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Region 2 RAC2
Remedial Action Contract

Final Work Plan, Volume 1

Pierson's Creek Site

Remedial Investigation/ Feasibility Study

Newark, New Jersey

January 26, 2017

537550

CDM Smith

REMEDIAL ACTION CONTRACT 2
FOR REMEDIAL RESPONSE, ENFORCEMENT OVERSIGHT,
CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR
THREATENED RELEASE OF HAZARDOUS SUBSTANCES
IN EPA REGION 2

FINAL WORK PLAN
VOLUME 1

PIERSON'S CREEK SITE
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY
NEWARK, NEW JERSEY
Work Assignment No. 060-RICO-02MV

U.S. EPA CONTRACT NO. EP-W-09-002
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Prepared for:
U.S. Environmental Protection Agency
290 Broadway
New York, New York 10007-1866

Prepared by:
CDM Federal Programs Corporation
14 Wall Street, Suite 1702
New York, New York 10005

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14 Wall Street, Suite 1702
New York, New York 10005
tel: +1 212 785-9123
fax: +1 212 227-1692
cdmsmith.com

January 26, 2017

Ms. Helen Eng
U.S. Environmental Protection Agency
290 Broadway - 18th Floor
New York, NY 10007-1866

Ms. Pamela Tames
U.S. Environmental Protection Agency
290 Broadway - 20th Floor
New York, NY 10007-1866

PROJECT: EPA Region 2 RAC2 Contract No.: EP-W-09-002
Work Assignment No.: 060-RICO-02MV

DOC. CONTROL NO.: 3323-060-03106

SUBJECT: Final Work Plan, Volume 1
Pierson's Creek Site
Remedial Investigation/ Feasibility Study
Newark, New Jersey

Dear Ms. Eng and Ms. Tames:

CDM Federal Programs Corporation (CDM Smith) is pleased to submit this Final Work Plan Volume 1, for the Pierson's Creek Site, Remedial Investigation/ Feasibility Study in Newark, New Jersey.

If you have any questions regarding this work plan, please contact me at your earliest convenience at (212) 785-9123.

Very truly yours,
CDM FEDERAL PROGRAMS CORPORATION

J. Litwin

Jeanne Litwin, PMP, REM
RAC2 Program Manager

Enclosure

cc: D. Butler, EPA Region 2
B. MacDonald, CDM Smith
E. Leonard, CDM Smith
F. Gellati, CDM Smith
RAC2 Document Control

REMEDIAL ACTION CONTRACT 2
FOR REMEDIAL RESPONSE, ENFORCEMENT OVERSIGHT, CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES IN EPA REGION 2

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Prepared by: _____ Date: 1/26/2017
Edward Leonard
Site Manager

Approved by: _____ Date: 1/26/2017
Jeanne Litwin, PMP, REM
RAC2 Program Manager

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Appendix A Well Inventory Checklist

Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
CLP	contract laboratory program
CO	contracting officer
COPC	chemical of potential concern
CRQL	Contract Required Quantitation Limit
CSM	conceptual site model
DER	Data Evaluation Report
DESR	Data Evaluation Summary Report
DO	dissolved oxygen
DPM	deputy program manager
DQO	data quality objectives
DQM	data quality manager
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
EPCs	exposure point concentrations
EQuIS	Environmental Quality Information Systems
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESAT	Environmental Services Assistance Team
FAM	finance and administration manager
FS	feasibility study
GIS	Geographic Information System
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HRS	Hazard Ranking System
mg/kg	milligram per kilogram
NCP	National Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NPL	National Priority List
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAR	Pathway Analysis Report
PM	program manager
PO	project officer
PSO	Project Support Office
PVSC	Passaic valley sewage commission
QA	quality assurance
QAPP	quality assurance project plan
QAS	quality assurance specialist
QC	quality control
QMP	Quality Management Plan

RAC	Remedial Action Contract
RACMIS	remedial action contract management information system
RAGS	Risk Assessment Guidance for Superfund
RI	remedial investigation
ROD	record of decision
ROV	remotely operated vehicle
RPM	remedial project manager
RQAS	regional quality assurance specialist
SLERA	Screening Level Ecological Risk Assessment
SM	site manager
TRC	Technical Review Committee
UCL	Upper Confidence Limit
WA	work assignment
WAM	work assignment manager
WWTP	wastewater treatment plant

Section 1

Introduction

The purpose of this Remedial Investigation/Feasibility Study (RI/FS) is to evaluate the nature and extent of contamination and develop remedial alternatives for the Pierson's Creek Superfund Site, Operable Unit (OU) 1 located in Newark, Essex County, New Jersey. Data collected during the field investigations will be used to prepare an RI Report, a Baseline Human Health Risk Assessment (HHRA), a Screening Level Ecological Risk Assessment (SLERA), and a Feasibility Study (FS). The FS will develop a full range of remedial alternatives, which will support selection of a remedy and preparation of a Record of Decision (ROD) by the United States Environmental Protection Agency (EPA). The work plan was prepared for implementation by the principal responsible parties.

The sampling approach for the RI/FS is presented in Section 3. A Quality Assurance Project Plan (QAPP) detailing sample and analytical requirements for the field investigation and a health and safety plan (HASP) will be prepared and submitted separately.

The RI/FS will be completed in accordance with EPA guidance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) "Interim Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988), or the most recent EPA FS guidance document.

1.1 Site Description and History Summary

Large amounts of data were previously collected at the Pierson's Creek site, primarily at the Troy Chemical Corporation (Troy Chemical) property, but also at nearby properties, during investigations conducted by various agencies during the period from 1977 to present. The existing data and information were collected, reviewed, evaluated, and summarized in a Technical Memorandum – Summary of Existing Information and Data Gap Evaluation (CDM Smith 2016). A brief description of the Pierson's Creek site and a brief site history are provided in the sections below.

1.1.1 Site Description

Pierson's Creek is an approximately 1.5-mile, man-made ditch located in a heavily industrialized section of Newark, New Jersey. Figure 1-1 shows the site location. The Creek has been used as an urban stormwater drainage structure for more than 100 years, and it continues to be a component of the City of Newark's stormwater management system. Historically (including at the time of mercury releases), Pierson's Creek surfaced from a 36-inch stormwater culvert just to the north of the Troy Chemical property and flowed in the concrete channel that bisects the Troy Chemical facility; an unnamed, intermittent tributary flowed along the eastern property boundary and joined Pierson's Creek just south of the facility. Due to a drainage improvement project completed in 2007, the perennial portion of Pierson's Creek now begins just south of the Troy Chemical facility, where it receives stormwater runoff from a large culvert and an unnamed tributary on the Troy property.

Pierson's Creek flows from the Troy Chemical facility through a series of open channels and culverts, in a general south-southwesterly direction for approximately 1.5 miles to the Port Newark Channel portion of Newark Bay. Moving from Troy Chemical in the north to south, the creek flows through the former Red Star property (currently occupied by Continental Hardware), the vacant former Engelhard property (currently owned by 429 Delancy Associates LLC), Conrail's Oak Island rail yard, and private parking lots built on a former landfill within the Port of Newark. The creek flows through these properties for approximately 1 mile before being routed through culverts beneath Interstate 78, Newark International Airport, and New Jersey Turnpike.

Newark Bay is part of the New York-New Jersey Harbor Estuary, which also includes Upper New York Bay, Lower New York Bay, and Raritan Bay; the channels that connect the bays, including Arthur Kill/Pratt Creek, Kill Van Kull, and The Narrows; and the tidal portions of the Hackensack River, Passaic River, and other rivers. The surface water migration pathway for the Pierson's Creek site extends throughout the coastal tidal waters of Newark Bay, Arthur Kill, Kill Van Kull, Upper New York Bay, The Narrows, and into Lower New York Bay, in a series of arcs through the bays and lines through the channels.

Investigations by Troy Chemical, the New Jersey Department of Environmental Protection (NJDEP), and EPA have indicated significant increases in sediment mercury concentrations at and downstream of the facility compared to upstream sediment concentrations, as recently as 2010. In July 1979, EPA collected a sediment sample from Pierson's Creek just downstream of the mercury wastewater treatment system, and reported a mercury concentration of 22,400 milligrams per kilogram (mg/kg), compared to upstream concentrations of 140 and 191 mg/kg; EPA also reported mercury concentrations above background for samples collected downstream of the facility. The same report indicates a significant increase in water concentrations for benzene.

EPA conducted an investigation of Pierson's Creek in October 2012, which confirmed the observed release of mercury to the creek sediments. Mercury was detected in sediment samples collected throughout the accessible portions of the creek, and a site-attributable observed release is documented for a distance of approximately 0.25 mile downstream of the Troy Chemical facility. The affected area includes 0.15 mile of wetland frontage.

A number of metals which are hazardous substances under CERCLA, including arsenic, copper, lead, mercury, silver, and zinc, were detected at the site in the creek sediment and adjacent soils, at greatly elevated concentrations. Aroclor 1260 (Polychlorinated biphenyl [PCB-1260]), a hazardous substance, has also been found at the site. Exposure to the various hazardous substances present at the site by direct contact, ingestion, or inhalation can cause a variety of adverse human health effects.

EPA placed the Pierson's Creek site on the National Priorities List (NPL) by publication in the Federal Register on September 16, 2014.

1.1.2 Site History

The Troy Chemical property is a 6.11-acre property having a history of chemical manufacturing uses dating back to the 1880s. Chemicals produced at the property have included ultramarine, aniline, and coal tar dyes as well as metallic soaps, paint dryers, mercuric oxide, and fungicides.

The property was acquired by the present-day owner and operator, the Troy Chemical Corporation, Inc. (Troy Chemical), in 1980, although the company operated under the Troy Chemical Company name beginning in 1953.

The Troy Chemical facility discharged mercury-bearing wastewaters directly to Pierson's Creek without treatment until 1965, when the facility's mercury pretreatment system was installed at the edge of the Creek. Discharges of mercury-bearing wastewaters to Pierson's Creek continued from 1965 to 1976, even after a sulfide precipitation pretreatment system was installed. In 1976, the facility connected to the Passaic Valley Sewerage Commission (PVSC) sewer system, and began diverting wastewater from the mercury pretreatment system to the facility waste water treatment plant (WWTP), where wastewaters were treated by settling, removal of suspended solids and oil, and neutralization before subsequent discharge to the PVSC system. The additional levels of treatment at the WWTP did not remove all mercury from the process wastewater; the mercury contribution to PVSC as tested in 1979 was calculated to be approximately 327 pounds per day, and the facility discharged an average of more than 30,000 gallons per day of mercury-bearing wastewater to the PVSC sewer system for a 91-day period in 1986. The facility reported that it ceased the production of mercury-containing products that discharged to the sewer effluent as of February 1, 1987.

Other properties which may have contributed to contamination in and adjacent to Pierson's Creek include the former Prentiss Drug & Chemical Co. property, the former Albert Steel Drum Co. property, the former Engelhard Corporation property, including the dredge spoils placed by the City of Newark on the southeastern portion of the Engelhard property. Additional information pertaining to potential sources of contamination in the vicinity of Pierson's Creek can be found in the Technical Memorandum – Summary of Existing Information and Data Gap Evaluation (CDM Smith 2016).

1.2 RI/FS Objectives

The overall purpose of the RI/FS is to select a remedy to eliminate, reduce, or control risks to human health and the environment at the Pierson's Creek site. The objectives of this Work Plan are as follows:

- Characterize the nature and extent of contamination at Operable Unit 1 (OU1) of the site which consists of Pierson's Creek and its tributaries and excludes the Troy Chemical property, which EPA has designated as OU2.
- Prepare the RI Report, FS, and human health and ecological risk assessments.
- Provide adequate data to support the selection of an approach for site remediation and development of a Record of Decision (ROD).

1.3 Work Plan Content

This Work Plan contains three sections as described below.

- Section 1 – Introduction: Presents a brief description of the site, the Work Plan objectives, and format of the Work Plan.

- Section 2 – Work Plan Approach: Presents an overview of the technical approach to development of the Work Plan, the project schedule, project management plan, and quality assurance (QA) and document control.
- Section 3 – Task Plans: Presents the specific activities that will be performed and describes the reports and other deliverables that will be prepared and submitted to EPA.

For presentation purposes, figures and tables are presented at the end of this Work Plan.

Section 2

Work Plan Approach

2.1 Technical Approach to the RI/FS

This Work Plan was prepared to ensure that all work and submittals meet the requirements of the following documents and policies:

- CERCLA, as amended
- Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, EPA/540/G-89/004, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01 (EPA 1988)
- Other applicable federal, state, and local requirements

A preliminary review of existing data and documents provided by EPA was performed including the Hazard Ranking System (HRS) Documentation Record and associated references, the Proposed Remedial Approach Report prepared for the Troy Chemical facility, dated September 2015, and other documents provided by EPA.

The NJDEP Technical Coordinator for the Troy Chemical facility and Pierson's Creek site and the NJDEP Chief Records Custodian were contacted and available records, reports, and data were obtained from NJDEP for the Pierson's Creek Site, the Troy Chemical facility, and nearby properties. The City of Newark Engineering Office was also contacted and provided documents related to the of Pierson's Creek and historical dredging that occurred in the Creek. The documents obtained from these file searches were evaluated and summarized in a Technical Memorandum – Summary of Existing Information and Data Gap Evaluation (CDM Smith 2016).

2.2 Quality Assurance

All work on this RI/FS will be performed in accordance with an applicable corporate or programmatic Quality Management Plan (QMP). Evaluation of the existing data will be performed in accordance with EPA's policies for non-direct measurements and the site-specific Quality Assurance Project Plan (QAPP). The quality assurance specialist (QAS) will maintain QA oversight for the duration of the RI/FS. A QAS has reviewed this Work Plan for QA requirements.

The PRP's site manager (SM) is responsible for implementing appropriate quality control (QC) measures on this RI/FS. Such QC responsibilities include:

- Implementing the QC requirements referenced or defined in this Work Plan
- Adhering to accordance with the applicable corporate or programmatic Management Information System document control system
- Organizing and maintaining RI/FS files

- Conducting planning meetings, as needed, in accordance with the QMP

Technical and QA review requirements as stated in the QMP will be followed on this WA.

Records shall be complete, properly stored and managed in accordance with the Code of Federal Regulations in a manner that keeps documents secure, and facilitates easy retrieval.

2.3 Project Schedule

A project schedule is included as **Figure 2-1**.

2.4 General Requirements

General requirements include those relating to sustainable (or green) remediation, project data management, and record-keeping, as described in the following sections.

2.4.1 Green Remediation

Green remediation is the practice of considering all environmental effects of the implementation of a remedy and incorporating options to maximize the net environmental benefit of cleanup actions. In accordance with EPA's strategic plan for compliance and environmental stewardship, EPA strives for cleanup programs that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize or eliminate pollution at its source, and reduce waste to the maximum extent possible. EPA's Region 2 Superfund program supports the adoption of "green site assessment and remediation," which is defined as the practice of considering all environmental impacts of studies, selection, and implementation of a given remedy, and incorporating strategies to maximize the net environmental benefit of cleanup actions (see http://www.clu-in.org/greenremediation). In addition, EPA established a "Clean & Green" policy to enhance the environmental benefits of Superfund cleanups by promoting technologies and practices that are sustainable.

To the extent practicable, green remediation strategies will be implemented during the performance activities described in this work plan to maximize sustainability, reduce energy usage, promote carbon neutrality, promote industrial materials reuse and recycling, and protect and preserve land resources. The ASTM Standard Guide for Greener Cleanups (ASTM 2016) will be reviewed and implemented. Green remediation related activities will be reported to EPA in monthly progress reports or as requested by EPA.

2.4.2 Laboratory Accreditation/Certification Requirements

The PRP will collect environmental samples in accordance with the EPA-approved rationale, procedures, and protocol provided in the project-specific QAPP. All environmental and analytical subcontract laboratories to be used for execution of this RI/FS will be currently certified or accredited for the matrices and analyses to be conducted. The certification or accreditation shall be granted by the National Environmental Laboratory Accreditation Program (NELAP) or the American Association of Laboratory Accreditation (AALA). Certification or accreditation must be valid at the time of the subcontract award and maintained throughout the duration of the work assignment.

2.4.3 Project Data Management and Electronic Data Deliverable Requirements

The goals of project data management are to store and manage the data generated during the project so they are ready and available for analysis and reporting, and to prepare the project electronic data deliverable (EDD) for submittal to EPA. Examples of the data to be managed during this project include logbooks, maps, field data sheets, location data (survey and global positioning system [GPS] data), well construction data, water level data, field results, and sample analytical results. Data on paper will be stored and managed using a project filing system. Data in electronic format will be stored and managed using Environmental Quality Information System (EQuIS™) environmental database software from EarthSoft (version 5.5 or current version). The data stored in EQuIS™ will ultimately be used to generate the required EPA Region 2 EDD.

As data becomes available, EDDs will be submitted to EPA. The EDDs will include field sampling and laboratory analytical results, geologic data, and well location data in accordance with Region 2's policies, guidelines, and formats. The EDD will be prepared in accordance with the EPA Region 2 Electronic Data Deliverable Comprehensive Specification Manual 3.0 (EPA 2015a) for the systematic implementation of EDD requirements, data preparation, and identification of data fields required for data submissions. Other Region 2 EDD guidance and requirements documents that will be followed include the Electronic Data Deliverable Valid Values Reference Manual and tables (EPA 2015b), the Basic Manual for Historic Electronic Data (EPA 2015c), "Standalone EQuIS Data Processor User Guide," the "CLP EDD Conversion Tool Manual" and EDD templates will be followed and utilized.

2.4.4 Record-Keeping Requirements

All technical records for this RI/FS will be maintained by the PRP. These technical records will be in sufficient detail to support decisions made during this RI/FS. At the completion of the RI/FS, three bound copies of the official record of the work will be submitted to EPA. One copy each of the major deliverables in electronic format will be submitted to the EPA RPM and the NJDEP for review and one hard copy will be submitted to the EPA records manager.

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Section 3

Task Plans

The tasks for the RI/FS presented below correspond to the applicable tasks presented in the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA 1988).

3.1 Project Planning and Support

The project planning task generally involves several subtasks that must be performed in order to develop the plans and the corresponding schedule necessary to execute the RI/FS. These subtasks include performing a review and detailed analysis of existing data, attending technical meetings with EPA and other support agencies, preparing addendums to this RI/FS work plan, preparing the QAPP and HASP, and preparation the Pathway Analysis Report (PAR).

3.1.1 Evaluate Existing Data and Documents

Additional information from City of Newark, Port Authority of NY and NJ, Conrail and New Jersey Department of Transportation (NJDOT) will need to be obtained and reviewed to support development of the RI/FS Work Plan sampling activities for those sections of Pierson's Creek that are culverted beneath Conrail's Oak Island rail yard, Interstate 78, Newark International Airport, and New Jersey Turnpike.

3.1.2 Quality Assurance Project Plan

A site-specific Quality Assurance Project Plan (QAPP) will be prepared covering activities that will be performed as part of the RI/FS. The QAPP will be prepared in accordance with EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans" (EPA 2006); EPA 505-B-04-900A, "Uniform Federal Policy for Quality Assurance Project Plans" (EPA 2005a) and optimized 2012 worksheets; and current EPA Region 2 QAPP guidance and procedures. The QAPP will be reviewed and subject to approval by EPA.

The QAPP includes sampling objectives; sample locations and frequency; sampling equipment and procedures; personnel and equipment decontamination procedures; sample handling and analysis; and a breakdown of samples requiring analysis, as well as the justification for those analyses.

The logistics of all field investigation activities are described. The QAPP will include a project organization chart and delineate the responsibilities of key field and office team members. A schedule will be included that shows the proposed schedule for each major field activity.

Any significant changes to the QAPP will require an amendment; minor changes will be submitted in a letter to the EPA RPM and EPA QA officer. All modifications of the QAPP must be approved by EPA.

3.1.3 Health and Safety Plan

A HASP will be prepared specifying the health and safety requirements for all field activities to be performed during the RI. The HASP will be in accordance with Subpart B, Section 150, "Worker health and safety" of the National Contingency Plan (NCP) at 40 Code of Federal Regulations (CFR) 300.150, and with 29 CFR 1910.120 (1)(1) and (1)(2). The HASP will be subject to revision, as necessary, based on new information that is discovered during the field investigation.

3.1.4 Pathway Analysis Report

A Pathway Analysis Report will be prepared and submitted in accordance with the "Risk Assessment Guidance for Superfund (RAGS): Part D" (EPA 2001). The submittal will include the conceptual site model (CSM), the RAGS Part D Standard Tables 1 and 4 series, and a description of the risk characterization and how the draft HHRA will be prepared. The Pathway Analysis submittal will contain information necessary for a reviewer to understand how the risks at the Site will be estimated, including the statistical treatment of the data, the methods for selection of the chemicals of potential concern (COPCs), the exposure pathways, receptors and parameters to be used, and the basis for identification of current toxicological values (e.g., the hierarchy in accordance with OSWER Directives 9285.7-53 and 9285.7-86). The Pathway Analysis tables will be prepared after all analytical data are collected, in accordance with the requirements of RAGS Part D Tables 1 and 4. If modeling is recommended, a description of the model and an explanation of the inputs and assumptions will be included in the submittal so their appropriateness can be determined. At EPA's discretion, HHRA Table 1 and 4 and a CSM may be accepted in lieu of a full PAR.

The following receptors and pathways are anticipated for evaluation in the HHRA:

<u>Current/Future Land Use Scenario</u>
Upper Creek (area of potential past flooding)

- Trespassers – Adolescent (12 to 18 years of age)
  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)
- Site Worker - Adult
  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)

Middle Creek (area includes sidecast and potential past flooding)

- Trespassers – Adolescent (12 to 18 years of age)
  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)
- Site Worker - Adult

  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)

- Construction Worker – Adult
  - Incidental ingestion of and dermal contact with contaminated surface/subsurface soil (i.e., top 12 feet of soil)

Lower Creek (areas of potential past flooding adjacent to airport parking lot)

- Trespassers – Adolescent (12 to 18 years of age)
  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)
- Site Worker - Adult
  - Incidental ingestion of and dermal contact with contaminated surface soil (i.e., top 6 inches of soil)

Pierson's Creek and tributaries (non-culverted sections)

- Recreational User/Trespasser – Adult, Adolescent (12 to 18 years of age)
  - Incidental ingestion of and dermal contact with contaminated surface water
  - Incidental ingestion of and dermal contact with contaminated sediment

A fish consumption exposure pathway is currently considered to be incomplete for Pierson's Creek and its tributaries due to the shallow depth of water and the presence of downstream tide gates. However, if the habitat survey determines that fish and/or crabs are present, this exposure pathway will be considered complete and included in the Pathway Analysis submittal and HHRA.

Upon receipt of EPA comments on the Pathway Analysis submittal, a conference call will be scheduled with the EPA RPM and risk assessor to discuss EPA comments. The results of the Pathway Analysis submittal will be included in the draft HHRA described under Subtask 3.7.1.

3.2 Field Investigation

3.2.1 Site Reconnaissance

Site Reconnaissance will be conducted to identify and locate existing monitoring wells, storm sewers in the parking lot areas, seeps and other point source and non-point source discharges to the creek, culverts and other significant drainage infrastructure, potential access locations to buried portions of the creek, background locations and sampling locations. The locations of relevant features to be surveyed will be marked with stakes, paint or flagging, as appropriate.

A topographic and bathometric survey will be conducted by a licensed surveyor covering property boundaries, utility rights-of-way, channel dimensions of Pierson's Creek and its

tributaries, locations and elevations of culverts, locations of potential manholes or other access points, existing monitoring wells and marked locations and site topographic information.

If the site reconnaissance activities listed above do not adequately provide the information necessary to conduct a remedial investigation to adequately characterize the nature and extent of contamination at the site, ROV/robots, subsurface geophysics (ground penetrating radar (GPR) and/or magnetometer), aerial thermal imagery, and dye testing may be required.

3.2.2 Mobilization and Demobilization

This task includes mobilizing personnel, equipment, and materials necessary to perform the field investigation. Mobilization activities will include a field planning meeting, an initial health and safety debriefing for project team members, siting and electrical hookup of a trailer, and purchase/rental and mobilization of equipment and supplies.

Demobilization activities will include removal of all equipment and facilities brought to the site.

Site Access

Access to public areas (roads, sidewalks, etc.) and private property will be needed to execute the field investigation. The PRP will be responsible for obtaining access to private and public properties. If necessary, access support will be provided by EPA.

A list of owners of properties (public and private) to be accessed during the field activities will be provided to EPA. The list will include contact names, mailing addresses and telephone numbers of the property owners. The PRP will coordinate with property owners, local officials, and appropriate City of Newark agencies (for work in public areas) to support sampling activities.

Cultural Resources Survey

In accordance with the National Historical Preservation Act, a Phase IA cultural resources survey will be conducted to determine the presence or absence of cultural resources that may be impacted by the implementation of the RI or Remedial Action (RA).

3.2.3 Hydrogeological Assessment

In order to investigate contamination in site groundwater, 15 existing monitoring wells will be located and evaluated, and if suitable, recommended for use in the RI/FS. Twenty-four additional monitoring wells will also be installed, with the support of a subcontract drilling firm. Oversight and direction of the subcontract drilling firm will occur during well drilling, installation, development, and surveying of monitoring wells. Locations will be selected for the monitoring wells following the completion of site reconnaissance described in **Section 3.2.1**. Preliminary proposed locations are shown on **Figures 3-1 to 3-3**. Final locations will be confirmed with EPA prior to installation.

Monitoring Well Evaluation

Existing monitoring wells will be evaluated to determine their suitability, both conceptually and technically, for sampling and/or for water level measurements required to characterize groundwater for the RI. Existing wells will be visually inspected to determine if the surface completion is intact. The wells will be sounded with a weighted tape and well depths will be compared to well installation records to determine if sediment has entered the well. The wells

will also be redeveloped as described below to ensure a good hydraulic connection with the aquifer. Existing wells that will be used in the RI will be surveyed and all pertinent information will be captured on an EPA well inventory checklist (included in **Appendix A**) and included in the Field Information EDD described in **Section 2.5.3**.

Monitoring Well Installation

Monitoring wells will be installed to straddle the water table, which is expected to be encountered at depths of 2 to 6 feet below ground surface (bgs). Well screens will be 10 feet in length. The proposed drilling method is hollow-stem auger (HSA) drilling with 4.25-inch inside diameter (I.D.) augers to allow installation of a 2-inch I.D. Schedule 40 polyvinyl chloride (PVC) monitoring well. Well installation methods and the intervals screened may be adjusted based on access and the depth to water at each well location.

Split-spoon samples will be collected continuously from the surface to total depth in each well. The split-spoon samples will be lithologically logged by the onsite geologist and scanned with a PID and a mercury vapor detector and sampled as described in **Section 3.3.5.5**. Upon reaching the terminal depth, the annulus around the well screen will be backfilled with sand, which will extend 2 feet above the well screen, followed by a 4-foot bentonite chip seal, which will be allowed to hydrate before the borehole is grouted to the surface. Wells will be completed with heavy duty 6-inch diameter flush-mount curb boxes and fitted with lockable compression plugs. Well drilling and construction details will be specified in the QAPP.

Details on the proposed monitoring well installation locations are provided in **Section 3.3.5.5**.

Monitoring Well Development

Monitoring well development will be performed to remove silt and clay from the well and sand pack and to provide a good hydraulic connection between the well and the aquifer materials. Turbidity, pH, temperature, conductivity, and dissolved oxygen (DO) will be monitored during development. Development will continue until all parameters have stabilized (within 10 percent for successive measurements) and the water is clear. Well development procedures will be detailed in the QAPP.

Synoptic Water Level Measurements

Four rounds of synoptic water levels will be collected to better define groundwater flow and groundwater-surface water interactions in the vicinity of the site. Synoptic water level measurements will be collected with each round of groundwater sampling and concurrent with both the dry weather and wet weather surface water sampling. Measurements from staff gauges will also be collected during each synoptic water level measurement. The location and elevation of each monitoring well and staff gauge will be determined by a licensed land surveyor. Elevation measurements will be made at marked water level measuring points on the steel casing and on the adjacent ground surface.

Groundwater/Surface Water Interaction

Concurrent with the Site Reconnaissance described in **Section 3.2.1**, the creek and its tributaries will be inspected for evidence of groundwater seeps and site runoff. If locations are identified they will be flagged and captured using GPS and included in the site survey.

Staff gauges will be installed in the creek adjacent to each of the seven monitoring well transects. As discussed above, readings from the staff gauges will be collected during the rounds of synoptic water levels. If the staff gauges cannot be installed effectively, installation of stilling wells will be evaluated. The stilling well and the cross section of the creek channel will be surveyed by the survey subcontractor.

In areas where the stream is potentially gaining flow from groundwater or surface runoff, temporary piezometers will be installed in the creek bed and tributaries to measure the hydraulic-head difference between groundwater and surface water. Screened drive-point piezometers will be driven at least 3 feet into the creek bed by hand. Water level measurements relative to the creek bed surface will be collected from the temporary piezometers in conjunction with one round of the synoptic water level measurements described above.

Long-Term Water Level Measurements

Long-term water level monitoring data will be collected to evaluate temporal fluctuations in water levels. Long-term groundwater level monitoring will be conducted at two monitoring well transects and associated staff gauges over a period of 4 weeks. Proposed long term monitoring transect locations include the northernmost transect on the USF Redstar property and the middle transect on the 429 Delancy Street property as shown on **Figures 3-2 and 3-3**. Data will be collected using In-situ vented water level monitoring instruments (or equivalent) capable of storing water level data for the duration of the test. One instrument will be used to record barometric pressure. To provide baseline water levels and to verify the water level measurements, manual water levels will be collected at the start, midpoint, and conclusion of monitoring. At the midpoint of the monitoring period, the data will be downloaded and checked. At the end of the monitoring period, the data will be downloaded and stored for evaluation. Precipitation data for the monitoring period will be obtained from a local weather station.

3.2.4 Environmental Sampling

This subsection summarizes the various field investigations that will be performed to characterize the nature and extent of contamination at the site. These include:

- Sediment investigation
- Surface water investigation
- Soil boring investigation
- Groundwater investigation

Each media is divided into five sections of the site due to the differing physical characteristics and access limitations of each section. The sections are identified on **Figure 3-1**. The sections are the upper creek section (**Figure 3-2**), middle creek section (**Figure 3-3**), the lower creek section (**Figure 3-4**), the culverted section (**Figure 3-1**) and Port Newark Channel (**Figure 3-5**). Sample numbers and locations are assumed, but with the consent of EPA may need to be adjusted following site reconnaissance. All samples collected will be split with EPA, if requested.

3.2.4.1 Sediment Investigation

The purpose of sediment sampling is to delineate the horizontal and vertical extent of contamination at the site. Sediment cores will be collected using DPT sampling techniques. Sample cores in the upper creek section, middle creek section, and lower creek section will be collected to the native material contact and will include a minimum of 6-inches of native material. If native material is not encountered, cores will be collected to a maximum depth of 5 feet below the sediment surface or to refusal, if refusal is less than 5 feet. Cores will be scanned with a mercury vapor detector and a PID and described for lithology. Sample intervals may need to be adjusted based in depth to native sediment. Changes in sample intervals will be reviewed and approved by EPA. Sample analyses are presented in **Table 3-1**. Sampling and analytical methods will be detailed in the QAPP.

Upper Creek Section (Figure 3-2)

- Seven analytical samples will be collected from each boring, at depths of 0 to 0.5 foot, 0.5 to 1 foot, 1 to 2 feet, 2 to 3 feet, 3 to 4 feet, 4 to 5 feet, and the top 6 inches of native sediment (if encountered). Sediment cores will be collected approximately every 200 feet within the tributary to Pierson' Creek, for a total of six locations. The width of the channel will be measured and the boring will be collected at the location within the baseflow channel which has the greatest accumulation of sediment.
- Sediment cores will be collected every 100 feet in the Pierson's Creek channel south of Troy Chemical, for a total of four locations.
- Two transects of sediment cores will be collected within the upper creek section (Figure 3-2). Two sediment cores will be collected within the channel and one will be taken from each creek slope, for a total of four borings at each transect location (8 borings). Borings will be located in areas with the greatest deposition of sediments.

Middle Creek Section (Figure 3-3)

- Seven analytical samples will be collected from each boring, at depths of 0 to 0.5 foot, 0.5 to 1 foot, 1 to 2 feet, 2 to 3 feet, 3 to 4 feet, 4 to 5 feet, and the top 6 inches of native sediment (if encountered). Sediment cores will be collected approximately every 200 feet within the two tributaries to Pierson' Creek in this area, for a total of eight locations. The width of the channel will be measured and the boring will be collected at the location within the baseflow channel which has the greatest accumulation of sediment.
- Sediment cores will be collected every 100 feet in the Pierson's Creek channel, for a total of nine locations.
- Two additional sediment cores will be collected where the tributaries enter Pierson's Creek.
- Three transects of sediment cores will be collected within the middle creek section (**Figure 3-3**). Two sediment cores will be collected within the channel and one will be taken from each creek slope, for a total of 4 boring locations at each of the three transections (12 borings). Borings will be located in areas with the greatest deposition of sediments.

Lower Creek Section (Figure 3-4)

Seven analytical samples will be collected from each boring, at depths of 0 to 0.5 foot, 0.5 to 1 foot, 1 to 2 feet, 2 to 3 feet, 3 to 4 feet, 4 to 5 feet, and the top 6 inches of native sediment (if encountered). Samples collected from culverted areas will be grab samples from the top 0.5 feet of sediment, if available.

- Sediment cores will be collected approximately every 200 feet within the three tributaries to Pierson' Creek, for a total of seven locations. The width of the channel will be measured and the boring will be collected at the location within the baseflow channel which has the greatest accumulation of sediment.
- Large portions of Pierson's Creek are below ground in the lower creek section. Sediment samples will be collected every 100 feet in the Pierson's Creek channel where access is assumed, for a total of 10 locations. These locations are not shown on Figure 3-4 as access is currently undetermined.
- Three additional sediment cores will be collected where the tributaries enter Pierson's Creek.
- Three sediment grab samples will be collected from the culverted areas of this section, one from reach under the rail yard and two from below the parking lot.
- Additional sampling methods, including sampling from manholes or using remotely operated vehicles (ROVs) may be necessary to collect samples from the underground portions of Pierson's creek.

Culverted Section (Figure 3-1)

Samples collected from culverted areas will be grab samples from the top 0.5 feet of sediment, if available.

- Five grab samples will be collected from within the culverted section, approximately every 500 feet. These locations are not shown on Figure 3-1 as access is currently undetermined.
- Additional sampling methods, including sampling from manholes or using ROVs may be necessary to collect samples from the underground portions of Pierson's creek.

Port Newark Channel (Figure 3-5)

Ten sediment cores will be collected from within Port Newark Channel using the vibracore coring method. Cores will be scanned with a mercury vapor detector and a PID and lithologic descriptions recorded. For planning purposes, cores will be collected to a depth of 10 feet below the sediment surface. Seven analytical samples will be collected from each core, at depths of 0 to 0.5 foot, 0.5 to 1 foot, 1 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet, 8 to 10 feet, and the top 6 inches of native sediment (if encountered). Sample intervals may need to be adjusted based on the depth to native sediment. Changes in sample intervals will be reviewed and approved by EPA. Sample analyses are presented in Table 3-1. Sampling and analytical methods will be detailed in the QAPP.

3.2.4.2 Surface Water Investigation

The purpose of surface water sampling is to characterize the nature and extent of contamination within Pierson's Creek and the potential contributions of its tributaries. Two rounds of surface water samples will be collected, one under dry conditions and one under wet conditions during a rainfall event. The purpose of dry weather sampling is to assess baseline transport conditions. The purpose of wet weather sampling is to assess contaminant transport under conditions when contaminants will be mobilized from creek sediments and from areas within the drainage basin.

Dry conditions are defined as 0.1-inch or less of rain during the antecedent 48 hours. Wet conditions are considered to be a minimum of 0.5 inch of precipitation within an 8-hour period following a 48-hour dry period. Mobilization protocol for the dry and wet weather sampling will be detailed in the QAPP.

Surface water samples will be collected at multiple depths within the water column if the depth of water allows. If the water column of the creek is greater than 4-feet then samples will be collected from depths 6-inches below the water surface and 6-inches from the bottom of the creek. It is assumed however for this work plan that the water depth is shallower and only one sample will be collected from 6-inches below the water surface at each surface water sampling location.

The dry weather surface water sampling will be performed in conjunction with the sediment sampling. The co-located sampling locations will be sampled starting with downstream locations moving in the upstream direction to minimize potential mobilization of contamination into the water column. Sample analyses are presented in **Table 3-1**. Sampling and analytical methods will be detailed in the QAPP.

Upper Creek Section (Figure 3-2)

- Three surface water samples will be collected from the tributary in this section. Samples will be co-located with sediment core locations as shown on **Figure 3-2**.
- Four surface water samples will be collected from Pierson's Creek and co-located with the sediment transect locations as shown on **Figure 3-2**.

Middle Creek Section (Figure 3-3)

- Three surface water samples will be collected from Pierson's Creek and co-located with the sediment core locations.
- One surface water sample will be collected from Pierson's Creek where the creek emerges from passing under Delancy Street at the top of the section and one will be collected at the bottom of the middle creek section before the Pierson's Creek passes under Conrail Access Road. These samples are co-located with sediment cores.
- Two additional surface water samples will be collected where the tributaries enter Pierson's Creek. These samples are co-located with sediment cores.

Lower Creek Section (Figure 3-4)

- In the lower creek section, four surface water samples will be collected from Pierson's Creek where the creek enters and leaves culverts and co-located with the sediment core locations.
- Three additional surface water samples will be collected where the tributaries enter Pierson's Creek and will be co-located with sediment core locations.
- Three surface water grab samples will be collected from the culverted areas of this section, one from reach under the rail yard and two from below the parking lot.
- Additional sampling methods, including sampling from manholes or using ROVs may be necessary to collect samples from the underground portions of Pierson's creek.

Culverted Section (Figure 3-1)

- Five grab samples will be collected from within the culverted section, approximately every 500 feet.
- Additional sampling methods, including sampling from manholes or using ROVs may be necessary to collect samples from the underground portions of Pierson's creek.

Port Newark Channel (Figure 3-5)

- A surface water sample will be collected from the outfall of Pierson's Creek in to Port Newark.
- During collection of the water sample from the Pierson's Creek discharge to Port Newark Channel, a surface water sample will also be collected at mid-depth from the Port Newark Channel, at the location shown in **Figure 3-5**.

Point Sources

- Point and non-point discharges to Pierson's Creek or its tributaries identified during the site reconnaissance will be included in surface water sampling program. Sampling locations and sample analyses will be identified and discussed with EPA prior to conducting sampling of point and non-point discharges. For planning purposes, it is assumed that six point and non-point discharge locations will be identified and sampled during the dry and wet weather sampling.

3.2.4.3 Soil Investigation

The purpose of soil sampling is to characterize the nature and extent of contaminated soil within the Pierson's Creek watershed which can be eroded into the creek and to evaluate whether the soils adjacent to the creek have been impacted by creek overflow. One round of soil samples will be collected using either a direct push technology (DPT) drill rig or hand sampling methods depending on site access to a total depth of 5-feet bgs. Five analytical samples will be collected from each boring, at depths of 0 to 0.5 feet, 0.5 to 1.5 feet, 1.5 to 3 feet, 3 to 5 feet. Procedures for soil sampling will be detailed in the QAPP. Sample analysis is presented in **Table 3-1**.

Upper Creek Section (Figure 3-2)

- Three soil borings will be collected from adjacent to the tributary in this section. Sample locations are shown on **Figure 3-2**.

Middle Creek Section (Figure 3-3)

- Fifteen soil borings will be collected from the area adjacent to Pierson's Creek and the area between Pierson's Creek and the tributary to the east. Sample locations are shown on **Figure 3-3**.

Lower Creek Section (Figure 3-4)

- Nine soil borings will be collected from areas adjacent to the creek that may be associated with the former landfill in the area, or in areas where flooding may have mobilized site contaminants to the soils. If other areas of potential flooding/overflow or potentially erodible contaminated soils are identified during site reconnaissance additional sampling locations may be required.

Port Newark Channel (Figure 3-5)

- No soil samples are planned for this section of the site.

3.2.4.4 Groundwater Investigation

The purpose of the groundwater investigation is to delineate the impact of groundwater on the nature and extent of contamination within the creek and evaluate the groundwater-surface water interactions. Well installation and groundwater-surface water interactions are discussed in **Section 3.2.3**.

In order to meet these goals wells will generally be installed in transects within 50 feet from the edge of the creek bank. To provide some variation in the distance from the creek bank for evaluating groundwater gradient, where conditions allow, some wells will be placed up to 75 feet from the top of the bank. Wells on the western portion of the Engelhard property will be no more than 50 feet from the bank of the creek because future development is planned up to 50 feet from the bank of the creek.

Two rounds of groundwater samples will be collected from 15 existing and 22 newly installed wells. Sample analysis is presented in **Table 3-1**. Wells will be sampled using the low-flow sampling methods. Sampling methods will be detailed in the QAPP.

Upper Creek Section (Figure 3-2)

- Eleven historical wells are located in this section of the site.
- Eight new wells will be installed in this section of the site. The wells are located in a transect perpendicular to Pierson's Creek where the sediment transects are located.

Middle Creek Section (Figure 3-3)

- Four historical wells are located in this section of the site.
- Twelve new wells will be installed in this section of the site. The wells are located in a transect perpendicular to Pierson's Creek where the sediment transects are located.

Lower Creek Section (Figure 3-4)

- Four new wells will be installed in this section of the site.

Port Newark Channel (Figure 3-5)

- No groundwater samples are planned for this section of the site.

Existing wells will be identified during site reconnaissance and the number of existing wells to be sampled is subject to change and will be approved by EPA.

3.2.4.5 Air Investigation

Ambient air samples for mercury vapor will be collected at locations along the banks of the open portions (not culverted) of Pierson's Creek. Samples will be collected at each sediment sampling transect as well as other sediment sampling locations if elevated mercury vapor readings are detected during field screening of the breathing zone during sample collection by a Jerome mercury vapor analyzer.

Sample analysis is presented in **Table 3-1**. Active (vs. passive) air sampling for mercury vapor will be conducted using sorbent tubes and calibrated air pumps. Sampling methods will be detailed in the QAPP.

3.2.5 Ecological Characterization

An Ecological Characterization will be performed that will include a qualitative assessment of general Site habitats. Information regarding the presence of threatened and endangered species, and ecologically sensitive environments that may exist at or in the vicinity of the Site will be requested from the appropriate agencies.

The field effort will identify Site habitats both within and in the vicinity of the Site that may potentially be affected by Site contaminants. Site conditions and conditions of the adjacent area will be visually inspected. Representative photographs to document field activities will be taken. Observations of general site habitats, wildlife utilization, and contaminant exposure pathways will be made and include the types of information summarized below.

- Vegetation cover types on and in areas immediately adjacent to the Site
- Dominant vegetation species and general visual observations of abundance/diversity
- Topographic features (e.g., drainages, sinkholes)
- Location of surface waters and their general aquatic habitat characteristics (e.g., approximate size, flow and direction, bottom substrate, and plant coverage)

- Observations of wildlife use, including (to the extent practicable) species identification and evidence of usage
- Indications of environmental stress that may be related to site contaminants

The results of this characterization will be used in the SLERA and in the ecological characterization section of the RI report.

3.2.6 Investigation Derived Waste Characterization and Disposal

The PRP will be responsible for the removal and proper disposal of all IDW, including drilling cuttings, waste soils, liquids, solids, and personal protective equipment. Representative waste samples will be collected and analyzed by a laboratory to characterize the waste. Field oversight and health and safety monitoring will be conducted during all waste disposal field activities.

Disposal of IDW is subject to EPA approval under EPA's Off-Site Disposal Rule (September 22, 1993 [52 FR 49200]) and 40 CFR 300.440.

3.3 Analytical Support and Data Validation

3.3.1 Data Validation

All laboratory data will be validated. All chemical data will be validated in accordance with the most recent EPA Region 2 data validation protocols. The validation will determine the usability of the data. The data validation reports will be submitted to EPA after all data have been validated. Data validation will verify that the analytical results were obtained following the protocols specified in the QAPP and are of sufficient quality to be relied upon to prepare the RI report, HHRA report, FS report, and to support a ROD.

3.4 Data Evaluation

This task includes efforts related to the compilation of analytical and field data. All validated data generated during this RI will meet EPA Region 2 EDD requirements. Tables, figures, and maps will be generated from the data to support preparation of the RI report, the HHRA report, and the FFS report. The data will be reviewed and carefully evaluated to identify the nature and extent of site-related contamination.

3.4.1 Data Usability Evaluation

The usability of the data, including any uncertainties associated with the data, will be fully evaluated in a data evaluation report (DER). The data validation reports will be reviewed and field sampling techniques, laboratory analytical methods and techniques, and data validation will all be considered in evaluating the usability of the data. The usability of the data will be evaluated using the DQOs as defined in the QAPP. Any rejected data will be discussed in the DER.

The existing data listed below were generated under an EPA-approved QAPP. Analyses were performed by an EPA laboratory or by a laboratory that met the requirements established in the EPA-approved QAPP. These data are considered usable in the RI/FS and risk assessments.

- HRS data, Pierson's Creek (Weston Solutions 2013)

- Newark Bay Study Area Phase 1 and Phase 2 sediment coring data (Tierra Solutions 2008)

Existing data, other than the data listed above, that is proposed for use in the RI/FS and risk assessments must be reviewed and validated in accordance with the EPA-approved QAPP and subject to a data usability assessment in accordance with applicable EPA requirements and guidance including EPA Guidance for Data Usability in Risk Assessment (EPA 1992). Data usability assessments will be submitted to EPA for review and approval before using the data in the RI/FS or risk assessments.

3.4.2 Data Reduction, Tabulation and Evaluation

This subtask will include reduction, tabulation, and evaluation of the data collected during the RI field activities. This subtask includes the following activities.

Database Management

Data will be stored in EQuIS™ and can be exported as required to support the analysis and presentation of data. The system will provide data storage, retrieval, and analysis capabilities, and be able to interface with a variety of spreadsheet, word processing, statistical, and graphics software packages to meet the full range of site and media sampling requirements for an RI/FS. Analytical parameters are presented in Table 3-1. Database management activities, including upload of field sample information, will be performed for all of the samples collected during the RI field program (includes field quality control samples).

All data entry will be checked for QC throughout the multiple phases of the project. Tables that compare analytical results with both state and federal applicable or relevant and appropriate requirements (ARARs) will be prepared and evaluated.

Well Construction and Soil Boring Logs

Lithologic data from boring and well installation and well construction information will be used to generate soil boring logs, well construction diagrams, and cross sections. Lithologic and well construction data will be transferred to EQuIS™ and transferred to EPA when they are available. The following data logs will be generated:

- boring logs for the creek sediment and soil borings
- monitoring well completion logs
- channel sediment core logs

GIS and Figures

A site geographic information system (GIS) (including a basemap) will be created in order to facilitate spatial analysis of the data and to generate figures for reports and presentations. As samples are collected and wells are installed, the locations will be registered in the GIS. Current and select historical analytical results will be added, creating functionality that will be used to support data visualizations appropriate to complement the RI report, FS report, HHRA, and SLERA.

Electronic Data Deliverable

An EDD will be prepared in accordance with EPA Region 2 EDD requirements https://www.epa.gov/superfund/region-2-superfund-electronic-data-submission. The EDD will include the analytical and geologic data generated during the course of the RI as well as the GIS basemap.

3.4.3 Modeling (Optional)

Groundwater modeling is not required by EPA at this time. If during the course of this RI/FS EPA determines performance of this subtask is necessary, the existing data collected under the field investigation will be evaluated and an assessment made of the need for modeling to complete an accurate characterization of the nature, extent, distribution and movement of site contamination. This evaluation is expected to cover the historical distribution and movement of site contamination (forensic modeling) to help identify potential source areas. A technical memorandum will be prepared summarizing the results of this evaluation and recommendations concerning performance of modeling for this RI/FS. Based on its review of this technical memorandum, EPA will determine whether modeling will be conducted for this RI/FS.

3.4.4 Data Evaluation Summary Report

A Data Evaluation Summary Report (DESR) will be prepared to summarize the findings of the RI and identify any gaps in the RI data. EPA will review the Data Evaluation Summary Report and determine if gaps exist in the RI data and whether any supplemental investigation activities are required. Supplemental investigation and data collection activities may include, but are not limited to, the following:

- Activities related to characterization of the underground (culverted) portion of the creek
  - GPR to identify stormwater or other piping connections
  - Robotics to investigate the condition of the underground sections of the creek and stormwater connections
  - Dye studies to verify pipe connections to the creek
- Identification and characterization of upland sources potentially impacting the creek
  - Installation and sampling of well to characterize upland groundwater sources
  - Hydrogeologic studies further characterize groundwater flow and discharge to the creek
  - Soil sampling to characterize upland soil sources
  - Sampling of discharges (via pipes or runoff) to characterize discharges from upland sources
- Further study of potential groundwater discharge to the creek based on data gap evaluation
  - Sediment porewater sampling at select locations

- Study of potential for vapor intrusion based on data gap evaluation
  - Vapor intrusion sampling at select locations
- Sampling and analysis
  - Mercury speciation of sediments using electron microprobe technology
  - Biota tissue sampling to support ecological risk assessment
  - Fish and crab tissue sampling to support evaluation of human health risks and hazards due to fish/crab consumption

3.5 Assessment of Risk

The objective of the HHRA is to provide an evaluation of potential threats to human health that could occur from exposure to contaminants originating from the site in the absence of any remedial action. The risk assessment also provides the basis for determining whether remedial action is necessary and the justification for performing remedial actions.

3.5.1 Human Health Risk Assessment

A baseline HHRA will be prepared in accordance with the "Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual" (EPA 2001), using the most current toxicity values. The HHRA in will be prepared in accordance with the approach and parameters described in the approved Pathway Analysis submittal.

Draft Baseline Human Health Risk Assessment

Hazard Identification. Identify and describe the COPCs based on their intrinsic toxicological properties, their frequency of detection, their classification as a nutrient, examination of viable exposure routes, and statistically generated exposure point concentrations (EPCs).

Characterization of Site and Potential Receptors. Identify and characterize human populations in the exposure pathways.

Exposure Assessment. The exposure assessment will identify the magnitude of actual or potential human exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. The exposure assessment will include an evaluation of the likelihood of such exposures occurring and will provide the basis for the development of acceptable exposure levels. In preparing the exposure assessment, reasonable maximum estimates and central tendencies of exposure (when appropriate) will be developed for potential future land use conditions at the Site. The justification and rationale for use of site-specific over default exposure factors will be provided. Note: Calculations of 95% upper confidence limits (UCLs) will be made using ProUCL Version 5.1 (or most current) for the purpose of selecting EPCs.

Toxicity Assessment. All toxicity values (slope factors and reference doses) for the COPCs and the sources of the toxicity values will be provided, in accordance with EPA's current toxicity hierarchy, as specified in "Human Health Toxicity Values in Superfund Risk Assessments" (EPA

2003). Chemicals without assigned toxicity values in Tiers 1 and 2 will be submitted to EPA for review and determination of the appropriate values.

Risk Characterization. During risk characterization, chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, will be compared to measured levels of contaminant exposure and the levels predicted through environmental fate and transport modeling. (note: empirical data are preferred over levels predicted through modeling, and will be used where available) These comparisons will determine whether concentrations of contaminants at or near the site are affecting or could potentially affect human health. Based on these results, other concerns important to the risk characterization, such as a qualitative discussion of chemicals without toxicity data and how concentrations found on site relate to background concentrations will be addressed.

Identification of Limitations/Uncertainties. Critical assumptions and uncertainties (e.g., background concentrations and conditions, modeling inputs, toxicity data, environmental data, etc.) will be identified in the report.

Site Conceptual Model. A conceptual model of the Site will be developed based on the contaminant identification, exposure assessment, toxicity assessment, and risk characterization. The model will initially be submitted as part of the PAR (Subtask 3.1.4).

Final Baseline Human Health Risk Assessment Report
A Final Baseline HHRA Report will be submitted incorporating all EPA review comments.

3.5.2 Ecological Risk Assessment

A Screening Level Ecological Risk Assessment (SLERA) will be prepared in accordance with the current Superfund ecological risk assessment guidance "Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments" (EPA 1998). Maximum contaminant concentrations in each medium of concern will be compared to appropriate conservative ecotoxicity screening values and will use conservative exposure estimates. EPA will review and approve the SLERA and determine whether a full Baseline Ecological Assessment is required. At EPAs direction, a Baseline Ecological Risk Assessment will be performed in accordance with Ecological Risk Assessment Guidance for Superfund (ERAGS).

The SLERA will evaluate and assess the risks to the environment posed by Site contaminants. The activities described below will be performed.

Draft Screening Level Ecological Risk Assessment Report
The draft SLERA report will addresses the topics described below.

Hazard Identification (sources). Available information on the hazardous substances present at the Site will be reviewed and the major contaminants of concern will be identified.

Dose-Response Assessment. Identify and select contaminants of concern based on their intrinsic toxicological properties.

Characterization of Site and Potential Receptors. Identify and characterize environmental exposure pathways.

Select Chemicals, Indicator Species, and End Points. In preparing the assessment, select representative chemicals, indicator species (species that are especially sensitive to environmental contaminants), and end points on which to concentrate.

Exposure Assessment. The exposure assessment will identify the magnitude of actual or environmental exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. The exposure assessment will include an evaluation of the likelihood of such exposures occurring and will provide the basis for development of acceptable exposure levels. In preparing the exposure assessment, reasonable maximum estimates of exposure will be developed for both current and potential land use conditions at the Site.

Toxicity Assessment/Ecological Effects Assessment. The toxicity and ecological effects assessment will address the types of adverse environmental effects associated with chemical exposures, the relationships between magnitude of exposure and adverse effects, and the related uncertainties for contaminant toxicity (e.g., weight of evidence for a chemical's carcinogenicity).

Risk Characterization. As part of the risk characterization, compare chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, to measured levels of contaminant exposure levels and the levels predicted through environmental fate and transport modeling. These comparisons will determine whether concentrations of contaminants at or near the Site are affecting or could potentially affect the environment.

Identification of Limitations/Uncertainties. Identify critical assumptions (e.g., background concentrations and conditions) and uncertainties in the report.

Site Conceptual Model. Develop a conceptual model of the Site based on contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

Final Screening Level Ecological Risk Assessment Report
A final Screening Level Ecological Risk Assessment Report will be prepared incorporating all EPA review comments.

3.6 Treatability Study and Pilot Testing

Remedial technologies that may be suitable to the Site should be identified as early as possible to determine whether there is a need to conduct treatability studies to better estimate performance capabilities and costs. The treatability study would determine the suitability of remedial technologies to Site conditions and problems. The three levels of treatability studies are: laboratory screening, bench-scale testing, and pilot-scale testing. The laboratory screening is used to establish the validity of a technology to treat waste and is normally conducted during the Feasibility Study. Bench-scale testing is used to identify the performance of the technology specific to a type of waste for an operable unit; bench-scale tests are often conducted during the FS. Pilot-scale testing is used to provide quantitative performance, cost, and design information for remediation, and is typically performed during the RI/FS. EPA's "Guide for Conducting Treatability Studies under CERCLA, Final" (1992c) will be followed.

3.6.1 Literature Search

Viable technologies that may be applicable to site-related contaminants and the Site conditions encountered will be researched. A technical memorandum to the EPA RPM will be prepared summarizing the results of the literature research and assessing the need for additional treatability studies. The technical memorandum will also include a plan recommending performance of a treatability study at one of the above levels and identifying the types and specific goals of the study. The treatability study will determine the suitability of remedial technologies to Site conditions and problems. Based on its review of this technical memorandum, EPA will determine whether a bench test or pilot study will be conducted for this project, and will direct CDM Smith to prepare an addendum to this RI/FS work plan describing the detailed approach for performance of the treatability study, in accordance with the requirements described in **Subtask 3.6.2** below.

3.6.2 Treatability Study Work Plan (Optional)

If EPA determines that this task is needed, the treatability study work plan addendum will be prepared and describe in detail the treatment process and how the proposed technology or vendor (if the technology is proprietary) will meet the performance standards for the Site. The treatability study work plan addendum will address how the proposed technology or vendor of the technology will meet all discharge or disposal requirements for any and all treated material, air, water, and expected effluents. In addition, the work plan addendum will explain the proposed final treatment and disposal of all material generated by the proposed treatment system. The treatability study work plan addendum will describe the technology to be tested, test objectives, test equipment or systems, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety procedures, and residual waste management. The data quality objectives (DQO) for the treatability study will also be documented. If pilot-scale treatability studies are to be done, the treatability study work plan addendum will describe pilot plant installation and startup, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed off-site, the addendum will address permitting requirements. The addendum will include a proposed schedule for performing the treatability study, with specific dates for each task and subtask (including anticipated EPA review periods). Key milestones for which completion dates will be specified include procurement of subcontractors, sample collection, sample analysis and preparation of the treatability study report.

3.6.3 Conduct Treatability Studies (Optional)

If EPA determines that this task is needed a treatability study will be conducted in accordance with the approved treatability study addendums to the RI/FS work plan, QAPP, and HASP, to determine whether the remediation technology (or vendor of the technology) can achieve the required performance standards. The activities described below are required as part of the performance of the treatability study and pilot testing.

<u>Procure Test Facility and Equipment</u>. Procure the subcontractors, test facility and equipment necessary to perform the tests.

<u>Test and Operate Equipment.</u> Test the equipment to ensure proper operation, and operate or oversee operation of the equipment during the testing.

Retrieve Samples for Testing. Collect samples for testing as specified in the treatability study work plan addendum.

Perform Laboratory Analysis. Establish a field laboratory to facilitate fast turnaround analysis of test samples, or if necessary, will procure subcontractor laboratory services to analyze the test samples and evaluate test results.

Characterize and dispose of residual wastes. Ensure that residual wastes are characterized and disposed of in accordance with the work plan addendum and QAPP.

3.6.4 Treatability Study Report (Optional)

If EPA determines that this task is needed, a treatability study evaluation report will be prepared that describes the performance of the technology. The study results will clearly describe the performance of the technology or vendor in comparison with the performance standards established for the site. The report will also evaluate the treatment technology's effectiveness, implementability, cost, and final results as compared with the predicted results. The report will evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

3.7 Remedial Investigation Report

An RI report will be developed and submitted that accurately establishes Site characteristics including the identification of contaminated media, definition of the extent of contamination in Site media, and delineation of the physical boundaries of contamination. Sampling data will be used to identify key contaminants and determine the movement and extent of contamination in the environment. Key contaminants will be identified in the report and will be selected based on toxicity, persistence, and mobility in the environment.

3.7.1 Draft Remedial Investigation Report

A draft RI report will be prepared in accordance with the format described in EPA guidance documents such as the "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA 1988). A draft outline of the report, adapted from the 1988 guidance, is shown in **Table 3-2**. This outline should be considered draft and subject to revision based on the data obtained. Upon completion, the draft RI report will be submitted to EPA, and other city, state, and federal agencies, as directed by EPA, for formal review and comment.

3.7.2 Final Remedial Investigation Report

Upon receipt of all EPA and other federal and state written comments, responses to significant comments will be developed. EPA will review and approve the responses and the report will be finalized in accordance with the EPA approved responses.

3.8 Remedial Alternatives Screening

This task covers the development of appropriate remedial alternatives that will undergo full evaluation. The alternatives will encompass a range, including innovative treatment technologies, consistent with the regulations outlined in the National Contingency Plan (NCP), 40 CFR Part 300, the "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA"

(EPA 1998), and other applicable Office of Solid Waste and Emergency Response (OSWER) directives, policies and guidance (including "Considerations in Ground Water Remediation at Superfund Sites," (EPA 1989), and "Considerations in Ground Water Remediation at Superfund Sites - Update," (EPA 1992).

Alternatives will be investigated that will remediate or control contaminated media related to the Site, as defined in the RI, to provide adequate protection of human health and the environment. The potential alternatives will encompass, as appropriate, a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes but vary in the degree to which long-term management of residuals or untreated waste is required. Innovative treatment technologies will be included. One or more alternatives will be included that involve containment with little or no treatment, as well as a no-action alternative.

The alternatives will be screened qualitatively against three criteria: effectiveness, implementability, and relative cost. A brief description of the application of these criteria is presented below.

- Effectiveness - The evaluation focuses on the potential effectiveness of technologies in meeting the remedial action goals; the potential impacts to human health and the environment during construction and implementation; and how proven and reliable the process is with respect to the contaminants and conditions at the site.
- Implementability - This evaluation encompasses both the technical and administrative feasibility of the technology. It includes an evaluation of treatment requirements, waste management, and relative ease or difficulty in achieving the operation and maintenance requirements. Technologies that are clearly unworkable at the site are eliminated.
- Relative Cost - Both capital cost and operation and maintenance cost are considered. The cost analysis is based upon engineering judgment, and each technology is evaluated as to whether costs are high, moderate, or low relative to other options within the same category.

The screening evaluation will generally focus on the effectiveness criterion, with less emphasis on the implementability and relative cost criteria. Technologies surviving the screening process are those that are expected to achieve the remedial action objectives for the Site, either alone or in combination with others.

3.8.1 Technical Memorandum

A technical memorandum will be prepared and a meeting with EPA will be attended that describes the remedial technology screening and that includes the information summarized below.

- Establish Remedial Action Objectives. Based on existing information, site-specific remedial action objectives will be identified that should be developed to protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).

- Establish General Response Actions. General response actions will be developed for each medium of interest by defining contaminant, treatment, excavation, pumping, or other actions, singly or in combination to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characteristics of the site.

- Identify and Screen Applicable Remedial Technologies. Technologies will be identified and screened based on the general response actions. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other Site characteristics will be considered. This screening will be based primarily on a technology's ability to address the contaminants at the site effectively, but will also take into account that technology's implementability and cost. Representative process options will be selected, as appropriate, to carry forward into alternative development and will identify the need for treatability testing for those technologies that are probable candidates for consideration during the detailed analysis.

- Develop Remedial Alternatives in accordance with the NCP. Subsequent to the screening of the applicable remedial technologies and process options, remedial action alternatives will be developed by combining the retained remedial technologies and process options. Remedial alternatives are developed from either stand-alone process options or combinations of the retained process options.

- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost. Alternatives will be screened to identify the potential technologies or process options that will be combined into media-specific or site-wide alternatives. The developed alternatives will be defined with respect to size and configuration of the representative process options, time for remediation, rates of treatment, spatial requirements, distance for disposal, required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct viable options are available and developed, the alternatives undergoing detailed analysis will be screened to provide the most promising process options.

The technical evaluations completed as part of this task will also be summarized and presented to EPA in a technical meeting following submission of the technical memorandum.

3.8.2 Final Technical Memorandum

As directed by EPA, this subtask is not applicable. EPA's review comments on the technical memorandum will be incorporated into the draft FS report.

3.9 Remedial Alternatives Evaluation

Detailed descriptions of the individual remedial alternatives will be developed and the alternatives will be assessed against each of the nine current evaluation criteria and the comparative analysis of remedial alternatives with respect to the evaluation criteria. The analysis will be consistent with the National Contingency Plan, 40 CFR Part 300 and will consider the "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA" (EPA 1988) and other pertinent guidance.

The nine criteria are: (1) overall protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements (ARARs); (3) long-term effectiveness; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state acceptance; and (9) community acceptance. These evaluation criteria are detailed in **Table 3-3**.

Each remedial alternative will be subject to a detailed analysis according to the first seven of the nine above evaluation criteria (State and community acceptance will be addressed later). A comparative analysis of all alternatives will then be performed to evaluate the relative benefits and drawbacks of each according to the same seven criteria.

3.9.1 Technical Memorandum

A Technical Memorandum will be prepared to discuss the following topics: (1) a technical description of each alternative will outline the waste management strategy involved and identify the key ARARs associated with each alternative; and (2) a summary of each alternative compared to the evaluation criteria. Tables will be provided that summarize the evaluations. At EPA's discretion, a meeting may be held in lieu of a technical memorandum to discuss the remedial alternatives and their evaluation against the evaluation criteria.

3.10 Feasibility Study Report

A feasibility study report will be developed consisting of a detailed analysis of alternatives and a cost-effectiveness analysis, in accordance with the NCP (40 CFR Part 300) as well as the most recent guidance.

3.10.1 Draft Feasibility Study Report

A draft feasibility study report will be submitted to EPA that includes the following detailed information. The draft FS report will address comments received from EPA and other reviewers on the Technical Memorandum submitted under Task 10 and the meeting under Task 11.

- Summary of the RI – Summarize key elements of the RI including the nature and extent of contamination in all site media of concern, the fate and transport factors that affect the identified contamination, and the results of the site risk assessments.
- Establish Remedial Action Objectives.
- Identify General Response Actions.
- Screen Applicable Remedial Technologies - EPA may, if applicable, request an analytical flow model to support groundwater flow and plume capture model of the hydrogeologic system at the Site and surrounding area.
- Develop Remedial Alternatives in accordance with the NCP - Assemble technologies into remedial alternatives to address the identified contamination at the Site.
- Screen Remedial Alternatives for effectiveness, implementability, and cost.

- Develop Detailed Alternative Descriptions - Develop detailed technical descriptions of each alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative.
- Screen Against Evaluation Criteria - Present discussions that describe the performance of each alternative with respect to the evaluation criteria described in Section 3.11. The results of the analysis will be summarized in a table.
- Comparative Evaluation of Alternatives - Compare and contrast the alternatives to one another, with respect to each of the evaluation criteria.

The technical feasibility considerations will include the careful study of any problems that may prevent a remedial alternative from mitigating site problems. Therefore, the Site characteristics from the RI will be kept in mind as the technical feasibility of the alternative is studied. Specific items to be addressed will be reliability (operation over time), safety, operation and maintenance, ease with which the alternative can be implemented, and time needed for implementation.

Evaluation criteria are shown on Table 3-3. The executive summary will be a brief overview of the FS and the analysis underlying the remedial actions that were evaluated.

The draft FS report will be reviewed by a Technical Review Committee (TRC). TRC comments will be addressed prior to submittal to EPA, and other city, state, and federal agencies, as directed by EPA, for formal review and comment.

3.10.2 Final Feasibility Study Report

Upon receipt of all EPA and other federal and state written comments, a response to comments letter for major comments will be prepared. After EPA approves the responses, the FS report will be finalized for submittal to EPA.

Section 4

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Tables

Table 3-1
Field Sampling Program Summary
Pierson's Creek Site
Newark, New Jersey

Task	Section	Locations	Laboratory TAT	Sampling/Measurement Activities					
				Frequency / Intervals	Analytical Parameters			Field Parameters	Total Samples[1]
					DESA or CLP	DESA	Subcontract Lab		
Sediment Sampling	Background	3 cores	42 days validated	0 to 0.5, 0.5 to 1, 1 to 2, 2 to 3, 3 to 4 and 4 to 5 feet, and top 6 inches of native sediment	TCL organics, CN, filtered and unfiltered TAL metals and Hg	grain size, TOC	Dioxins/ Furans from transect locations; Total, elemental and methylmercury, % total solids, mercury by sequential extraction (0-0.5 feet only)	none	21
	Upper Creek Section	18 cores							126
	Middle Creek Section	31 cores							217
	Lower Creek Section	20 cores							140
	Lower Creek Section/Culverted Section	8 samples		Grab Sample					8
	Port Newark Channel Background	3 cores		0 to 0.5, 0.5 to 1, 1 to 2, 2 to 4, 4 to 6, 6 to 8 and 8 to 10 feet, and top 6 inches of native sediment					21
	Port Newark Channel	10 cores							84
Waste Characterization Sediment Sampling	One Sample from each section	5 samples	42 days validated	composite 0-6 inches bgs	none	none	Leachability (modfied SPLP for 8 RCRA metals); TCLP for 8 RCRA metals, Reactivity (hydrogen sulfide gas generates at a pH of 2)	none	5
Surface Water Sampling (Dry Weather)	Upper Creek Section	7 locations	42 days validated	48 hours with no precipitation	TCL organics, CN, filtered and unfiltered TAL metals and Hg	TDS, TSS, POC, DOC, chloride, sulfate, phosphate, nitrate, bicarbonate, calcium, magnesium, sodium, potassium, ammonia and alkalinity	Total and filtered trace mercury and methylmercury	pH, Temp, Cond, DO, Redox Potential, Turbidity, UVA at 254 nm	7
	Middle Creek Section	7 locations							7
	Lower Creek Section	7 locations							7
	Lower Creek Section/Culverted Section	8 locations							8
	Port Newark Channel	2 locations							2
	Point and Non-Point Sources	6 locations							6
Surface Water Sampling (Wet Weather)	Upper Creek Section	4 locations	42 days validated	Minimum 0.5 inch storm following 48 hours of no precipitation	TCL organics, CN, filtered and unfiltered TAL metals and Hg	TDS, TSS, POC, DOC, chloride, sulfate, phosphate, nitrate, bicarbonate, calcium, magnesium, sodium, potassium, ammonia and alkalinity	Total and filtered trace mercury and methylmercury	pH, Temp, Cond, DO, Redox Potential, Turbidity, UVA at 254 nm	4
	Middle Creek Section	7 locations							7
	Lower Creek Section	7 locations							7
	Lower Creek Section/Culverted Section	8 locations							8
	Port Newark Channel	2 locations							2
	Point and Non-Point Sources	6 locations							6

Table 3-1
Field Sampling Program Summary
Pierson's Creek Site
Newark, New Jersey

Task	Section	Locations	Laboratory TAT	Sampling/Measurement Activities					
				Frequency / Intervals	Analytical Parameters			Field Parameters	Total Samples[1]
					DESA or CLP	DESA	Subcontract Lab		
Soil Sampling	Background	3 borings	42 days validated	0 to 0.5, 0.5 to 1.5, 1.5 to 3, 3 to 5 feet	TCL organics, TAL metals, CN, Hg	grain size, TOC	Total, elemental and methylmercury, % total solids	mercury vapor and organic vapors (PID)	15
	Upper Creek Section	3 borings							15
	Middle Creek Section	15 borings							75
	Lower Creek Section	9 borings (4 collected during monitoring well installation, 5 in potential flooding areas)							45
Air Sampling	Site Wide	7 locations	Field Sampling	1 sample at each sediment sampling transect (7 total)	none	none	none	mercury vapor	7
Groundwater sampling (Round 1)	Upper Creek Section	11 existing, 8 new	42 days validated	per well	TCL organics, CN, filtered and unfiltered TAL metals and Hg	TDS, TSS, TOC, DOC, ammonia, chloride, sulfate, phosphate, nitrate, bicarbonate, calcium, magnesium, sodium, potassium, and alkalinity	Total and filtered trace mercury and methylmercury,	pH, Temp, Cond, DO, Redox Potential, Turbidity	19
	Middle Creek Section	4 existing, 12 new							16
	Lower Creek Section	4 new							4
Groundwater sampling (Round 2)	Upper Creek Section	11 existing, 8 new	42 days validated	per well	TCL organics, CN, filtered and unfiltered TAL metals and Hg	TDS, TSS, POC, DOC, ammonia, chloride, sulfate, phosphate, nitrate, bicarbonate, calcium, magnesium, sodium, potassium, and alkalinity	Total and filtered trace mercury and methylmercury,	pH, Temp, Cond, DO, Redox Potential, Turbidity	19
	Middle Creek Section	4 existing, 12 new							16
	Lower Creek Section	4 new							4

Notes: 1: Totals do not include QC samples

Abbreviations:

CLP - Contract Laboratory Program
CN - Cyanide
Cond - conductivity
DESA - Division of Environmental Science and Assessment
DO - dissolved oxygen
DOC - dissolved organic carbon
Hg - mercury
NM - Nanometer
PID - Photoionization detector
POC - Particulate Organic Carbon
RCRA - Resource Conservation and Recovery act
SPLP - Synthetic Precipitation Leaching Procedure (SPLP) (U.S. EPA Method 1312)
TAL - Target analyte list
TAT - Turn around time
TCL - Targetcompound list
TOC - Total organic carbon
TDS - Total Dissolved Solids
Temp - Temperature
TSS - Total Suspended Solids
TCLP - Toxicity Characteristics Leaching Procedure
UVA - Ultraviolet absorbance

Table 3-2
Proposed RI Report Format
Pierson's Creek Site
Newark, New Jersey

1.0	Introduction		
	1.1	Purpose of Report	
	1.2	Site Background	
		1.2.1	Site Description
		1.2.2	Site History
		1.2.3	Previous Investigations
	1.3	Report Organization	
2.0	Study Area Investigation		
	2.1	Surface Features	
	2.2	Soil Investigations	
	2.3	Hydrogeological Investigations	
	2.4	Ecological Characterization	
3.0	Physical Characteristics of Site		
	3.1	Topography	
	3.2	Meteorology	
	3.3	Soils	
	3.4	Geology	
	3.5	Hydrogeology	
	3.6	Supply Wells	
	3.7	Demographics and Land Use	
4.0	Nature and Extent of Contamination		
	4.1	Selection of Site-Related Contaminants	
	4.2	Screening Criteria	
	4.3	Sediment Results	
	4.2	Surface Water Results	
	4.2	Soils Results	
	4.4	Groundwater Results	
	4.5	Evaluation of Sediment, Surface Water, Soil and Groundwater Results	
5.0	Contaminant Fate and Transport		
	5.1	Routes of Migration	
	5.2	Contaminant Persistence	
	5.3	Contaminant Migration	
6.0	Summary of Risk Assessments		
	6.1	Summary of the Baseline Human Health Risk Assessment (full report submitted separately from RI report)	
	6.2	Summary of the Screening Level Ecological Risk Assessment (full report submitted separately from RI report)	
7.0	Conclusions and Recommendations		
	7.1	Conclusions by Media	
	7.2	Recommendations for Future Work	

Table 3-3
Detailed Evaluation Criteria for Remedial Alternatives
Pierson's Creek Site
Newark, New Jersey

- OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

- COMPLIANCE WITH ARARs
  - Compliance with chemical-specific ARARs
  - Compliance with action-specific ARARs
  - Compliance with location-specific ARARs
  - Compliance with appropriate criteria, advisories and guidance

- LONG-TERM EFFECTIVENESS
  - Magnitude of risk remaining at the site after the response objectives have been met
  - Adequacy of controls
  - Reliability of controls

- REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT
  - Treatment process and remedy
  - Amount of hazardous material destroyed or treated
  - Reduction in toxicity, mobility or volume of the contaminants
  - Irreversibility of the treatment
  - Type and quantity of treatment residuals

- SHORT-TERM EFFECTIVENESS
  - Protection of community during remedial action
  - Protection of workers during remedial actions
  - Time until remedial response objectives are achieved
  - Environmental impacts

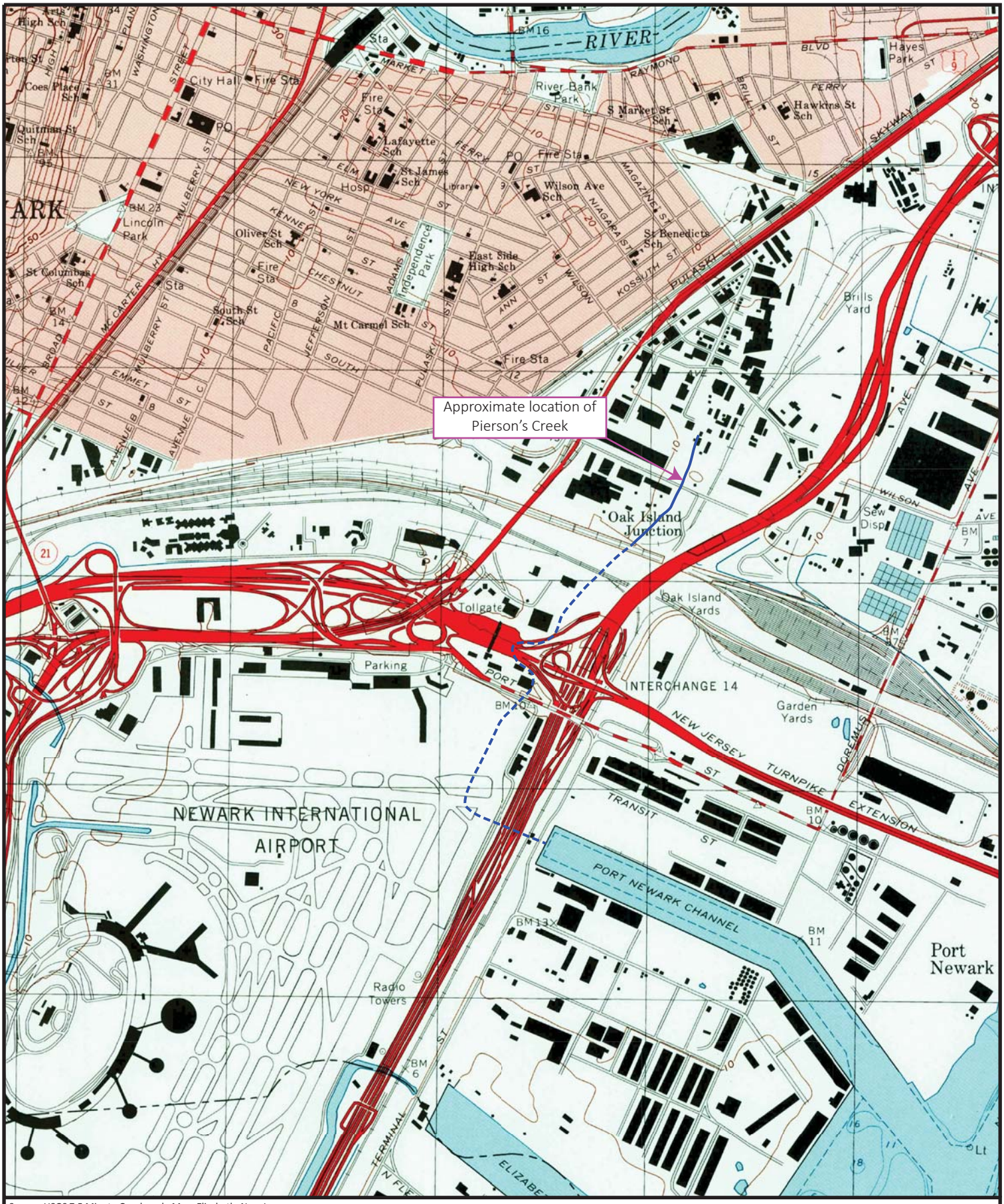
- IMPLEMENTABILITY
  - Ability to construct technology
  - Reliability of technology
  - Ease of undertaking additional remedial action, if necessary
  - Monitoring considerations
  - Coordination with other agencies
  - Availability of treatment, storage capacity, and disposal services
  - Availability of necessary equipment and specialists
  - Availability of prospective technologies

- COST
  - Capital costs
  - Annual operating and maintenance costs
  - Present worth
  - Sensitivity Analysis

- COMMONWEALTH ACCEPTANCE

- COMMUNITY ACCEPTANCE

Figures



Source: USGS 7.5 Minute Quadrangle Map, Elizabeth, New Jersey

Aboveground portion of Pierson's Creek

Underground portion of Pierson's Creek

CDM Smith

N

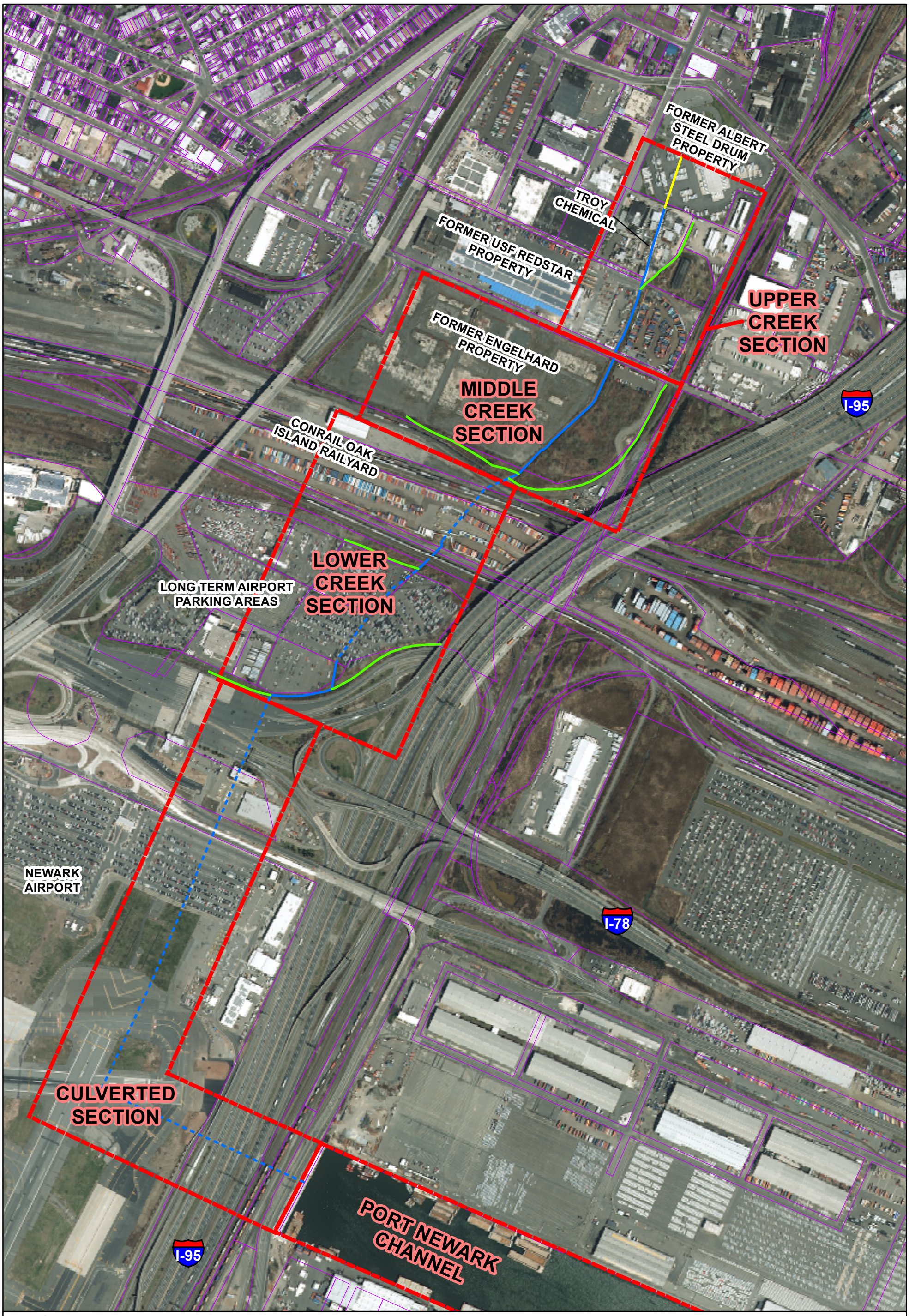
0 1,000 2,000 3,000 Feet

Figure 1-1
Site Location
Pierson's Creek
Newark, New Jersey

Figure 2-1 Estimated Project Schedule

Deliverable or Milestone	Description	Critical Preceding Element	Estimated Duration (months)*
Project Planning			**6**
Evaluation of Existing Data and Documents	Includes procurement and review of additional documents for the downstream portions of Pierson's Creek.		2
Work Plan Addendums	Summarize additional work to be completed following review of existing data.		1
Quality Assurance Project Plan/ Health and Safety Plan	Draft plans prepared for EPA review. Final plans incorporate all comments.	EPA approval of Work Plans	2
Field Investigation			**8**
Mobilization	Includes procurement of site access, equipment and facilities necessary to complete field program.	EPA approval of planning documents	2
Hydrogeologic Assessment	Installation of monitoring wells and staff gauges, long term water level monitoring.	Mobilization	3
Environmental Sampling	Sediment, surface water, soil and groundwater sampling	Mobilization	3
Data Evaluation			**4**
Analytical Support and Data Validation	Data analysis, validation and usability evaluation.	Completion of field sampling	**3**
Data Evaluation Summary Report	Summarizes all data and identifies data gaps. EPA will review to determine if additional investigation activities are necessary.	Receipt and validation of analytical data.	1
Additional Remedial Field Investigation	To be completed if EPA deems necessary.	Data Evaluation Summary Report	TBD
Reporting			**11**
Pathways Analysis Report	Draft Report prepared for EPA review. Comments to be incorporated in draft HHRA.	Data Evaluation	1
Baseline Human Health Risk Assessment (HHRA)	Draft Baseline HHRA to be reviewed by EPA. Comments to be incorporated into Final Baseline HHRA.	Data Evaluation	3
Screening Level Ecological Risk Assessment (SLERA)	Draft SLERA to be reviewed by EPA. Comments to be incorporated into Final SLERA.	Data Evaluation	3
Remedial Investigation (RI) Report	Draft RI Report to be reviewed by EPA. Comments to be incorporated into Final RI.	Data Evaluation	4
Treatability Study/ Pilot Testing	Additional studies to determine what remedial technologies may be effective at the Site (if necessary)	Data Evaluation	TBD
Remedial Alternatives Screening and Technical Memorandum	Development of remedial alternatives. EPA comments on technical memorandum to be incorporated into Draft FS	Draft RI Report	2
Remedial Alternatives Evaluation and Technical Memorandum	Evaluation of remedial alternatives. EPA comments on technical memorandum to be incorporated into Draft FS	Remedial Alternatives Screening	2
Feasibility Study (FS) Report	Draft FS Report to be reviewed by EPA. Comments to be incorporated into Final FS.	Remedial Evaluation Technical Memorandum	3

Note: Estimated durations do not include EPA review time on plans or reports.



Pierson's Creek Orientation

- Current Pierson's Creek Channel (open channel)
- Current Pierson's Creek Channel (culverted)
- Feeder Creeks
- Former Portion of Pierson's Creek
- Tax Parcels
- Creek Sections

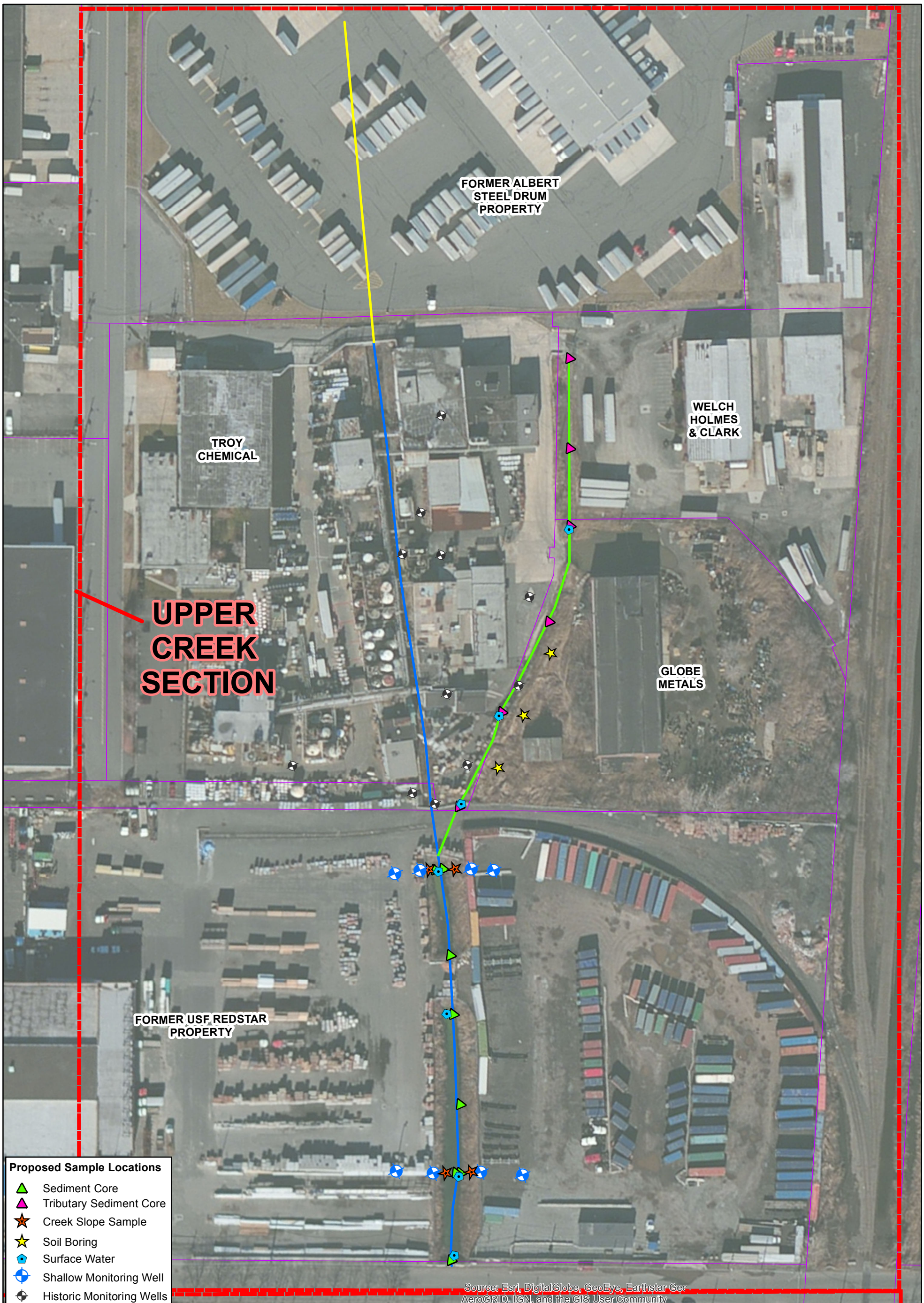
N

0 600 1,200 Feet

1 in = 600 feet

Figure 3-1
Pierson's Creek Sections
Pierson's Creek Superfund Site
Newark, NJ

CDM Smith



Pierson's Creek Orientation

- Current Pierson's Creek Channel (open channel)
- Current Pierson's Creek Channel (culverted)
- Feeder Creeks
- Former Portion of Pierson's Creek
- Tax Parcels
- Creek Sections

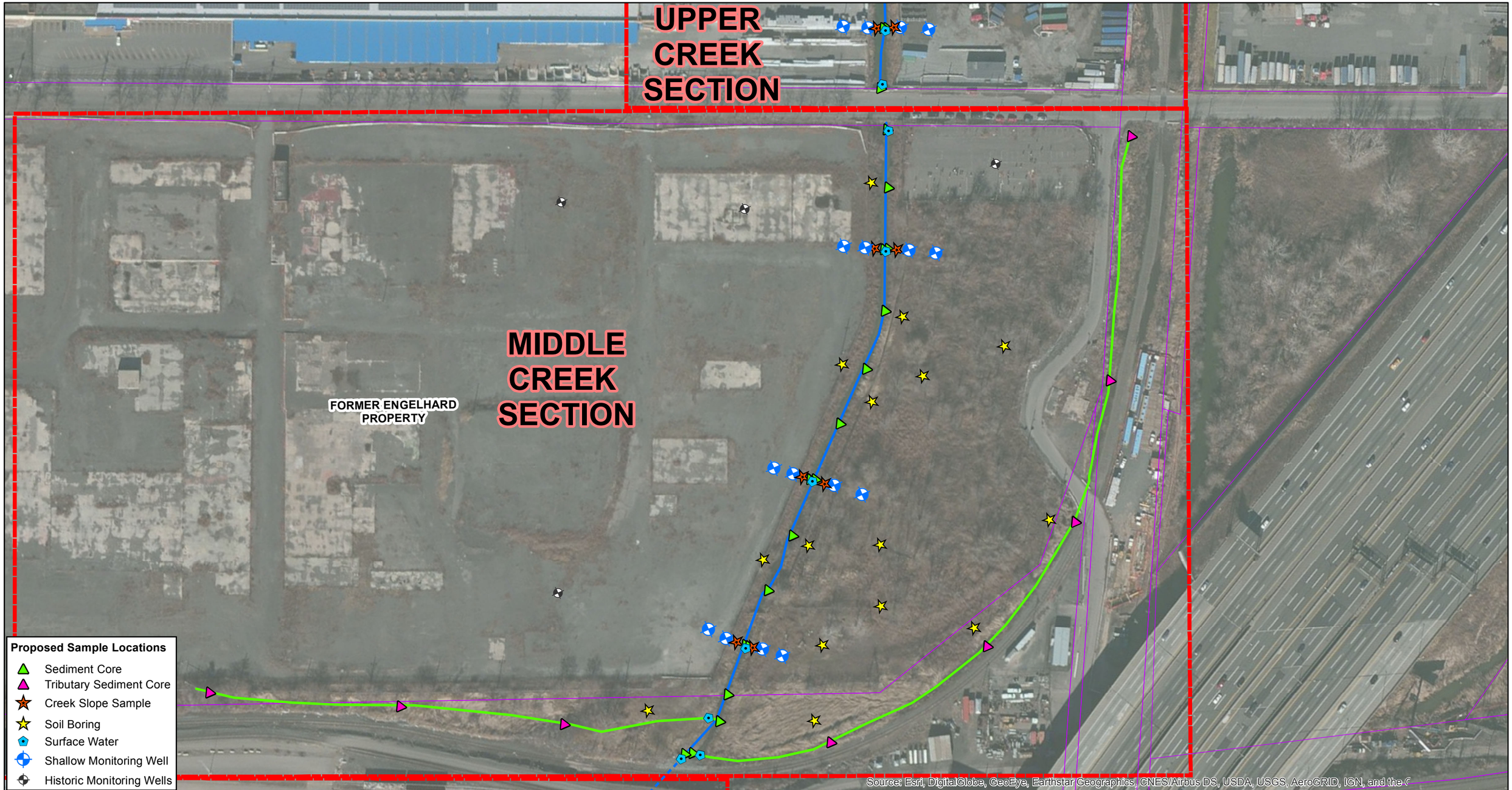
N

0 100 200 Feet

1 in = 100 feet

Figure 3-2
Proposed Sampling Locations - Upper Creek
Pierson's Creek Superfund Site
Newark, NJ

CDM Smith



Pierson's Creek Orientation

- Current Pierson's Creek Channel (open channel)
- Current Pierson's Creek Channel (culverted)
- Feeder Creeks
- Former Portion of Pierson's Creek
- Tax Parcels
- Creek Sections

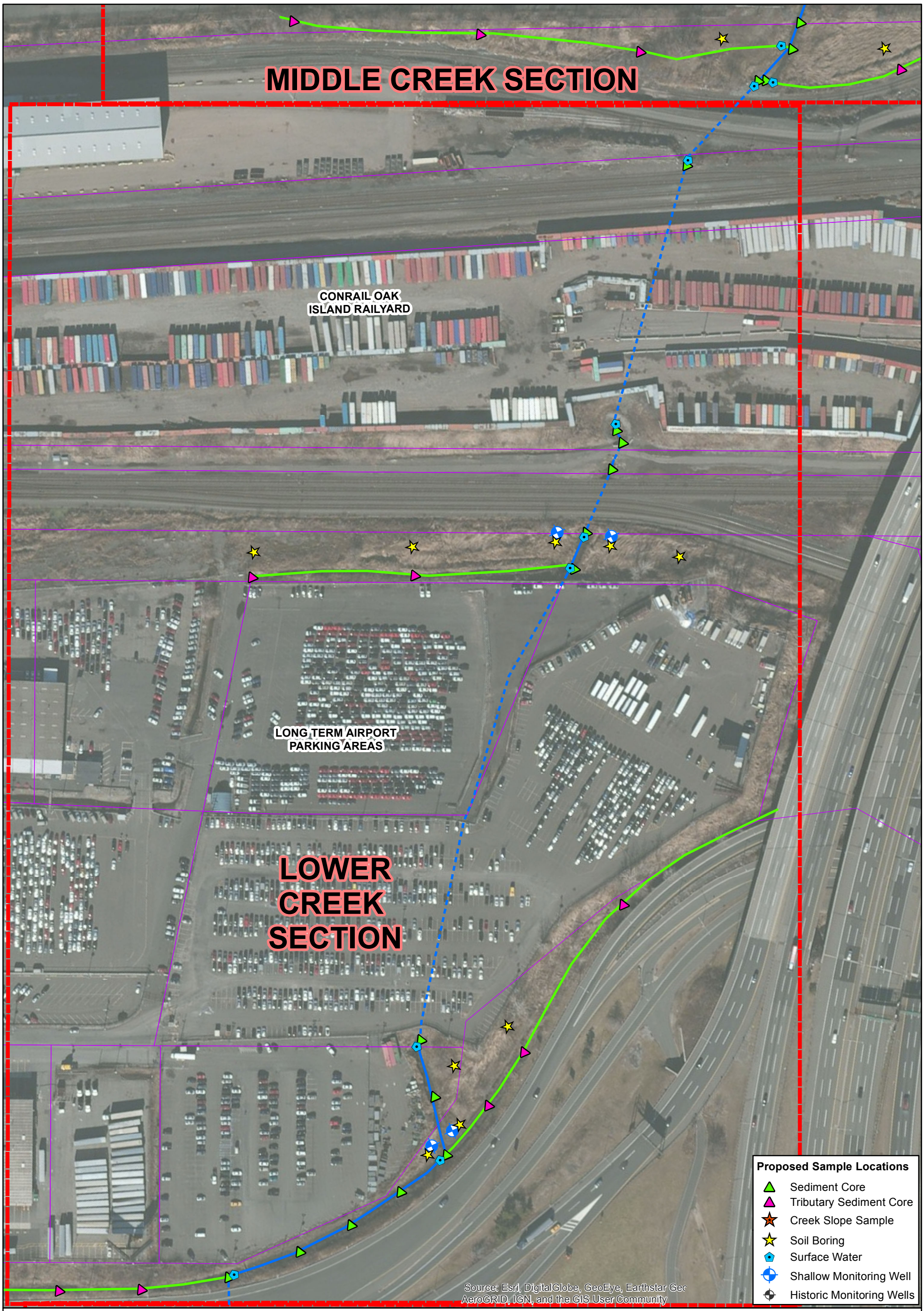
N

0 150 300 Feet

1 in = 150 feet

Figure 3-3
Proposed Sampling Locations - Middle Creek
Pierson's Creek Superfund Site
Newark, NJ

CDM Smith



Pierson's Creek Orientation

- Current Pierson's Creek Channel (open channel)
- Current Pierson's Creek Channel (culverted)
- Feeder Creeks
- Former Portion of Pierson's Creek
- Tax Parcels
- Creek Sections

N

0 150 300 Feet

1 in = 150 feet

Figure 3-4
Proposed Sampling Locations - Lower Creek
Pierson's Creek Superfund Site
Newark, NJ

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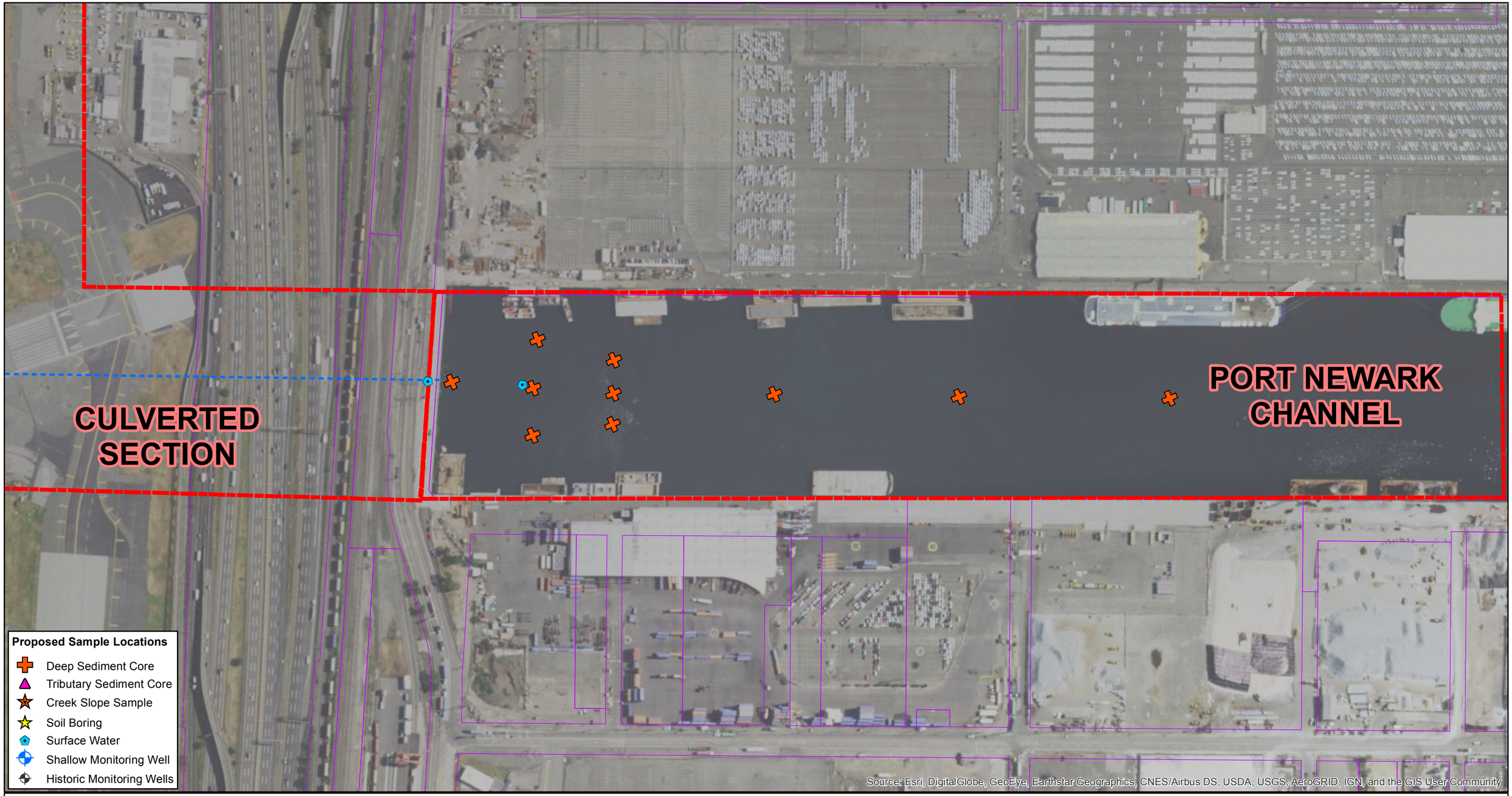

Pierson's Creek Orientation

- Current Pierson's Creek Channel (open channel)
- Current Pierson's Creek Channel (culverted)
- Feeder Creeks
- Former Portion of Pierson's Creek
- Tax Parcels
- Creek Sections

N

0 300 600 Feet

1 in = 300 feet

Figure 3-5
Proposed Sampling Locations - Port Newark Channel
Pierson's Creek Superfund Site
Newark, NJ

CDM Smith

Appendix A

Appendix A
Well Inventory Checklist

EPA Region 2 Superfund Well Assessment Checklist

Facility Information

EPA Site ID Number: _____
Site Name: _____
EPA Project Manager (contact name): _____
Site Address Line 1: _____
Site Address Line 2: _____
City: _____
County: _____
State: _____
Zip Code _____
Site Owner: _____

Well Locational Information

State Well ID Number: _____
Local Well Name (Well Tag ID): _____

	By Field GPS
Latitude, in decimal degrees	
Longitude, in decimal degrees	

GPS Instrument used: _____
Datum: _____
Accuracy/Precision: _____
Cross streets (if applicable): _____

Well Construction Details

Type of well (Circle one) Flush Mount Stick up Multilevel Well*

Height/Depth of well inner casing above/below ground surface, in feet _____

Well inner casing material: _____
Well inner casing diameter: _____ *inches*
Well Depth: _____ *as measured, in feet below top of casing*

Protective outer surface casing material: _____
Protective outer surface casing diameter: _____ *inches*

Depth to water: _____ *feet below measuring point (usually top of inner casing)*
Date: _____ *Time:* _____
Elevation of Measuring Point, as surveyed (usually top of inner casing) _____
Elevation Datum NGVD29 or NAVD88

** If multilevel well please see attached worksheet.

EPA Region 2 Superfund Well Assessment Checklist

Well Headspace Readings

PID/FID Reading taken inside top of casing: _____ *ppm*

Multi-gas/CGI meter Readings taken:

LEL: _____ *% LEL*
O_2: _____ *40% Vol.*
CO: _____ *ppm*
H_2S: _____ *ppm*

Do readings indicate unsafe conditions exist? Yes No

Well Condition

Is the concrete pad in good condition?	Yes	No
Is there any evidence of soil erosion or settling?	Yes	No
Is the well surface casing in good condition?	Yes	No
Is the protective outer surface casing vertical and in good condition?	Yes	No
Is the inner cap or well seal in place?	Yes	No
Has there been physical damage to the well?	Yes	No
Is measuring point marked?	Yes	No
Is the well clearly labeled?	Yes	No
Is the well lock functional?	Yes	No

Type of lock and key number: _____

Flush mount - Are bolts and gasket in good condition?	Yes	No
Flush mount - Any evidence of ponded water?	Yes	No
Is the well currently used for water-level measurements?	Yes	No
Is the well currently used for water-quality sampling?	Yes	No

Other Comments _____

Recommendations

Does the well require any of the following actions? (Check all that apply)

Well needs to be redeveloped _____
Well needs to be re-surveyed. _____
Well needs to be repaired. _____
Well needs to be replaced. _____
Well needs new lock or security device. _____
Well needs to be properly decommissioned. _____

Comments

_____

Inspected by: _____
Date of Inspection: _____
Reviewed by: _____ **(Print)**
_____ **(Sign)**

EPA Region 2 Superfund Well Assessment Checklist

Multilevel Well Worksheet

Type of Well: _____

Number of sampling ports: _____

Depth of sampling ports (measured in feet below top of casing):

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____
13 _____
14 _____
15 _____
16 _____
17 _____
18 _____
19 _____
20 _____