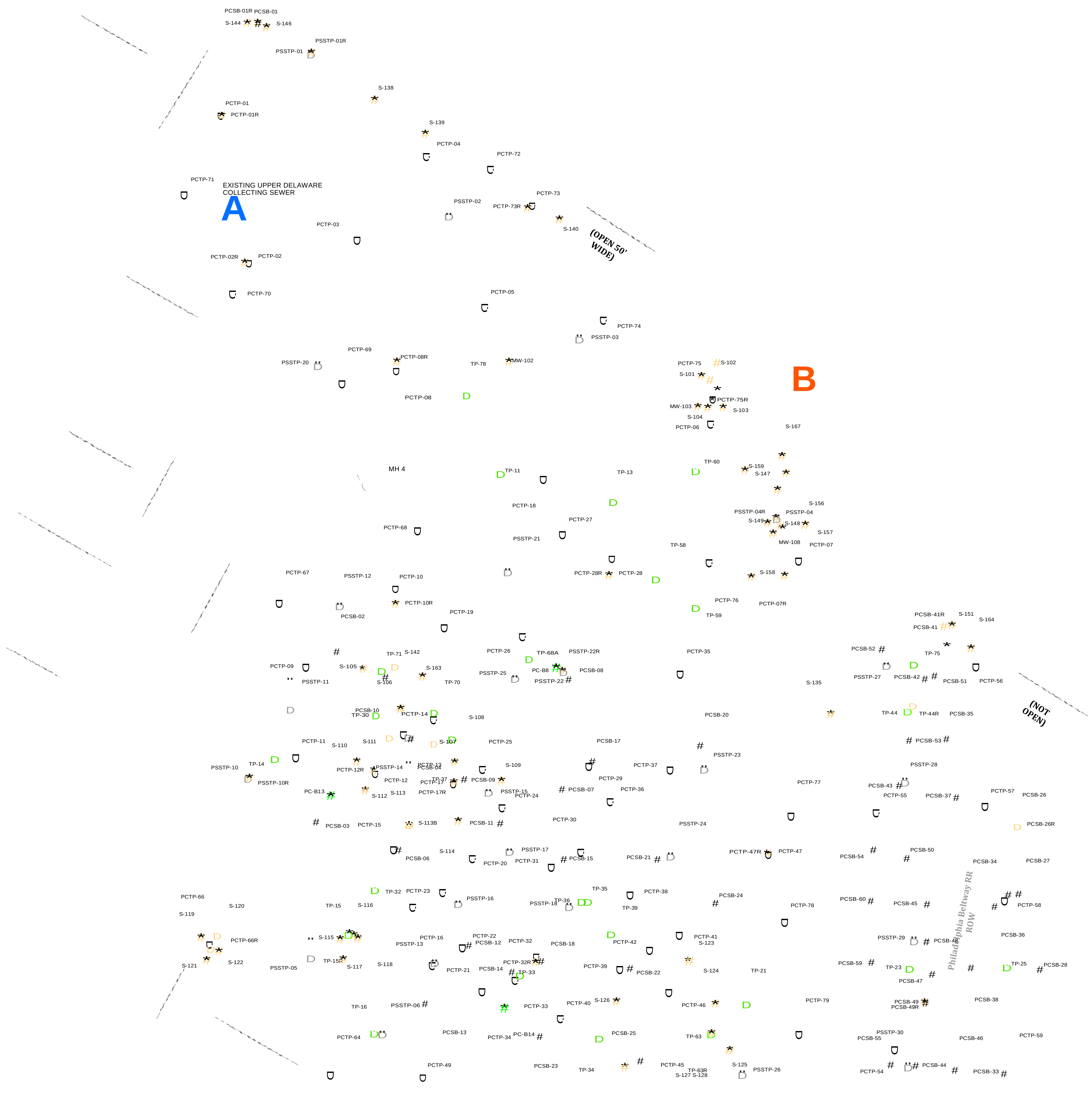
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SITE GEOLOGY MAP WITH LOCAL WELLS WITHIN HALF MILE RADIUS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
13

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
T:_ENV\NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig13_HalfMileRadius_DSCP_GeologicMapand_WaterSupply_B-size.mxd 6/24/2021 4:29:46 PM



LEGEND:

(S-101) ARCADIS SOIL BORING LOCATION (2019)

(S-120) ARCADIS TEST PIT LOCATION (2019)

(PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(TP-46) EEI GEOTECHNICAL TEST PITS (2005)

(B-06) EEI GEOTECHNICAL SOIL BORINGS (2005)

FORMER RCRAEXCAVATION

FORMER STRUCTURE/OPERATION

SITE BOUNDARY

SHORELINE

CROSS SECTION TRANSECTS

A-A'

B-B'

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY
PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC,
TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED
APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. FIGURE ONLY SHOWS SAMPLE LOCATIONS WHERE

t Saved By: AKENS
Fig14_CXLocationMap.mxd 6/24/2021 4:30:45 PM

SOIL SAMPLES WERE COLLECTED FOR

LABORATORY ANALYSIS.

0 250 500

Feet

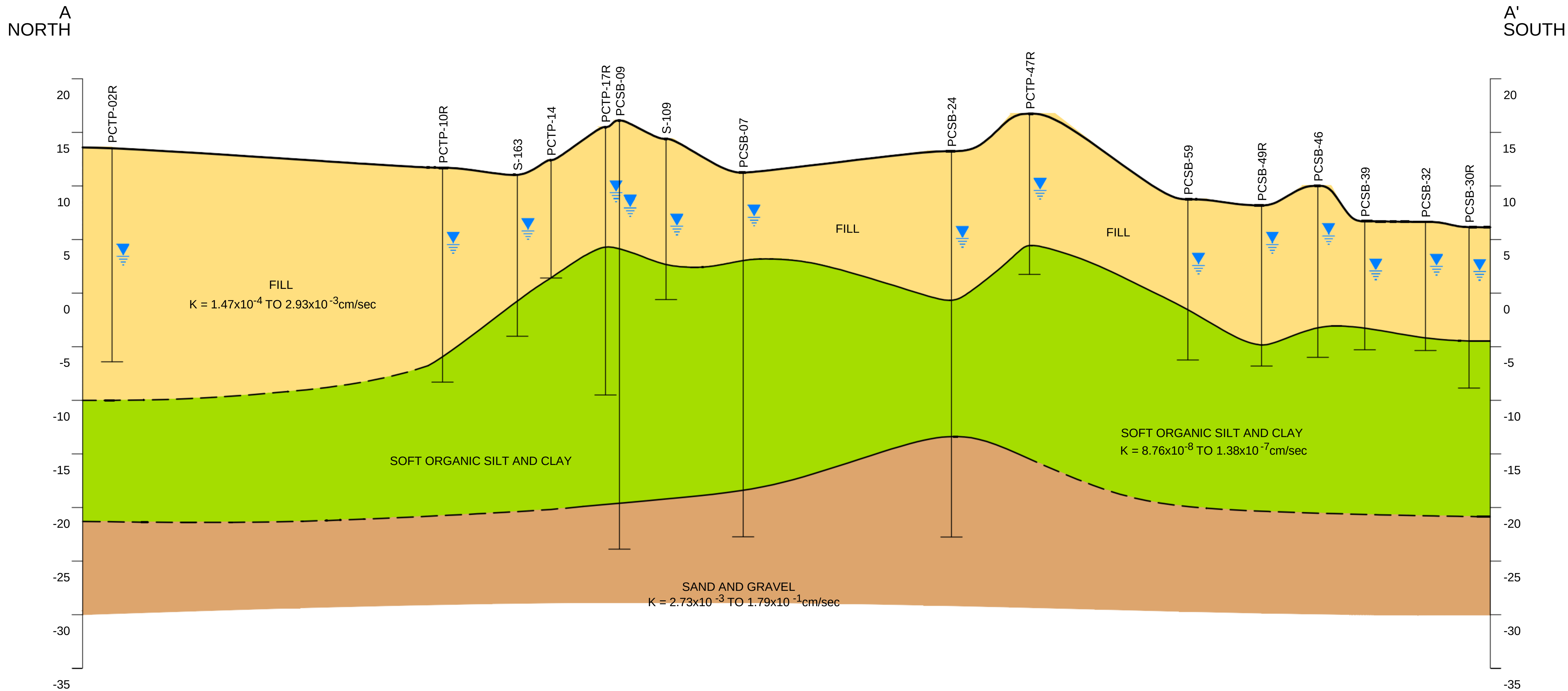
GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

CROSS SECTION LOCATION MAP

FIGURE
14

ARCADIS Design & Consultancy for natural and built assets



LEGEND

S-163 ARCADIS SOIL BORING LOCATION (2019)

PCSB-09 PSS ENVIRONMENTAL SOIL BORING (2005)

PCTP-14 PSS ENVIRONMENTAL TEST PIT (2005)

K HYDRAULIC CONDUCTIVITY

cm/sec CENTIMETER PER SECOND

WELL/BORING LOCATION

APPROXIMATE GROUNDWATER ELEVATION BASED ON ELEVATION OF GROUNDWATER ENCOUNTERED IN THE BORING OR TEST PIT

FILL

CLAY

SAND AND GRAVEL

ASSUMED GEOLOGIC CONTACTS BASED ON AVAILABLE BORINGS

10 0 100 200

CROSS-SECTION SCALE IN FEET

VERTICAL EXAGGERATION: 20x

DRAFT
CONFIDENTIAL

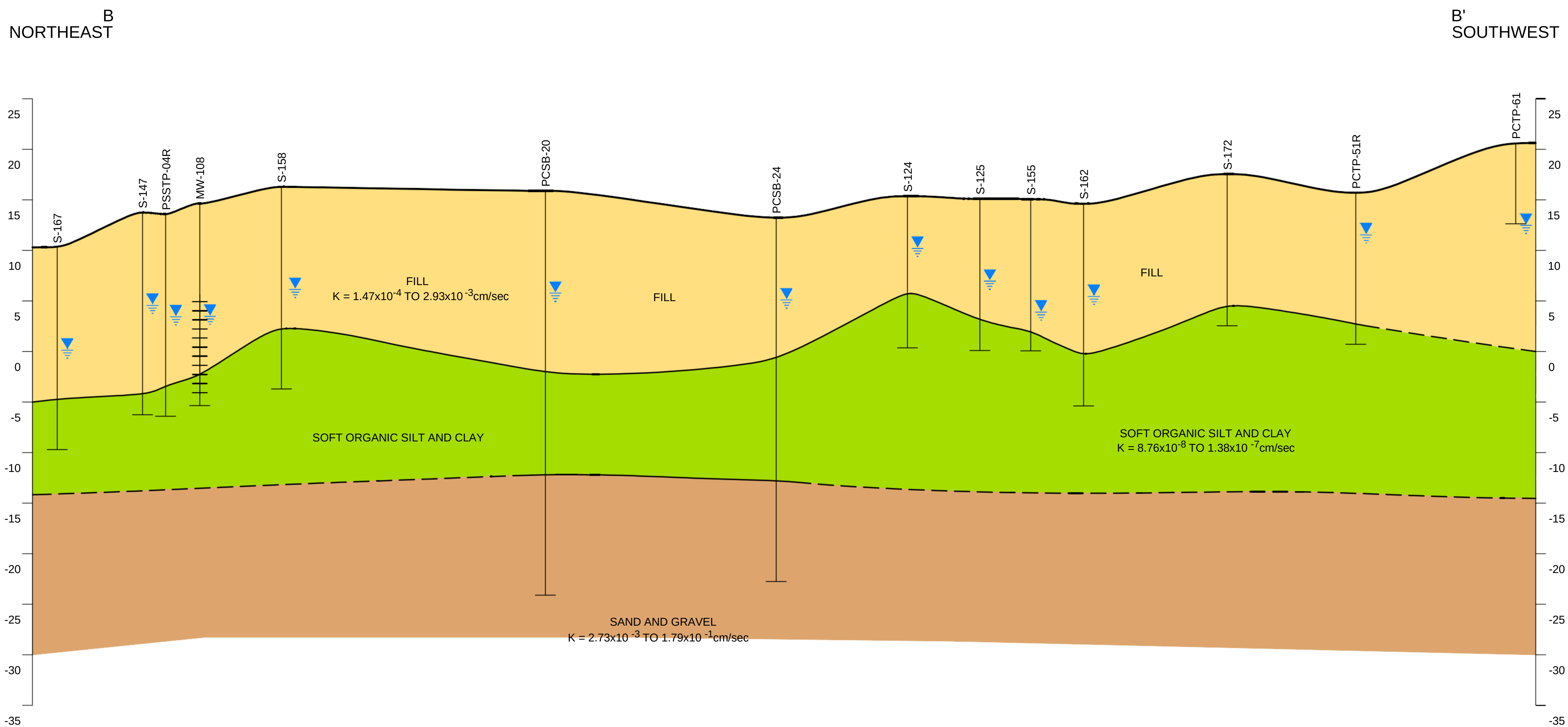
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

GEOLOGIC CROSS-SECTION A - A'

ARCADIS Design & Consultancy for natural and built assets

FIGURE

DIV/GROUP: ENV DB: C. McKeough PIC:(Opt) PM:(Reqd) TM: E. Green LYR:(Opt)ON=*;OFF=*REF*
C:\Users\akens\OneDrive - ARCADIS\BIM 360 Docs\National Grid\Project Files\Philadelphia Coke\2020\30004026\01-DWG\Xsec-WellPts.dwg LAYOUT: 15 SAVED: 6/24/2021 2:10 PM ACADVER: 23.0S (LMS TECH) PAGESETUP: PDF-LB PLOTSTYLETABLE: BLACKGRAY.CTB PLOTTED: 6/24/2021 4:06 PM
BY: AKENS, DAVID
PROJECTNAME: ----
XREFS:



LEGEND

S-163	ARCADIS SOIL BORING LOCATION (2019)
MW-108	ARCADIS GROUNDWATER MONITORING WELL LOCATION (2019)
PCSB-09	PSS ENVIRONMENTAL SOIL BORING (2005)
PCTP-14	PSS ENVIRONMENTAL TEST PIT (2005)
K	HYDRAULIC CONDUCTIVITY
cm/sec	CENTIMETER PER SECOND
	WELL/BORING LOCATION
	SCREENED INTERVAL

APPROXIMATE GROUNDWATER ELEVATION BASED ON ELEVATION OF GROUNDWATER ENCOUNTERED IN THE BORING OR TEST PIT

FILL

CLAY

SAND AND GRAVEL

ASSUMED GEOLOGIC CONTACTS BASED ON AVAILABLE BORINGS

10 0 50 100

CROSS-SECTION SCALE IN FEET

VERTICAL EXAGGERATION: 10x

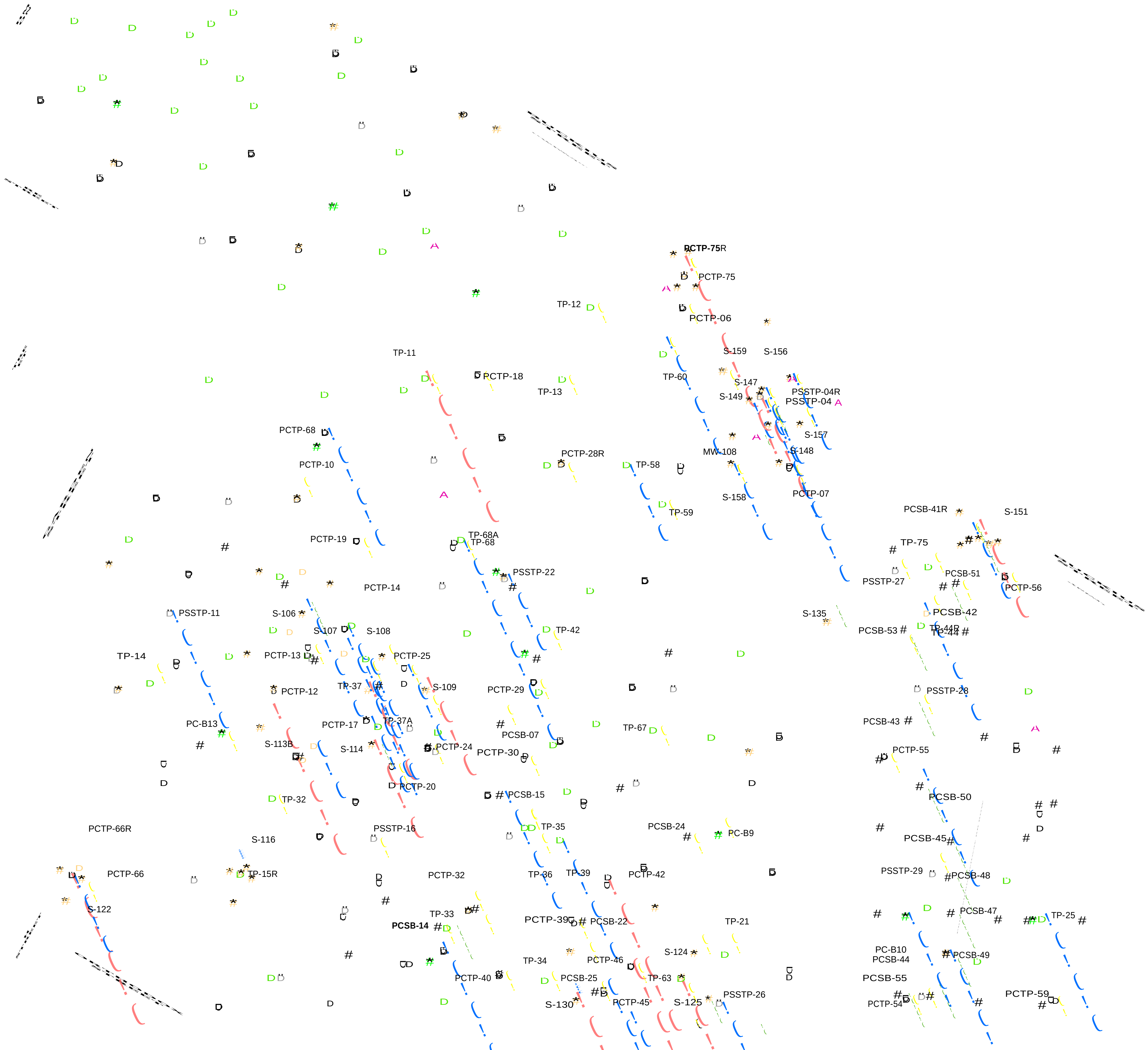
DRAFT
CONFIDENTIAL

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

GEOLOGIC CROSS-SECTION B - B'

ARCADIS Design & Consultancy for natural and built assets

FIGURE



LEGEND:

HEADSPACE PID READING >= 100 PPM

SHEEN

SOLIDIFIED TAR OR TAR-LIKE MATERIAL

VISCOUS TAR OR OIL-LIKE MATERIAL

(S-101) ARCADIS SOIL BORING LOCATION (2019)

(S-120) 2019 ARCADIS TEST PIT LOCATION (2019)

(PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(TP-46) EEI GEOTECHNICAL TEST PITS (2005)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)

FORMER RCRA EXCAVATION

FORMER STRUCTURE/OPERATION

SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. SAMPLE IDs ARE SHOWN FOR LOCATIONS WHERE PHOTOIONIZATION DETECTORS (PID) READINGS EQUAL TO OR GREATER THAN 100 PARTS PER MILLION (PPM), SHEEN, SOLIDIFIED TAR, AND/OR VISCOUS TAR/OIL-LIKE MATERIAL WERE OBSERVED.

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036790.0000.00001)
lphiaCoke\2021\RICP report\Fig17_SBObservations.mxd 6/24/2021 4:32:39 PM

0 200 400

Feet

GRAPHIC SCALE

NATIONAL GRID

FORMER PHILADELPHIA COKE PLANT

PHILADELPHIA, PENNSYLVANIA

RI REPORT

SOIL BORING OBSERVATIONS

FIGURE

17

ARCADIS Design & Consultancy for natural and built assets

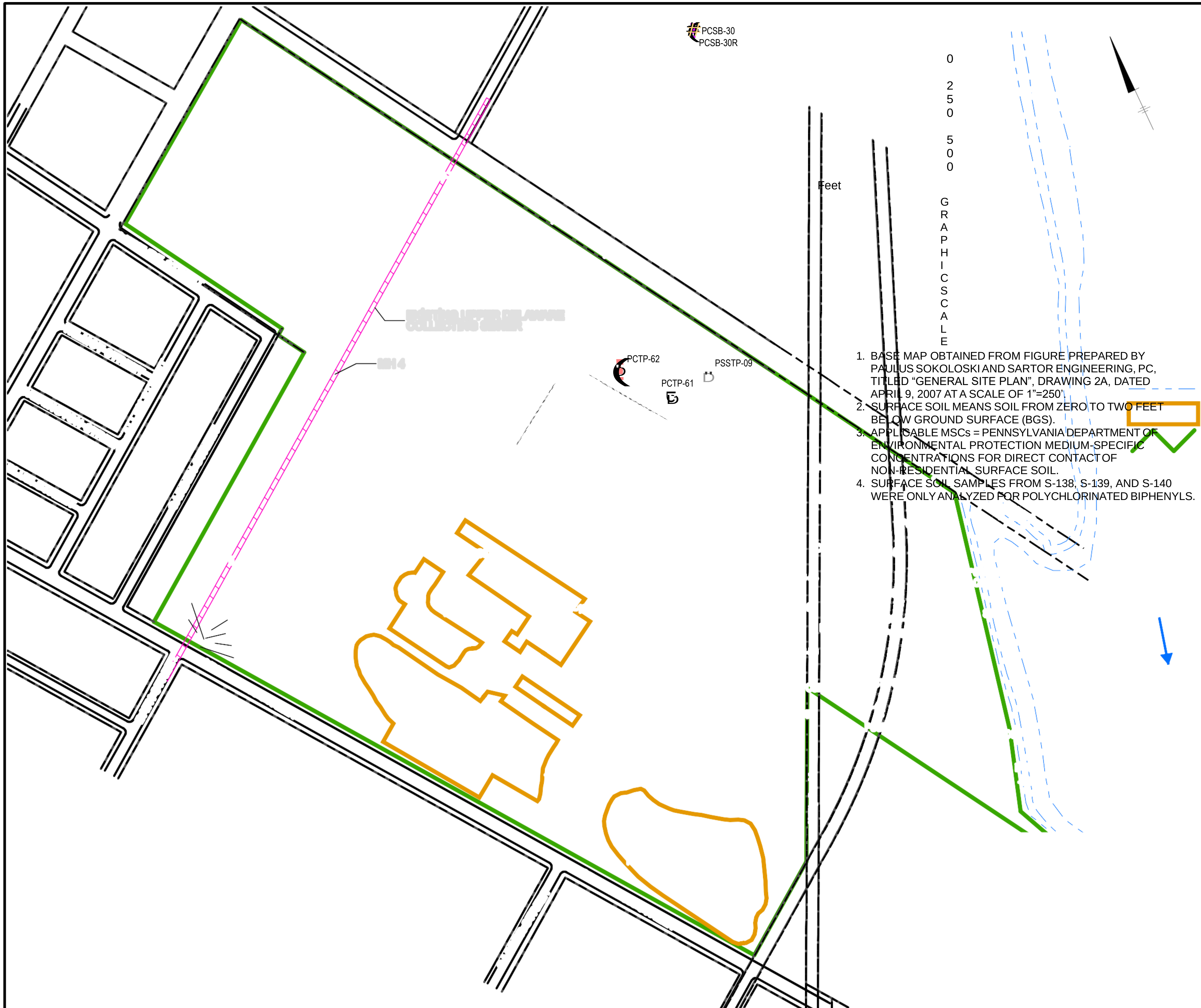
LEGEND:

- # (PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS
- D (PCTP-01) PSS ENVIRONMENTAL TEST PITS
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS
- (S-163) ARCADIS SOIL BORING LOCATION
- D (S-113) ARCADIS TEST PIT LOCATION
- LOCATION WHERE ONE OR MORE INORGANIC CONSTITUENTS EXCEED APPLICABLE MSCs
- LOCATION WHERE ONE OR MORE SVOC CONSTITUENTS EXCEED APPLICABLE MSCs
- SHORELINE
- FORMER RCRA EXCAVATION
- APPROXIMATE SITE

TES:

N
O

DV Created By: K. Sinsabaugh Last Saved By: AKENS
e (B0036790.0000.00001)
hiladelphiaCoke\2021\RICP report\Fig18_SurfaceSoilResults.mxd 6/24/2021 4:58:19 PM

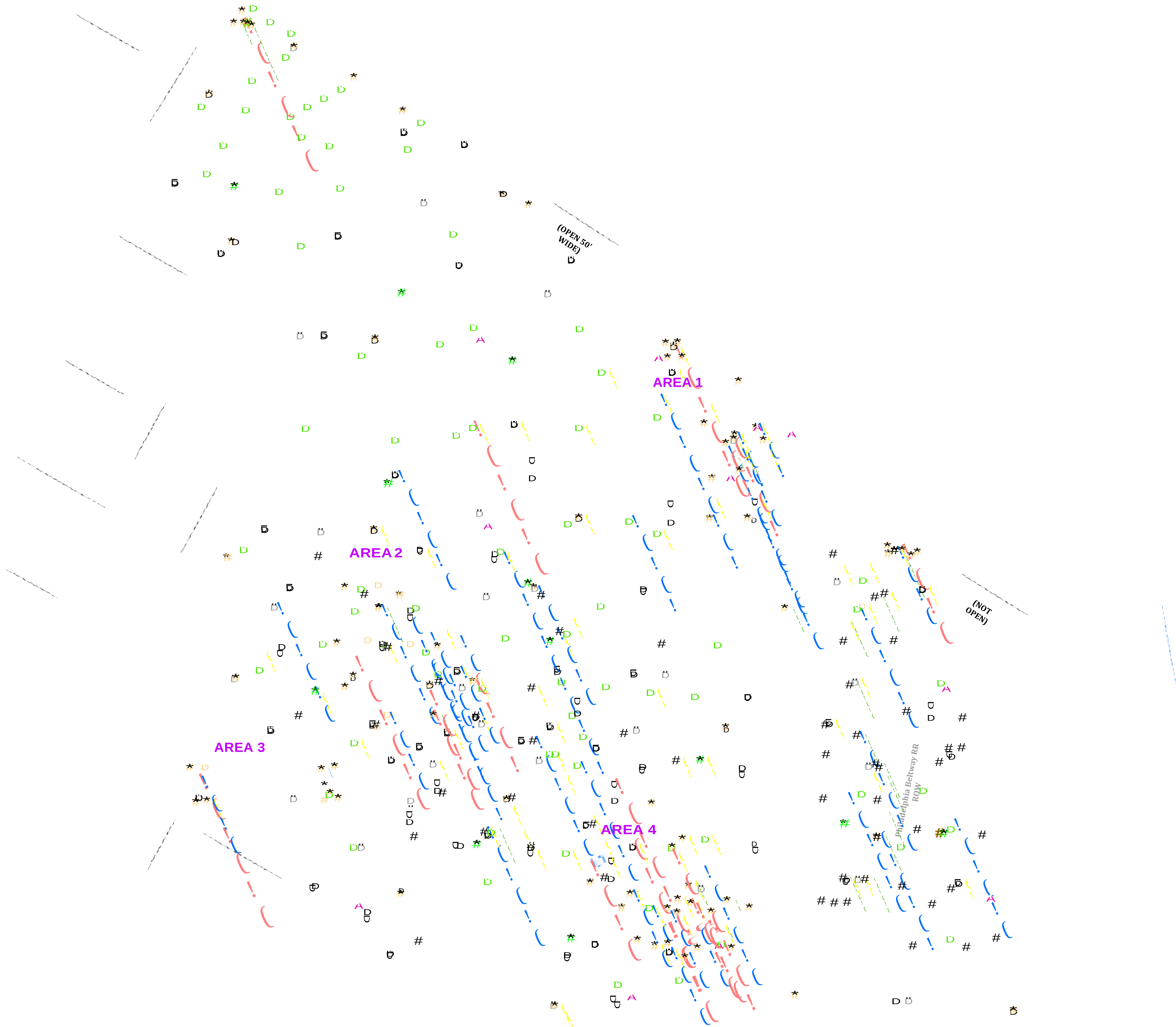


NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SURFACE SOIL ANALYTICAL RESULTS

FIGURE
18

ARCADIS Design & Consultancy for natural and built assets



LEGEND:

- HEADSPACE PID READING >= 100 PPM
- SHEEN
- SOLIDIFIED TAR OR TAR-LIKE MATERIAL
- VISCOUS TAR OR OIL-LIKE MATERIAL
- (S-101) ARCADIS SOIL BORING LOCATION (2019)
- (S-120) 2019 ARCADIS TEST PIT LOCATION (2019)
- (PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)
- (PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)
- (TP-46) EEI GEOTECHNICAL TEST PITS (2005)
- (MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- (PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)
- RCRAEXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY
- SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. PID = PHOTOIONIZATION DETECTOR.
3. PPM = PARTS PER MILLION.

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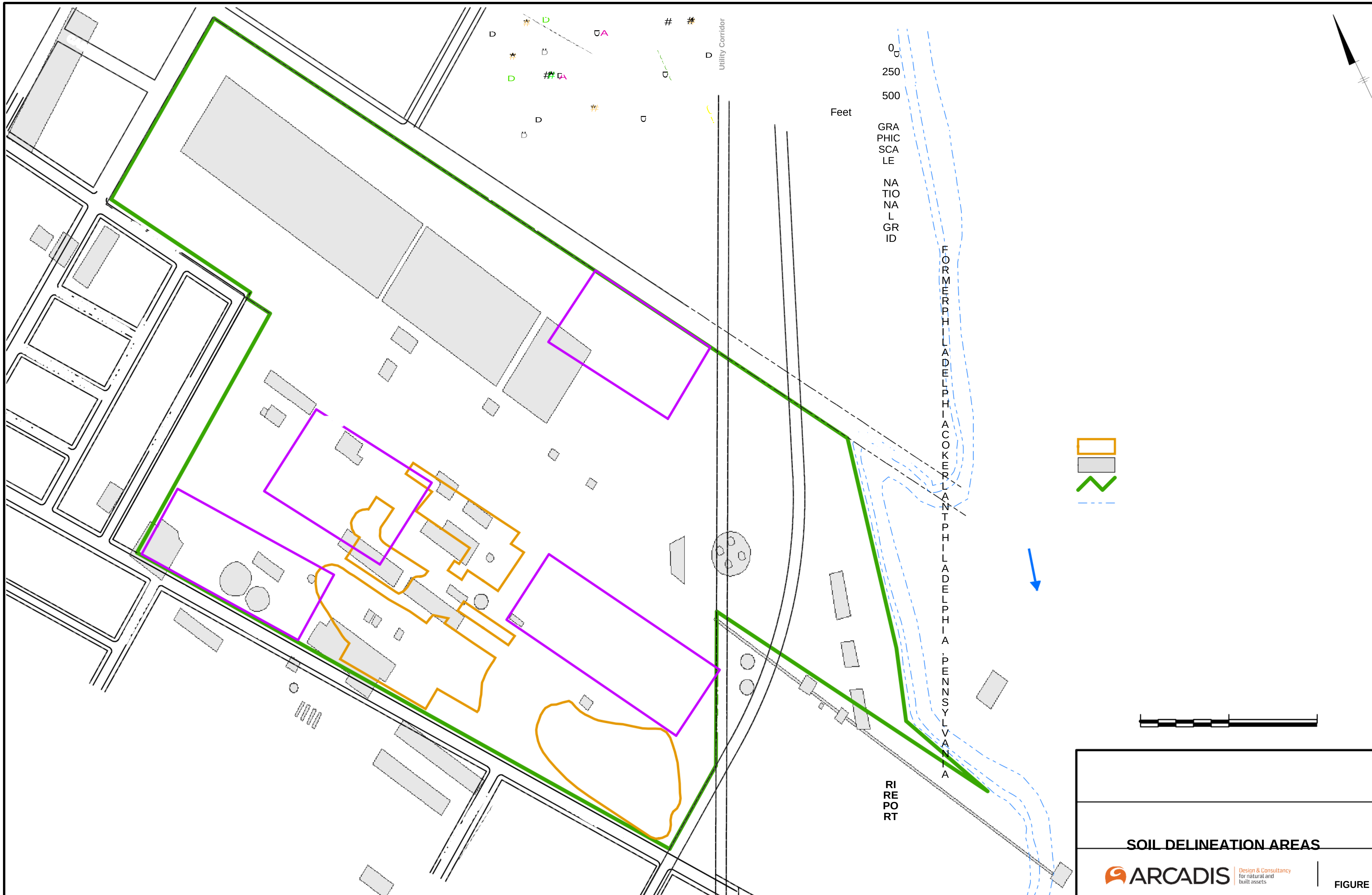
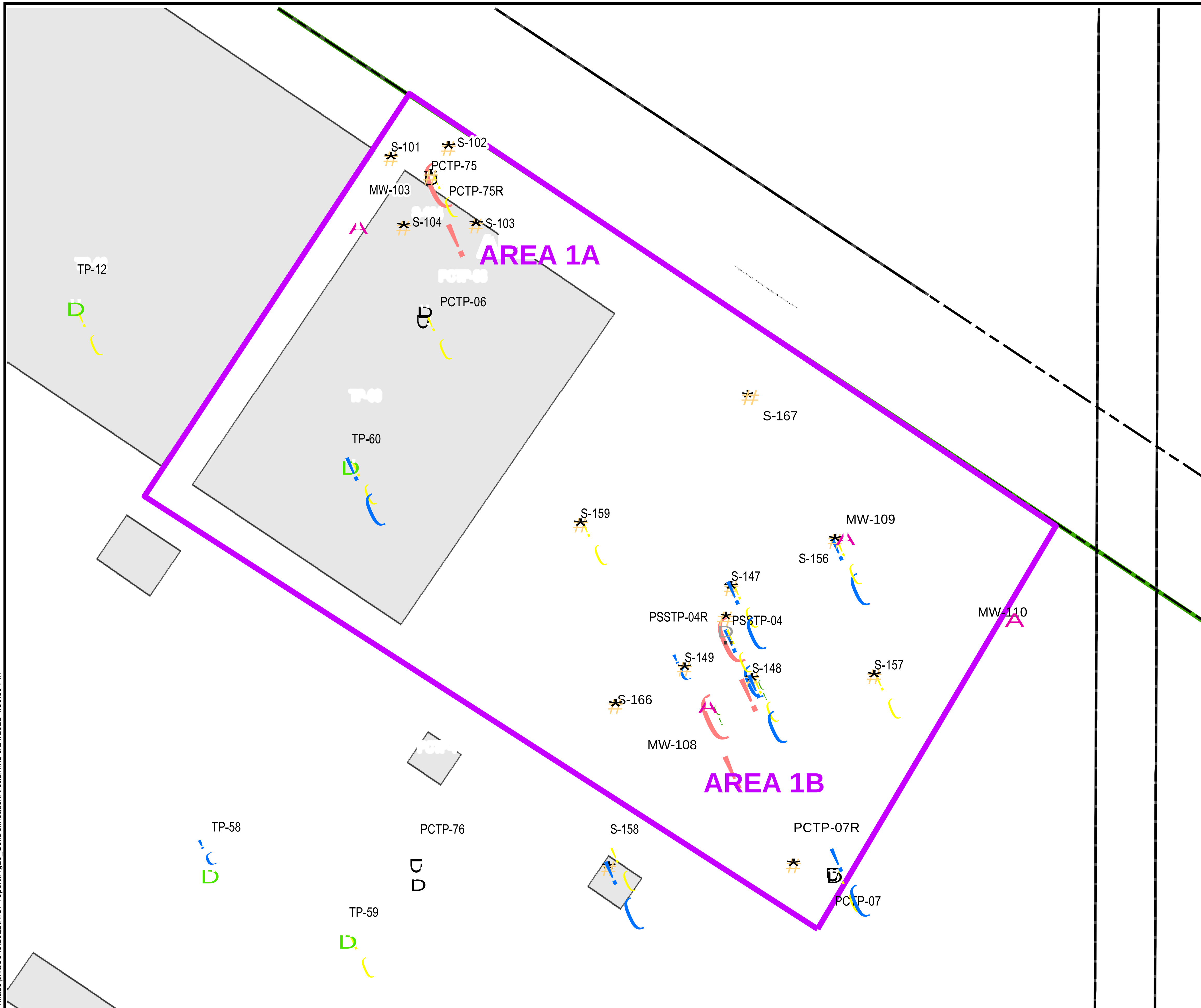
iaCoke\2021\RICP report\Fig19_SoilDelineationAreas.mxd 6/24/2021 4:35:06 PM



SOIL DELINEATION AREAS

ARCADIS Design & Consultancy for natural and built assets

FIGURE



LEGEND:

- HEADSPACE PID READING >= 100 PPM
- SHEEN
- SOLIDIFIED TAR OR TAR-LIKE MATERIAL
- VISCOUS TAR OR OIL-LIKE MATERIAL
- (S-101) ARCADIS SOIL BORING LOCATION (2019)
- (PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)
- (TP-46) EEI GEOTECHNICAL TEST PITS (2005)
- (MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- RCRAEXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.
2. PID = PHOTOIONIZATION DETECTOR.
3. PPM = PARTS PER MILLION

0 50 100
Feet
GRAPHIC SCALE

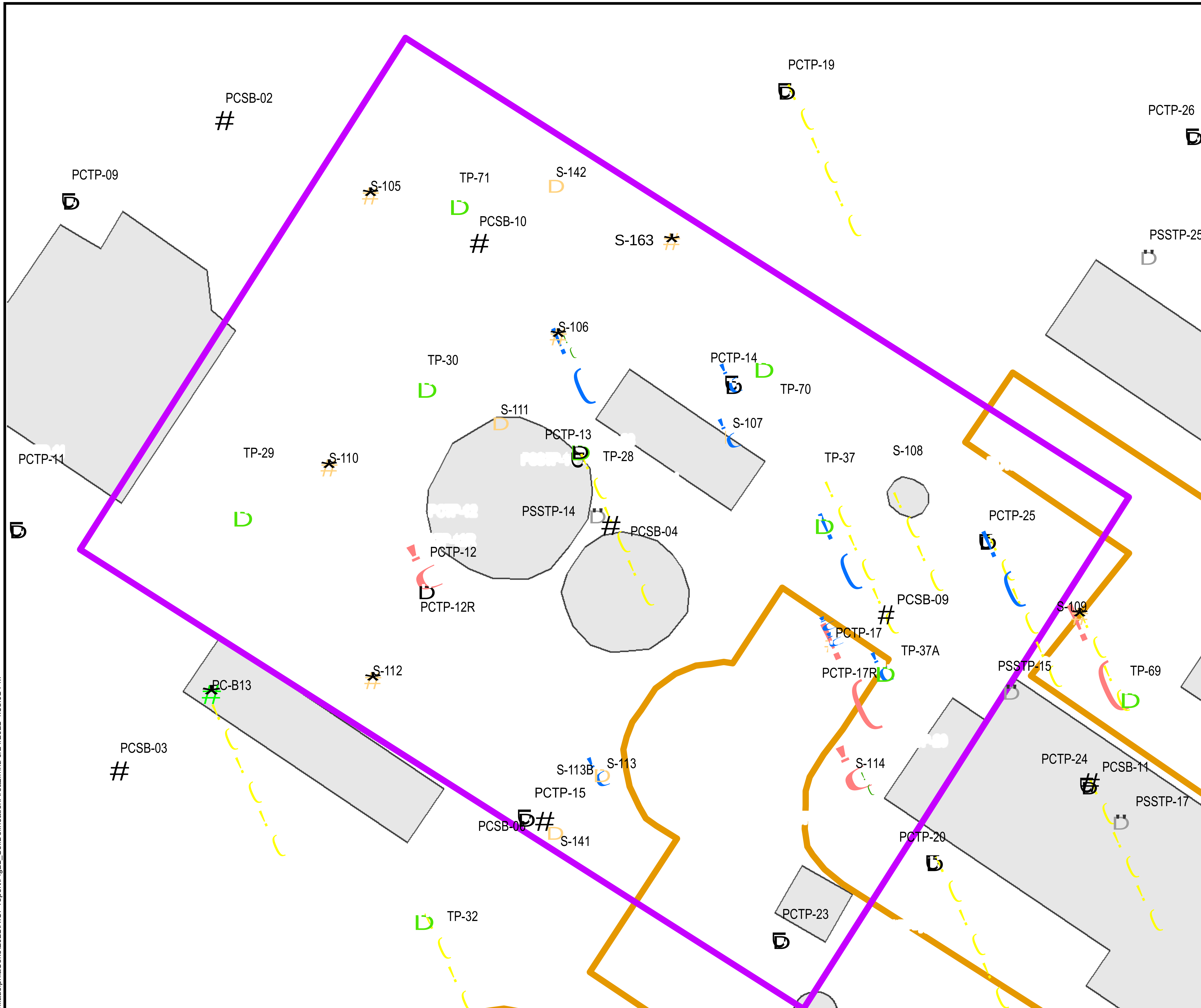
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

ARCADIS

Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
Grid Philly Coke (B0036790.0000.00001)
NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig20_SoilDelineationArea1.mxd 6/24/2021 4:36:59 PM

SOIL DELINEATION AREA 1

FIGURE
20



LEGEND:

HEADSPACE PID READING >= 100 PPM
SHEEN

SOLIDIFIED TAR OR TAR-LIKE MATERIAL

VISCOUS TAR OR OIL-LIKE MATERIAL

(S-101) ARCADIS SOIL BORING LOCATION (2019)

(S-120) 2019 ARCADIS TEST PIT LOCATION (2019)

(PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(TP-46) EEI GEOTECHNICAL TEST PITS (2005)

(PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)

RCRA EXCAVATION

FORMER STRUCTURE/OPERATION

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.
2. PID = PHOTOIONIZATION DETECTOR.
3. PPM = PARTS PER MILLION.

0 50 100
Feet

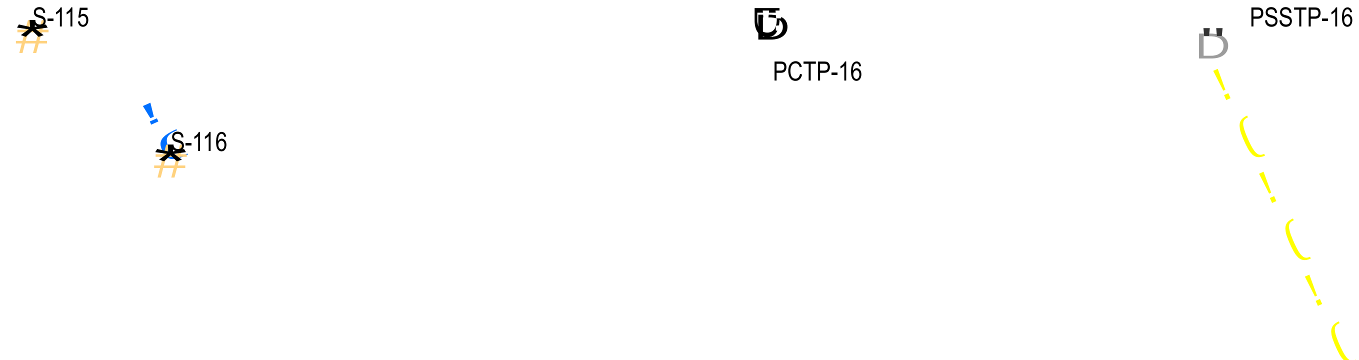
GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA

RI REPORT

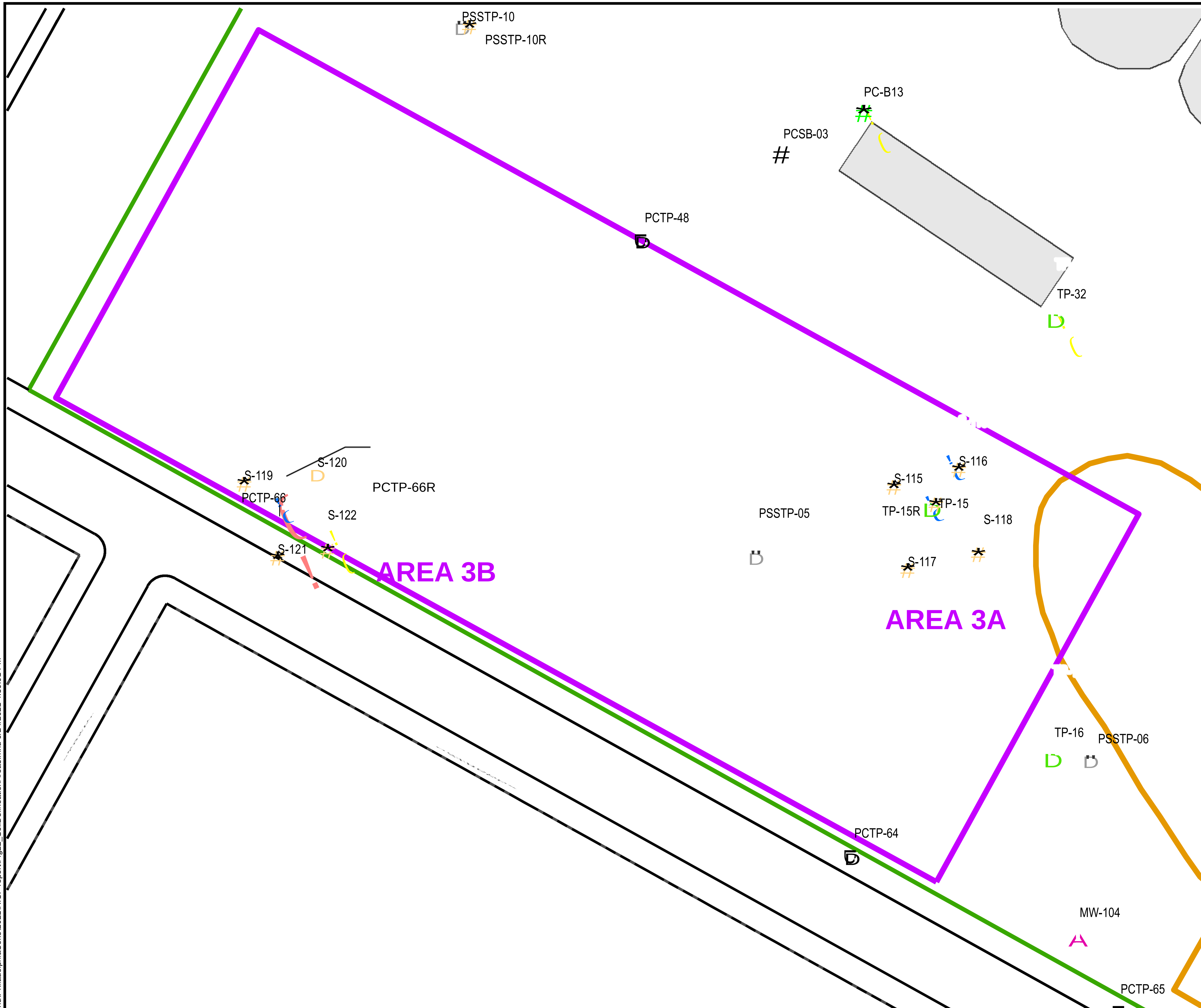
ARCADIS

Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
Grid Philly Coke (B0036790.0000.00001)
NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig21_SoilDelineationArea2.mxd 6/24/2021 4:38:01 PM



SOIL DELINEATION AREA2

FIGURE
21



LEGEND:

- SHEEN
- SOLIDIFIED TAR OR TAR-LIKE MATERIAL
- VISCOUS TAR OR OIL-LIKE MATERIAL
- (S-101) ARCADIS SOIL BORING LOCATION (2019)
- (S-120) 2019 ARCADIS TEST PIT LOCATION (2019)
- (PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)
- (PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)
- (TP-46) EEI GEOTECHNICAL TEST PITS (2005)
- (MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- (PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)
- RCRAEXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.
2. PID = PHOTOIONIZATION DETECTOR.
3. PPM = PARTS PER MILLION.

0 50 100
Feet

GRAPHIC SCALE

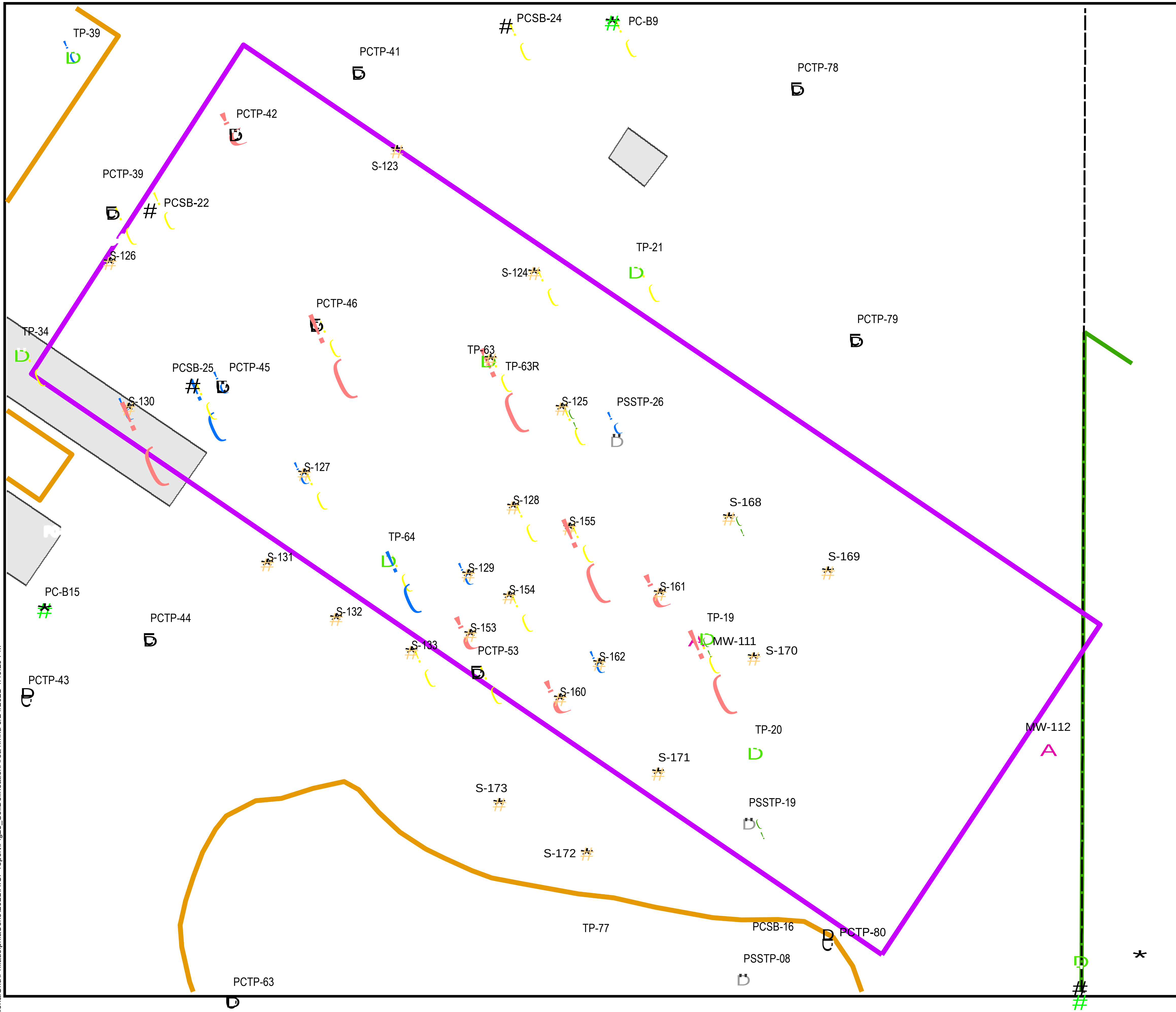
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

ARCADIS Design & Consultancy for natural and built assets

SOIL DELINEATION AREA 3

Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
onal Grid Philly Coke (B0036790.0000.00001)
ENV\NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig22_SoilDelineationArea3.mxd 6/24/2021 4:39:01 PM

FIGURE
22



LEGEND:

- HEADSPACE PID READING >= 100 PPM
- SHEEN
- SOLIDIFIED TAR OR TAR-LIKE MATERIAL
- VISCOUS TAR OR OIL-LIKE MATERIAL
- (S-101) ARCADIS SOIL BORING LOCATION (2019)
- (PCSB-04) PSS ENVIRONMENTAL SOIL BORINGS (2005)
- (PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)
- (TP-46) EEI GEOTECHNICAL TEST PITS (2005)
- (PC-B6) EEI GEOTECHNICAL SOIL BORINGS (2005)
- RCRAEXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.
2. PID = PHOTOIONIZATION DETECTOR.
3. PPM = PARTS PER MILLION.

0 50 100
Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA

ARCADIS Design & Consultancy for natural and built assets

Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
nal Grid Philly Coke (B0036790.0000.00001)
NV\NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig23_SoilDelineationArea4.mxd 6/24/2021 4:40:29 PM

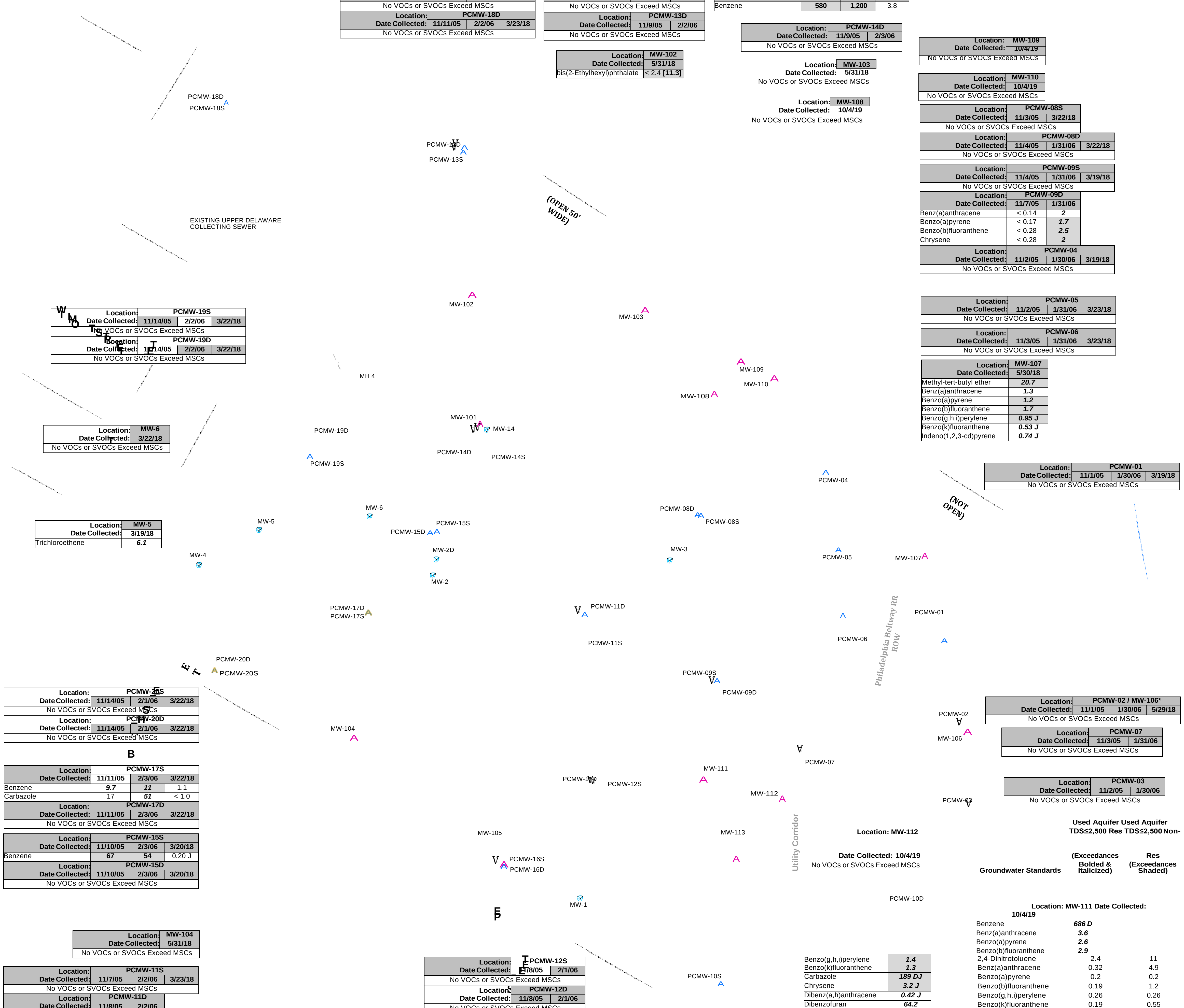
PC-B16 A

MW-113

RI REPORT

FIGURE 23

SOIL DELINEATION AREA 4



Location:	PCMW-18S		
Date Collected:	11/11/05	2/2/06	3/23/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-18D		
Date Collected:	11/11/05	2/2/06	3/23/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-13S	
Date Collected:	11/9/05	2/2/06
No VOCs or SVOCs Exceed MSCs		

Location:	PCMW-13D	
Date Collected:	11/9/05	2/2/06
No VOCs or SVOCs Exceed MSCs		

Location:	PCMW-14S / MW-101*		
Date Collected:	11/9/05	2/3/06	5/30/18
Benzene	580	1,200	3.8

Location:	PCMW-14D	
Date Collected:	11/9/05	2/3/06
No VOCs or SVOCs Exceed MSCs		

Location:	MW-102
Date Collected:	5/31/18
bis(2-Ethylhexyl)phthalate	< 2.4 [11.3]

Location: MW-103
Date Collected: 5/31/18
No VOCs or SVOCs Exceed MSCs

Location: MW-108
Date Collected: 10/4/19
No VOCs or SVOCs Exceed MSCs

Location:	MW-109
Date Collected:	10/4/19
No VOCs or SVOCs Exceed MSCs	

Location:	MW-110
Date Collected:	10/4/19
No VOCs or SVOCs Exceed MSCs	

Location:	PCMW-08S	
Date Collected:	11/3/05	3/22/18
No VOCs or SVOCs Exceed MSCs		

Location:	PCMW-08D		
Date Collected:	11/4/05	1/31/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-09S		
Date Collected:	11/4/05	1/31/06	3/19/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-09D	
Date Collected:	11/7/05	1/31/06
Benz(a)anthracene	< 0.14	***2***
Benzo(a)pyrene	< 0.17	***1.7***
Benzo(b)fluoranthene	< 0.28	***2.5***
Chrysene	< 0.28	***2***

Location:	PCMW-04		
Date Collected:	11/2/05	1/30/06	3/19/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-05		
Date Collected:	11/2/05	1/31/06	3/23/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-06		
Date Collected:	11/3/05	1/31/06	3/23/18
No VOCs or SVOCs Exceed MSCs			

Location:	MW-107
Date Collected:	5/30/18
Methyl-tert-butyl ether	***20.7***
Benz(a)anthracene	***1.3***
Benzo(a)pyrene	***1.2***
Benzo(b)fluoranthene	***1.7***
Benzo(g,h,i)perylene	***0.95 J***
Benzo(k)fluoranthene	***0.53 J***
Indeno(1,2,3-cd)pyrene	***0.74 J***

Location:	PCMW-19S		
Date Collected:	11/14/05	2/2/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-19D		
Date Collected:	11/14/05	2/2/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location:	MW-6
Date Collected:	3/22/18
No VOCs or SVOCs Exceed MSCs	

Location:	MW-5
Date Collected:	3/19/18
Trichloroethene	***6.1***

Location:	PCMW-01		
Date Collected:	11/1/05	1/30/06	3/19/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-20S		
Date Collected:	11/14/05	2/1/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-20D		
Date Collected:	11/14/05	2/1/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

B

Location:	PCMW-17S		
Date Collected:	11/11/05	2/3/06	3/22/18
Benzene	***9.7***	***11***	1.1
Carbazole	17	***51***	< 1.0

Location:	PCMW-17D		
Date Collected:	11/11/05	2/3/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-15S		
Date Collected:	11/10/05	2/3/06	3/20/18
Benzene	67	54	0.20 J

Location:	PCMW-15D		
Date Collected:	11/10/05	2/3/06	3/20/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-02 / MW-106*		
Date Collected:	11/1/05	1/30/06	5/29/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-07	
Date Collected:	11/3/05	1/31/06
No VOCs or SVOCs Exceed MSCs		

Location:	PCMW-03	
Date Collected:	11/2/05	1/30/06
No VOCs or SVOCs Exceed MSCs		

Location: MW-112
Date Collected: 10/4/19
No VOCs or SVOCs Exceed MSCs

Location:	MW-104
Date Collected:	5/31/18
No VOCs or SVOCs Exceed MSCs	

Location:	PCMW-11S		
Date Collected:	11/7/05	2/2/06	3/23/18
No VOCs or SVOCs Exceed MSCs			

Location:	PCMW-11D	
Date Collected:	11/8/05	2/2/06

Location:	PCMW-12S	
Date Collected:	11/8/05	2/1/06
No VOCs or SVOCs Exceed MSCs		

Location:	PCMW-12D	
Date Collected:	11/8/05	2/1/06
No VOCs or SVOCs Exceed MSCs		

Benzo(g,h,i)perylene	***1.4***
Benzo(k)fluoranthene	***1.3***
Carbazole	***189 DJ***
Chrysene	***3.2 J***
Dibenz(a,h)anthracene	***0.42 J***
Dibenzofuran	***64.2***

Location: MW-111 Date Collected: 10/4/19

Benzene	***686 D***
Benz(a)anthracene	***3.6***
Benzo(a)pyrene	***2.6***
Benzo(b)fluoranthene	***2.9***

Groundwater Standards	Used Aquifer TDS≤2,500 Res (Exceedances Bolded & Italicized)	Used Aquifer TDS≤2,500 Non-Res (Exceedances Shaded)
Volatile Organic Compounds		
Benzene	5	5
Methyl-tert-butyl ether	20	20
Tetrachloroethene	5	5
Trichloroethene	5	5
Semi-Volatile Organic Compounds		
2,4-Dinitrotoluene	2.4	11
Benz(a)anthracene	0.32	4.9
Benzo(a)pyrene	0.2	0.2
Benzo(b)fluoranthene	0.19	1.2
Benzo(g,h,i)perylene	0.26	0.26
Benzo(k)fluoranthene	0.19	0.55

0 250 500
Feet
GRAPHIC SCALE

LEGEND:

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)
(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
FORMER RCRA EXCAVATION
APPROXIMATE SITE BOUNDARY
SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. SAMPLES PRIOR TO 2018 WERE COLLECTED BY PAULUS, SOKOLOWSKI, AND SARTOR ENGINEERING, PC. SAMPLES IN 2018 AND 2019 WERE COLLECTED BY ARCADIS.

3. ONLY COMPOUNDS EXCEEDING MEDIUM SPECIFIC CONCENTRATIONS (MSCS) ARE SHOWN IN THIS FIGURE.

4. < = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.

5. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L) OR PARTS PER BILLION (ppb).

6. SHADING INDICATES AN EXCEEDANCE OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S (PADEP'S) NONRESIDENTIAL MSCS FOR USED AQUIFERS CONTAINING TOTAL DISSOLVED SOLIDS (TDS) ≤ 2,500 MILLIGRAMS PER LITER (mg/L).

7. ITALICS AND BOLDING INDICATES AN EXCEEDANCE OF PADEP'S RESIDENTIAL MSCS FOR USED AQUIFERS CONTAINING TDS ≤ 2,500 mg/L.

8. BRACKETS INDICATE THE REPORTED CONCENTRATION OF A DUPLICATE SAMPLE.

9. D = CONCENTRATION IS BASED ON DILUTED SAMPLE ANALYSIS.

10. J = ANALYTE IS AN ESTIMATED VALUE.

11. * = INDICATES THAT THE GROUNDWATER MONITORING WELL WAS INSTALLED TO REPLACE THE MISSING HISTORICAL WELL ALSO LISTED IN THE WELL ID.

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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GROUNDWATER ANALYTICAL RESULTS VOCs AND SVOCs EXCEEDING MSCs

FIGURE

24

Location:	PCMW-16S / MW-105*		
Date Collected:	11/10/05	2/1/06	5/30/18
Benz(a)anthracene	< 0.14	**3.3**	< 0.95
Benzo(a)pyrene	< 0.17	**3.2**	< 0.95
Benzo(b)fluoranthene	< 0.28	**4.1**	< 0.95
Benzo(g,h,i)perylene	< 0.14	**1.7**	< 0.95
Benzo(k)fluoranthene	< 0.35	**1.4**	< 0.95
Chrysene	< 0.28	**3.1**	< 0.95
Indeno(1,2,3-cd)pyrene	< 0.17	**1.5**	< 0.95

Location:	PCMW-16D		
Date Collected:	11/10/05	2/1/06	3/19/18
2,4-Dinitrotoluene	NA	NA	***13.3 J***

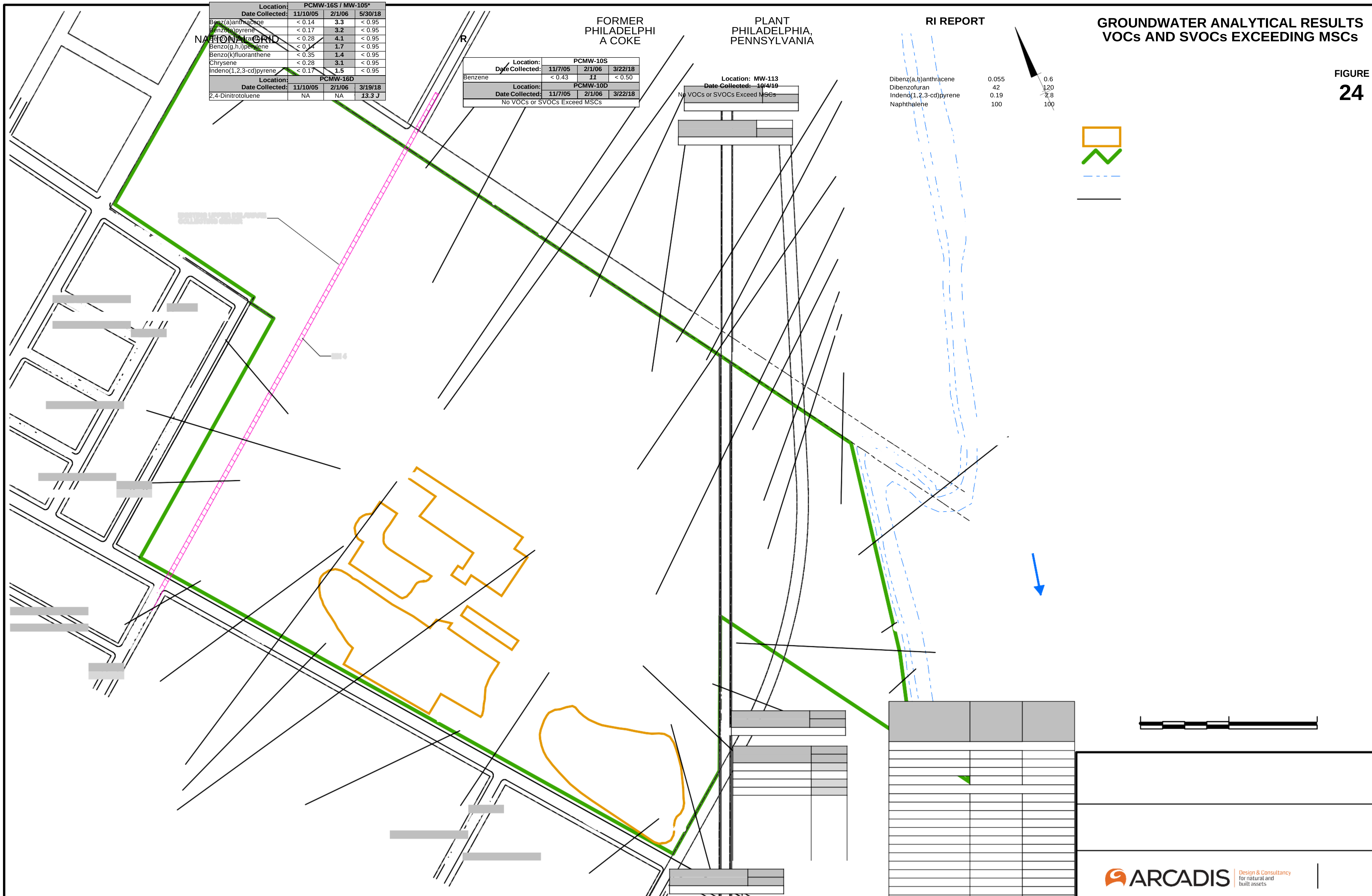
Location:	PCMW-10S		
Date Collected:	11/7/05	2/1/06	3/22/18
Benzene	< 0.43	***11***	< 0.50

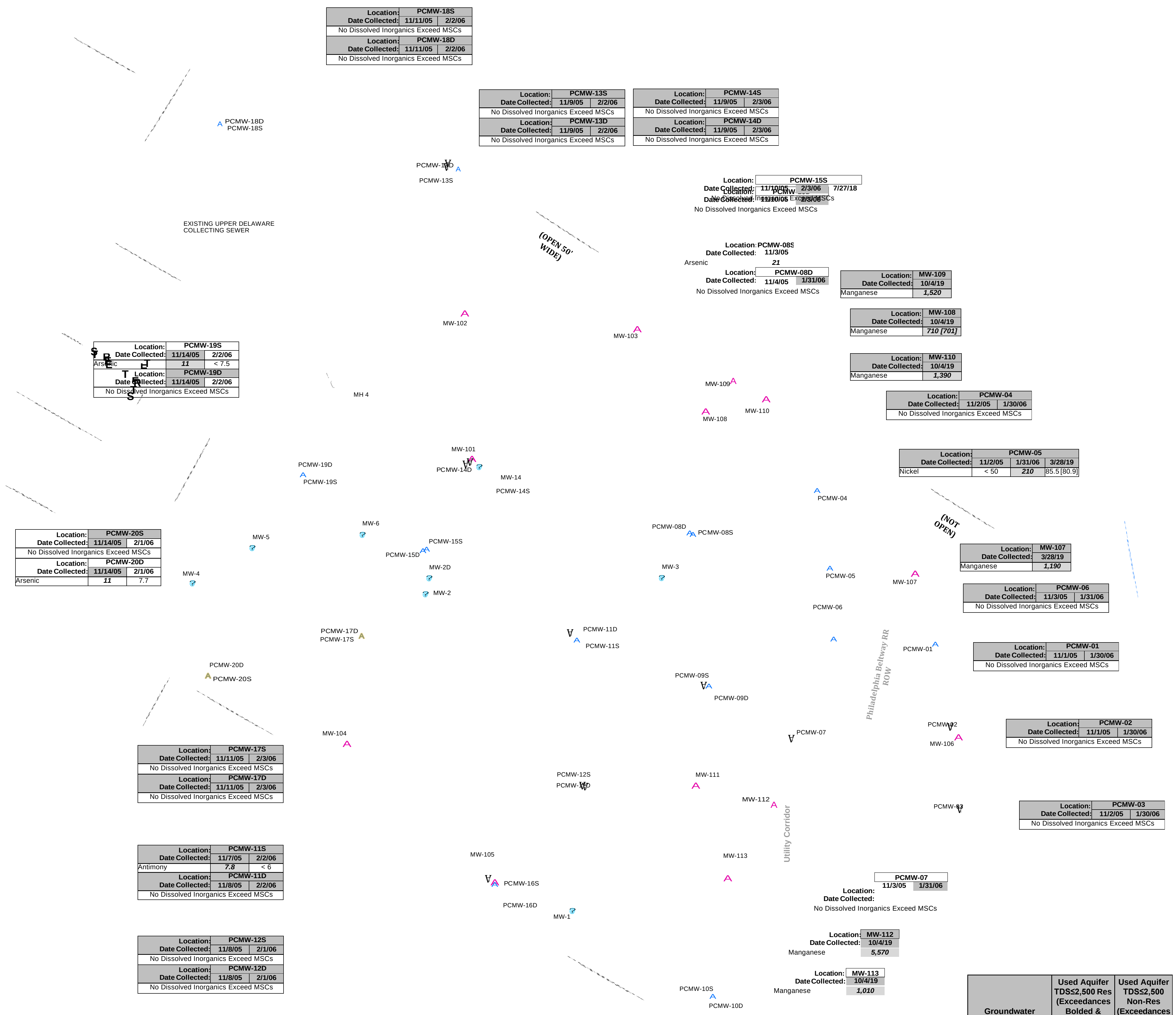
Location:	PCMW-10D		
Date Collected:	11/7/05	2/1/06	3/22/18
No VOCs or SVOCs Exceed MSCs			

Location: MW-113
Date Collected: 10/4/19
No VOCs or SVOCs Exceed MSCs

RI REPORT

Dibenz(a,h)anthracene	0.055	0.6
Dibenzofuran	42	120
Indeno(1,2,3-cd)pyrene	0.19	2.8
Naphthalene	100	100





LEGEND:

- (MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- (PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)
- (PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
- (MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
- FORMER RCRA EXCAVATION
- APPROXIMATE SITE BOUNDARY
- SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. SAMPLES PRIOR TO 2018 WERE COLLECTED BY PAULUS, SOKOLOWSKI, AND SARTOR ENGINEERING, PC. SAMPLES IN 2018 AND 2019 WERE COLLECTED BY ARCADIS.

3. ONLY COMPOUNDS EXCEEDING MEDIUM SPECIFIC CONCENTRATIONS (MSCS) ARE SHOWN IN THIS FIGURE.

4. < = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.

5. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L) OR PARTS PER BILLION (ppb).

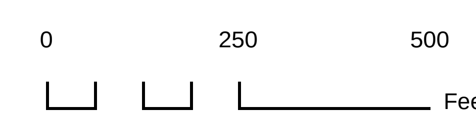
6. SHADING INDICATES AN EXCEEDANCE OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S (PADEP'S) NONRESIDENTIAL MSCS FOR USED AQUIFERS CONTAINING TOTAL DISSOLVED SOLIDS (TDS) ≤ 2,500 MILLIGRAMS PER LITER (mg/L).

7. ITALICS AND BOLDING INDICATES AN EXCEEDANCE OF

PADEP'S RESIDENTIAL MSCS FOR USED AQUIFERS CONTAINING TDS ≤ 2,500 mg/L.

8. * = INDICATES THAT THE GROUNDWATER MONITORING WELL WAS INSTALLED TO REPLACE THE MISSING HISTORICAL WELL ALSO LISTED IN THE WELL ID.

9. J = ANALYTE IS AN ESTIMATED VALUE.



GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

GROUNDWATER ANALYTICAL RESULTS

Groundwater Standards	Used Aquifer TDS≤2,500 Res (Exceedances Bolded & Italicized)	Used Aquifer TDS≤2,500 Non-Res (Exceedances Shaded)
Antimony	6	6

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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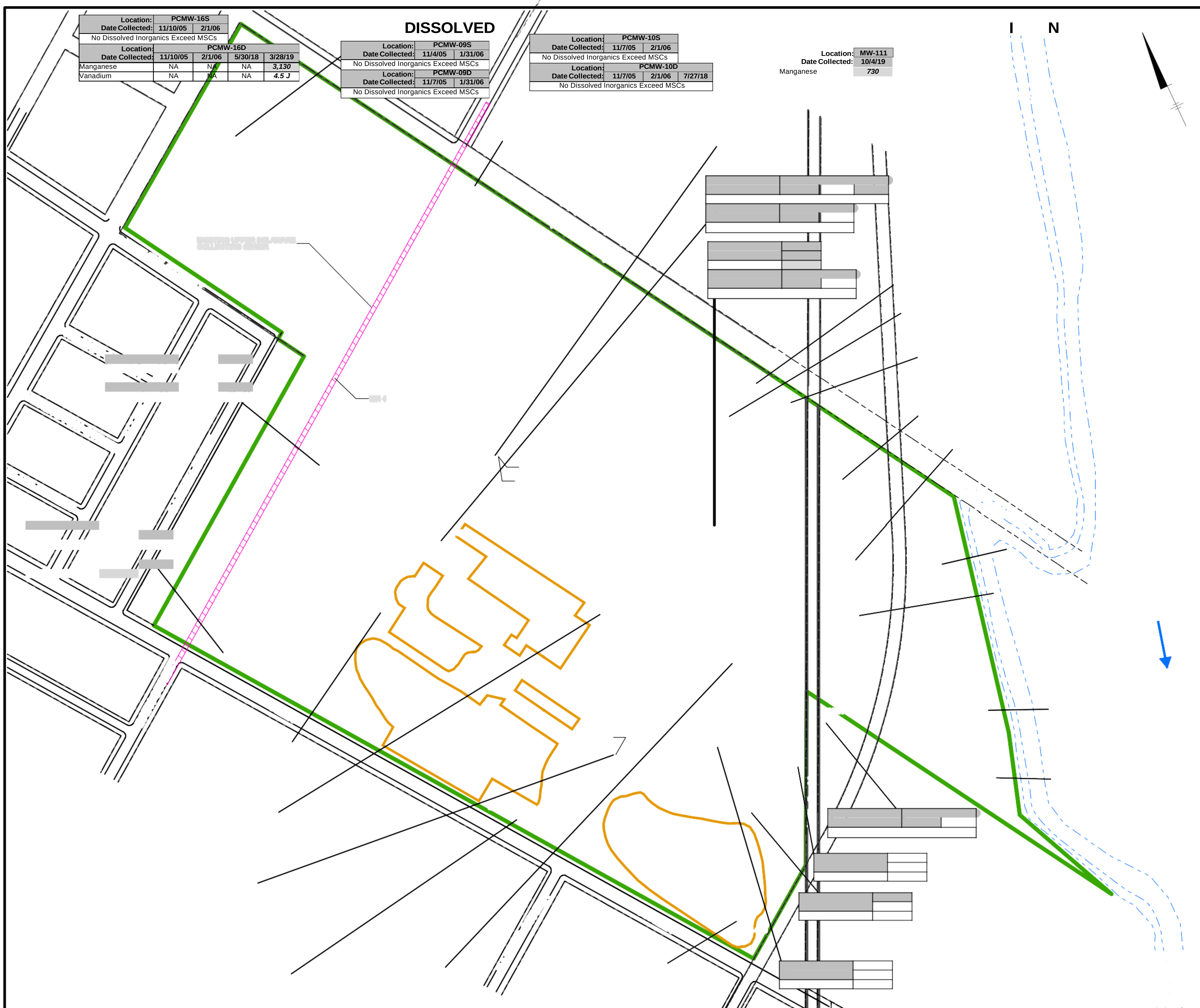
DISSOLVED

I N

ORGANICS EXCEEDING MSCs

FIGURE 25



Location:	PCMW-16S	
Date Collected:	11/10/05	2/1/06
No Dissolved Inorganics Exceed MSCs		

Location:	PCMW-16D			
Date Collected:	11/10/05	2/1/06	5/30/18	3/28/19
Manganese	NA	NA	NA	***3,130***
Vanadium	NA	NA	NA	***4.5 J***

Location:	PCMW-09S	
Date Collected:	11/4/05	1/31/06
No Dissolved Inorganics Exceed MSCs		

Location:	PCMW-09D	
Date Collected:	11/7/05	1/31/06
No Dissolved Inorganics Exceed MSCs		

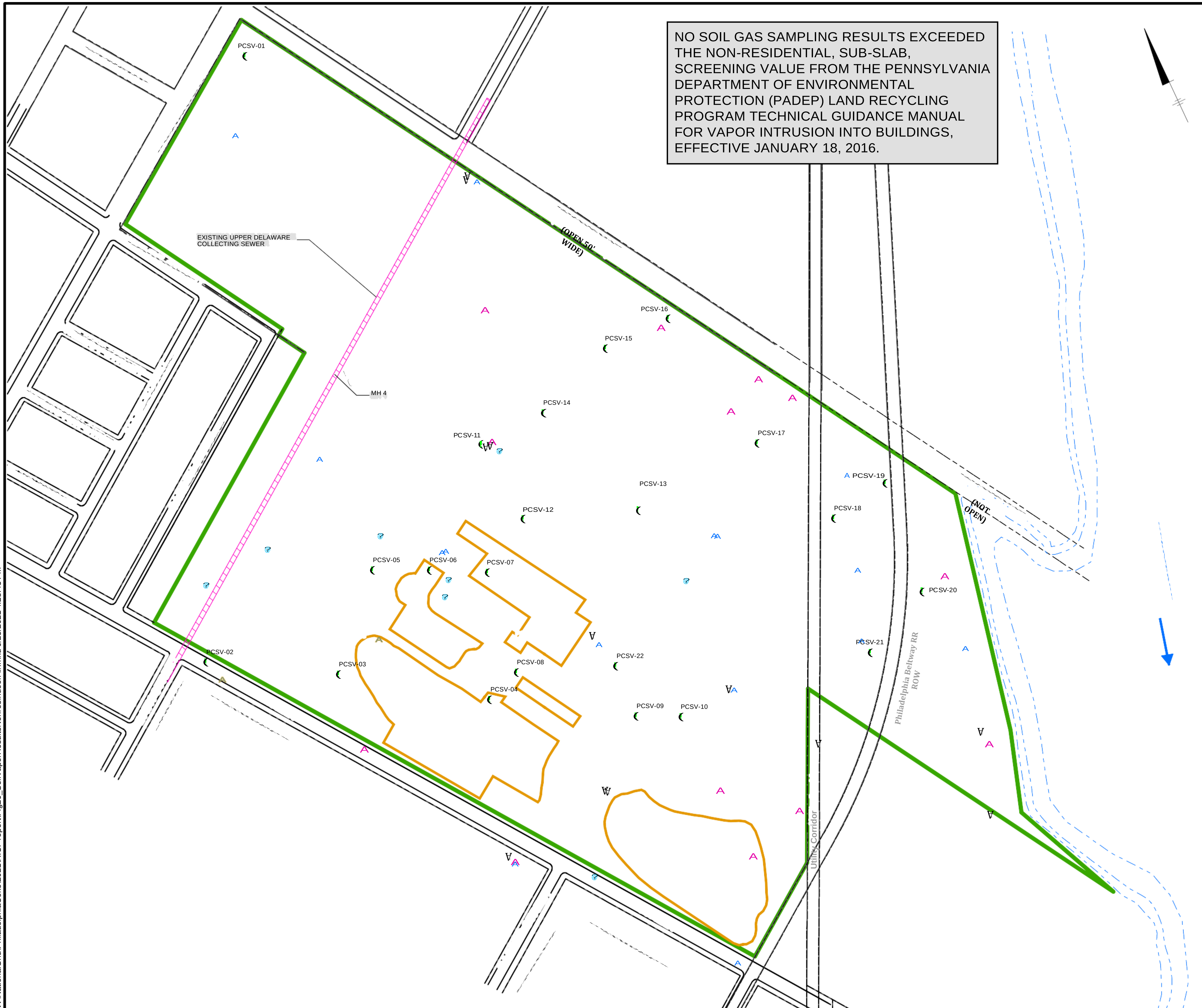
Location:	PCMW-10S	
Date Collected:	11/7/05	2/1/06
No Dissolved Inorganics Exceed MSCs		

Location:	PCMW-10D		
Date Collected:	11/7/05	2/1/06	7/27/18
No Dissolved Inorganics Exceed MSCs			

Location:	MW-111
Date Collected:	10/4/19
Manganese	***730***

ARCADIS Design & Consultancy for natural and built assets

NO SOIL GAS SAMPLING RESULTS EXCEEDED THE NON-RESIDENTIAL, SUB-SLAB, SCREENING VALUE FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) LAND RECYCLING PROGRAM TECHNICAL GUIDANCE MANUAL FOR VAPOR INTRUSION INTO BUILDINGS, EFFECTIVE JANUARY 18, 2016.



LEGEND:

- (PCSV-20) PSS SOIL VAPOR SAMPLING LOCATIONS (2006)
- (MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)
- (PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)
- (PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
- (MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)
- FORMER RCRA EXCAVATION
- APPROXIMATE SITE BOUNDARY
- SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. SAMPLES WERE COLLECTED BY PAULUS, SOKOLOWSKI, AND SARTOR ENGINEERING, PC ON THE DATES INDICATED.

0 250 500
Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SOIL GAS SAMPLING LOCATIONS

ARCADIS

FIGURE

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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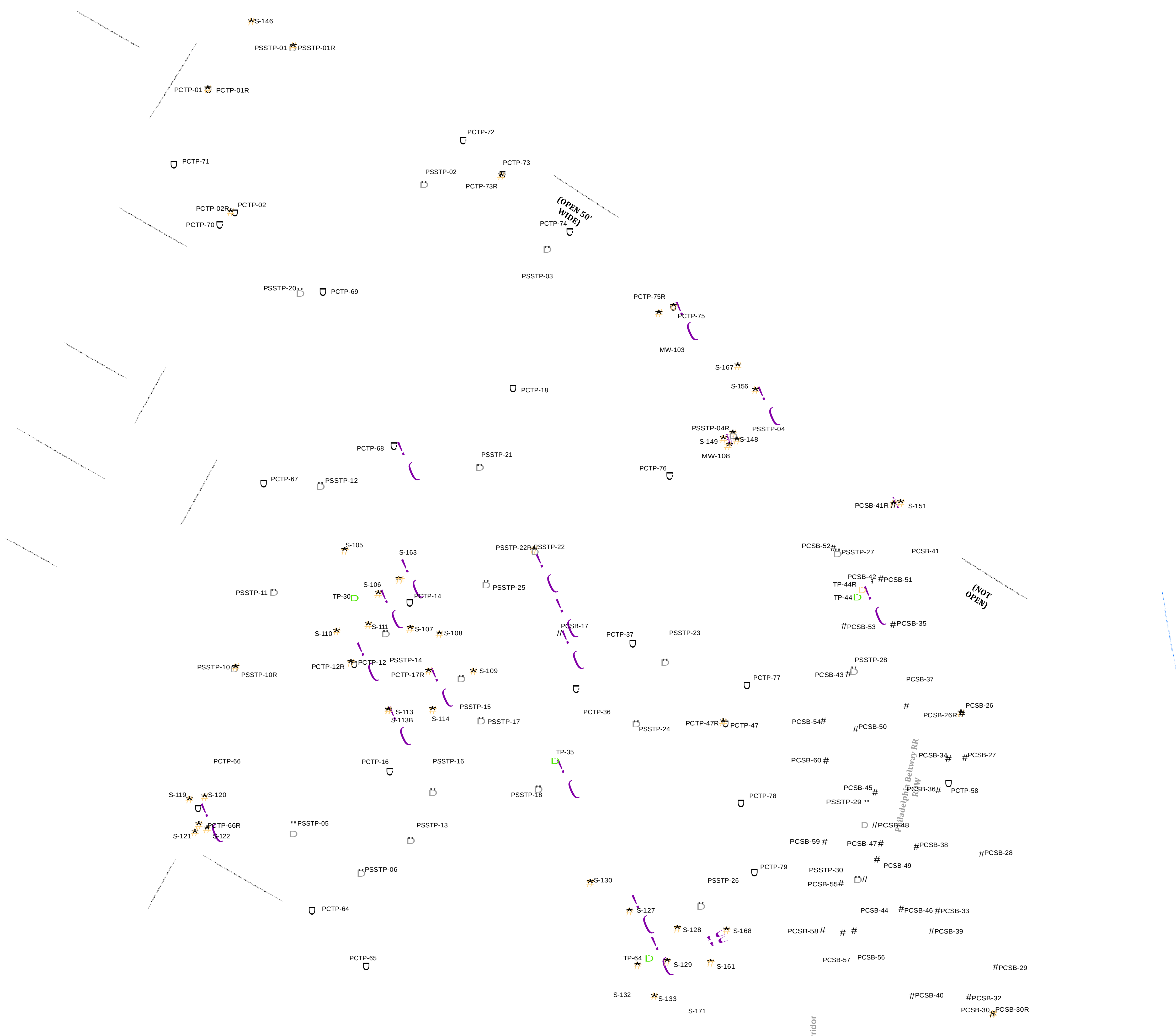


LEGEND:

- LOCATION WHERE ONE OR MORE CONSTITUENTS EXCEED APPLICABLE VAPOR INTRUSION SCREENING STANDARDS
- (S-105) 2019 SOIL BORING LOCATION (2019)
- (S-120) 2019 TEST PIT LOCATION (2019)
- (PCSB-17) PSS ENVIRONMENTAL SOIL BORINGS (2005)
- (PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)
- (PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)
- (TP-44) EEI GEOTECHNICAL TEST PITS (2005)
- RCRA EXCAVATION
- FORMER STRUCTURE/OPERATION
- SITE BOUNDARY
- SHORELINE

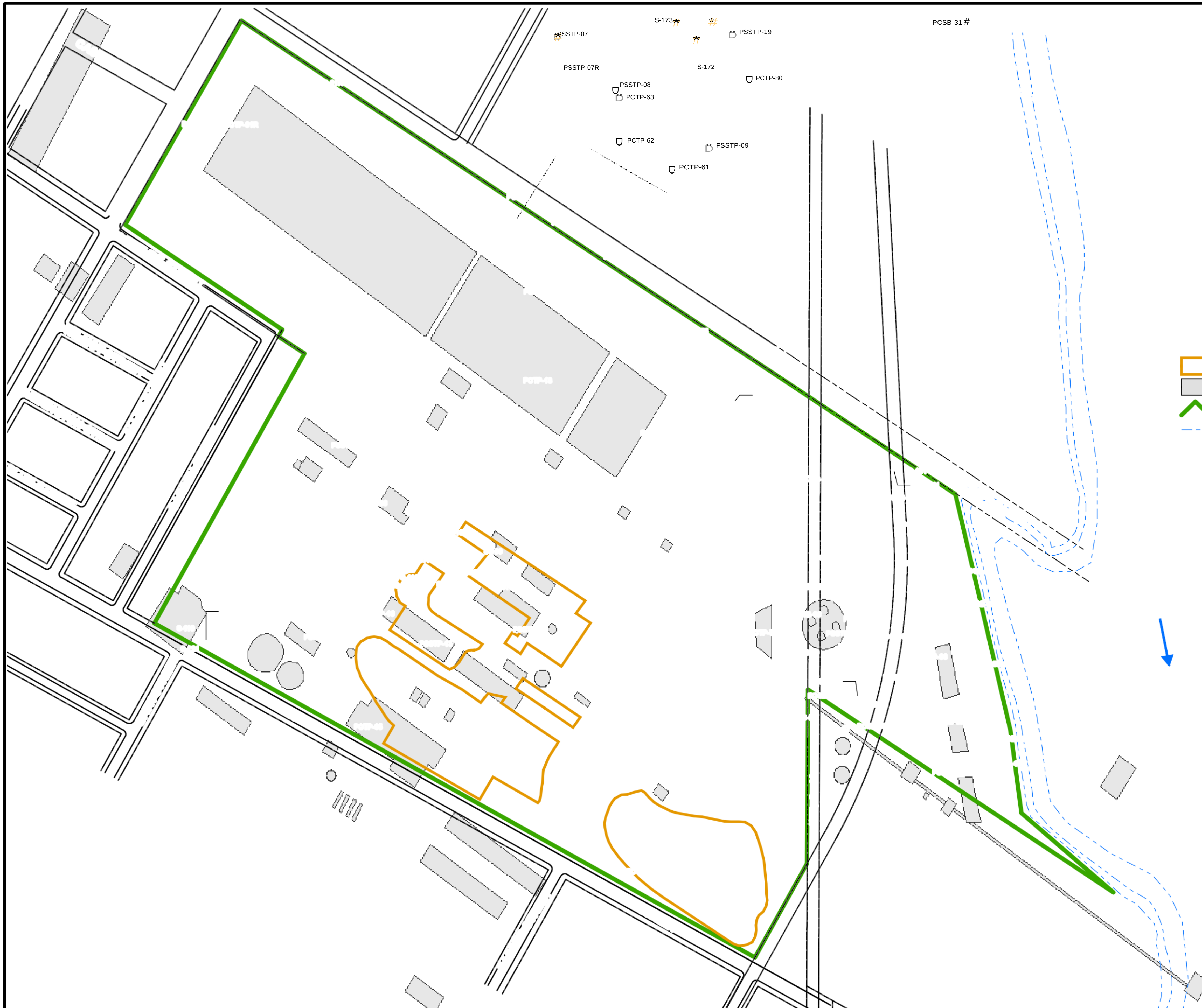
NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. FIGURE ONLY SHOWS SAMPLE LOCATIONS WHERE UNSATURATED SOIL SAMPLES WERE COLLECTED FOR LABORATORY ANALYSIS.

3. VAPOR INTRUSION SCREENING VALUES OBTAINED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) TECHNICAL GUIDANCE MANUAL FOR VAPOR INTRUSION INTO BUILDINGS FROM GROUNDWATER AND SOIL UNDER ACT 2, DATED NOVEMBER 19, 2016.

4. APPLICABLE VAPOR INTRUSION SCREENING STANDARD IS THE PADEP STATEWIDE HEALTH STANDARD VAPOR INTRUSION SCREENING VALUE FOR NONRESIDENTIAL SOIL.



0 250 500
Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SOIL SAMPLING LOCATIONS EXHIBITING POTENTIAL VAPOR INTRUSION CONCERNS IN VADOSE ZONE

FIGURE
27

ARCADIS Design & Consultancy for natural and built assets

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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LEGEND:

LOCATION WHERE ONE OR MORE CONSTITUENTS EXCEED APPLICABLE VAPOR INTRUSION SCREENING STANDARD

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(MW-5) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

FORMER RCRA EXCAVATION

APPROXIMATE SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. VAPOR INTRUSION SCREENING VALUES OBTAINED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) TECHNICAL GUIDANCE MANUAL FOR VAPOR INTRUSION INTO BUILDINGS FROM GROUNDWATER AND SOIL UNDER ACT 2, DATED NOVEMBER 19, 2016.

3. APPLICABLE VAPOR INTRUSION SCREENING STANDARD IS THE PADEP STATEWIDE HEALTH STANDARD VAPOR INTRUSION SCREENING VALUE FOR NONRESIDENTIAL GROUNDWATER.

0 250 500
Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

GROUNDWATER MONITORING WELLS EXHIBITING POTENTIAL VAPOR

INTRUSION CONCERNS

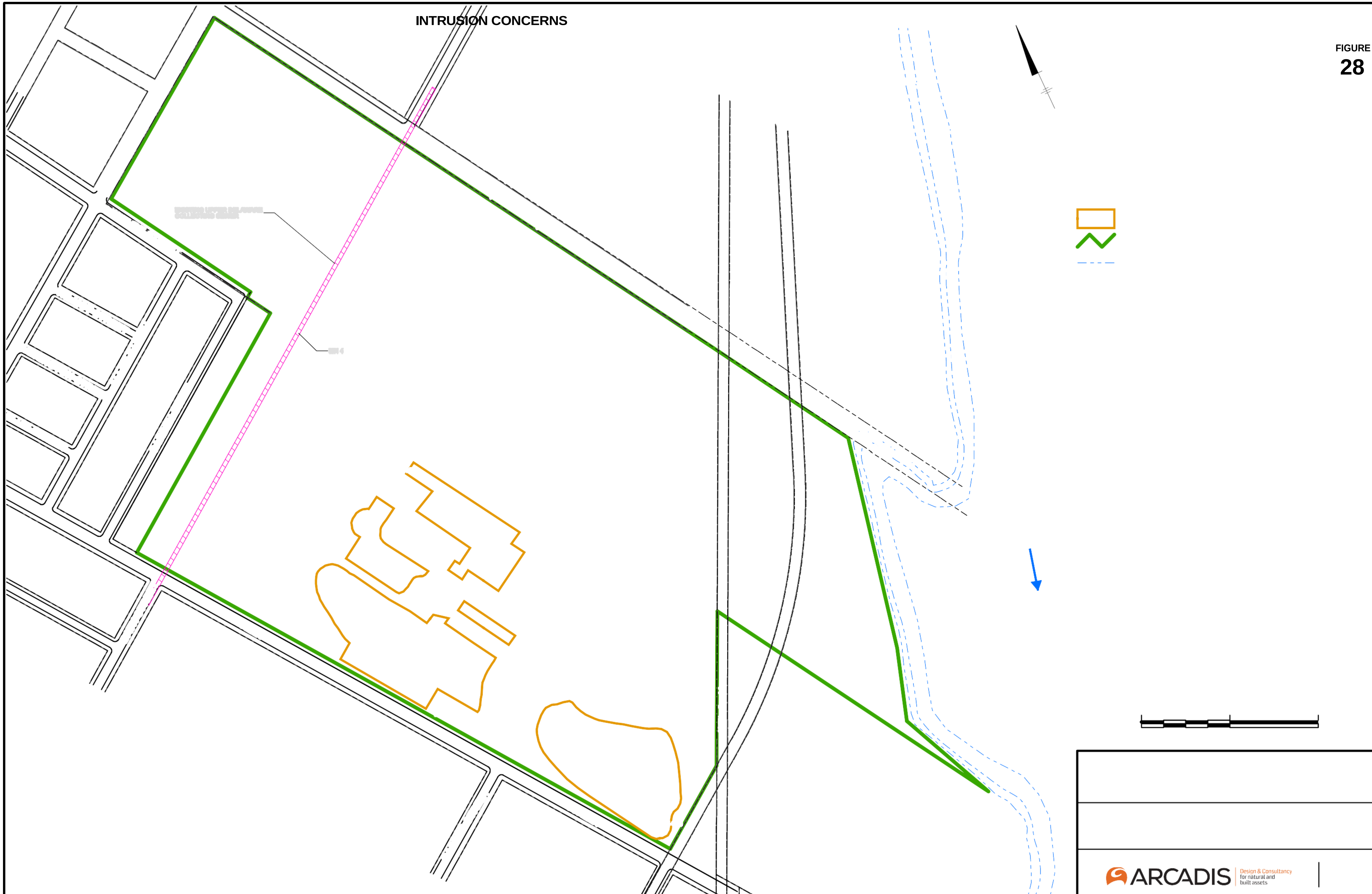
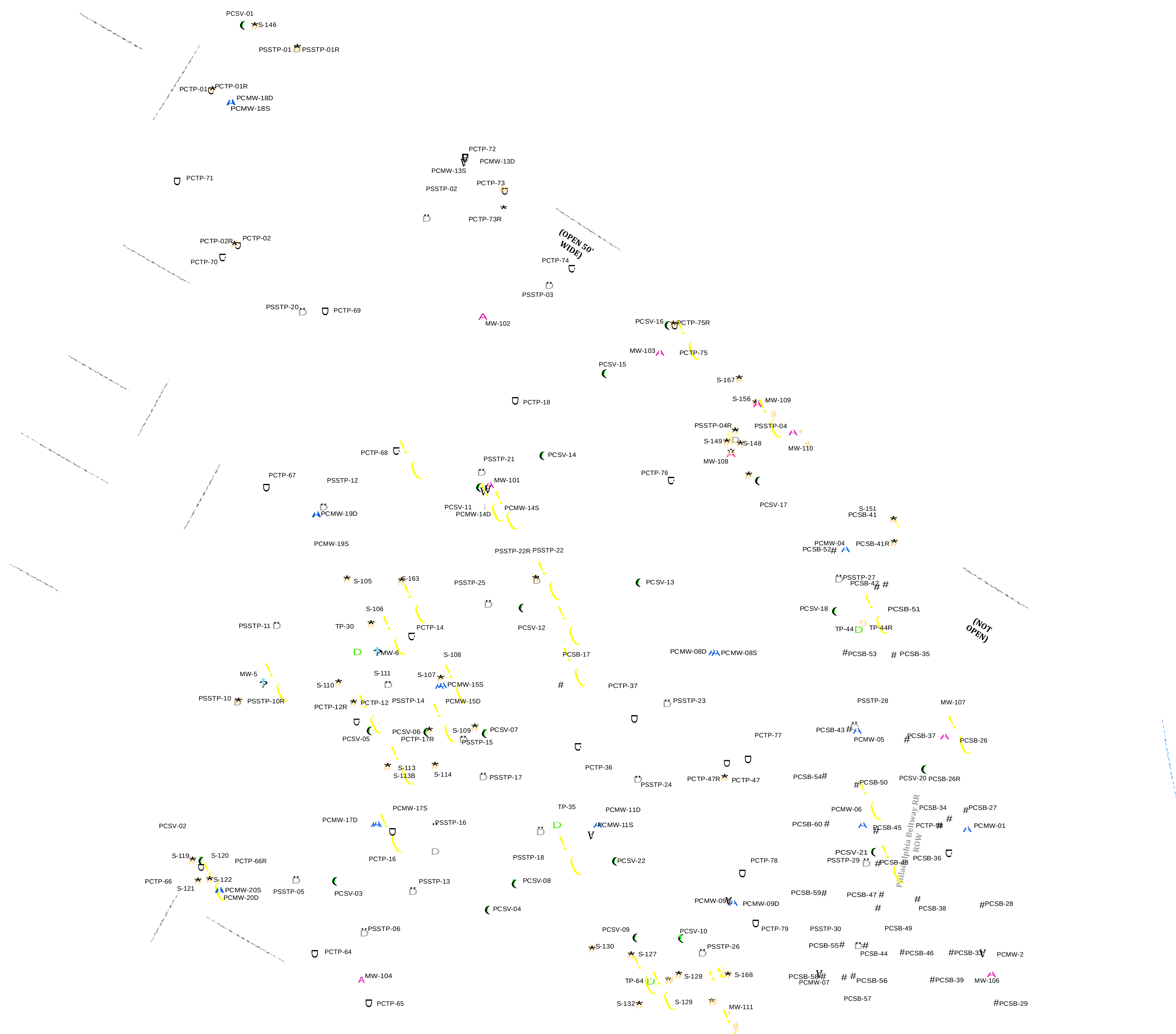


FIGURE
28



LEGEND:

PROXIMITY DISTANCE AROUND POTENTIAL VAPOR INTRUSION CONCERN FROM SOIL-GAS SAMPLING

PROXIMITY DISTANCE AROUND POTENTIAL VAPOR INTRUSION CONCERN FROM SOIL

PROXIMITY DISTANCE AROUND POTENTIAL VAPOR INTRUSION CONCERN FROM GROUNDWATER

LOCATION WHERE ONE OR MORE CONSTITUENTS EXCEED APPLICABLE VAPOR INTRUSION SCREENING STANDARDS

(S-105) 2019 SOIL BORING LOCATION (2019)

(S-120) 2019 TEST PIT LOCATION (2019)

(PCSB-17) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(TP-44) EEI GEOTECHNICAL TEST PITS (2005)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELLS

(MW-05) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

(PCSV-20) PSS SOIL VAPOR SAMPLING LOCATIONS (2006)

FORMER STRUCTURE/OPERATION

SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.

2. FIGURE ONLY SHOWS SOIL SAMPLING LOCATIONS WHERE UNSATURATED SOIL SAMPLES WERE COLLECTED FOR LABORATORY ANALYSIS. ALL GROUNDWATER MONITORING WELLS AND SOIL GAS SAMPLING LOCATIONS ARE SHOWN.

3. VAPOR INTRUSION SCREENING VALUES OBTAINED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) TECHNICAL GUIDANCE MANUAL FOR VAPOR INTRUSION INTO BUILDINGS FROM GROUNDWATER AND SOIL UNDER ACT 2, DATED NOVEMBER 19, 2016 (THE "VI GUIDANCE").

4. APPLICABLE VAPOR INTRUSION SCREENING STANDARD IS THE PADEP STATEWIDE HEALTH STANDARD VAPOR INTRUSION SCREENING VALUE FOR RESIDENTIAL GROUNDWATER AND SOIL.

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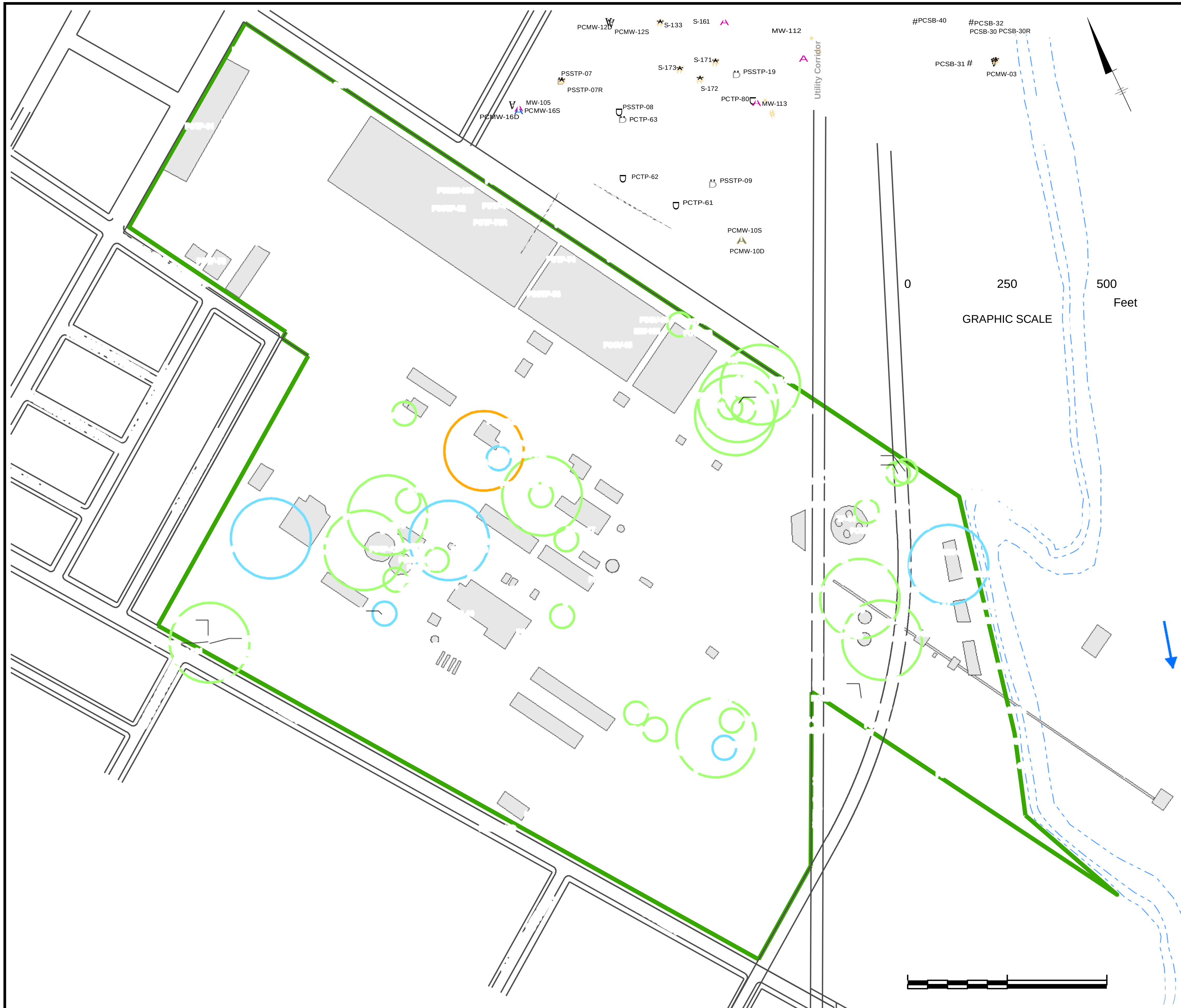
01)
CP report\Fig29_PotentialVaporIntrusionEval.mxd 6/24/2021 4:47:32 PM

5. PROXIMITY DISTANCE RADII ARE 30 FEET FOR PETROLEUM CONSTITUENTS (e.g., BENZENE, TOLUENE, NAPHTHALENE) AND 100 FEET FOR NON-PETROLEUM CONSTITUENTS PER SECTION E OF THE VI GUIDANCE.

6. FIGURE ONLY SHOWS SAMPLING LOCATIONS WHERE UNSATURATED SOIL SAMPLES WERE COLLECTED FOR LABORATORY ANALYSIS.

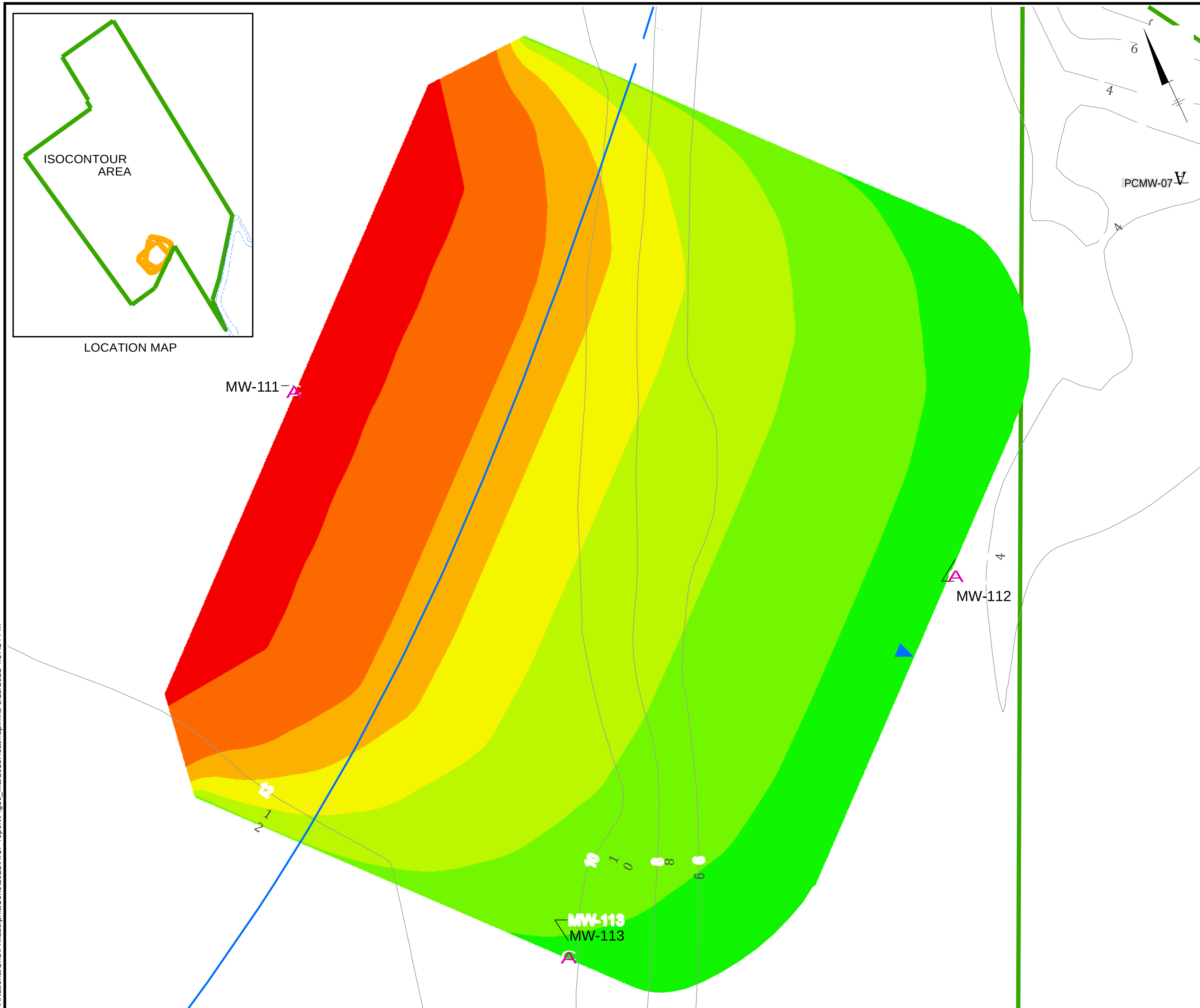


NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

POTENTIAL VAPOR INTRUSION EVALUATION

FIGURE
29

ARCADIS Design & Consultancy for natural and built assets



LEGEND:

BENZENE CONCENTRATIONS (µg/L)

- 0.25 - 1
- 1.0-5.0
- 5.0-20
- 20-50
- 50-100
- 100-300
- >300

INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD 88)

GROUNDWATER FLOW DIRECTION FROM MW-111

ARCADIS GROUNDWATER MONITORING WELL LOCATION (2019)

MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT. (PHILADELPHIA VERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)

APPROXIMATE SITE BOUNDARY

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. WATER LEVEL ELEVATIONS ARE FROM MARCH 19, 2018 APPROXIMATELY AN HOUR BEFORE LOW TIDE THROUGH THE DURATION OF LOW TIDE.

3. PCMW-07 OBSTRUCTED BY OVERGROWN ROOTS IMMEDIATELY BELOW THE WATER TABLE. HOWEVER, WATER ELEVATIONS WERE STILL OBTAINED FROM BOTH WELLS.

4. MONITORING WELLS MW-101 THROUGH MW-113 WERE NOT YET INSTALLED DURING THE MARCH 2018 WATER LEVEL GAUGING EVENT.

Feet

GRAPHIC SCALE

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

CALIBRATION ISOCONCENTRATION MAP
MARCH 19, 2018

ARCADIS Design & Consultancy for natural and built assets

FIGURE

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
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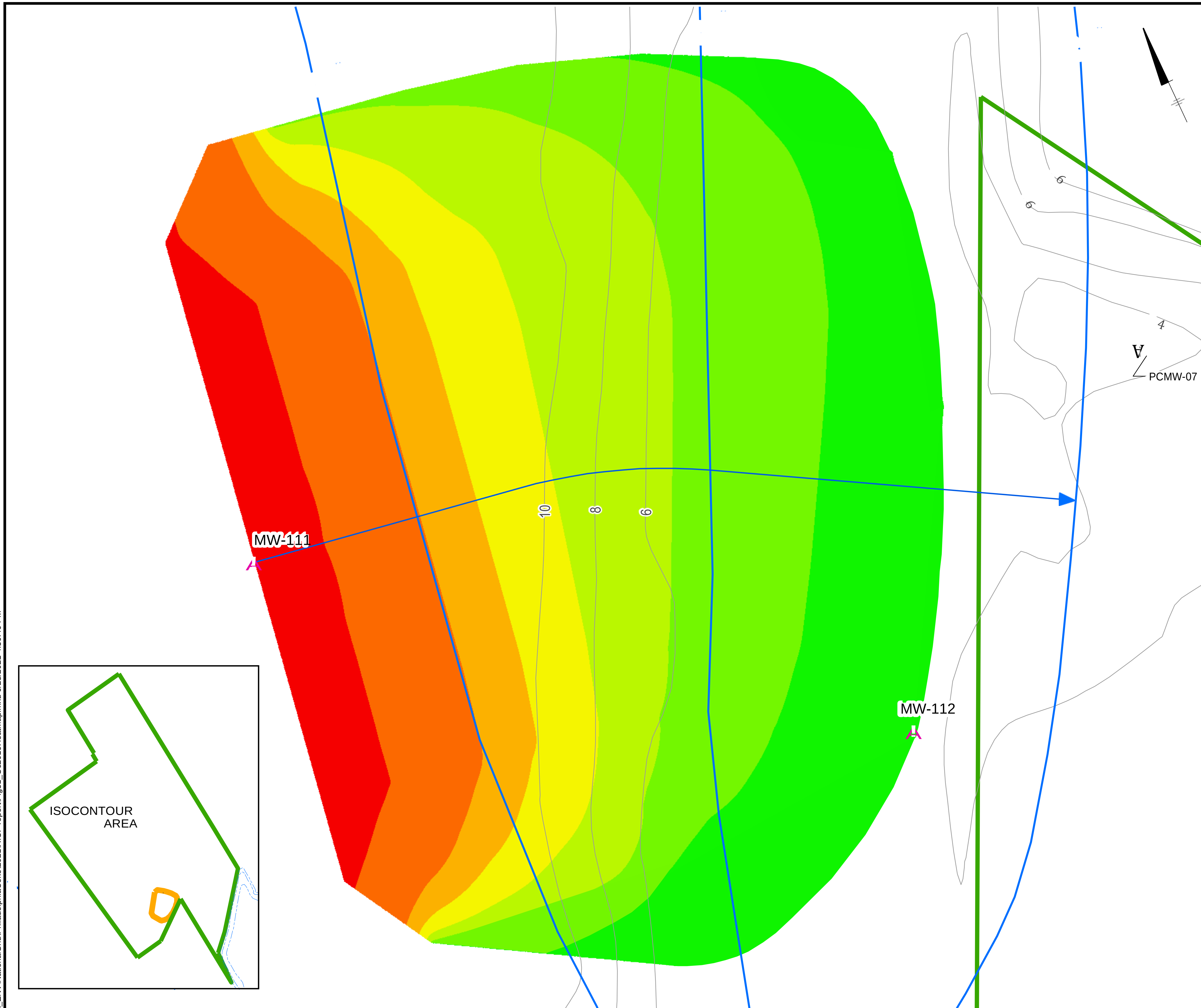


LEGEND:

BENZENE CONCENTRATIONS (µg/L)

- 0.25-1.0
- 1.0-5.0
- 5.0-20
- 20-50
- 50-100
- 100-300
- >300

- INFERRED GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL, NAVD88)
- GROUNDWATER FLOW DIRECTION FROM MW-111
- ARCADIS GROUNDWATER MONITORING WELL LOCATION (2019)
- MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL
- GROUND SURFACE ELEVATION CONTOURS FROM DATA CLEARINGHOUSE PHILADELPHIA CONTOURS 2-FT (PHILADELPHIA VERTICAL DATUM, 2004 - CITY OF PHILADELPHIA)
- APPROXIMATE SITE BOUNDARY

NOTE:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED “GENERAL SITE PLAN”, DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1”=250’.
2. WATER LEVEL ELEVATIONS ARE FROM OCTOBER 3, 2019 APPROXIMATELY 2 HOURS BEFORE LOW TIDE THROUGH THE DURATION OF LOW TIDE.

Feet

GRAPHIC SCALE

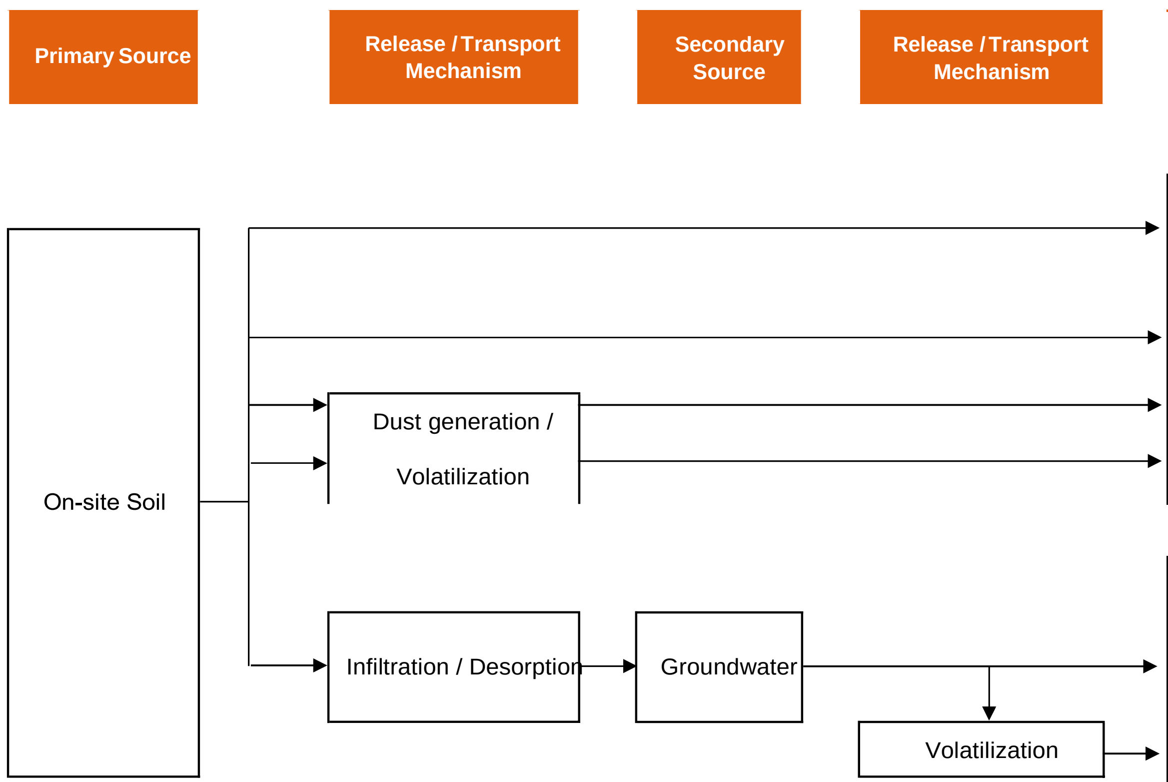
NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

CALIBRATION ISOCONCENTRATION MAP
OCTOBER 3, 2019

ARCADIS Design & Consultancy for natural and built assets

FIGURE
31

City: Syr Div/Group: IM/DV Created By: K. Sinsabaugh Last Saved By: AKENS
National Grid Philly Coke (B0036790.0000.00001)
T:_ENV\NationalGrid\PhiladelphiaCoke\2021\RICP report\Fig31_Oc2019HeatMap.mxd 6/25/2021 4:30:40 PM



Exposure Medium	Exposure Route	Current Exposure Scenario			Future Exposure Scenario				
		Utility Worker	Outdoor Worker	Trespasser	Resident	Utility Worker	Indoor Worker	Outdoor Worker	Recreational User
Surface Soil	Ingestion	○ [a]	○ [a]	○ [b]	○ [c]	○ [d]	○ [d]	○ [d]	○ [d]
	Dermal Contact	○ [a]	○ [a]	○ [b]	○ [c]	○ [d]	--	○ [d]	○ [d]
Subsurface Soil	Ingestion	○ [a]	--	--	--	○ [d]	--	--	--
	Dermal Contact	○ [a]	--	--	--	○ [d]	--	--	--
Outdoor Air	Inhalation	○ [a]	○ [a]	○ [b]	○ [c]	○ [d]	--	○ [d]	○ [d]
Indoor Air	Inhalation	--	--	--	○ [c,d]	--	◐ [f]	--	--
Groundwater	Ingestion	○ [a]	--	--	○ [c,e]	○	○ [e]	--	--
	Dermal Contact	○ [a]	--	--	○ [c,e]	○	○ [e]	--	--
	Inhalation	○ [a]	--	--	○ [c,e]	○	○ [e]	--	--
Indoor Air	Inhalation	--	--	--	○ [c,d]	○ [d]	◐ [f]	--	--

Legend:

● = Complete Exposure Pathway.
◐ = Potentially Complete Exposure Pathway.
○ = Incomplete Exposure Pathway.
-- = Not applicable.

NOTES:

Exposure pathway completeness is evaluated based on current and anticipated future use and

[a] Exposure route is currently incomplete due to vegetative cover and/or existing health and safety plan (HASP) requiring use of personal protective equipment (PPE) for ground intrusive / excavation work.

[b] Exposure route is currently incomplete for trespassers due to Site security fencing.

[c] Exposure route will be incomplete after a soil cover system and deed restriction are in place, limiting the property to commercial/industrial use (no fence will be required).

[d] Exposure route is incomplete due to the exising vegetative cover (or soil cover system to be installed during redevelopment) and/or exisiting HASP requiring use of PPE for ground-instrusive / excavation work. No passive recreational use will be allowed at the Site until after the soil cover system is installed, mitigating potential exposure.

[e] Exposure route will be incomplete due to a groundwater use ordinance to be established for the Site.

[f] Vapor intrusion (VI) exposure pathway will be fully assessed by a VI evaluation once the redevelopment plans are complete. Altenatively, a VI mitigation system can be installed in lieu of a VI evaluation that eliminates potential exposure pathways.

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

HUMAN HEALTH CONCEPTUAL SITE MODEL

ARCADIS Design & Consultancy for natural and built assets

FIGURE
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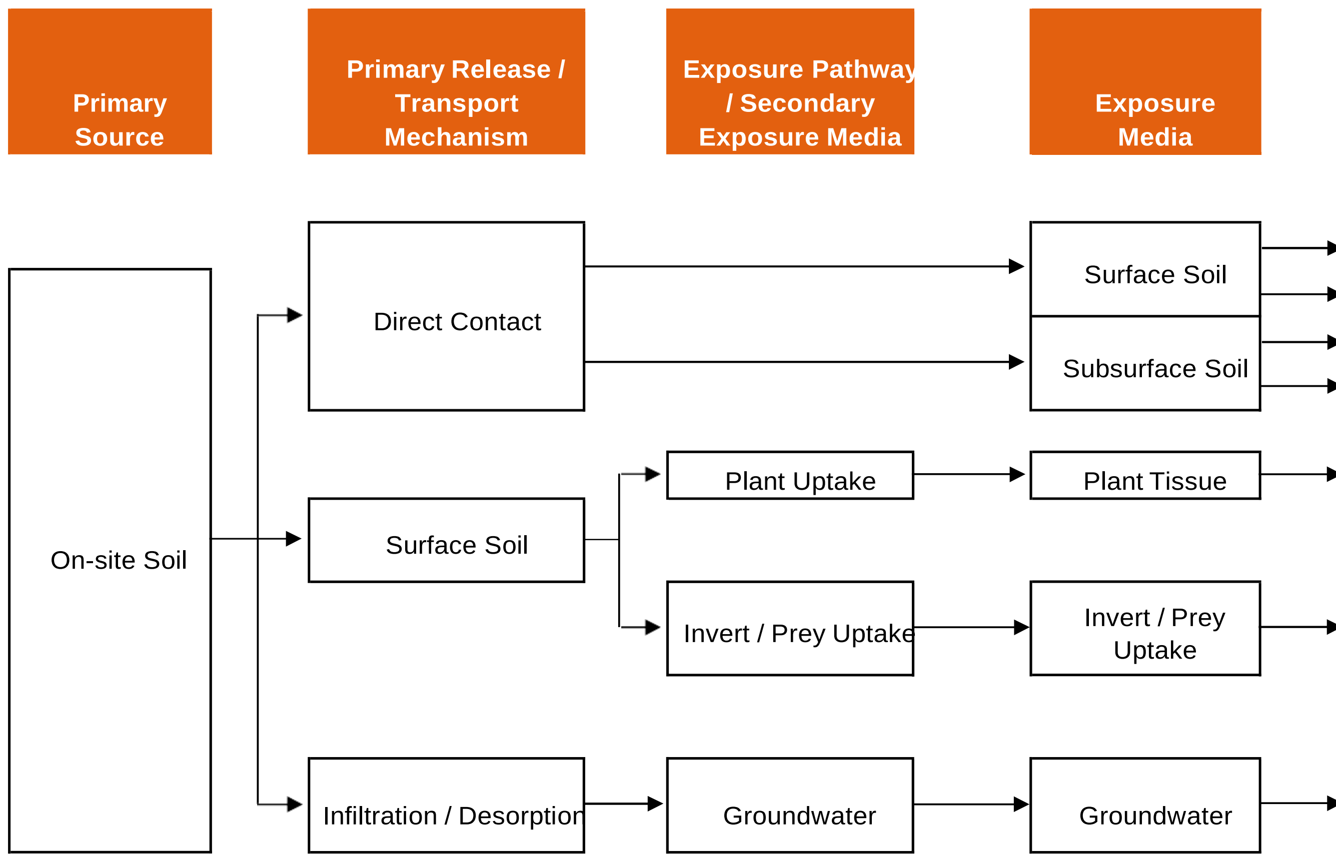
NOTE:
1. 2016 AERIAL IMAGE ACCESSED VIA ARC GIS ONLINE
2. HABITAT ASSESSED BY ARCADIS NOVEMBER, 2019

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

FIGURE 33. ECOLOGICAL COVER TYPE

ARCADIS Design & Consultancy for natural and built assets



Exposure Media	Exposure Route	Current Exposure Scenario: Terrestrial Plants	Current Exposure Scenario: Soil Invertebrates	Current Exposure Scenario: Wildlife	Future Exposure Scenario: Terrestrial Plants	Future Exposure Scenario: Soil Invertebrates	Future Exposure Scenario: Wildlife
Surface Soil	Incidental Ingestion	○	◐	●	○	○	○
Surface Soil	Direct Contact	●	●	◐	○	○	○
Subsurface Soil	Incidental Ingestion	○	○	○	○	○	○
Subsurface Soil	Direct Contact	○	○	○	○	○	○
Plant Tissue	Ingestion	○	◐	◐	○	○	○
Invert / Prey Uptake	Ingestion	○	○	◐	○	○	○
Groundwater	Ingestion	○	○	○	○	○	○
Groundwater	Dermal Contact	○	○	○	○	○	○

Legend:

● = Complete Exposure Pathway. Evaluated quantitatively through applicable ecological screening benchmarks.

◐ = Potentially Complete Exposure Pathway. Pathway expected to be insignificant. Pathway may be evaluated qualitatively.

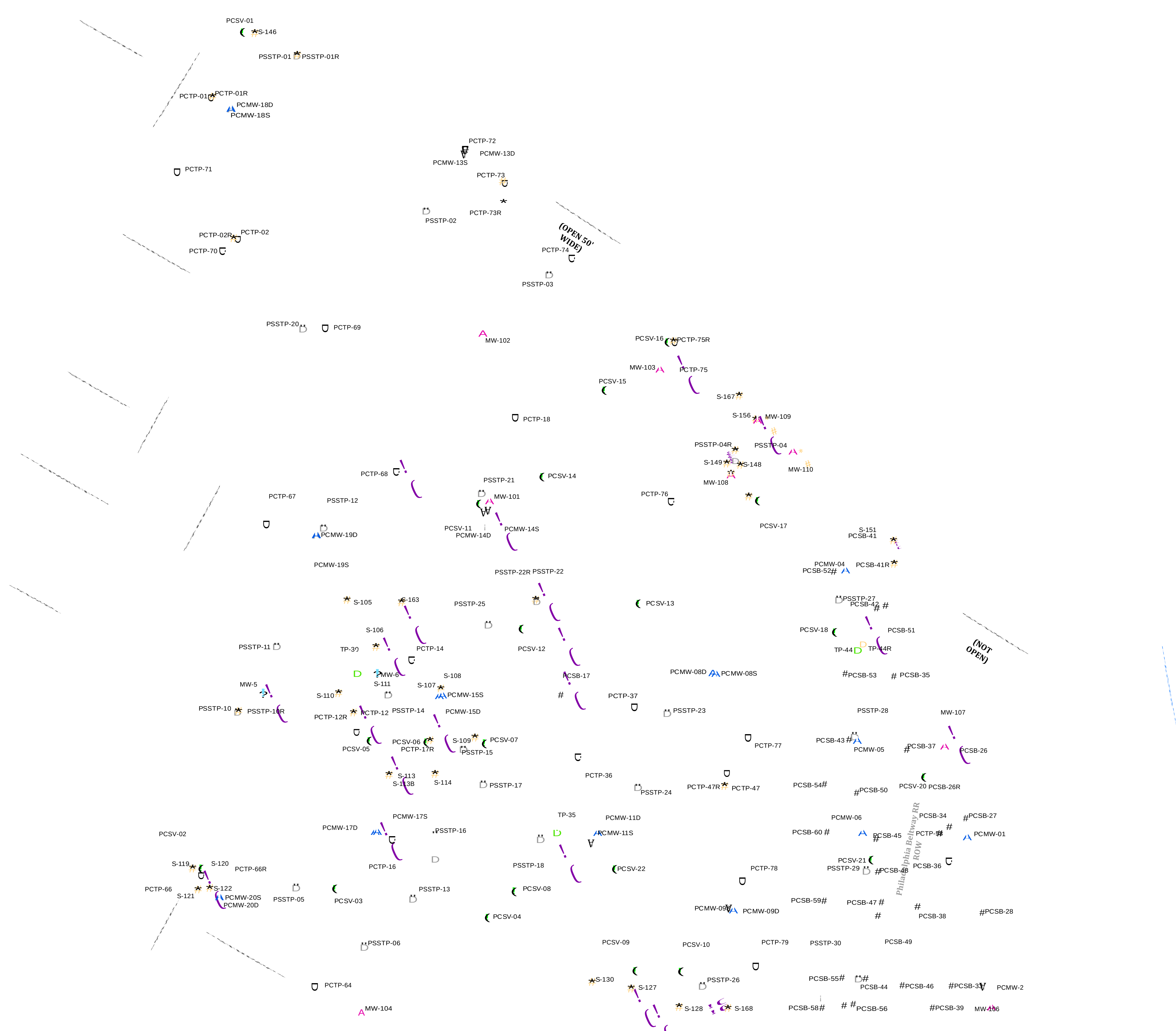
○ = Incomplete Exposure Pathway. Not evaluated.

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

ECOLOGICAL CONCEPTUAL SITE MODEL

ARCADIS Design & Consultancy for natural and built assets

FIGURE
34



LEGEND:

APPROXIMATE AREAS WHERE POTENTIAL BUILDINGS WILL NEED VAPOR INTRUSION MITIGATION MEASURES OR ADDITIONAL VAPOR INTRUSION EVALUATION IS NEEDED

PROXIMITY DISTANCE AROUND POTENTIAL VAPOR INTRUSION CONCERN FROM SOIL

PROXIMITY DISTANCE AROUND POTENTIAL VAPOR INTRUSION CONCERN FROM GROUNDWATER

LOCATION WHERE ONE OR MORE CONSTITUENTS EXCEED APPLICABLE VAPOR INTRUSION SCREENING STANDARDS

(S-105) 2019 SOIL BORING LOCATION (2019)

(S-120) 2019 TEST PIT LOCATION (2019)

(PCSB-17) PSS ENVIRONMENTAL SOIL BORINGS (2005)

(PSSTP-23) PSS ENVIRONMENTAL TEST PITS (2003)

(PCTP-01) PSS ENVIRONMENTAL TEST PITS (2005)

(TP-44) EEI GEOTECHNICAL TEST PITS (2005)

(MW-101) ARCADIS GROUNDWATER MONITORING WELL LOCATION (2018-2019)

(PCMW-12S) PSS GROUNDWATER MONITORING WELL (2005)

(PCMW-12D) MISSING/DESTROYED PSS GROUNDWATER MONITORING WELL

(MW-05) RCRA CLOSURE GROUNDWATER MONITORING WELL (1992 AND EARLIER)

(PCSV-20) PSS SOIL VAPOR SAMPLING LOCATIONS (2006)

FORMER STRUCTURE/OPERATION

SITE BOUNDARY

SHORELINE

NOTES:

1. BASE MAP OBTAINED FROM FIGURE PREPARED BY PAULUS SOKOLOSKI AND SARTOR ENGINEERING, PC, TITLED "GENERAL SITE PLAN", DRAWING 2A, DATED APRIL 9, 2007 AT A SCALE OF 1"=250'.

2. FIGURE ONLY SHOWS SOIL SAMPLING LOCATIONS WHERE UNSATURATED SOIL SAMPLES WERE COLLECTED FOR LABORATORY ANALYSIS. ALL GROUNDWATER MONITORING WELLS AND SOIL GAS SAMPLING LOCATIONS ARE SHOWN.

3. VAPOR INTRUSION SCREENING VALUES OBTAINED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) TECHNICAL GUIDANCE MANUAL FOR VAPOR INTRUSION INTO BUILDINGS FROM GROUNDWATER AND SOIL UNDER ACT 2, DATED NOVEMBER 19, 2016 (THE "VI GUIDANCE").

4. APPLICABLE VAPOR INTRUSION SCREENING STANDARD IS THE PADEP STATEWIDE HEALTH STANDARD VAPOR INTRUSION SCREENING VALUE FOR NONRESIDENTIAL GROUNDWATER AND SOIL.

5. PROXIMITY DISTANCE RADII ARE 30 FEET FOR PETROLEUM CONSTITUENTS (e.g., BENZENE, TOLUENE, NAPHTHALENE) AND 100 FEET FOR NON-PETROLEUM CONSTITUENTS PER SECTION E OF THE VI GUIDANCE.

6. FIGURE ONLY SHOWS SAMPLING LOCATIONS WHERE UNSATURATED SOIL SAMPLES WERE COLLECTED FOR LABORATORY ANALYSIS.

NATIONAL GRID
FORMER PHILADELPHIA COKE PLANT
PHILADELPHIA, PENNSYLVANIA
RI REPORT

SITE LOCATIONS WITH POTENTIAL VAPOR INTRUSION CONCERNS

FIGURE
35

ARCADIS Design & Consultancy for natural and built assets

APPENDIX B

BSI CORPORATE HASP

735 Birch Avenue
Bensalem, PA 19020
p.215-447-3140
f. 215-447-3145
www.bsiconst.com

General Overview of Site Specific Safety Policy

Job Name: Bridge Point Philadelphia
Job Address: 4501 Richmond Street, Philadelphia, PA 19137
Superintendent: Fred Lombardo – 215-694-8504
Construction Manager: Andy Gebhart – 215-532-4157
Project Executive: Tom Howland – 215-805-3822
Site Safety Manager/ Competent persons: Andy Gebhart – 215-532-4157
Fred Lombardo – 215-694-8504
Emergency: 911
Nearest Medical Facility: Jefferson Frankford Hospital
4900 Frankford Ave
Philadelphia, PA 19124
Philadelphia Police: 15th District 215-686-3150
Philadelphia Fire Department: Engine 33
4750 Richmond Street
Philadelphia PA 19137
215-686-4519

Scope of Project: BSI Construction, LLC will be developing this industrial site involving 2 warehouse buildings for Bridge Point Philadelphia.

Site Safety Policies:

- All contractors of BSI Construction will always follow all OSHA regulations.
- Each employee is always to follow all of BSI Construction's Safety Manual rules and the Safety Requirements outlined in Project Specifications (General Conditions 10, attached)
- Each employee on the jobsite will always wear all necessary PPE.
- Each employee will be required to go through site-orientation. Signed orientation sheets will be kept on-site & available to the owner.
- PPE will be kept in good, functional and working order.
- Each employee on site has already been properly and thoroughly trained to identify safety hazards on the jobsite.
- The foreman will hold Tool Box Talks bi-weekly for the duration of the job.

- Additional Tool Box Talks will be held if a new hazardous situation arises.
- All employees are to report any/all safety related issues to the foreman immediately.
- The full BSI Construction, LLC Safety Manual Is available upon request and located in the construction trailer on site.
- All electrical connections are to use GFCI.
- No flammable liquids shall be stored within the building overnight.
- All activities requiring a crane lift are required to submit a crane lift plan 10 working day prior to and must be approved before lift can proceed.
- All contractors and subcontractors must inspect work areas daily and BSI will submit a weekly Project Self Inspection Report to SDP.
- All subcontractors are to designate a Competent person for all activities requiring a Competent person as per OSHA CFR 1926.
- Penalties for Safety violations will follow SDP's penalties (10.5.14)
  - 1st offense – Employee is issue a written warning, the Orientation meeting is considered the first written warning.
  - 2nd offence – The worker is directed to leave the project for the remainder of the day or SDP's discretion.
  - 3rd offence for the same violation – The worker is directed to leave the project and not permitted to return.
- Hazardous Communication Program coordinator is Andy Gebhart and Fred Lombardo
  - SDS will be located in the construction trailer.

Accident /Injury Policy:

All accidents will be reported immediately to the foreman and safety director. All recordable accidents/injuries will be kept on file at the company office. In the event of a serious accident /injury all work will cease immediately, and the jobsite will be left undisturbed in order to investigate further. After an injury BSI will follow SDP's Return-to-Work policy stated in the General Conditions 10.5.13.

Job Hazard Analysis Procedure:

For each new contractor coming on-site, a preliminary review will be conducted to identify potential hazards. Upon identification, each hazard will be outlined with the location, likelihood dangers, and corrective actions needed to move forward.

Specific Hazards:

- Sub-Contractors:
  - All sub-contractors working on this project for BSI Construction, LLC will always follow all OSHA rules and regulations.
  - No flammable liquid shall be stored in the building overnight.
  - All sub-contractors are to have a competent person on site for Excavation, Fall protection, and all job site hazards.
  - Sub-contractors will always follow the BSI Construction, LLC Safety Manual rules.
  - Sub-contractors will not operate any equipment (regardless of ownership) unless trained and certified to do so.

- Subcontractors will be responsible for the maintenance and storage of their own PPE
- Subcontractors will wear the proper PPE when necessary.
  - Hard hats, Eye protection and Hi-vis clothing are to be worn at all times.
- Sub-contractors will supply their own manpower.
- Employees of the sub-contractor will not be permitted on site unless they are properly trained and qualified to complete the specific task.
- Employees of the sub-contractors are required to have OSHA 10 Construction or an approved alternative, as per Philadelphia License and Inspection.
- Sub-contractors are required to inspect and document the inspection of all their equipment before each shift begins.
- Any equipment in need of repair will be removed from service until repaired or replaced.
- Subcontractors will hold their own Tool Box Talks at least once per week.
- Tool Box Talks will be signed and dated by all attendees and a copy will be given to BSI Construction, LLC and kept on file.
- BSI Foreman will oversee quality control of work and safety throughout the project.

- Pedestrians:
  - Pedestrians will not be permitted into the work areas.
  - Temporary barriers will be used where needed to block off access to the work area.
  - Only trained employees will be permitted into the work area.
  - All equipment will be kept inside the work area
  - Work is not to be done outside the work area.
  - All pedestrian walk ways are to be kept from trip/slip/fall hazards.
  - Deliveries will be coordinated as needed to ensure the safety of the workers and potential traffic.

Accident/ injury notification:

- If any accident or injuries happen on the work site BSI must be notified immediately.
  - Andy Gebhart – 215-532-4157
  - Fred Lombardo – 215-694-8504
  - Tom Howland – 215-805-3822

Directions to the Hospital:

- Head northwest on Orthodox St toward Bath St 0.3 mi
- Turn right onto Richmond St 0.2 mi
- Turn left onto Lefevre St 0.5 mi
- Turn right onto Aramingo Ave 0.3 mi
- Slight left onto Wakeling St 0.5 mi
- Continue onto Harrison St 0.5 mi

APPENDIX C

ENVIRONMENTAL CONDITIONS REPORT, ROUX ASSOCIATES, INC.

MEMORANDUM

Date: August 16, 2021

To: Jim Marshall
Bridge Industrial
One Gatehall Drive – Suite 201
Parsippany, New Jersey 07054

From: Peter Downham - Roux Associates

Subject: Summary of Environmental Conditions
Former Philadelphia Coke Plant
4501 Richmond Ave, Philadelphia, Pennsylvania

Roux Associates, Inc. (Roux) has prepared this summary memorandum (Memo) for Bridge Industrial (Bridge) in association with the above referenced property located in Philadelphia, Pennsylvania (Site). This Memo summarizes the environmental conditions of the Site and is anticipated that it will be utilized as a supporting document for Bridge's Request for Proposal (RFP) to be issued to potential general contractors. A Site Location Map and Site Plan are included as **Figure 1** and **Figure 2**, respectively. In addition, a summary of the Site background, previous investigation/remediation activities, proposed cleanup plan and anticipated soil management procedures are provided below.

Site Background

The Site is a vacant lot (Tax Identification No.885914840) encompassing approximately 63 acres and is owned by Eastern Enterprises (a/k/a National Grid). There are no site improvements other than fencing surrounding the Site, paved parking and driveways, and concrete building foundations. Historically the Site was utilized as a manufactured gas plant (Mid 1920s), metallurgical coke production (1929-1982) and fuel oil blending facility (1969-1989). Operations ceased in 1989. Roux recently prepared a Phase I Environmental Site Assessment (ESA) for the Site which identified recognized environmental conditions (RECs) including historical industrial operations and contaminated groundwater. The Phase I ESA is included as **Attachment 1**. Current environmental investigation and remediation activities are being completed through the Pennsylvania Department of Environmental Protection (PADEP) Act 2 program by Arcadis on behalf of the Philadelphia Coke Company (PCC). A summary of these activities is provided below, however further details are provided in the July 2021 *Philadelphia Coke Co., Inc. Remedial Investigation Report and Cleanup Plan (RICP)* which is included as **Attachment 2**.

Summary of Previous Investigation/Remediation Activities

Operations at Site were discontinued in 1989. Following the cessation of operations, Resource Conservation and Recovery Act (RCRA) investigation and remediation activities were conducted. The RCRA activities included the excavation of ~39,000 tons of impacted soil and implementation of bioremediation activities within the former fuel blending area as well as the location of the former underground storage tanks (USTs). RCRA closure was obtained through a Certificate of Completion on December 28, 1994. Following RCRA closure, significant remedial investigation (RI) activities were conducted to characterize the horizontal and vertical extent of remaining impacts across the Site. The RI activities consisted of the following:

- Completion of 197 test pits;
- Advancement of 179 soil borings;

402 Heron Drive ■ Logan Township, New Jersey 08085 ■ +1.856.423.8800 ■ www.rouxinc.com
California ■ Illinois ■ Massachusetts ■ New Jersey ■ New York ■ Texas

- Installation and sampling 53 groundwater monitoring wells;
- Laboratory analysis of 540 soil samples and 112 groundwater samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganics, cyanide, pesticides, and/or polychlorinated biphenyls (PCBs); and
- Laboratory analysis of 21 soil gas samples for VOCs (via Method TO-15), Naphthalene (via GC/MS in the full scan mode) methane, and fixed gases.

Soil analytical results and visual impacts (e.g., viscous tar, oil-like material, and solidified tar) from the activities described above indicate the presence of localized impacts in the center of the Site and at isolated locations on the remainder of the Site. Constituents of concern (COCs) in soil are generally limited to polycyclic aromatic hydrocarbons (PAHs), arsenic and lead. Visual impacts are limited to the fill layer or the top few feet of the silt and clay layer. Additionally, groundwater impacts are limited to the areas where viscous tar and oil-like materials were observed. Groundwater data generated downgradient from the localized impacts do not exhibit concentration above applicable standard and confirm that impacts do not migrate offsite.

Areas of the Site exhibiting elevated concentrations of COCs and visual impacts have been delineated for purposes of the cleanup plan (summarized below). Overall, there are currently no exposure pathways for human receptors. Soil exposure is controlled by Site use (i.e., the Site is vacant), Site fencing, vegetation, and the presence of non-permeable surface covers (e.g., old asphalt parking lots). In addition, no exposure pathways are complete for soil or soil vapor. Further details regarding the extent of COCs are included in **Attachment 1**.

Summary of Proposed Cleanup Plan

Based on the RI results, PCC is proposing to pursue a release of liability under the Act 2 Site-Specific Standard via a “pathway elimination” cleanup approach. The proposed remediation will achieve the Site cleanup objectives to protect human health by mitigating identified future exposure pathways with soils and groundwater impacted by applicable Site COCs. The remediation approach generally consists of the following:

- Providing methods to achieve pathway elimination for soils using engineering controls (i.e., capping of soils as part of redevelopment with buildings, roadways, parking lots, and landscaping);
- Outlining procedures and plans to allow for safe execution of future Site remediation and/or redevelopment activities;
- Identifying institutional controls to be implemented (i.e., deed notice and restrictions); and
- Outlining a Post-Remediation Care Plan.

The remedial goals for soil will be to allow historic fill and impacted soils to remain in place or be reused onsite (e.g., as subsurface fill), while mitigating complete exposure pathways via engineering and institutional controls.

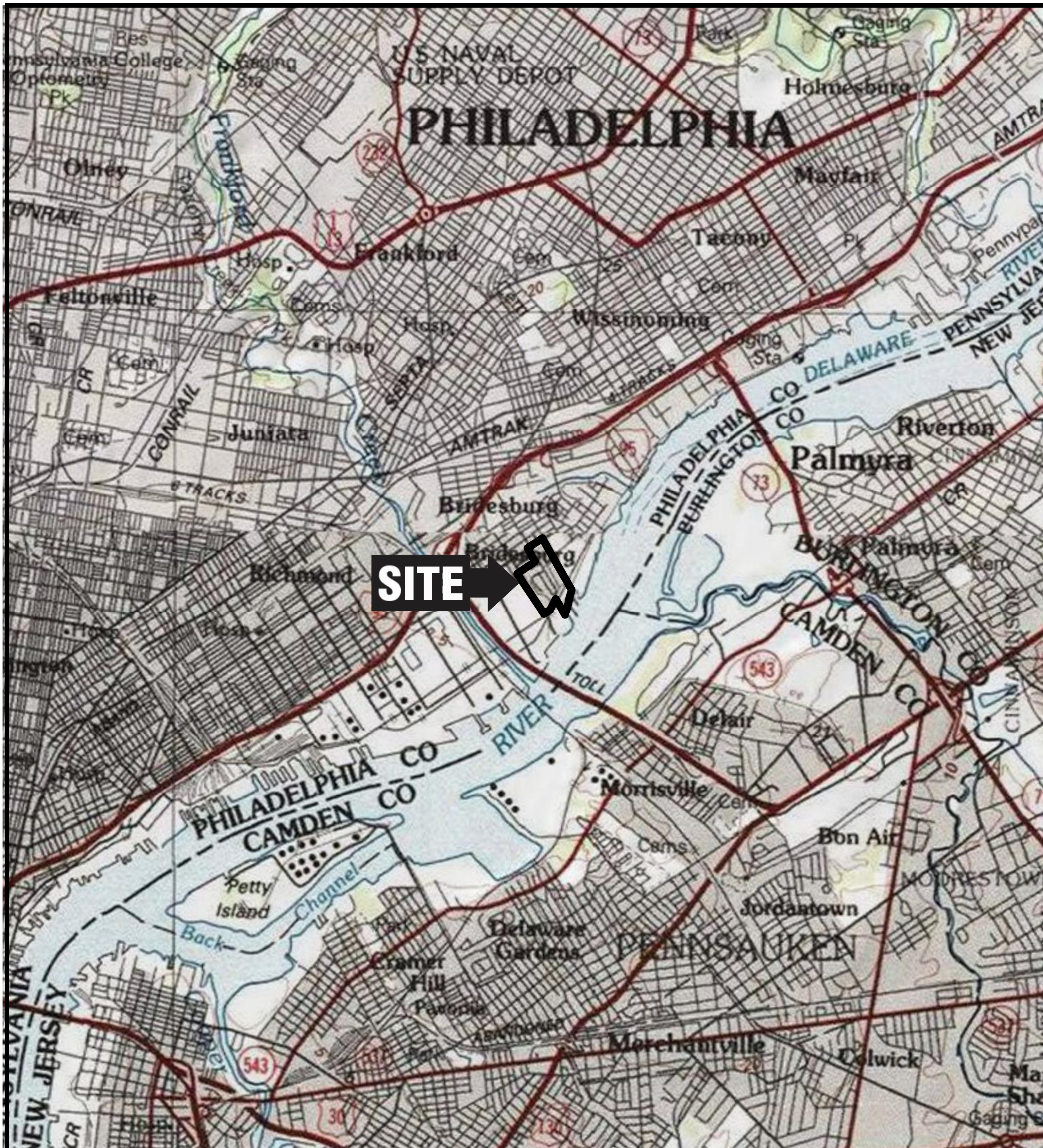
Soil Management Summary

Prior to mobilization to the Site, the general contractor should prepare a Site-Specific Health and Safety Plan that details the potential hazards that could be encountered onsite. The HASP should be submitted to Roux and Bridge for review and approval. While conducting intrusive work, it is possible that soils contaminated with low level impacts described above may be encountered. It is anticipated that Level D personal protective equipment (PPE) will be sufficient to deal with soil conditions, however, the general contractor will need to consult with Occupational Safety and Health Administration (OSHA) requirements. It is not anticipated that any special precautions are needed for work that does not involve intrusive activities (i.e., earth work or breaking ground), however, it is recommended that the general contractor review OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards to determine applicability.

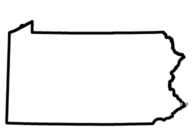
Prior to any soil moving activities, the redevelopment area shall be prepared in accordance with the Soil Erosion and Sediment Control (SESC) Plan. Preparation activities shall consist of (but not limited to) installation of silt fencing and a stabilized construction entrance. Installed SESC measures will be inspected, maintained, and replaced (as needed) throughout the duration of the development work.

Based on the conclusion of the RCIP (**Attachment 2**), Site soils require no further remedial action and can be moved and used throughout the Site without restriction, unless unanticipated material is encountered during development work including but not limited to underground storage tanks (USTs); visually contaminated soils [non-aqueous phase liquid (NAPL)]; and soil deemed insufficient for development/geotechnical purposes. A set plan (including the chain of command) should be in place with the general contractor on who is notified when unanticipated material is encountered. Roux and Bridge shall be notified immediately upon the discovery of unanticipated materials. In the unlikely event unanticipated material is encountered, the material shall be characterized and segregated for off-site disposal at an approved licensed disposal/recycling facility. Roux and Bridge will pre-approve the disposal/recycling facilities prior to the material going off-site. Soil excavation documentation will be required, including an ongoing log tracking soil origin and end use location.

FIGURES



QUADRANGLE LOCATION



Pennsylvania

NOTES
EASTING (X): 39.9967600
NORTHING (Y): -75.0683300

N

5,000 0 5,000'

Title:

SITE LOCATION MAP

BRIDGE POINT BRIDESBURG
4501 RICHMOND STREET, PHILADELPHIA, PA, 19137

Prepared for:

BRIDGE INDUSTRIAL

ROUX

Compiled by: EJT	Date: 10/23/20	FIGURE
Prepared by: EJT	Scale: AS SHOWN	
Project Mgr: MM	Project: 3165.0012J000	1
File: F1(AP)		

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\\SRVLTNJFP1\LIMITED\PROJECTS-08\3165 - BRIDGE DEVELOPMENT PARTNERS, LLC\PROJECT DATABASE\PHILA, PA\F2(BP)SITEPLAN.MXD

LEGEND

- Property Boundary
- Parcels
- Streets

NOTES

1. Service Layer Credits: ESRI, DigitalGlobe, GeoEye, Earthstar Geopgraphics, CNES /Airbus DS , USDA, USGS , AEX , Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Layer Access Date: 10/21/2020.

N

300 0 300'

Title:

SITE PLAN

BRIDGE POINT BRIDESBURG
4501 RICHMOND STREET, PHILADELPHIA, PA, 19137

Prepared for:

BRIDGE INDUSTRIAL

ROUX

Compiled by: EJT	Date: 10/23/20	FIGURE
Prepared by: EJT	Scale: AS SHOWN	2
Project Mgr: MM	Project: 3165.0012J000	
File: F2(BP)		