AECOM

Targeted Removal and Capping Alternative - Pre-Design Investigation Work Plan

North Water Street Former MGP, Poughkeepsie, NY

Central Hudson Gas & Electric Corp.

Project Reference: NYSDEC Site C314070
Project Number: 60643314

March 26, 2025

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Quality information

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Revision	Revision date	Details	Authorized	Name	Position
0	9/10/2024	Initial issue	9/10/2024	Robert Forstner	PM
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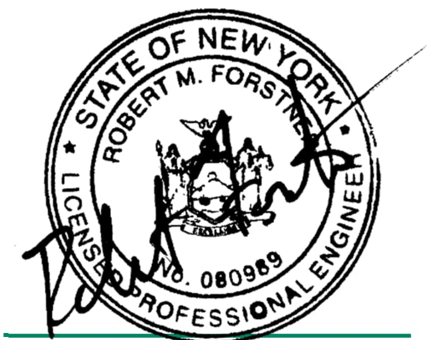
CERTIFICATION STATEMENT

I, Robert Forstner, certify that I am currently a New York State registered professional engineer as defined in 6 NYCR Part 375 and that this Pre-Design Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and DER Green Remediation (DER-31).



080989	March 26, 2025	
NYS Professional Engineer License #	Date	Signature & Seal

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Abbreviations and Acronyms

AECOM	AECOM USA, Inc.
ANOVA	Analysis of Variance
BMP	best management practice
btos	below top of sediment
CETIS	Comprehensive Environmental Toxicity Information System
CHGE	Central Hudson Gas and Electric Corporation
COC	chain of custody
COI	constituents of interest
DPT	direct-push technology
EDD	electronic data deliverbale
ESBs	Equilibrium Partitioning Sediment Benchmarks
FCV	final chronic value
ft	feet
GPS	global positioning system
HASP	Health and Safety Plan
HD	hydraulic dredging
HDPT	hydraulic dredging pilot test
IDW	investigation derived waste
IGS	Integrated Geosciences Laboratories, LLC
LC50	median lethal concentration
NAD83	North American Datum of 1983
NAPL	non-aqueous phase liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
MGP	manufactured gas plant
MNR	montiored natural recovery
PAHs	polycyclic aromatic hydrocarbons
PDIWP	Pre-Design Investigation Work Plan
PDF	Portable Document Format
PEC	probable effect concentration

PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
%PV	% pore volume
PWTF	Poughkeepsies’ Water Treatment Facility
QC	quality control
RI	Remedial Investigation
RSP	residual saturation point
SPME	solid-phase microextraction
SRT	standard reference toxicant test
TOC	total organic carbon
TU	toxic unit
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UV	ultraviolet
WOTH	Walkway Over the Hudson
WQC	Water Quality Certification

1. Introduction

AECOM USA, Inc. (AECOM) has prepared this Pre-Design Investigation Work Plan (PDIWP) at the request of Central Hudson Gas and Electric Corporation (CHGE) to assess a targeted removal approach for the non-aqueous phase liquid (NAPL)-impacted sediment in the Hudson River at the former North Water Street Manufactured Gas Plant (MGP) site (Site) located at 2 Dutchess Avenue, Poughkeepsie, New York (Figure 1.1).

This PDIWP presents the sampling and analyses scope of work elements for evaluating the extent of the concentrated NAPL in the Central Area as documented in the *North Water Street Site – Targeted Sediment Removal Area Based on Three-Dimensional NAPL Modeling* (AECOM, 2024) memorandum, as well as the limits of sediment remediation throughout the remainder of the Decision Document Area. This information will be evaluated for the development of a revised remedial alternative, while also incorporating observations and lessons learned from the three completed remedial construction seasons.

AECOM

CENTRAL HUDSON GAS & ELECTRIC CORP. FORMER NORTH WATER STREET MGP POUGHKEEPSIE, NY	SITE LOCATION MAP
DATE: 2/1/2018	FIGURE 1.1

2. Site Background & Setting

The Site is a former MGP in the City of Poughkeepsie, Dutchess County, New York. The upland portion is about 7 acres and fenced on the northern, eastern, and southern sides. The Hudson River borders the upland's western side. Additionally, MGP-impacted river sediments, 1.3 acres of underwater utility corridors, and 2.1 acres of shoreline slope are also included in the selected remedy. For purposes of this PDIWP, "Site" refers to all MGP-impacted media (upland and in-river) to be addressed under the original remedy.

Currently, CHGE operates a natural gas regulator station on the northwest portion of the Site and an electric transition and substation on the southern/eastern portion of the Site. Most of the upland portion of the Site has a gravel cover or is paved.

Dutchess Avenue is located immediately north of the Site, North Water Street and Amtrak railroad lines are located immediately east, the Hudson River is located immediately west, and the Dutchess County Upper Landing Park and Fall Kill Creek are located just south. To the north of Dutchess Avenue lies a mixed residential and commercial site, which is the location of the former A.C. Dutton Lumber Yard (New York State Department of Environmental Conservation [NYSDEC] Site No. C314081). The Site is zoned W (Waterfront District), and permits a variety of site uses (Dutchess County Department of Planning and Development, 2022).

An intake for the Poughkeepsie's Water Treatment Facility (PWTF), a public water supply system serving the Town and City of Poughkeepsie, is located in the Hudson River approximately 0.75 miles north of the Site. Potable water for most of the area within a 3-mile radius of the Site is supplied by the PWTF; the nearest water supply well is located 1.8 miles north of the Site (EA Science and Technology [EA], 1987). According to the Dutchess County Department of Health, there are no wells used for drinking water within one mile of the Site (Blasland, Bouck & Lee, Inc. 2000).

The remediation of the Site is being conducted pursuant to a Decision Document issued by the NYSDEC (NYSDEC, 2016). The NYSDEC approved the *Remedial Design/Remedial Action Work Plan* (RD/RA Work Plan; AECOM, 2018) and subsequent water quality control plans (AECOM, 2019; CHGE, 2019) which presented the removal of impacted sediment via mechanical dredging within a moon pool containment cell fitted with an impermeable fabric as the primary element of the remedy, installation of a subsurface barrier wall along the shoreline to prevent further migration of contaminants toward the Hudson River, and capping of areas that cannot be dredged due to utilities or structural stability concerns. Additional controls required by the NYSDEC to prevent the escape of constituents of interest (COI) from work areas included using a perimeter double-row barrier system, oil booms, bioremediation agents, support boats, and a substantial water quality monitoring program. COIs for the Site include NAPL, sheens, benzene, toluene, ethylbenzene, xylene, and polycyclic aromatic hydrocarbons (PAHs).

Site remediation activities commenced in the fall of 2018, following NYSDEC approval of the RD/RA Work Plan. Activities performed during Season 1 (November 26, 2018, to January 16, 2019) centered on remediation of the upland portion of the Site and installation of the barrier wall. A turbidity curtain with oil absorbent booms was deployed outboard of the barrier wall alignment as a water quality best management practice (BMP). In response to sheens that were observed during this construction activity, given the proximity of the work to the water intake for the PWTF, the NYSDEC and other stakeholders (including the PWTF, the New York State Department of Health [NYSDOH] and the Dutchess County Department of Health) required the development of additional measures to control the release and migration of COIs as a prerequisite to conducting dredging in Season 2.

To address the requirement to protect the public water supply, several modifications were made to the original moon pool containment cell design (AECOM, 2019). The moon pool design was revised to consist of an impermeable curtain extended to the full depth of the river. Additional measures taken to address water quality concerns included a double-row perimeter barrier system surrounding the entire work area, revisions to the water quality monitoring program (including an observer on the Walkway Over the Hudson [WOTH], additional support/observation vessels and more rigorous in-river monitoring requirements), and performance of a dye study to aid the understanding of any potential contaminant migration.

While many elements of the revised water quality control measures were successfully implemented in Season 2 (August 19, 2019 to January 6, 2020), mechanical dredging could not be initiated due to tearing of the impermeable curtain during assembly of the moon pool. Based on the Season 2 construction observations, it was determined that water depths and hydrodynamic forces present significant constraints that make use of a moon pool with an impermeable curtain extending close to the sediment surface technically infeasible at this Site. Season 1 and Season 2 work activities provided valuable insights regarding Site conditions as well as regulatory and third-party stakeholder expectations.

Following Season 2, an assessment of alternative technologies was conducted to identify an alternative approach to mechanical dredging of impacted sediment within a moon pool containment cell. The assessment concluded that hydraulic dredging (HD) was expected to be technically implementable; however, additional data collection was recommended to confirm the overall feasibility of this technology for full-scale implementation and to assess its ability to satisfy criteria established by the NYSDEC, NYSDOH, and other project stakeholders.

A hydraulic dredging pilot test (HDPT) was conducted during Season 3 (September 21, 2020 – December 14, 2020). Three areas were chosen to conduct the HDPT to evaluate the capabilities of the HD equipment, material management processes, dewatering technologies and needs, backfill placement technologies, and to assess the requirements for a full-scale HD operation. During the HDPT the three areas were dredged and backfilled, and the material was mechanically dewatered before being disposed off-site. Environmental controls and monitoring, including a floating sheen control barrier, sheen spotters and patrol boats, and an extensive program of real-time water quality monitoring and laboratory analysis of water both in the Hudson River and in the PWTF throughout the HDPT, were critical elements of the HDPT.

The HDPT activities during Season 3 helped to further characterize in-situ conditions and constraints at the Site and to assess the performance of each element of the hydraulic dredging process and its overall viability for full-scale implementation. The results of the HDPT indicate that, although the impacted sediments can be removed using HD in a protective manner (no exceedance of water quality criteria were encountered during the HDPT), full-scale remedial dredging using this methodology would require significant modifications to the remedial implementation criteria, enhancements to the HD equipment and processes, and modifications to the environmental controls and monitoring.

The realized production rates during the HDPT were much lower than anticipated. This lower production rate was attributed to two factors – loss in pump efficiency and limited available work hours. The loss in pump efficiency (capacity and percent solids) was primarily due to the presence of debris within the top two feet, and the use and positioning of the shroud on the HD pump. The limited available work hours were primarily due to work stoppages related to the presence of sheens outside of the perimeter boom and post-dredge activities (i.e., survey and placement of daily cover half-hour prior to sunset).

The issues impacting HD performance in the pilot test (debris and available hour limitations) were not related to the pilot-scale nature of the test (i.e., not expected to be alleviated by scaling up equipment in a full-production implementation), and consequently were carried forward in the evaluation of a potential full scale HD design. The *Hydraulic Dredging Pilot Test Summary Report* (AECOM, 2021a) concluded that full-scale remediation as required per the Decision Document would take 14 seasons to implement. As such, reevaluation and optimization of the previously conducted remedial alternatives analyses considering the available data were recommended as the next steps for this project.

In November 2021, a *Focused Remedial Alternatives Analysis* (AECOM, 2021b) was submitted by CHGE to NYSDEC. This report evaluated three alternatives for sediment remediation:

- Targeted dredging to accommodate a reactive cap to grade;
- A reactive cap-on-grade only; and
- A reactive cap-on-grade with enhanced/ monitored natural attenuation.

On April 8, 2022, NYSDEC submitted their written responses to this report to CHGE requesting additional information. CHGE submitted the responses to NYSDEC on May 24, 2022.

On September 5, 2023, NYSDEC had a call with CHGE during which NYSDEC requested that a revised targeted removal approach be developed. AECOM subsequently completed a sediment impact reevaluation to refine the understanding of where Site-related impacts are concentrated in Hudson River sediments. This reevaluation employed three-dimensional (3D) modeling of sediment data to identify areas where the ratio of target dredging to overall disruption to the river could be maximized, possibly contributing to development of an optimized remedy. The 3D model was based on data collected during the project's remedial investigation (RI) phase, as documented primarily in the *Remedial Investigation Report* (Arcadis, 2010) and *2011 Supplemental Sediment Investigation Report* (Arcadis, 2012).

The 3D modeling results were presented by CHGE and AECOM to NYSDEC on a December 7, 2023 call, after which NYSDEC requested some additional information. On February 2, 2024, CHGE sent the NYSDEC a memorandum entitled *North Water Street Site – Targeted Sediment Removal Area Based on Three-Dimensional NAPL Modeling* (AECOM, 2024).

On May 24, 2024, NYSDEC sent CHGE a response letter requesting a revised Alternatives Analysis to include this proposed alternative. In this letter, NYSDEC requested that a surficial evaluation be made as part of a PDI throughout the Decision Document area to justify all proposed remedial actions. NYSDEC stated that the PDI should include supplemental field work to confirm that existing conditions are consistent with the 2007 observational and analytical data in cores and shallow sediment samples analyzed for PAHs and toxicity. NYSDEC also requested that bulk sediment and porewater data be collected to support conceptual cap details and thicknesses given the presence of NAPL below the suggested removal depths.

In response, on June 25, 2024, CHGE and AECOM presented a conceptual PDI scope of work. On July 16, 2024, NYSDEC sent a letter to CHGE agreeing to the conceptual scope and requested that CHGE provide a PDI Work Plan for review by NYSDEC and NYSDOH. This PDIWP addresses the request for a detailed Work Plan and utilizes separate phases to address specific data gaps requiring investigation. As detailed in the following sections, these two phases include additional visual assessment of river sediment to further delineate areas of concentrated NAPL impacts (Phase 1), and toxicity testing to evaluate remedial needs for sediments within the Decision Document area that are outside of the concentrated NAPL area (Phase 2). The plan is phased because the extent of Phase 2 is defined, in part, by the extent of concentrated NAPL impacts to be investigated in Phase 1. However, the results of Phase 1 are observational and do not involve analytical methods; therefore, it is possible to implement the two phases of this program sequentially in a single mobilization. Further investigations to support cap design would be performed later, under a different Work Plan.

3. Phase 1 – NAPL Visual Assessment

3.1 Objectives

As noted above, the *North Water Street Site – Targeted Sediment Removal Area Based on Three-Dimensional NAPL Modeling* memorandum described the development of a 3D computer model to establish the extent of a targeted removal option based on the presence of accessible, concentrated NAPL impacts as defined by visual assessment of sediment cores. The core logs used to develop the model were primarily from the RI phase of the project. Figures 3.1 and 3.2A through 3.2C depict the 3D model in a series of two-dimensional views, showing all existing boring locations used to develop the model, and the inferred extent of concentrated NAPL impacts. Because the focus of prior investigations was on identifying the fullest extent of MGP impacts generally (and not specifically on delineating areas with varying degrees of NAPL impacts), there are data gaps when employing these logs for the purpose of delineating a targeted area of concentrated NAPL impacts.

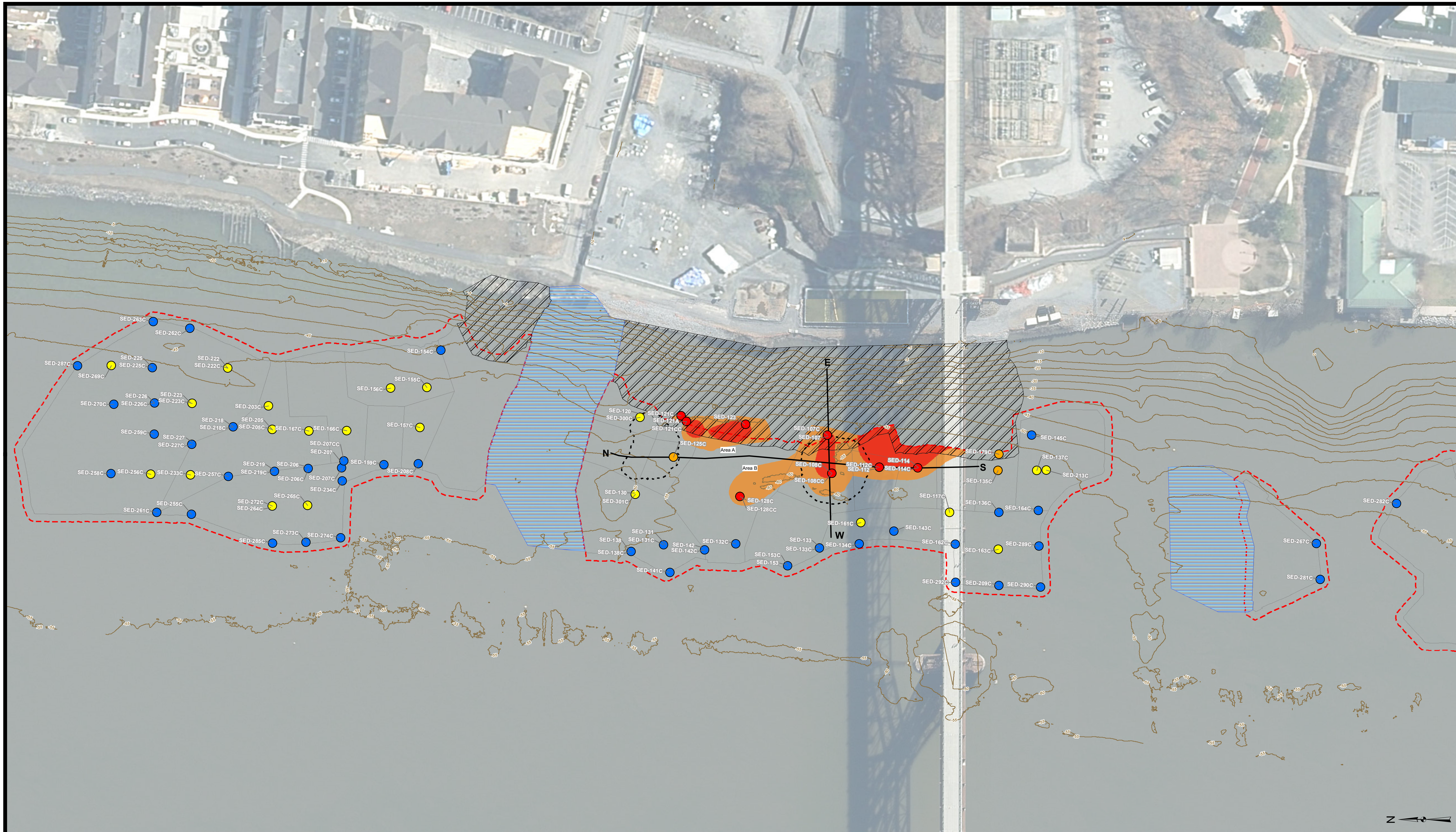
The purpose of the NAPL visual assessment is to address these data gaps by collecting data to support delineation of a targeted removal area based on presence of concentrated NAPL. The area to be targeted for removal in this scenario includes accessible sediments with concentrated NAPL impacts as identified in the memorandum.

For purposes of remediation, "accessible" is to be determined based on a holistic evaluation of the 3D model as updated with data collected during this program and consideration of constructability. For working purposes in designing this visual assessment program, it is assumed that "accessible" will include sediment within six feet of the surface and not within an area where capping was proposed in the Decision Document due to proximity to utility corridors, or the existing river bank slope where excavation is not possible due to slope stability concerns. To ensure potentially-accessible sediments with concentrated NAPL impacts are not overlooked, however, the visual assessment will be conducted to depths of at least 10 feet in all locations. Deeper sediments are assumed to be not accessible due to previously-demonstrated issues with controlling potential NAPL releases from areas being disturbed by dredging for an extended period, while utility conflicts and slope stability issues present physical constraints on where removal can proceed. Nevertheless, as described below, if concentrated NAPL impacts are observed at or near 10 feet below the sediment surface, the investigation would continue to greater depths at that location when feasible.

"Concentrated NAPL impacts" occur where, based on visual observation, a connected NAPL body can be inferred to exist. As detailed in the modeling memorandum, this includes NAPL within seams, fractures or along debris embedded in the sediment matrix, or where NAPL exists throughout the interstitial spaces of the sediment. Concentrated NAPL does not include diffused NAPL throughout the sediment matrix (typically described as blebs or stringers).

3.2 Field Sampling Approach

The NAPL visual assessment will be conducted by conventional drilling techniques from a floating platform that is capable of being navigated to and secured at the proposed coring locations. As detailed below, the primary objective for the NAPL visual assessment is to categorize NAPL impacts through visual observation, and there is no laboratory program associated with this work. A limited number of undisturbed, *in situ* samples of NAPL-impacted sediment will be collected for mobility testing at a specialized laboratory for purposes of evaluating the practicality and applicability of such testing for future project phases. It is not expected that data from the mobility evaluation will be used as part of the visual assessment, although to the extent data for this purpose can be observed, it will be reported as part of this



Legend:

Maximum Visual Sediment Impact Observed in Any Interval

- NAPL observed in at least one interval
- NAPL observed in seams/fractures or along wood
- Some, little, or trace NAPL observed
- No NAPL impact observed
- Decision Document (2016) Targeted Remedial Area
- Sediment Surface Elevation Contour (ft NAVD)
- Utility Cap
- Slope Cap
- Decision Document (2016) Dredge Areas
- Hydraulic Dredge Pilot Test Excavated Area
- Inferred Area of Contiguous NAPL Impacts in Seams, Fractures or Along Wood
- Inferred Area of Contiguous NAPL Impacts Throughout

ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid

0 60 120 240 Feet

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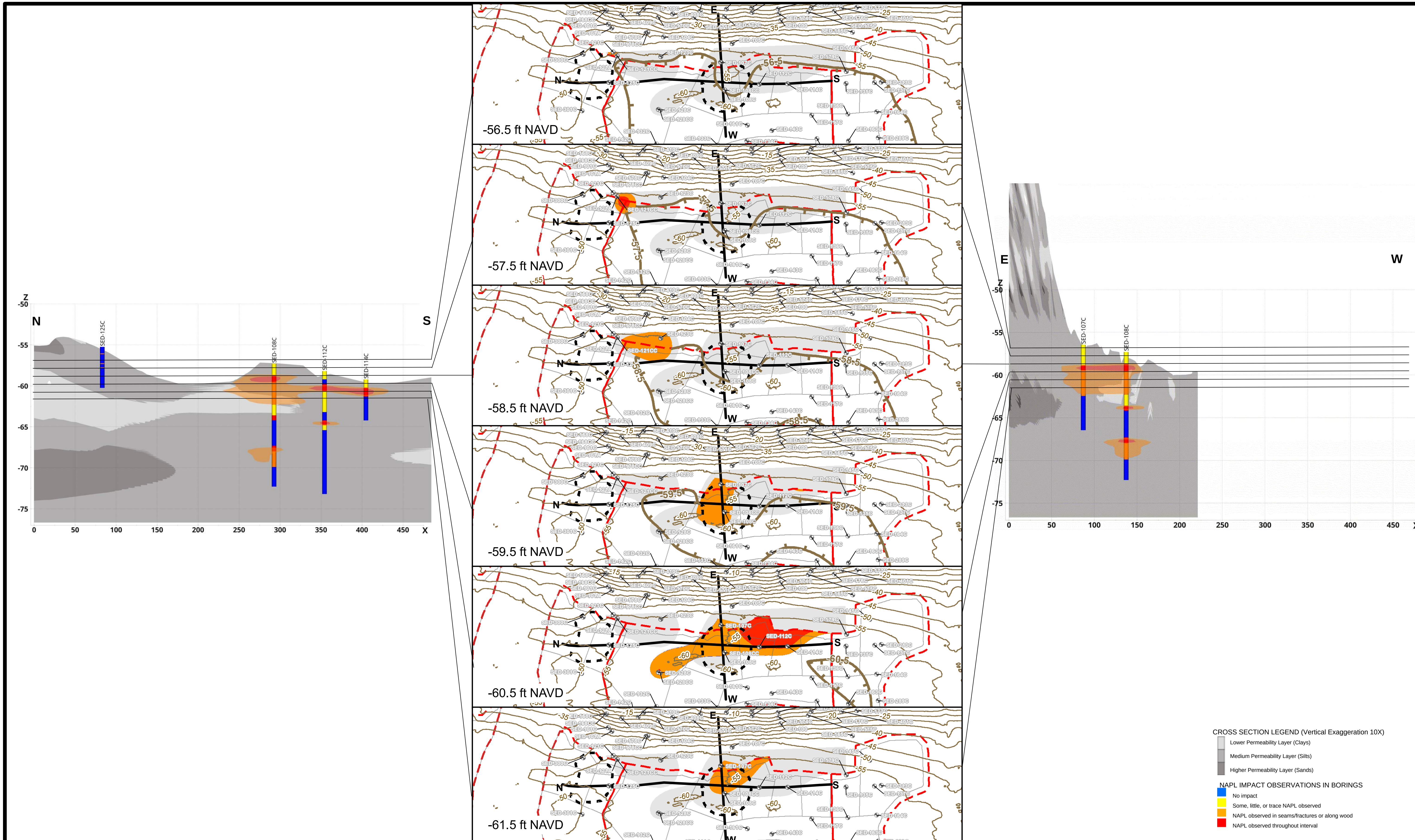
FORMER NORTH WATER STREET MGP SITE
CENTRAL HUDSON GAS & ELECTRIC CORPORATION
POUGHKEEPSIE, NY

VISUALLY OBSERVED NAPL IMPACTS IN SEDIMENT

DATE: 1/11/2024 | DRWN: RGM

FIGURE 3.1

File: \\na\l01\p172\data\EnvData\ArcPFG\GIS\MXD\NAPL Impacts_Landscape_mikeas 1/11/2024



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Legend

- Boring
- Transect
- Sediment Surface Contour (Reference Elevation)
- Decision Document (2016) Targeted Remedial Area
- Decision Document (2016) Dredge Areas
- Hydraulic Dredge Pilot Test Excavated Area
- Sediment Surface Elevation Contour (ft NAVD)
- Maximum Visual Sediment Impact Observed in Any Interval
- Inferred Area of Contiguous NAPL Impacts in Seams, Fractures or Along Wood
- Inferred Area of Contiguous NAPL Impacts Throughout

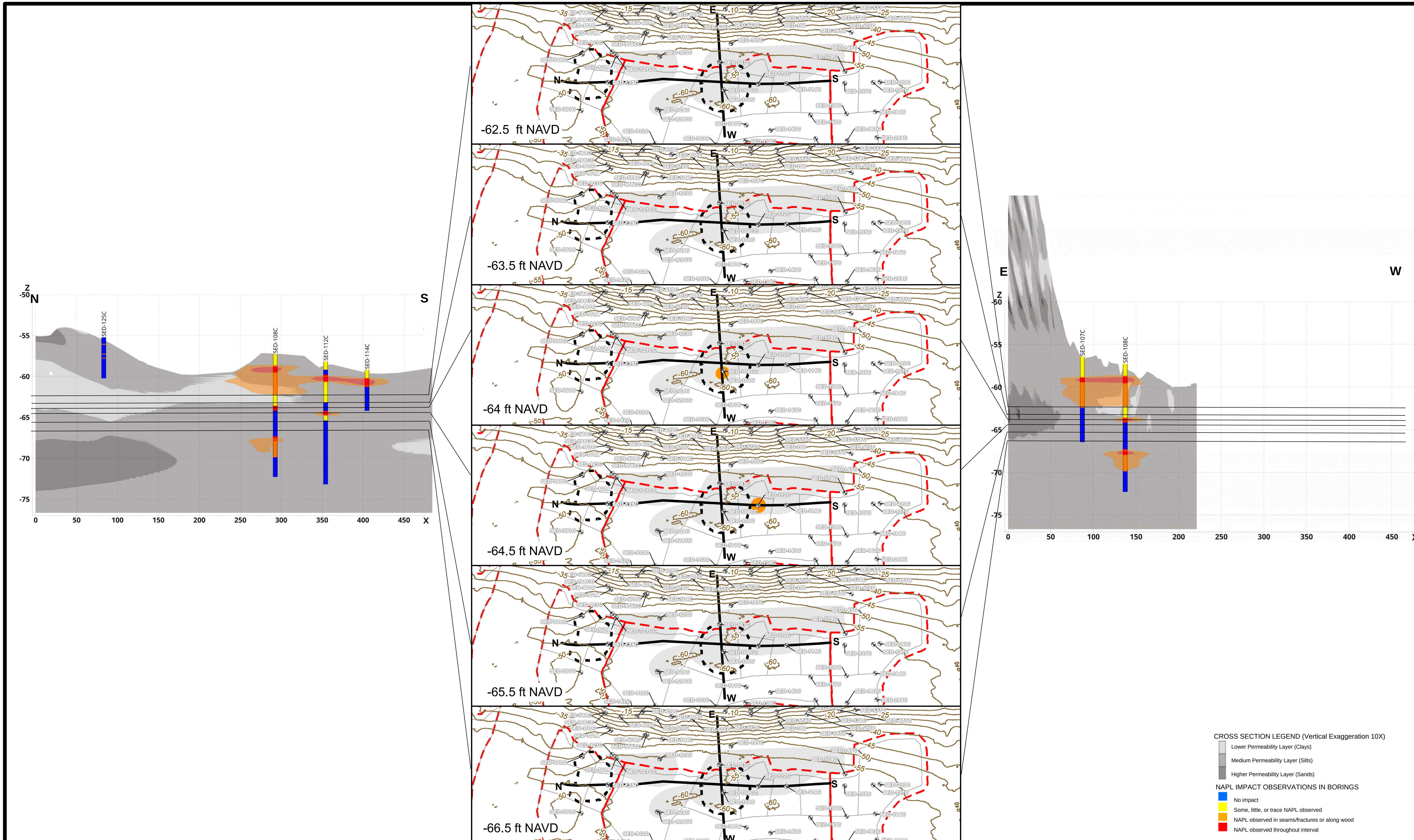
ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid

0 80 160 320 Feet

FORMER NORTH WATER STREET MGP SITE
CENTRAL HUDSON GAS & ELECTRIC CORPORATION
POUGHKEEPSIE, NY

VISUALLY OBSERVED NAPL IMPACTS IN SEDIMENT (-56.5 to -61.5 ft-NAVD)

DATE: 12/21/2023 | DRWN: RGM | **FIGURE 3.2A**



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Legend

- Boring
- Transect
- Sediment Surface Contour (Reference Elevation)
- Decision Document (2016) Targeted Remedial Area
- Decision Document (2016) Dredge Areas
- Hydraulic Dredge Pilot Test Excavated Area
- Sediment Surface Elevation Contour (ft NAVD)
- Maximum Visual Sediment Impact Observed in Any Interval
- Inferred Area of Contiguous NAPL Impacts in Seams, Fractures or Along Wood
- Inferred Area of Contiguous NAPL Impacts Throughout

ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid

N

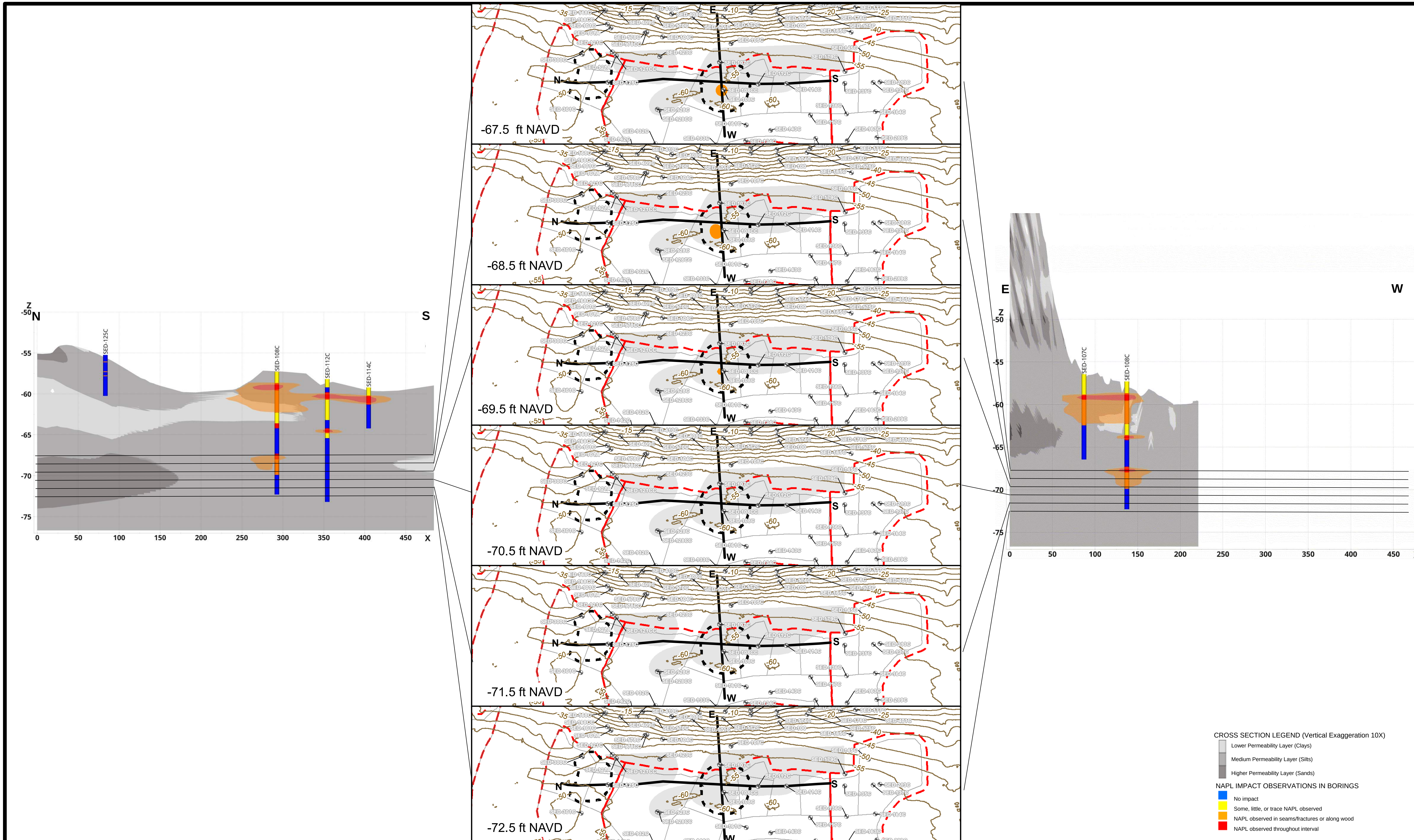
0 80 160 320 Feet

FORMER NORTH WATER STREET MGP SITE
CENTRAL HUDSON GAS & ELECTRIC CORPORATION
POUGHKEEPSIE, NY

VISUALLY OBSERVED NAPL IMPACTS IN SEDIMENT (-62.5 to -66.5 ft NAVD)

DATE: 12/21/2023 | DRWN: RGM

FIGURE 3.2B



AECOM

Legend

- Boring
- Transect
- Sediment Surface Contour (Reference Elevation)
- Decision Document (2016) Targeted Remedial Area
- Decision Document (2016) Dredge Areas
- Hydraulic Dredge Pilot Test Excavated Area
- Sediment Surface Elevation Contour (ft NAVD)
- Maximum Visual Sediment Impact Observed in Any Interval
- Inferred Area of Contiguous NAPL Impacts in Seams, Fractures or Along Wood
- Inferred Area of Contiguous NAPL Impacts Throughout

ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid

0 80 160 320 Feet

FORMER NORTH WATER STREET MGP SITE
CENTRAL HUDSON GAS & ELECTRIC CORPORATION
POUGHKEEPSIE, NY

VISUALLY OBSERVED NAPL IMPACTS IN SEDIMENT (-67.5 to -72.5 ft NAVD)

DATE: 12/21/2023 | DRWN: RGM

FIGURE 3.2C

program. While actual disturbance of the riverbed, and thus release of NAPL, will be minimal (limited to the diameter of boreholes, plus any surface disturbances associated with anchorage), site controls will be in place (as described below) to provide immediate response as needed.

Mobilization for the NAPL visual assessment effort is anticipated to consist of the following:

- Drilling Platform and Rig: The drilling platform will consist of a barge with tug(s), a self-powered sampling vessel, or combination thereof capable of supporting a Geoprobe® direct-push technology (DPT) or equivalent rig, capable of advancing a borehole to a depth of up to 20 feet (ft) below top of sediment (btos). The planned depth of all boreholes is 10 ft btos; however, it is possible that borings could extend to as much as 20 ft btos if extra macrocores and/or Shelby tube samples (as discussed below) are collected.
- Samplers: The primary sampling spoons will be 3-inch diameter, 5-foot long Geoprobe® MC-7 macrocore samplers, or spoons of other dimensions as approved by AECOM, capable of completing at least a 10-foot btos boring in no more than two sampler drives. To minimize the chance of borehole collapse, the drilling subcontractor will have a minimum of four (4) samplers available to support continuous drilling of all borings to completion without delay for logging and equipment decontamination between sampler drives. Shelby tubes will also be used for selected samples; Shelby tubes are sacrificial (shipped with the sample and not reused onsite), and as many as five (5) samples may be collected with Shelby tubes at each location.
- Drill rod: Water depths in the sampling area may be as much as 60 ft, depending on the boring location and tidal stage at the time of drilling. Additionally, there may be as much as 20 ft of air draft for each boring (distance from water surface to the maximum height of the drill rig head). Therefore, a minimum of 100 ft of drill rods will be available on the sampling vessel.
- Casing: A minimum of 100 ft of larger-diameter steel casing (four-inch minimum diameter) will be available for casing of borings through the air draft, water column and the length of the boring to maintain an open and stable borehole for the duration of the boring.
- Ancillary equipment: Support gear would include, but is not necessarily limited to, generators and compressors to provide power sources for tools, computers and other devices, power washer(s) for decontamination, navigation & communication equipment (such as marine radios and cellular telephones), a portable restroom, anchorage devices, and monitoring equipment (e.g., a photoionization detector [PID] for both health and safety monitoring as well as core evaluation).
- Site control vessels and personnel: As detailed below in Section 3.2.1, in addition to the drilling platform, additional vessel(s) with appropriate staffing will be available to respond to and control sheens, if generated by the sampling outside of the control zone at the active sampling location.
- Tide gauge: A temporary water level meter and data recorder will be installed at a secure location along the sheet pile barrier wall to collect tide height data for use in correlating sampling coordinates to water depths.
- Personnel: Workers on board the sampling vessel will include, at a minimum a captain and mate for vessel operation, a driller and helper, and an AECOM geologist. Staffing of site control vessels will depend on the vessel(s) deployed but is expected to consist of at least a captain and a mate for each vessel. Finally, an AECOM scientist will be stationed on the WOTH as a sheen observer at all times when active drilling work is underway.

All coordinates used for navigational and drilling planning, and as-built coordinates to be collected during the work, will utilize the New York State Plane Coordinate system, East zone, with the North American Datum of 1983 (NAD83), feet as the datum and unit of measurement.

As this scope is limited to investigation only and consists solely of minimal and short-duration (one work day or less at each sampling station) disruption of the riverbed, it is assumed that this work can be conducted pursuant to United States Army Corps of Engineers (USACE) Nationwide Permit #6 (Survey Activities) (USACE, 2021) and in compliance with the general and regional conditions of that permit (USACE, 2022). With respect to potential impacts to threatened and endangered species, the underwater noise to be generated during this work is not expected to exceed levels that would cause injury or behavioral disturbances; additional details regarding underwater noise are included in a memorandum dated February 20, 2025 responding to a specific NYSDEC inquiry, included herein as Appendix A. Accordingly, the work is expected to meet the conditions of the blanket Water Quality Certification (WQC) issued by the NYSDEC for Nationwide Permit #6, and no individual permit conditions or time-of-year restrictions apply. All work will be done consistent with relevant regulations and/or best practices so as to not interfere with Hudson River navigation while the work is performed.

3.2.1 Site Control

Access to the Site will be controlled by CHGE's normal security of locked fencing along its gas regulator yard's upland perimeter and the sheet pile wall along its waterfront. The drilling platform would be moored either along this wall or at a local marina when not in use.

All investigation-derived waste (IDW) will be drummed and off-loaded to the CHGE gas regulator yard or another staging area as necessary for off-site disposal by CHGE at a regulated facility. IDW will include all drill cuttings generated during the investigation, decontamination fluids, and any other disposable materials that come into contact with river sediments (e.g., disposable personal protective equipment [PPE], and single-use sampling items [used core liners, disposable knives, etc.]). IDW will be profiled and disposed of at authorized facilities per CHGE's existing policies for disposal of IDW and/or other MGP-impacted materials.

Sheen monitoring and control procedures will be conducted throughout the drilling and sample collection activities. Sheens generated by these activities would be controlled by a patrol boat using absorbent materials. The patrol boat would be a large vessel capable of deploying an oil containment boom from either side of the vessel via outriggers, deploying a sorbent boom, storing sorbent materials and able to deploy skimmers.

The patrol boat will be directed to the sheen locations, if present, via radio by an AECOM observer on the WOTH.

All spent absorbent materials will be drummed and off-loaded to the CHGE gas regulator yard as necessary for off-site disposal by CHGE at a regulated facility. The sheen patrol boat will be moored at a local marina when not in use.

3.2.2 Sampling Locations

Based on the objectives described above regarding targeting accessible areas of concentrated NAPL impacts, the NAPL visual assessment program will target the larger of two concentrated NAPL impact areas identified in the modeling memorandum (i.e., Area B) for delineation. Based on the model, the accessible portion of Area B is approximately 300 ft in length along the river alignment by a 100 ft section across the river, near the toe of the eastern shoreline and positioned mostly north of the WOTH bridge. The extents of the concentrated NAPL impacts in Area B will be investigated further using transects connecting known points (i.e., RI-phase borings) to find the apparent edge of concentrated NAPL impacts using a “step-in, step-out” approach.

The general sampling layout is shown on Figure 3.3. First, three prior RI-phase boring locations interior to Area B will be reoccupied and sampled for purposes of calibrating expectations as to the current intensity and condition NAPL impacts:

- SED-112, which included “NAPL in seams, fractures and along debris” impacts in three intervals from 0 to 1.0 ft, 2.5 to 5.0 ft and 6.6 to 7.2 ft, and “NAPL throughout” impacts in two intervals from 1.6 to 2.5 ft and 6.0 to 6.6 ft;
- SED-114, which included “NAPL in seams, fractures and along debris” impacts from 0 to 1.0 ft and “NAPL throughout” impacts from 1 to 2.1 ft; and
- SED-128, which included “NAPL in seams, fractures and along debris” impacts in two intervals from 0 to 1.5 ft and 1.9 to 7.2 ft, and “NAPL throughout” impacts from 1.5 to 1.9 ft.

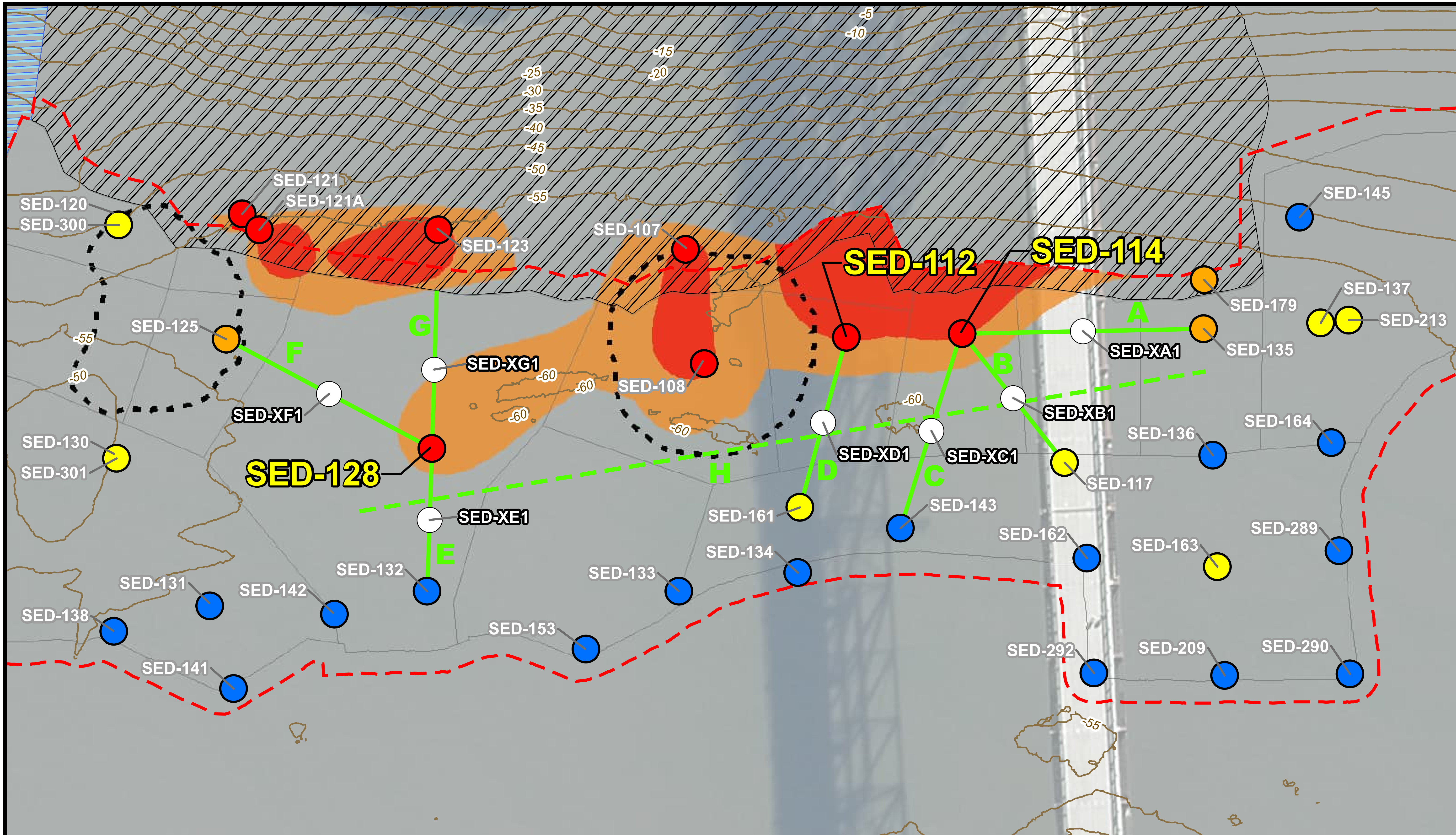
Consistent with the approach for categorizing visual NAPL impacts from the RI phase, impacts will be categorized (as detailed below) on a scale that includes “no NAPL impact,” “some/little/trace NAPL, “NAPL in seams, fractures or along debris” or “NAPL throughout.” The “NAPL in seams, fractures or along debris” or “NAPL throughout” classifications are assumed to represent concentrated NAPL, and presence or absence of these impacts in a boring will be the primary input into the progression of the transects.

Broadly speaking, each investigation transect will connect an RI boring location with visual NAPL impacts within Area B (the “interior end”) to another nearby boring where visual NAPL impacts were classified as “little/trace/some NAPL” or “no impact” that is outside of the inferred limits of the concentrated NAPL body (the “exterior end”). A series of seven transects (A through G) connecting interior and exterior points around Area B will be used to delineate a potential targeted removal area. A boring inside Area B may be used as the interior end of multiple transects; however, the exterior end borings are unique to each transect. The three RI-phase borings to be redrilled constitute all of the interior end borings to be used for the transects.

Following redrilling of the three interior end borings, all transects will begin with a boring located at the center point between the interior and exterior ends. The next boring would then be located at the midpoint between the first boring and the interior or exterior end, depending on whether concentrated NAPL is found. If concentrated NAPL is not found, the next boring would be a “step-in” located halfway between the midpoint boring and the interior end. If concentrated NAPL is found, the next boring would be a “step-out” located halfway between the subject boring and the exterior end. This “step-in, step-out” process will be repeated, halving the distance between borings along the transect until two borings are located within 20 ft of each other (at which point, the edge of the concentrated NAPL is assumed to be between the final two borings).

Finally, one transect (Transect H) will be located toward the exterior ends of Transects A through E, with the purpose of confirming a “clean edge” along the targeted area between transects and will not follow the “step-in/step-out” procedure. (Given their alignment and position relative to Area B, Transects F and G will not overlap with Transect H.) A wider spacing of borings will be used along Transect H, with borings located approximately every 40 to 50 ft as needed to fill in gaps between borings located along Transects A through E.

Table 3.1 summarizes the transects and the expected number of borings needed to locate the edge of concentrated NAPL in Area B to within 20 ft.



Legend

Red circle	NAPL observed in at least one interval
Orange circle	NAPL observed in seams/fractures or along wood
Yellow circle	Some, little, or trace NAPL observed
Blue circle	No NAPL impact observed
White circle	Initial (Transect Midpoint) NAPL Visual Assessment Boring
Green line	Transect
Red dashed line	Decision Document (2016) Targeted Remedial Area
Brown line	Sediment Surface Contour
	Utility Cap
	Slope Cap
	Dredge Polygon
	Footprint of NAPL Impacts (Total Extent)
	Dredge Area

ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid
sq ft: square feet

0 20 40 80 Feet

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POUGHKEEPSIE, NY

NAPL VISUAL ASSESSMENT BORING LAYOUT

DATE: 9/9/2024 | DRWN: ML

FIGURE 3.3

Table 3.1 Visual NAPL Investigation Transect Summary

Transect	Interior End	Exterior End	Transect Length (ft)	Number of Borings Planned
A	SED-114	SED-135	105	3
B	SED-114	SED-117	75	2
C	SED-114	SED-143	90	3
D	SED-112	SED-161	78	2
E	SED-128	SED-132	60	2
F	SED-128	SED-125	100	3
G	SED-128	SED-123[1]	70	2
H[2]	--	--	383	5

[1] SED-123 lies within the shoreline cap area and is therefore in an inaccessible area; the exterior end for Transect G is instead taken as the limit of the proposed slope cap area along a line from SED-128 to SED-123 for purposes of determining the length of Transect G

[2] Transect H is intended confirm a “clean edge” and is not a step-in/step-out transect; total number of borings planned is estimated based on total length of Area B,

Figure 3.3 shows the proposed layout of the sampling transects, overlain on the inferred limits of concentrated NAPL as established in the 3D modeling memorandum. Because only the existing interior and exterior end points and the initial transect mid-point sampling coordinates are known prior to mobilization, only these points are shown on Figure 3.3. During NAPL visual assessment field work under this PDIWP, the station ID nomenclature for all borings will use a SED prefix to maintain consistency with prior station IDs. The three locations to be reoccupied and redrilled will use the original station IDs with an R suffix appended (i.e., SED-112R, SED-114R and SED-128R). The transect station IDs will begin with an X to denote their location on a transect and the transect ID (e.g., XB for transect B) followed by a numeral starting with 1 for the initial transect mid-point boring, and then increasing sequentially. As examples, SED-XA1 will be the station ID for the mid-point boring along Transect A, SED-XB2 will be the station ID for the second boring completed along Transect B, and SED-XC3 will be station ID for the third boring completed along Transect C. For Transect H, Station IDs will be established from north to south starting with SED-XH1 and increasing sequentially toward south (note that SED-XH1 would not be the midpoint of Transect H, as the approach for establishing the Transect H locations differs from the other transects).

A provisional listing of planned borings IDs, including coordinates for the midpoint and redrilled borings, is included as Appendix B. The total number of borings, inclusive of Transects A through H and redrilling of SED-112R, SED-114R and SED-128R, is estimated at 25 borings. As-drilled locations for all borings in the NAPL visual assessment program will be recorded as described in this PDIWP, and a working copy of Figure 3.3 will be updated after each transect is completed.

3.2.3 Navigation and Drilling

Coordinates of the interior, exterior and mid-point locations for each transect will be established prior to mobilization. At the start of work on a transect, the captain will pilot the sampling vessel using Global Positioning System (GPS) for navigation to the mid-point and attempt to drill as close to the planned coordinates as possible, considering river conditions (currents, winds, tide, etc.) at that time – ideally, to within 10 ft of the planned location, but this requirement may be waived in the field if precise navigation proves to be time consuming. The captain will secure the vessel using spuds, anchors or other appropriate means of anchorage. The vessel will be navigating by means of on-board motors, tug, or a combination of power plants to each transect. Each transect will be completed in its entirety before remobilizing the drilling platform to the next transect. The drilling platform will be maintained on-location at each boring by use of spuds, anchors or other devices at the discretion of the vessel captain(s).

Once the captain declares the sampling vessel is secure and ready for drilling, the boring will be completed using a DPT or equivalent rig, capable of advancing a boring to a minimum depth of 20 ft. Upon establishment of each boring location, an outer casing will be lowered to and set just into the sediment surface. The coordinates for the center point of the casing will be recorded using a GPS receiver, for use as the final as-built coordinates of the boring.

The planned depth for all boring is 10 ft below the sediment surface. A 5-foot-long sampling spoon will be used, so each boring will require tripping the rods at least once to complete a second sampler drive. The borings will be completed as follows:

- Prior to starting the boring, two 5-foot long, 3-inch diameter macrocores with liners will be prepared for use on the borehole.
- The drill rig will advance the first macrocore to a depth of 5 ft below the sediment surface.
- After the initial drive of the macrocore and prior to pulling the drill string the drillers may, at their discretion, advance the outer casing up to 5 ft if needed to maintain the borehole while the drill string is tripped.
- The drill string will be removed from the borehole, and the macrocore will be disconnected. The first spoon will be temporarily secured upright, and the second spoon will be attached to the drill string and immediately lowered to the end point of the prior drive, to maintain an open borehole.
- The second macrocore will be driven to a depth of 10 ft below the sediment surface, the drill string will be removed from the borehole, and the macrocore disconnected.
  - Both macrocores will be opened for inspection on-board by the AECOM geologist. If the AECOM geologist determines that concentrated NAPL impacts are present within one foot of the bottom of the second macrocore, a third macrocore will be inserted into the borehole; the outer casing may be advanced by up to 5 ft (if needed to maintain the borehole), and then the third macrocore will be driven to a depth of 15 ft below the sediment surface. If concentrated NAPL impacts are again observed within the bottom foot of the third macrocore, this step may be repeated for a fourth macrocore driven to a depth of 20 ft below the sediment surface.
- Upon confirmation from the geologist that the cores are suitable for logging, the drilling crew will grout the borehole with a lean cement grout mixture and then retrieve the outer casing to abandon the borehole.
- Concurrent with the borehole abandonment, the AECOM geologist will log the boring in accordance with the logging procedure described below.
- If concentrated NAPL impacts are not observed in the boring, the AECOM geologist will direct the captain to navigate to a “step-in” location; if concentrated NAPL impacts are observed in the boring, the AECOM geologist will direct the captain to navigate to a “step-out” location. The boring procedure will be repeated at the step-in or step-out location, unless the next location would be within 20 ft of the just-completed boring (in which case, the transect will be considered complete).

3.2.4 Visual NAPL Logging

The objective of the logging for each boring is to identify whether concentrated NAPL is present, or not. To determine the relative quantity of MGP impacted material within the sediment cores, multiple field determinations may be utilized to quantify/qualify the extent of MGP impacts. In addition to strictly visual observations, olfactory observations and scanning of cores with a PID can also be used to identify MGP impacts. Typically, it is expected that MGP impacts will be present as a tar-like material (TLM), although other forms of MGP-related NAPLs may be present in river sediments. NAPL impacts will fall into one of six categories:

- No impacts – No observed TLM; low PID readings (less than 25 parts per million [ppm]), faint or passing olfactory impacts.
- Coated – Soil grains are coated with TLM, but there is not sufficient free-phase material present to saturate pore spaces.
- Blebs – Observed discrete spherules (droplets) of TLM; however, the majority of the soil matrix is not visibly saturated.
- Stringers – Observed horizontal to sub-horizontal non-planar strings or ganglia of TLM ranging typically less than 1/4 of an inch thick.
- Micro-lenses – Observed horizontal to sub-horizontal bands of TLM ranging from less than 1/8 of an inch to an inch thick.
- Saturated – The entirety of the pore space for a horizon greater than one inch contains TLM.

Each sediment core will be inspected by the field geologist for impacts. In the event any sediment core is observed with impacts ranging from “coated” to “saturated”, further field testing may be performed to quantitively estimate the level of impact in the core.

Select portions of the sediment cores without obvious visual or PID indications of NAPL impacts, but where impacts are suspected due to olfactory or other observations, may undergo a “jar” field test to evaluate whether slight and dispersed NAPL impacts are present:

  – From the portion of greatest suspected impact within an individual sediment core, approximately 8 ounces of sediment will be placed into a clear 16-ounce jar.

- Clear water will be added to create a total volume of 12-14 ounces.
- The sample will be agitated, so that complete separation of MGP materials and sediment occurs.
- Light NAPL will float at or near the surface of the water and will provide a visual representation of an estimate of the quantity of light NAPL in a sediment core.

Based on the observations made per the procedure above, MGP impacts to the sediment will be logged consistent with both the legacy terminology used in the RI-phase borings (i.e., “no impact”, “some/trace/little NAPL”, “NAPL in seams, fractures or along debris” and “NAPL throughout”) and current best practices, as summarized in the NYSDEC technical guidance “Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites” (included in Appendix C).

The assignment of impact type under the legacy RI system is qualitative, but in general it is expected that the identification of micro-lenses and/or saturated segments will lead to classification of cores as containing at least one interval of “NAPL in seams, fractures or along debris” and “NAPL throughout” impact levels. Cores may have varying levels of impact along their length; for purposes of making “step-in” or “step-out,” the presence of any “NAPL in seams, fractures or along debris” and “NAPL throughout” in any interval will be considered indicative of concentrated NAPL impacts to a boring.

3.2.5 NAPL Mobility Sample Handling, Shipping and Disposal

A limited number of samples will be collected from within Area B for NAPL mobility testing. The purpose of this sampling is to evaluate the feasibility of NAPL mobility sampling and analysis for potential future phases of the investigation and design of a targeted remedy. Up to five (5) samples will be collected from Area B, ideally at locations/depths where NAPL has been observed beneath the practical depth of dredging (6 ft btos). To the extent possible, intervals of varying impact (i.e., saturated thickness, stringers, and blebs) will be targeted. Samples will be collected and prepared for analysis by Integrated Geosciences Laboratories, LLC (IGS) in Houston, Texas using the following procedure:

- The preferred sampling method for evaluation of NAPL mobility in sediment is an undisturbed sample. As often employed in geotechnical sampling, this would preferentially mean sampling by means of a Shelby tube – a thin-walled metal sampling tube with typical dimensions of 2 ft in length by 3 inches in diameter. Shelby tubes would be pushed by a DPT rig by direct pressure from the drill column only (i.e., without use of the drive hammer).
- Recovery in Shelby tubes can be affected by excess hydrostatic pressure that accumulates in the sample during driving. If initial sampling attempts do not yield acceptable recovery, on subsequent drives the Shelby tube will be left in place after driving for up to 10 minutes to allow excess hydrostatic pressures to dissipate, before pulling the drill string.
- Samples in Shelby tubes cannot be logged in a conventional manner as described above for the visual NAPL impact assessment until the sample is extruded. If possible, plastic liners will be used so that samples may be extracted and logged in the field prior to shipment, but if not possible, samples will be described and logged on the basis of exposed sediment at both ends of the tube.
- NAPL mobility samples will be frozen on-site and prepared for shipment under dry ice to Integrated Geosciences Laboratory of Houston, Texas. Due to the use of dry ice and the presumed presence of concentrated NAPL, sample shipping options may be limited. There are no holding time restrictions because no chemistry analyses are proposed as part of this analysis. The Health and Safety Plan (HASP) that will be developed prior to mobilization for this PDIWP will address all special shipping and handling issues associated with these samples.

3.3 Data Collection

Data to be collected in the field during the NAPL visual assessment includes navigational information to document boring locations, boring logs to document the results of the NAPL visual assessment, and general narrative summaries of the work and relevant support activities. These data will be recorded as follows:

- Lithology, NAPL impact observations, and all other field observations will be recorded in a dedicated field book and/or boring log form. Drilling observations to be recorded include, at a minimum, a description of the sediment according to the Unified Soil Classification System (USCS), PID readings, olfactory and visual observations of MGP-related impacts (such as presence of TLM or other NAPLs), severity of impacts, and disposition of any samples retained from the borings.
- Drilling coordinates will be recorded electronically by the vessel captain and provided to AECOM via email daily. Coordinates will be included on boring logs.
- Photographs will be taken of each core, any associated TLM field testing, and any other pertinent field observations, and uploaded daily to a secure data repository.

3.4 Laboratory Procedures (NAPL Mobility)

Upon receipt at IGS, the NAPL mobility sample tubes will be opened, and the frozen cores photographed using ultraviolet (UV) light. The photographs will be used to confirm the nature of the NAPL impacts and identify the most concentrated section of the sample interval for the collection of aliquots (cross-cut slices of the core) for testing using ASTM Method E3282-22, *Standard Guide for NAPL Mobility and Migration in Sediments – Evaluation Metrics*.

Mobility testing incorporates the use of physical and analytical methods to evaluate the potential mobility of NAPL within the structure of the sediment media, i.e., at the “pore” scale. Initially, the samples will be processed physically in a centrifuge to determine if the pressure from environmental forces are likely to mobilize the NAPL from the sample pores. The samples will be subjected to a centrifugal force of 20 pounds per square inch for a period of 10 hours. The centrate will be collected and quantified.

- Observations of “no NAPL” in the centrate will demonstrate that the NAPL is not mobile, i.e. that the organic content is less than the residual saturation point (RSP) of the sediment.
- Observations of NAPL in the centrate will indicate that the organic content is greater than the RSP and the NAPL is potentially mobile at pore scale.

In the second step of the evaluation, the Dean Stark extraction method will be used to quantify the organic content of the samples. The analysis allows the quantity of water and NAPL to be extracted and measured. The results are used with the findings from other physical tests (particle size, porosity, moisture content, etc.) to express the organic content of the processed sample as percent of pore volume (%PV).

In instances where NAPL is expressed into the centrate, the result of the Dean Stark extraction represents the RSP (%PV) of the sample. The quantity of NAPL in the centrate is included in the calculation to determine the organic content of the original sample.

The results from this testing will be used to evaluate potential uses for mobility data going forward, e.g., informing a cap design, or broader efforts to determine the effects of NAPL migration. Use and applicability of these data will be subject to evaluation and discussion after the data are received from IGS, and may constitute a separate deliverable with a scope to be determined after initial assessments about the usability of NAPL mobility samples have been established by IGS.

3.5 Analysis and Reporting

The primary objective of the NAPL visual assessment is to augment the existing database of visual impact data used in the 3D model to establish the limits of concentrated, accessible NAPL in Area B. To that end, the primary output of the NAPL visual assessment will be the boring logs. The boring logs (including both legacy RI-phase descriptions of NAPL impacts as well as description under the current methodology as presented in Appendix C) will be included as an appendix to the *Pre-Design Investigation Data Report*. A narrative summary of the NAPL visual assessment program will be included in this report. The NAPL visual impact and lithology data from the boring logs will be added to the existing database, and a series of figures depicting updated horizontal and vertical limits of Area B will be presented in the report. The updated model will serve as a basis for future evaluation of a potential targeted removal area.

The *Pre-Design Investigation Data Report* will also include, at a minimum, summary information provided by IGS as to NAPL mobility. However, as noted above, a full evaluation of the applicability and usability of this information would not be made until after receipt of the data. Depending on the findings of the NAPL mobility testing, if a need for separate reporting deliverables and/or a work plan on how this data may be used is identified, this would be communicated to the NYSDEC and be discussed in the *Pre-Design Investigation Data Report*.

4. Phase 2 – Toxicity Testing

4.1 Objectives

The purpose of this section of the PDIWP is to provide guidance for field and analytical work for a toxicity and sediment chemistry analytical program, by defining the sampling and data gathering procedures to be used to provide data of sufficient quality to support the reevaluation and optimization of the previously conducted remedial alternatives analyses.

The proposed toxicity testing investigation is designed to include supplemental field work to assess the need for remedial action in areas without concentrated NAPL impacts. The tasks discussed in this section are intended to support the following objectives:

- To better characterize the toxicity of PAHs to benthic invertebrates in sediments within the current remedial footprint in the Northern, Southern and (potentially) Central Areas, but without concentrated NAPL impacts.
- To understand the bioavailability of PAHs to the benthic community.

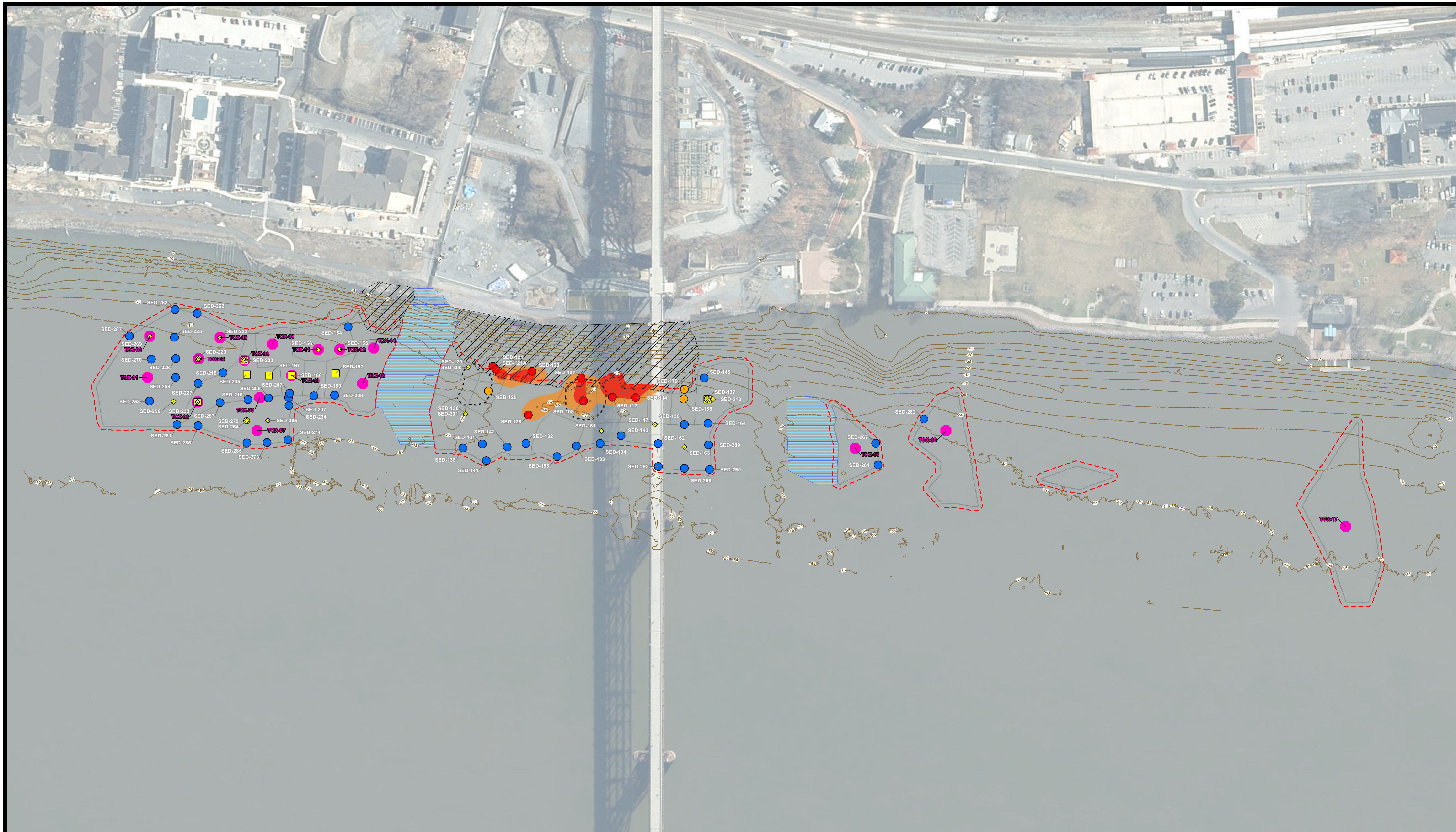
These findings will be used to identify candidate areas for either a cap-on-grade or a monitored natural recovery (MNR) remedy.

Sampling locations for the toxicity testing will be inside the existing remedial footprint, with the purpose of determining whether a cap is needed to provide protectiveness in areas of the remedial footprint outside of the potential targeted removal area, and/or whether another remedial approach may be preferred. Seventeen surface sediment sampling locations within the Northern and Southern Areas have been identified on Figure 4.1. The need for sampling within the Central Area will be dependent on the findings of the NAPL visual assessment described in Section 3. In addition to sampling within the remedial footprint, toxicity testing will be performed at three upstream reference locations to provide Site-specific context.

Contemporary literature has documented that risks to benthic receptors in surficial sediments due to PAHs are a function of porewater concentrations rather than the bulk sediment PAH concentrations (Brennan and Johnson, 2017; Geiger, 2010; Geiger, et al., 2015; Hawthorne, et al., 2007; Mayer et al., 2014; McGrath, et al., 2019; United States Environmental Protection Agency [USEPA], 2003; USEPA, 2012). Therefore, decisions regarding the potential for risk to the benthic community in the river and the need for remedial action should consider Site-specific bioavailability, rather than bulk sediment data alone. The proposed toxicity evaluations will include paired toxicity testing and chemistry analyses of at least the 17 Site surface sediment locations shown in Figure 4.1, and three reference samples. Toxicity testing will be conducted using the amphipod *Hyalella azteca* and analytical chemistry samples will be collected for PAHs, total organic carbon (TOC), and grain size in bulk sediment and PAHs in porewater via solid-phase microextraction (SPME). The selected reference sample locations and the general approach for the toxicity evaluation are consistent with the *2011 Supplemental Sediment Investigation Report* (Arcadis, 2012).

4.2 Field Sampling Approach

The proposed field investigation activities are designed to evaluate the potential impact of PAHs in the sediment of Hudson River adjacent to the Site on the benthic invertebrate community and assess the need for remedial action. The toxicity testing program will focus on sampling locations without concentrated NAPL impacts that are located within the remedial footprint in the Northern and Southern Areas; additional sampling in the Central Area is also provisionally anticipated, pending outcome of the NAPL visual assessment work (i.e., if the NAPL



AECOM

Legend

- NAPL observed in at least one interval
- NAPL observed in seams/fractures or along wood
- Some, little, or trace NAPL observed (0.0' - 0.5')
- Some, little, or trace NAPL observed (0.5' - 1.0')
- Some, little, or trace NAPL observed (>1.0')
- No NAPL impact observed
- Proposed Toxicity Location
- Decision Document (2016) Targeted Remedial Area
- Sediment Surface Contour
- Utility Cap
- Slope Cap
- Dredge Polygon
- Footprint of NAPL Impacts (Total Extent)
- Dredge Area

ABBREVIATIONS:
ft NAVD: feet North American Vertical Datum
NAPL: Non-Aqueous Phase Liquid
sq ft: square feet

0 100 200 400 Feet

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SEDIMENT TOXICITY SAMPLING LAYOUT

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FIGURE 4.1

visualization assessment identifies areas without NAPL impacts outside of the targeted removal area, additional sediment toxicity testing may be added to this program). All field investigation activities will be conducted in accordance with the approved PDIWP and HASP that will be developed prior to mobilization for this PDIWP.

This section discusses the tasks involved with the planning and execution of the proposed sediment sampling. Although extensive investigations have been performed within the Hudson River adjacent to the Site, NYSDEC has requested that additional field work be conducted to confirm that existing conditions are consistent with the 2007 observational and analytical data and to support conceptual cap details. The proposed toxicity testing and analytical chemistry sampling will support these evaluations and help assess the extent of the remedial footprint subject to active remediation by evaluating whether Site-related toxicity to benthic invertebrates is expected in the river.

Benchmarks based on bulk sediment concentrations, including the probable effect concentration (PEC) for Total PAHs, are useful for identifying constituents that require additional evaluation with more Site-specific information, but may overestimate actual impacts to the benthic community since site-specific bioavailability is not considered. McGrath, et al. (2019) reported that bulk sediment PAH PEC comparisons overestimated toxicity in 43.3% of test sediment results reviewed and that the use of passive sampling methods (including SPME) provides the most direct way to quantify the bioavailability of PAHs in sediments and refine risk estimates for benthic life.

As reported in the *2011 Supplemental Sediment Investigation Report* (Arcadis, 2012), although initial benchmark comparisons identified potential risks to the benthic community based on bulk sediment PAH results, toxicity testing and porewater analyses from 20 Site locations collected beyond the limits of the NAPL-impacted area of the Hudson River adjacent to the Site indicated that PAHs present in sediments and porewater were not toxic to benthic aquatic organisms. This was demonstrated by the high *H. azteca* survival in the toxicity testing and a lack of correlations between toxicity testing results and PAHs in sediment or porewater.

The proposed toxicity testing program includes sampling at locations within the Northern and Southern Areas as indicate on Figure 4.1. The need for sampling within the Central Area will be dependent on the findings of the NAPL visual assessment described in Section 3. Toxicity samples will not be collected from within the utility corridor areas. It is assumed that nearby toxicity testing locations may be used to indicate sediment quality in these areas.

The reference samples collected upstream of the Site represent local sediment conditions in the absence of Site-related constituents. Testing a reference sediment provides a site-specific basis for evaluating toxicity (USEPA, 2000). The three reference locations were selected from among the five upstream samples collected to support the 2011 sediment investigation. The selected reference locations have similar water depths and sediment characteristics (e.g., organic carbon, grain size) to what is expected within the Site sampling locations.

Mobilization for the toxicity sampling effort will preferentially occur in conjunction with the NAPL visual assessment, with toxicity sampling work to commence immediately after the NAPL visual assessment work is complete. Regardless of whether the two programs occur immediately in sequence or in separate mobilizations, the same or a similar working platform and the same or similar equipment and procedures as described above in Section 3.2 for navigation and sampler deployment will be used. However, instead of a DPT drill rig, sampling equipment would include a grab sampler such as a Van Veen, Ted Young modified Van Veen, or power grab sampler (as detailed further, below).

As detailed in Section 3.2, because this scope is limited to investigation only and consists solely of minimal and short-duration (one work day or less at each sampling station) disruption of the riverbed, it is assumed that this work will be completed pursuant to USACE Nationwide Permit #6 (Survey Activities) and relevant general and regional conditions and blanket WQC, and no time-of-year restrictions apply. All work will be done consistent with relevant regulations and/or best practices so as to not interfere with Hudson River navigation while the work is performed.

4.2.1 Site Access and Control

As indicated in Section 3.2.1, access to the Site will be controlled by CHGE's normal security of locked fencing along its gas regulator yard's upland perimeter and the sheet pile wall along its waterfront. The sediment sampling vessel would be moored either along this wall or at a local marina when not in use.

Management of IDW and sheen monitoring and control procedures for the sediment sampling effort will be consistent with those described in Section 3.2.1 for the NAPL visual assessment.

4.2.2 Sample Collection and Logging

The vessel will navigate to each pre-determined sampling station using onboard GPS. Sampling locations are provided in Figure 4.1 for the Northern and Southern Areas. If sampling is warranted within the Central Area following the NAPL visual assessment, then coordinates for those locations will be provided to the sampling team. The vessel will be navigating by means of on-board motors, tug, or a combination of power plants, ideally to within 10 ft of the planned location. This requirement may be waived in the field if precise navigation proves to be time consuming. The captain will secure the vessel using spuds, anchors or other appropriate means of anchorage. Once the sampling vessel has occupied a station and been anchored, sampling activities will begin.

4.2.2.1 Water Depth and Quality

At each sediment toxicity sampling location, depth to sediment surface and two sets of field measurements of water quality will be taken prior to sampling. Due to water depths and currents, use of a line for water depth measurement is not expected to provide accurate data and water depths in the field will be measured using an echosounder mounted to the sampling vessel as a point of reference for sampling operations. However, determination of water depth using tide height data from the temporary tide gauge in concert with river bottom elevation data from existing bathymetric mapping of the Site will provide the most accurate measurement of water depths, and water depths as determined by this method will be used where required for analysis of data.

Water quality data will be collected using a water quality sonde (YSI EXO or similar) lowered into the water column with the sampler. One water quality measurement will be taken approximately one foot below the water surface and a second measurement within one foot of the sediment surface. The water quality parameters to be measured in the field include:

- Temperature;
- Dissolved oxygen;
- pH;
- Turbidity; and
- Conductivity.

After water quality measurements are complete, surficial sediment sampling will be initiated.

4.2.2.2 Sediment Sampling

Surficial sediment samples will be collected from 0 to 0.5 ft btos. Large sediment volumes (over 2 gallons per station) are needed to complete the proposed analyses (i.e., toxicity testing, PAHs in porewater, and TOC, grain size, and PAHs in sediment). Because of the volume of sediment required for the analyses, large volume samplers are needed. If obstructions such as boulders, logs, or cobbles are encountered at a specific station, the location of the station may be changed to collect sediment samples as required.

Surficial sediment grab sampling equipment will be decontaminated between sampling locations. Sampling equipment will not be cleaned between grab samples at a location, if multiple grabs are required to achieve the required sample volume. Equipment blanks for PAH analysis will be collected at a frequency of one per twenty field samples to monitor the effectiveness of reused equipment decontamination.

Personnel will record field observations of the physical characteristics of the sediment encountered at each sampling station, and will record observations regarding the physical characteristics of the study area. Surficial sediment grab samples will be visually evaluated for indications of bioactivity. Surficial sediment grab samples will be geologically characterized, screened with a PID, logged, photographed, and sub-sampled. Sediment samples will be collected leaving a 1-inch ring of sample around the edge of the sampler (i.e., the sediment that has come in contact with the sampler will not be included in the sample).

Oversized material such as twigs, shells, leaves, stones, pieces of wood, and vegetation will be removed by hand. The grab sample will be removed from the sampling device using a stainless-steel spoon/scoop and placed in a decontaminated stainless steel mixing bowl. The sample will be homogenized in the mixing bowl and placed in appropriate sample containers. Sediment sampling equipment such as bowls, spoons, augers, and grab samplers will be decontaminated prior to and following sample collection. Each sampling container will be properly labeled with the name of the study site, the station location designation, the time of collection, the date of collection, and name of collector. Following sample preparation, glass jars will be kept at 4 degrees Celsius.

Sufficient sediment volume for toxicity testing, grain size, and analytical chemistry will be collected at all sediment sample locations. A 2-gallon sample container will be filled at each sediment sample location for the toxicity tests. Additional sample volumes from the same location will be collected for sediment and porewater analyses. A field duplicate sample for sediment chemistry (PAHs in sediment and porewater, and TOC in sediment) will be collected at a frequency of one per ten samples to assess the precision of sample collection and homogenization procedures.

Sediment not placed in specified sample containers for analysis will be placed in an IDW container on-board for disposal as IDW.

4.2.3 Sediment Sample Handling, Shipping and Disposal

Standard environmental sample handling and custody procedures will be employed for all samples collected as part of the toxicity sampling program. All samples will be shipped under Chain of Custody (COC) procedures to provide complete traceability of all results. Each sample will be assigned a unique sample identifier, and the location, date/time of collection, and required analyses for each sample will be tracked on sample container labels, COC forms, and in routine site documentation (e.g., the field notebook, sample log sheets, etc.).

Samples will be packaged on ice at 4 degrees Celsius for shipment, with a separate signed COC enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be sealed and secured with strapping tape and custody seals for shipment to the laboratory. Sample container, preservation and holding times for various analyses are summarized in Table 4.1.

Table 4.1 Sample Containers, Preservation and Hold Times

Analyte/ Analyte Group	Matrix	Method	Container(s) [1] (number, size, type per sample)	Preservation	Preparation Holding Time [2,3]	Analytical Holding Time [2,3]
PAHs (parent and alkylated)	Sediment (for porewater analysis)	ASTM Method D7363-13	(1) 8-ounce amber glass, Teflon-lined cap	Ship at 0-6°C	28 days to generate porewater	24 hours
PAHs (parent and alkylated)	Sediment	USEPA Method 8270E-SIM	(1) 4-ounce amber glass, Teflon-lined cap	4 ± 2°C from collection to lab, lab storage at 0-6°C for up to 14 days, or at <-20°C for longer storage	1 year if frozen; 14 days if refrigerated	40 days from extraction
Toxicity Test	Sediment	USEPA Method 100.4	(1) 2-gallon plastic	0 - 6°C	56 days	
Total Organic Carbon	Sediment	Lloyd Kahn	(1) 4-ounce amber glass, Teflon-lined cap	4 ± 2°C	28 days	Not applicable
Grain Size	Sediment	ASTM Methods D6913 and D7928	(1) 16-ounce glass or plastic	None	None	None

Notes:
1 Alternate containers may be substituted, assuming that method requirements are met.
2 All days are calendar days.
3 Holding time begins at time of collection unless noted otherwise

If the samples are sent by common carrier, the waybill will be used. Waybills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

IDW generated during the sampling may include the following:

- Disposable material such as PPE, plastic sheeting, etc.
- Excess sediment leftover from sampling activities.
- Decontamination water.

IDW will be containerized and disposed of at properly permitted off-site disposal facilities using the analytical results from the investigation.

4.3 Data Collection

Data to be collected in the field during sediment sampling includes navigational information to document toxicity testing and sediment chemistry locations, depth to sediment, water quality measurements, documentation of sediment characteristics, and general narrative summaries of the work and relevant support activities. These data will be recorded as follows:

- Coordinates for sediment grab sampling locations will be recorded electronically by the vessel captain and provided to AECOM via email daily. Coordinates will be included on sediment sampling data sheets.
- Depth to the top of sediment, water quality parameters, physical characteristics of the sediment (including presence of organisms, PID measurements, and geological characterization) will be recorded on sediment sampling data sheets.
- Photographs will be taken of each grab sample collected and uploaded daily to a secure data repository.

4.4 Laboratory Procedures

An overview of the sediment toxicity testing and analytical chemistry procedure is provided in the following sub-sections.

4.4.1 Sediment Toxicity Testing

Sediment toxicity testing with the amphipod *H. azteca* will be conducted in the laboratory using the Site sediment samples and three upstream samples described above. Similar testing with *H. azteca* was previously conducted at the Site in 2011. USEPA (2000) guidance provides an accepted 28 day sediment toxicity test method with *H. azteca*, and this species has been used to evaluate impacts on benthic invertebrates due to exposure to PAHs in sediment in several studies (Geiger, 2010; Geiger, et al., 2015; Kreitinger, et al., 2007; Hawthorne, et al., 2007, McGrath, et al., 2019).

Samples collected from upstream locations will be used as reference samples in the evaluation of the toxicity testing results. Laboratory control samples (i.e., unimpacted sediment provided by the laboratory) will be included with each test to confirm that the health of the test organisms and test conditions did not adversely impact the test results.

Testing will be conducted in accordance with USEPA Method 100.4 (USEPA, 2000) and will evaluate survival and growth (as dry weight and biomass) after 28 days. Growth as average dry weight will be calculated for each tested sample based on the dry weight at test termination divided by the number of surviving amphipods on Day 28. Growth as average biomass will be calculated based on dry weight at test termination divided by the number of amphipods added at test initiation. Biomass is an optional endpoint for Test Method 100.4, but can be useful in assessing differences between samples when there is a reduction in survival in some samples by normalizing the growth endpoint to the number of test organisms at the start of the test.

Sediment toxicity testing was previously performed in support of the *2011 Supplemental Sediment Investigation Report*. The 2011 sampling was conducted beyond the limits of the NAPL-impacted area of the Hudson River adjacent to the Site. That investigation included 28-day testing of 20 Site samples and five upstream reference samples with *H. azteca* via USEPA Method 100.4 (USEPA, 2000). The proposed sediment testing approach in this PDIWP is consistent with the 2011 sampling, with the addition of the biomass endpoint that was not reported in 2011. The 28-day amphipod assay proposed for use has been used in several studies evaluating the potential for adverse effects of PAHs on benthic invertebrates, including at MGPs (Geiger, 2010; Geiger, et al., 2015; Kreitinger, et al., 2007; Hawthorne, et al., 2007).

The laboratory will conduct pair-wise statistical testing to determine if toxicity test metrics (i.e., percent survival and growth) are statistically different for the Site samples compared to the reference samples and the laboratory control (additional information is provided in Section 4.5).

4.4.2 Analytical Chemistry

Samples for sediment and porewater analytical chemistry will be collected from all sample locations subject to toxicity testing (including the reference locations) to permit an evaluation of the co-occurring data.

Sediment samples will be analyzed by the ESS Laboratory in Cranston, Rhode Island for the following parameters:

- 34 parent and alkylated PAHs using USEPA Method 8270E-SIM (see Table 4.2);
- TOC using the Lloyd Kahn method; and
- Grain size plus hydrometer for fines in bulk sediment using ASTM Methods D6913 and D7928.

Table 4.2 List of Parent and Alkylated PAHs for Analysis

Parent and Alkylated PAHs	
Naphthalene	Fluoranthene
C1-Naphthalenes	Pyrene
C2-Naphthalenes	C1-Fluoranthenes/Pyrenes
C3-Naphthalenes	Benz[a]anthracene
C4-Naphthalenes	Chrysene
Acenaphthylene	C1-Benzanthracenes/Chrysenes
Acenaphthene	C2- Benzanthracenes/Chrysenes
Fluorene	C3- Benzanthracenes/Chrysenes
C1-Fluorenes	C4- Benzanthracenes/Chrysenes
C2-Fluorenes	Benzo[b]fluoranthene
C3-Fluorenes	Benzo[k]fluoranthene
Phenanthrene	Benzo[a]pyrene
Anthracene	Perylene
C1-Phenanthrenes/Anthracenes	Benzo[e]pyrene
C2-Phenanthrenes/Anthracenes	Indeno[1,2,3-cd]pyrene
C3-Phenanthrenes/Anthracenes	Dibenz[a,h]anthracene
C4-Phenanthrenes/Anthracenes	Benzo[ghi]perylene

Source: USEPA (2003)

The list of 34 parent and alkylated PAHs is recommended by USEPA to quantify and assess Equilibrium Partitioning Sediment Benchmarks (ESBs) based on potential chemical toxicity of sediments to benthic invertebrates from PAHs (USEPA, 2003; USEPA, 2012). NYSDEC (2014) recommends the analysis of this list of PAHs for sites where PAHs are suspected as being present.

The porewater analysis will measure the 34 parent and alkylated PAHs used for risk assessment as an indicator of bioavailability (USEPA, 2003). The porewater samples will also be analyzed by the ESS Laboratory in Cranston, Rhode Island for dissolved PAHs by the flocculation and SPME method.

Porewater samples will be generated ex-situ and analyzed for the 34 parent and alkylated PAHs using ASTM Method D7363-13. This method combines SPME and isotope dilution quantitation to measure the dissolved phase PAHs in porewater. The laboratory preparation involves centrifugation and flocculation of site sediment/porewater mixes, followed by SPME/gas chromatography-mass spectrometry analysis of the generated and equilibrated porewater. Results of this analysis have been demonstrated to correlate directly with benthic invertebrate toxicity in 28-day tests with *H. azteca* (Geiger, 2010).

The principal goal associated with the sampling effort will be to use procedures that minimize changes to the in-situ conditions of the interstitial (pore) water. Grab sampling techniques described in Section 4.2.3 will be used to collect sediment for porewater.

4.5 Data Verification, Analysis and Reporting

4.5.1 Data Verification

The toxicity testing laboratory will provide a report summarizing the results of the toxicity testing as well as statistical comparisons conducted. The report will include information regarding the performance of the test, including sourcing of the test organisms, water quality measurements, survival counts, and weights at termination. Laboratory data sheets and statistical exports will be included. For the amphipod test to be deemed acceptable, the average survival of amphipods in the laboratory control sample (i.e., negative control) must be equal to or greater than 80% on Day 28 and the environmental conditions of the test must be within the tolerance limits of *H. azteca* (USEPA, 2000). The inclusion of the laboratory control sample in the test is intended to confirm that the health of the test organisms and test conditions did not adversely impact the test results. A water-only standard reference toxicant test (SRT) (i.e., positive control) will be conducted by the laboratory concurrently with the sediment exposures and with the same batch of amphipods. The purpose of the SRT is to assess the sensitivity of the test organisms and to develop a control chart of median lethal concentration (LC50) values for this species. Results of the laboratory control sample and the SRT will be included in the laboratory report package.

All laboratory analytical data will be provided in electronic formats, both Portable Document Format (PDF) and electronic data deliverables (EDDs). The PDF format deliverable will include both sample results and all quality control (QC) results in standardized USEPA Contract Laboratory Program-like format, as well as all supporting raw data. The PDF report will be searchable (embedded text) and bookmarked to facilitate data review. The associated EDD will be provided in an EQuIS four-file or similar appropriate format. Requirements and clarifying definitions and valid values file for the EQuIS four-file or similar format will be provided to all laboratories.

The analytical laboratory results will be reviewed by AECOM to determine if the basic quality control criteria were met, and that results and statistical findings are clear and testing was conducted without deviations that would impact the interpretation of the results. This review will include the batch QC samples such the method blanks, laboratory control samples, laboratory replicates, and matrix spikes, as well as surrogate recoveries. The report narrative will be reviewed to determine if sample preservation and holding time requirements were met, that the chain-of-custody instructions were followed, and that any major deviations in laboratory protocols do not adversely affect the usability of the reported results. The data review is not a formal Stage 2B data validation and will not involve modifying the data qualifiers assigned by the laboratory. Any significant quality control problems identified during data review will be discussed in the sampling report.

4.5.2 Data Analysis and Reporting

Analytical chemistry results will be tabulated for discussion in the *Pre-Design Investigation Data Report*. Sediment results for the 16 priority pollutant PAHs will be summed into a Total PAHs-16 concentration for comparison to the freshwater sediment guidance provided by NYSDEC (2014). Sediment results for the 34 parent and alkylated PAHs and TOC analyses will be used to estimate porewater concentrations of PAHs using the theory of equilibrium partitioning (EqP) and calculate toxic units (TUs) as indicated in USEPA (2003) (referred to as the ΣESBTU) and NYSDEC (2014). The EqP approach accounts for the distribution of PAHs between sediment organic carbon and porewater and is expected to over-estimate PAH bioavailability relative to porewater PAHs measured via SPME. However, the ΣESBTU approach represents an alternative method for assessing PAH toxicity that may be relevant in future evaluations.

Porewater data provide a direct measure of the PAHs to which benthic invertebrates may be exposed in the interstitial water, rather than an estimate of exposure as provided by the bulk sediment-based TUs (i.e., the ΣESBTU). The individual parent and alkylated PAH results for the porewater samples will be evaluated against the USEPA (2003) final chronic values (FCVs) and summed to generate a porewater TU[1] referred to as the ΣPW TU. If the PAH ΣPW TU is less than one, the concentration of the PAH mixture is acceptable for the protection of benthic invertebrates (USEPA, 2003).

Results of the sediment toxicity testing will also be included in the report. This will include summaries of survival and growth data for all samples tested. Standardized statistical tests will be conducted by the toxicity testing laboratory to identify significant differences in survival, growth, or biomass between individual Site and upstream reference locations, and between individual Site and laboratory control samples. Survival, growth, and biomass data for each Site and reference location will be independently evaluated to determine homogeneity of sample variances and normality of distribution. For each comparison, Non-directional Analysis of Variance (ANOVA) will be performed to determine the F statistic with significance level at 0.05. Based on the outcome of the evaluation of distribution and variance, the appropriate two sample tests will be performed on the paired Site and reference samples using a significance level of 0.05. The individual paired statistics will be performed by the laboratory using Comprehensive Environmental Toxicity Information System (CETIS) software (or equivalent).

A statistical difference between an individual Site sample and an individual reference sample is not necessarily indicative of an ecologically relevant impact (e.g., when results exceed test acceptability criteria or when results are not statistically different from other reference samples). The statistical results for all comparisons (e.g., all test endpoints and reference sample comparisons) will be considered in the assessment of whether or not a particular Site sample is expected to adversely affect the benthic community.

If the potential for benthic toxicity is identified based on statistical comparisons to the upstream reference locations, toxicity testing endpoints and selected analytical and physical results from co-located sediment samples will be evaluated in a correlation analysis to identify potential relationships between potential stressors (e, g., PAHs in porewater, grain size) and biological responses. Statistically significant ($p<0.05$) correlations that suggest an adverse effect on the

[1] For each sample, the individual PAH concentrations are divided by the PAH-specific FCVs to generate PAH-specific TUs. The PAH-specific TUs for a sample are summed to represent the ΣPW TU for the sample.

benthic community due to PAHs will be considered in the identification of areas that are candidates for remedial action via cap-on-grade.

5. Data Synthesis & Recommendations

The data collected as part of this program will support the potential development of a revised or amended remedy.

Targeted removal of accessible sediments with concentrated NAPL impacts is expected to be part of any revised or amended remedy, and the outcome of the NAPL visual assessment will be a primary driver, along with engineering considerations, in establishing the limits of the targeted removal area. Depending on the results of the NAPL mobility testing conducted as part of this PDIWP, additional mobility testing may be recommended to evaluate protectiveness of a targeted removal option with respect to long-term migration of inaccessible concentrated NAPL that may be left in place at depth.

Multiple lines of evidence from the toxicity testing and analytical chemistry analyses will be used to identify candidate areas for either a cap-on-grade or MNR remedy for the remainder of the in-river portion of the Site. These lines of evidence will include sediment and porewater chemistry results, visual observations, sediment toxicity testing results (including statistical comparisons of Site and reference location results), and statistical correlations between toxicity testing results and chemistry results. Decisions regarding the need for remedial action will consider lines of evidence that assess Site-specific PAH bioavailability (i.e., sediment toxicity testing results, porewater chemistry), rather than bulk sediment data alone. If lines of evidence suggest adverse impacts to the benthic community within the current remedial footprint due to Site-related PAHs, then locations will be considered for design of a cap-on-grade. If adverse impacts to the benthic community are identified in the sediment toxicity tests, but do not appear to be due to Site-related PAHs, then locations will be considered for a natural recovery option. If the toxicity tests indicate that the benthic community is not impacted relative to upstream reference locations, then locations will be considered for no further action.

Ultimate selection of remedial approach(es) in non-removal areas will use a holistic approach considering all data, overall Site conditions and constructability considerations (e.g., a continuous cap may be preferred to a “patchwork” cap depending on overall coverage).

Additional investigation may be necessary for areas identified as candidate capping areas. Within areas where a cap is determined to be the most effective remedial option, additional sediment chemistry, NAPL mobility and geotechnical data may be needed to support detailed design.

The *Pre-Design Investigation Data Report* will present a consolidated assessment of the data gathered during the PDI and make recommendations for design criteria and/or additional sampling as appropriate based on the potential revised or amended remedy.

6. References

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Appendix A Underwater Noise Impact Memorandum

AECOM
605 Third Avenue
New York, NY 10158
aecom.com

Project name:
Former North Water Street MGP

Project ref:
60643314

From:
Robert Forstner

Date:
February 20, 2025

To:
Jesse Gallo
Environmental Coordinator
Central Hudson Gas & Electric Corp.
2001 Ulster Avenue
Lake Katrine, NY 12449

CC:
George Leahy

Memo

AECOM has reviewed the information request from the New York State Department of Environmental Conservation (NYSDEC) in their email of January 7, 2025. This information request was made in response to a November 22, 2024, memorandum replying to earlier NYSDEC comments on the draft Pre-Design Investigation (PDI) Work Plan submitted by Central Hudson Gas and Electric (CHGE) on September 10, 2024. The January 7th information request asks for data on underwater noise levels related to impact driving; the specific data requested are behavioral disturbance (RMS) levels from vibratory or impact driving, cumulative exposure injury levels (SELCum) from impact driving, and peak pressure injury levels (PK) from impact driving.

It is anticipated that the proposed sediment sampling activities will use a 2-inch diameter sampler advanced by a Direct Push Technology (DPT) rig (commonly known by the brand name Geoprobe) through an outer 6-inch-diameter drill casing. DPT rigs use a combination of weight and hydraulic pressure placed on the drill string and a small impulsive rotary hammer (when needed) to advance the sampler. Although the hammer may be used when weight or hydraulic pressure alone is insufficient to advance the sampler, the energy levels transmitted into the drill string (and thus underwater) are substantially less than that involved with more typical impulsive activities like Standard Penetration Test (SPT) sampling or pile driving.

A survey of the literature did not identify any research or data specifically on underwater noise levels associated with DPT sampling. The National Marine Fisheries Service (NMFS) has a Multi-Species Pile Driving Calculator, which is standardly used as a tool to assess the potential effects to Endangered Species Act-listed species exposed to elevated levels of underwater sound produced during pile driving, which is a much greater sediment impact activity versus a DPT sampling effort. This calculator does not include the proposed DPT-type sediment activities since the smallest pile diameter included in the calculator is 12 inches and the calculation is strictly for a hammering process.

The literature survey did identify some research into underwater noise levels associated with geotechnical drilling and SPT sampling, which involves higher energy transfers into the drill string than associated with a DPT approach and is believed to represent a conservative overestimate of noise generation as compared to DPT sampling. SPT drilling involves the use of a 140-pound hammer dropped 30 inches onto the drill string, imparting a theoretical maximum energy of 350 foot-pounds per blow. As cited in the reference below, for SPT sampling, peak pressure levels range from 155 to 167 dB re 1 µPA, peak-peak levels range from 161 to 172 dB re 1 µPA, and SEL for as many as 40 strikes of an SPT hammer did not exceed 140 dB re 1 µPA (Erbe and McPherson, 2017). Broadband source levels at a distance of 3 feet from the source were estimated at 142 to 145 dB re 1 µPA for drilling and 151 to 150 dB re 1 µPA for SPT sampling. Based on energy inputs, the proposed DPT investigation would be substantially below these levels.

Based on the size of the equipment and the technology involved, it is expected that the relatively small DPT equipment will not develop the underwater noise levels summarized above, and that most underwater noise from this effort will be that emanating from marine equipment at the surface used to position the sampling gear (i.e., noise levels will be similar to that emitted by typical commercial traffic in the river). Also, as noted in the December 13, 2024 response to NYSDEC's November 22, 2024 comments on the PDI Work Plan, based on review of previous SPT sampling data, blow counts in the area of interest were typically weight-of-rod or weight-of-hammer (in which case, impulsive hammering would not be needed at all) or one to two blows per six inches (in which case, it is expected that hammering, if needed to get through a sand lens or an obstruction such as a buried piece of wood or other debris, would not last more a few minutes at each boring location).

Reference:

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Appendix B PDIWP Station Coordinates

Station ID	Location Type	Northing	Easting	Notes
NAPL Visual Assessment - RI Boring Redrill Locations (Transect Interior Ends)				
SED-112R	Reoccupy RI Location	1,048,677	644,778	Also Transect D Interior Endpoint
SED-114R	Reoccupy RI Location	1,048,627	644,777	Also Transects A, B, C Interior Endpoint
SED-128R	Reoccupy RI Location	1,048,860	644,739	Also Transects E, F, G Interior Endpoint
NAPL Visual Assessment - Transect A				
SED-114R	Interior Endpoint	1,048,627	644,777	Transect A Interior Endpoint
SED-XA1	Midpoint	1,048,574	644,775	Transect A Midpoint
SED-XA2	Step-In/Step-Out	TBD	TBD	Transect A Step-In or Step-Out #1
SED-XA3	Step-In/Step-Out	TBD	TBD	Transect A Step-In or Step-Out #2
SED-135	*Exterior Endpoint*	*1,048,522*	*644,774*	*Transect A Exterior Endpoint*
NAPL Visual Assessment - Transect B				
SED-114R	Interior Endpoint	1,048,627	644,777	Transect B Interior Endpoint
SED-XB1	Midpoint	1,048,606	644,748	Transect B Midpoint
SED-XB2	Step-In/Step-Out	TBD	TBD	Transect B Step-In or Step-Out #1
SED-117	*Exterior Endpoint*	*1,048,585*	*644,719*	*Transect B Exterior Endpoint*
NAPL Visual Assessment - Transect C				
SED-114R	Interior Endpoint	1,048,627	644,777	Transect C Interior Endpoint
SED-XC1	Midpoint	1,048,642	644,735	Transect C Midpoint
SED-XC2	Step-In/Step-Out	TBD	TBD	Transect C Step-In or Step-Out #1
SED-XC3	Step-In/Step-Out	TBD	TBD	Transect C Step-In or Step-Out #2
SED-143	*Exterior Endpoint*	*1,048,658*	*644,694*	*Transect C Exterior Endpoint*
NAPL Visual Assessment - Transect D				
SED-112R	Interior Endpoint	1,048,677	644,778	Transect D Interior Endpoint
SED-XD1	Midpoint	1,048,689	644,742	Transect D Midpoint
SED-XD2	Step-In/Step-Out	TBD	TBD	Transect D Step-In or Step-Out #1
SED-161	*Exterior Endpoint*	*1,048,701*	*644,705*	*Transect D Exterior Endpoint*
NAPL Visual Assessment - Transect E				
SED-128R	Interior Endpoint	1,048,860	644,739	Transect E Interior Endpoint
SED-XE1	Midpoint	1,048,863	644,708	Transect E Midpoint
SED-XE2	Step-In/Step-Out	TBD	TBD	Transect E Step-In or Step-Out #1
SED-132	*Exterior Endpoint*	*1,048,866*	*644,677*	*Transect E Exterior Endpoint*

Station ID	Location Type	Northing	Easting	Notes
NAPL Visual Assessment - Transect F				
SED-128R	Interior Endpoint	1,048,860	644,739	Transect F Interior Endpoint
SED-XF1	Midpoint	1,048,904	644,765	Transect F Midpoint
SED-XF2	Step-In/Step-Out	TBD	TBD	Transect F Step-In or Step-Out #1
SED-XF3	Step-In/Step-Out	TBD	TBD	Transect F Step-In or Step-Out #2
SED-125	*Exterior Endpoint*	*1,048,948*	*644,791*	*Transect F Exterior Endpoint*
NAPL Visual Assessment - Transect G				
SED-128R	Interior Endpoint	1,048,860	644,739	Transect G Interior Endpoint
SED-XG1	Midpoint	1,048,858	644,773	Transect G Midpoint
SED-XG2	Step-In/Step-Out	TBD	TBD	Transect G Step-In or Step-Out #1
XG3	*Exterior Endpoint*	*1,048,855*	*644,808*	*Transect G Exterior Endpoint*
NAPL Visual Assessment - Transect H				
SED-XH1	In-fill	TBD	TBD	Transect H Clean-Edge Boring
SED-XH2	In-fill	TBD	TBD	Transect H Clean-Edge Boring
SED-XH3	In-fill	TBD	TBD	Transect H Clean-Edge Boring
SED-XH4	In-fill	TBD	TBD	Transect H Clean-Edge Boring
SED-XH5	In-fill	TBD	TBD	Transect H Clean-Edge Boring
Toxicity Sampling Stations				
TOX-01	Toxicity	1,049,691	644,822	
TOX-02	Toxicity	1,049,686	644,911	
TOX-03	Toxicity	1,049,582	644,768	
TOX-04	Toxicity	1,049,580	644,862	
TOX-05	Toxicity	1,049,533	644,908	
TOX-06	Toxicity	1,049,480	644,859	
TOX-07	Toxicity	1,049,453	644,705	
TOX-08	Toxicity	1,049,447	644,777	
TOX-09	Toxicity	1,049,418	644,894	
TOX-10	Toxicity	1,049,377	644,826	
TOX-11	Toxicity	1,049,319	644,882	
TOX-12	Toxicity	1,049,272	644,883	
TOX-13	Toxicity	1,049,222	644,808	
TOX-14	Toxicity	1,049,198	644,885	
TOX-15	Toxicity	1,048,148	644,667	
TOX-16	Toxicity	1,047,950	644,705	
TOX-17	Toxicity	1,047,078	644,496	

Notes:

Exterior endpoints (shown in *italics*) are existing RI-phase borings (except for exterior end-point XG3 on Transect G, which is placed at the limit of the accessible area) and are shown for reference only; no drilling or sampling planned at these locations.

Appendix C Sample Logging – Technical Guidance

Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites

SOIL SAMPLE DESCRIPTIONS

It is important that descriptive qualifiers are consistently used to characterize degree and nature of contaminant impacts and visual-manual soil classification. The following presents some examples of descriptive qualifiers.

SOIL LOGGING

• All soils are to be logged using the **Unified Soil Classification** (ASTM D 2488 field descriptions)

• **PID or FID** used to screen all soil samples (Jar Headspace method) – maximum readings should be recorded and included on the logs. The PID/FID should be calibrated daily at a minimum

• **Moisture terms** are: Dry, Moist, and Wet

• **Color terms -** use geotechnical color charts - colors may be combined: e.g. red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination (see below)

• **Log of each sample interval** should be prepared as follows:

[Coarse Grained Example] NARROWLY GRADED SAND (SP); mostly fine sand; <5% fines; red-brown, moist, environmental/depositional/geologic descriptions.

[Fine Grained Example] SANDY SILT (ML); heterogeneous till structure, nonplastic, ~30% fine to coarse, subangular sand; ~10% subangular fine gravel, max. size ~ 10 mm; brown; environmental/depositional/geologic descriptions.

• **Representativeness** – Soil logs should include particular notes if the field representative believes that there is a possibility that the soil sample being described is not representative of the interval sampled.

• **Intervals for Description** – if using a 2' (split spoon) or 4' (Macro-core) long sampler – the field description should not necessarily be for the entire sample interval. It is important to look for, identify, and describe small-scale units and changes within each sample interval.

DESCRIPTION OF CONTAMINANTS

Visible Contamination Descriptors

• **Sheen** - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen", which can be distinguished by its tendency to break up on the water surface at angles, whereas a petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test) , then observe the presence/absence of sheen on the surface of the water in the jar.

• **Stained** - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.

• **Coated** - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces. The degree of coating should be described as light, moderate, or heavy.

• **Blebs** - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product. The estimated size and number of blebs should be reported.

• **Saturated** - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you're not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.

• **Oil** - Used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from MGP-related odors/impacts.

• **Tar** - Used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g. naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.

• **Solid Tar** - Used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).

• **Purifier Material** - Purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.

Olfactory Descriptors

• Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor.

• Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

DNAPL/LNAPL

- A jar shake test should be performed to identify and determine whether observed tar/free phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

Viscosity of Free-Phase Product – If free-phase product/tar is present a qualitative description of viscosity should be made. Use descriptors such as:

- Highly viscous (e.g. taffy-like)
- Viscous (e.g. No. 6 fuel oil or bunker crude like)
- Low viscosity (e.g. No. 2 fuel oil like)

GROUNDWATER SAMPLING OBSERVATIONS

- Any observations of sheen, blebs, free-phase product/tar, staining or coating of the sampling equipment, odor, etc. that made during sampling of groundwater are to be included in the groundwater sample collection log.

Standard Colors for Reporting MGP Impacts

	RGB Color	Auto Cad Index
TAR SATURATED	255,0,0	10
COATED MATERIAL, LENSES	255,0,255	210
HARDENED TAR	129,64,0	34
BLEBS, GLOBS, SHEEN	255,191,0	40
STAINING, ODOR	255,255,0	50
PETROLEUM IMPACTS SATURATION & SHEENS	0,191,255	140
PETROLEUM IMPACTS STAINING & ODORS	170,234,255	141
PURIFIER WASTE AND ODOR	0,0,255	170
NO OBSERVED IMPACTS	0,165,0	92

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