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REPORT ON

PRE- DESIGN INVESTIGATION DATA SUMMARY REPORT
FORMER ANACONDA WIRE & CABLE PLANT SITE
HASTINGS-ON-HUDSON, NEW YORK
NYSDEC SITE #3-60-022

BY Haley & Aldrich of New York
Rochester, New York

FOR: Atlantic Richfield Company
Naperville, Illinois

File No. 28612
10 August 2015

Haley & Aldrich of New York
200 Town Centre Drive
Suite 2
Rochester, NY 14623
585.359.9000

10 August 2015
File No. 28612

Atlantic Richfield Company
150 West Warrenville Road
Naperville, IL 60563

Attention: Paul Johnson, P.G.

Subject: Pre-Design Investigation Data Summary Report
Former Anaconda Wire & Cable Plant Site
Hastings-on-Hudson, New York
Site No. #3-60-022

Paul:

The attached Pre-Design Investigation Data Summary Report has been prepared for submittal to the New York State Department of Environmental Conservation in accordance with the requirements of the Record of Decision dated March 2012 and the Remedial Design Work Plan dated July 2014.

Sincerely yours,
HALEY & ALDRICH OF NEW YORK

Wayne Hardison

Wayne C. Hardison, P.E.
Program Manager

Enclosures

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/324_PDI Completion/PDI Data Report/Text/2015_0727_PDI Data Report_Final.docx

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1. Introduction and Description of Activities

This report summarizes field investigations performed during the Pre-Design Investigation (PDI) for Operable Unit No. 1 (OU-1) and Operable Unit No. 2 (OU-2) State Superfund Site #360022 at 1 River Street, Hastings-on-Hudson, New York (Site), which was conducted between September 2013 and April 2015, and presents data collected during the PDI.

The PDI was performed in general accordance with the Remedial Design Work Plan (work plan), Former Anaconda Wire & Cable Plant Site, prepared by Haley & Aldrich of New York (Haley & Aldrich) for Atlantic Richfield Company (AR), dated July 2014. The work plan was prepared in accordance with the OU-1 ROD Amendment, and OU-2 ROD as well as the Amended Order on Consent dated November 6, 2013. Specifically, the on-shore (OU-1) subsurface delineation program was designed in accordance with the OU-1 ROD Amendment, and NYSDEC DER-10. The offshore (OU-2) sediment delineation program was designed in accordance with the OU-2 ROD. Other aspects of the PDI (i.e. geotechnical investigations, utility surveys, etc.) were completed in accordance with the work plan.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located on the eastern bank of the Hudson River within the confines of the Hudson River Valley (Figure 1). The ground surface at the Site is relatively flat with ground surface predominantly ranging from approximately El. 3 to El. 11.

The Site consists of two Operable Units, OU-1 and OU-2. OU-1 is an upland area approximately 2,400 feet long by 500 feet wide. OU-2 is the area that extends westward into the Hudson River approximately 400 feet from the western OU-1 boundary, north into the Old Marina (approximately 300 feet north of the northwestern corner of OU-1), and approximately parallel to the southern property boundary (Figure 1). OU-1 and OU-2 boundaries are described in the Records of Decision (ROD) (NYSDEC, 2012). Site features as discussed in this report are depicted on Figure 2 for reference.

The Hudson River is considered a drowned-river estuary. The river is approximately 4,800 feet wide at the Site with a maximum depth of about 50 feet at midstream. There is no navigation channel specified at the Site's location along the river. Based on historical studies, the currents vary from about 2.2 feet per second (fps) on the flood tide (flowing upstream) to about 2.9 fps on the ebb tide (flowing downstream). Depending on wind direction and velocity, wave heights of 3 feet to 5 feet and wakes of passing vessels of 2.5 feet have been observed. During the winter, ice floes may accumulate along the eastern shore of the Hudson River when there is a strong west wind.

1.2 PDI DATA SUMMARY REPORT ORGANIZATION

Organization of the PDI Data Summary Report is described below.

Section 1 provides background information pertaining to regulatory framework, schedule of milestones, purpose of the work, and requested approvals from NYSDEC.
Section 2 summarizes activities completed as described in the work plan.
Section 3 summarizes results of the PDI.
Section 4 provides interpretation of extents of on-shore excavation and off-shore dredging based on data collected
Section 5 discusses data validation.

Section 6 describes health and safety, air monitoring, and waste management
Section 7 summarizes the work and conclusions

1.3 SCHEDULE

As described in the work plan, schedule milestones include:

- Complete Pre-Design Investigation 270 days following approval of the work plan (approved on 14 July 2014, field work completed on 9 April 2015).
- Submit an initial PDI Data Summary Report 120 days following completion of the PDI (10 August 2015).
- Submit the Preliminary Design 180 days following submittal of the approved Final PDI Data Summary Report (TBD).

Based on discussions with NYSDEC, approval of the Final PDI Data Summary Report is considered to mean incorporation of all NYSDEC comments on report content, and NYSDEC final approval of data completeness and the interpretation therein including dredge and excavation delineation. Preliminary Design would commence after this approval is completed since the data will be the basis of the design. It should also be noted that the completeness of the Preliminary Design may be contingent on potential comments from the EPA on the TSCA application or that Building 52 cannot be demolished and investigation of PCBs beneath the slab completed.

The schedule for Final Design, procurement of contractors and construction will depend on the timing and results of the review process. The schedule will be updated as necessary.

1.4 EXCEPTIONS

Additional PDI that is required within or adjacent to Building 52 post demolition and other data gaps identified herein or identified during design may impact the duration of the design or design review.

1.5 PURPOSE OF THE PDI FIELD WORK

Environmental and geotechnical data is required to form the basis for and complete the design of the remedy. Historic data has been generated and documented in the following documents.

- Conceptual Site Model (CSM) (Haley & Aldrich, 2008)
- 50% Design Report for Operable Unit No. 1, Haley & Aldrich (2006)
- Supplemental Northwest Corner Investigation Findings Report", Haley & Aldrich (2008)
- DNAPL IRM Recovery Well Installation", Haley & Aldrich (2010)
- Data Report on Riprap Field Investigation, Haley & Aldrich (2010)
- Geotechnical Data Report, Haley & Aldrich (2011)

This existing data was not sufficient to complete a detailed design of the remedy. Specifically, results of historical investigations did not provide adequate data to

- define excavation or dredge extents,
- design the Northwest Extension bulkhead wall or select its final alignment,

- design the sloped shoreline, or
- evaluate site features that will impact design and constructability (e.g. obstructions, outfalls, former sumps, etc.).

Therefore, based on historic site investigations and the remedy described in the RODs, a PDI was completed to collect detailed site data to support completion of the design. The scope of the PDI was developed based environmental and geotechnical data generated and reported in the documents referenced above, documented in the work plan, and documents listed in Table 1.
Activities required to complete the design are described in the work plan and are summarized in Section 2 of this document. During completion of the PDI, some modifications were made and were primarily due to field conditions (i.e. thick foundations or other obstructions at proposed investigation locations requiring offsets), and are documented herein.

1.6 PURPOSE OF THE PDI DATA SUMMARY REPORT

Completion of the PDI Data Summary Report is required to comply with the RODs and to begin the design phase. Interpretation of on-shore and off-shore delineation of Site related contaminants of concern present at concentrations that exceed removal requirements is required for design and is included herein. By submitting this PDI Data Summary Report, AR is seeking approval of this report in its entirety including recommended remedial actions described in Section 4 and conclusions described in Section 7.

2. Description of Activities

The approved scope of the PDI is contained within the Remedial Design Work Plan (work plan). Work plan elements were attached as eight appendices and include the detailed tasks of proposed work. Summaries of the PDI tasks, as found in the work plan appendices, are provided in this section of the report. Proposed locations and activities were adjusted based on field conditions or added per the work plan requirements. Where changes to the scope were significant, modifications are discussed in Section 3 along with the results.

The PDI is a supplemental investigation that builds upon previous work. A summary of historical site investigations completed prior to the current work plan is provided in Table 1.

2.1 PHASE 1 PDI INVESTIGATION

2.1.1 Ground Penetrating Radar Survey

The intent of this survey was to use Ground Penetrating Radar (GPR) as a screening tool in OU-1 to identify subsurface features (such as basements, sumps, and large voids) that might require further delineation during other PDI activities. The first step in the field program was a pilot-test survey which evaluated GPR in several areas prior to finalizing the site-wide program. The pilot-test GPR results were evaluated for their ability to assess concrete slab thickness, the potential presence of shoreline voids, and other subsurface features and structures. Results of the pilot-test survey were inconclusive or did not agree with known information, likely due to field conditions and limitations in the technology, and as a result the full scale test was removed from the scope. More details are discussed in Section 3.2 of this document.

2.1.2 Surveys

Topographic Survey

Documentation of topography is required to complete the design, therefore, the existing topography map of the Site was updated. Additionally, subsurface features identified by the GPR survey and historical references were also surveyed. Results are discussed in Section 3.1. Figures in this report have been updated to include the new survey, where appropriate.

Bathymetric Survey

In addition to the upland survey completed as part of the PDI, an updated bathymetry survey was completed as part of the baseline sampling for the development of a Site Management Plan. The purpose of the off-shore bathymetry survey was to document bathymetric and shoreline elevations. This was completed in accordance with a separate work plan approved by NYSDEC (letter dated 10 October 2012). Results are included in Section 3.1 for reference.

2.1.3 Groundwater Level Data

The existing groundwater model will be updated as part of the design. The model will be used to evaluate the interaction of remedial components with site groundwater and the Hudson River. To update the groundwater model, groundwater elevation data at the Site was collected to depict groundwater fluctuations inland and near the Hudson River. These data were obtained by deploying data loggers in existing and newly installed monitoring wells (new monitoring wells are discussed in Section 2.2 of this report). Data logger deployment locations were chosen to monitor hydraulic gradient and tidal influence in the Fill and Basal Sand hydrostratigraphic units. Sixteen data loggers were planned to be installed in existing wells and in seven (7) newly installed groundwater monitoring wells (discussed in Section 2.2 of this document). Newly installed monitoring wells and associated data logger deployment were completed as part of the OU-1 Supplemental Investigation. Results and any work plan adjustments are discussed in Section 3.2

2.2 OU-1 SUPPLEMENTAL INVESTIGATION

Data collected in this section includes various topics or planning for OU-1 related information required for design of the remedy that will supplement the contamination investigation.

2.2.1 Groundwater Levels

Monitoring Well Installation

Seven monitoring wells - five shallow wells screened in the Fill unit and two deep wells screened in the Basal Sand unit - were installed as part of the investigation. Well locations were chosen to better understand tidal influences on the groundwater beneath the site, variation of hydraulic gradients east of the Hudson River, and for the purpose of updating the groundwater model. Hydraulic gradients and tides are important parameters which will affect groundwater modeling in support of the design. Results and any work plan adjustments are discussed in Section 3.2.

Transducer Deployment

As described in Section 2.1.3, additional monitoring wells were installed and pressure transducers deployed to supplement the existing groundwater monitoring network. Results and any work plan adjustments are discussed in Section 3.2.

2.2.2 Groundwater Sampling

One round of baseline groundwater sampling has been completed to monitor shallow groundwater prior to remedial construction, and allow for evaluating the long term effectiveness of the remedy. The approach for the baseline groundwater sampling program is to sample shallow-screened wells both upgradient of areas without known PCB and/or site specific metal impacted soils greater than remedial criteria and at locations down gradient or proximate to PCB, lead or other suspected sources of soil contamination, to establish a baseline for groundwater quality.

Baseline groundwater sampling was completed for three upgradient wells (PDMW-16S, PDMW-20S and PDMW-19S located on the site) and three wells located on the western portion of the site (MW-01A, MW-05 and MW-09). Sampling will be continued annually until the beginning of construction. Initial results and any work plan adjustments for groundwater sampling are discussed in Section 3.2; results for additional yearly sampling events will be included in future submittals.

2.2.3 Void Assessment

There are several areas of the Site, especially in areas adjacent to the Hudson River, where evidence of soil erosion or subsidence beneath concrete slabs, including voids, have been observed. An understanding of the depth and extent of void spaces beneath the slabs is required to provide data to estimate fill quantities for support of the design and to better define conditions which will affect the future construction. These potential void areas were assessed using a hammer drill to access the subsurface, and the soil horizon with respect to the slab was observed. Results and any work plan adjustments are discussed in Section 3.2.

2.2.4 Subsurface Anomalies

There are several areas of the Site in which subsurface anomalies (e.g. subsurface features that require special consideration during design such as vaults, sumps, NAPL, etc.) were identified during previous investigations and during routine site work. Investigation of these areas was required to assess existing subsurface voids, evaluate potential residual impacted material which may be present in the subsurface or within the features, and to better define conditions which will affect the future construction. The following subsurface anomalies were identified and investigated as part of the OU-1 Supplemental Investigation:

- Potential basements
- Potential NAPL
- Potential production wells
- Building 17 concrete slab

Additionally, during completion of subsurface investigations or monitoring well installations, evidence of LNAPL was observed at or near the water table at on-shore locations of the Site where observations had not been previously identified. These additional potential NAPL areas were further evaluated to determine the presence of PCBs. Results and any work plan adjustments are discussed in Section 3.2.

2.2.5 Outfall Investigations

Outfalls that conveyed water from Building 52 to the Hudson River were further investigated to determine potential PCB impacts to the subsurface resulting from former operations within the building. Previously, test pits were completed at several locations to expose some of the suspected Building 52 outfall pipes. Previous data and OU-1 pre-delineation excavation data were incorporated into the current Building 52 outfall investigation program. Based on review of the data from historical evaluations and analytical data one potential Building 52 outfall was investigated via test pit to assess the potential presence of PCBs source material. Results and any work plan adjustments are discussed in Section 3.2.

2.2.6 Existing Underground Utilities

During prior site investigation activities, presence of storm sewers and other utilities were identified but not well defined with respect to alignments and outfall locations. During the PDI, the presence, location, and general condition of existing utilities were evaluated with a focus on active utilities that originate offsite and pass through the site. This information will be incorporated into the design and may impact future easements and potential discharge permits. Data collection to support the civil portion of the design focused on confirming the locations of existing active utilities that will either remain on site after completion of the remedy, be removed or abandoned during completion of the remedy, be re-located in support of an approved site redevelopment plan, or be protected during construction.

The investigation used a combination of historical document review, direct visual observation (e.g. opening manholes), invert surveying, and utility tracer equipment to refine locations of utilities. Results and any work plan adjustments are discussed in Section 3.2.

2.3 OU-1 EXCAVATION PRE-DELINEATION

Excavation has been selected as the preferred remedy to address on-shore soils that exhibit concentrations of PCBs greater than removal criteria. Locations where excavation is required is based on historic data collected during the RI, previous OU-1 50% Design, and other Site activities, which are described in the Conceptual Site Model (CSM) (Haley & Aldrich, 2008). However, these data were not sufficient to delineate the extents of excavation required to meet the remedial action goals in the OU-1 ROD. A pre-excavation delineation sampling program was described in the work plan to fully define the required horizontal and vertical limits of removal prior to construction. This is of particular importance since many of the excavations may extend below the water table and will require shoring or other methods to support the excavation. Lead hotspot locations have an excavation depth limit of 2 feet, so offset borings were only completed to determine the horizontal distribution of subsurface impacts as specified in the ROD.

The approach to delineate the extents of excavation on shore was to first identify existing data points with PCBs or lead at concentrations that exceed removal requirements and then delineate. At select locations, new borings were completed to resample existing locations if existing data was incomplete (i.e. total boring depth was not sufficiently deep) or the historical sample intervals needed to be refined. In order to establish excavation limits to bound lateral and vertical extents of PCBs or lead present greater than removal criteria), additional borings were completed. Borings were completed sequentially as follows; 'offset' borings were completed adjacent to existing data points and, where required, 'step-out' borings adjacent to 'offsets', and additional 'step-outs' adjacent to initial 'step-outs' (and so on). Samples were collected and analyzed at specific depth intervals based on existing and new analytical data as well as "horizons" (as described in DER-10) based on spikes in contamination levels. Results and any work plan adjustments are discussed in Section 3.3.

The excavation pre-delineation program investigated PCB and Lead exceedances through sampling that satisfies the minimum requirements set forth in DER-10 guidance (i.e. one sample per 30 linear feet of sidewall, one sample per 900 square feet of excavation bottom, and horizon samples where applicable). The investigation used information known about each point and generally fell into one of three categories as described below:

- An "isolated" existing data point is an existing data point location in which no other data or subsurface features existed in the vicinity which exhibited the potential to be a source of PCBs.
- A "linear feature" is one or more data points with a criteria exceedance that may be associated with a utility or other liquid-conveying site feature (e.g. outfalls and associated pipe bedding from Building 52 that are potential PCB source areas).
- A "cluster" location is an area where multiple existing data points with criteria exceedances exist within close proximity to one another in an area greater than 900 square feet.

Sampling was completed at 2 foot intervals. In order to determine excavation limits, samples were analyzed that correspond with the bottom of excavation, bottom of sidewalls, and, where applicable, horizons. Sampling depths corresponded to the maximum excavation depth as defined in the OU-1 ROD:

- Up to 9 feet below ground surface (bgs) in the Northern Shoreline Area
- Up to 12 feet bgs in other areas
- Up to 2 feet bgs in Lead hotspot locations

Results and any work plan adjustments are discussed in Section 3.3.

2.4 EXTENSION ALIGNMENT INVESTIGATION

The selected remedy includes a bulkhead that extends into the Hudson River in the Northwest Off-shore Area. Probes were completed to evaluate the presence or absence of PCB Material (PCBM) and obstructions along the alignments of the proposed bulkhead extension wall and deadman. PCBM has been classified in three different physical states. The variation in the physical state of the material represents weathering changes since the material was released. As defined in the OU-2 ROD:

- Liquid PCBM or Dense Non-aqueous Phase Liquid was observed to be amber in color, is less viscous than the Semi-Solid or Trace PCB Material and is highly to moderately mobile, readily flowing into monitoring wells when it is encountered.
- Semi-Solid PCBM was generally observed to be more viscous than Liquid PCB Material and appeared grayish-brown in color. Based on visual observations, Semi-Solid PCBM has a sticky, string-like consistency and not as fluid or capable of migration.
- Trace PCBM, when observed, consists of small quantities of PCB Material intermingled with the soil and was more difficult to visually observe. Like the Semi-Solid PCBM, the Trace PCBM had a string-like consistency (small strings and hair-like filaments) and appeared grayer in color.

Confirmation that semi-solid or liquid PCBM does not exist along the alignment is important since this material could be dragged down to the Basal Sand aquifer during construction of the wall. Confirmation that obstructions do not exist along the alignment is important since they could impede the ability to construct the wall.

Results and any work plan adjustments are discussed in Section 3.4.

2.4.1 Off-shore Probes

The off-shore probes were drilled using a barge mounted drilling rig. Casing was advanced through the sediment and split spoon samples were advanced ahead of the casing. Samples and sampling equipment were examined for PCBM. The split spoons were advanced either to the top of the Marine Silt, or until drilling action indicated the potential presence of riprap.

A phased approach of probing was used in the vicinity of the planned extension wall with probe locations drilled at approximately 30-foot centers. Probe locations were moved outboard where semi-solid PCBM or significant obstructions were identified.

Results and any work plan adjustments are discussed in Section 3.4.

2.4.2 On-shore Probes

The purpose of the probes drilled adjacent to the north property line was to determine presence or absence of PCBM and obstructions, as discussed above, with the added objective of determining whether the wall alignment can potentially be moved south to coincide with the property line along the Old Marina. Due to the sloped shoreline and tidal conditions, it was not possible to position a drill rig directly at property line. Therefore, the approach for PDI was to position the drill rig on-shore as near as possible to the property line, and complete angled borings to evaluate conditions at the property line. The property line probes were spaced about 15 to 30 feet apart.

Two more areas of on-shore probes were also completed:

- Deadman: Due to the fact that the deadman to anchor the sheet pile bulkhead will be required to penetrate into the Basal Sand, a line of PCBM probes was also advanced along the approximate deadman alignment.
- Extension wall continuation: A continuation of the bulkhead extension wall is required at the transition between the higher elevation upland created by filling behind the wall, versus the lower elevation sloped shore just south of the Northwest Extension area. This continuation of the bulkhead extension wall may also need to be driven to the Basal Sand.

Results and any work plan adjustments are discussed in Section 3.4.

2.5 DEEPWATER INVESTIGATION

The goal of this investigation is to examine a targeted portion of the Deepwater Area where PCBs in excess of 50 milligrams per kilogram (mg/kg) are known or suspected to be present in order to gather data for making decisions regarding design of the remedy. The Deepwater Area of the site is shown in Figure 2. This investigation addressed areas in the proximity of existing exceedances and areas between historical borings EB-10 and EB-14, as shown in the work plan. The sediment sampling area was comprised of approximately 4 acres located about 300 feet off-shore of the Site. Results will be used to further understand lateral and vertical PCB contamination, within specific Deepwater Areas.

The sampling program employed a 160-foot triangulation grid for investigation areas and an 80-foot triangulation grid for refinement of extents of contamination. The tasks are outlined below:

- Resampling - Resample Specific Locations (PCBs > 50 mg/kg)
- Investigation Unit Sampling - Area Between EB-10 and EB-14
- Decision Unit Sampling - Including Step-out Investigation (as needed)
- Variability of Sediment Concentrations

Results and any work plan adjustments are discussed in Section 3.5.

2.6 OFF-SHORE PRE-DELINEATION

The purpose of the Off-shore Pre-delineation program is to provide supplementary data for making decisions regarding design of the remedy, relative to extent of sediment that will be required to be dredged. The existing sediment data collected during the RI and other Site activities was sufficient for completion of the feasibility study. However, additional data is necessary to further delineate areas for potential remedial action, including the extent of dredging, especially in the areas referred to as backwater areas consisting of the South Boat Slip, North Boat Slip and the Old Marina. Investigations were completed in Nearshore Area, Backwater Areas, and Northwest Area within the Deepwater Area adjacent to the Northwest Off-shore Area. This area of the site is shown in Figure 2.

As described in the work plan, vibracore samples along with ponar grabs for surface samples were collected from barge or boat-mounted equipment. Resampling was also conducted at some previously sampled locations to confirm existing data where PCB and metals concentrations greater than remedial criteria were detected.

Sampling intervals were used to delineate PCB and metal concentrations in targeted sediment deposits which may require dredging and to document the sediment concentrations that will be left in place after remedial action. An initial 0 to 0.5 ft depth interval (below mudline, or bml) was sampled to correspond to historical sampling depths and analyses along with a 0.5 to 1 ft interval. One-foot incremental sampling intervals were conducted up to 6 ft bml to refine the PCB and metals contaminant distribution data and residual concentrations as applicable. One two-foot interval sample (i.e. 6-8 ft bml) was analyzed as needed to document sediment concentrations that will be left in place after remedial action (i.e. documentation samples).

Results and any work plan adjustments are discussed in Section 3.6.

2.7 GEOTECHNICAL EXPLORATION

Several phases of geotechnical investigations have been performed at the Site in the past and some data gaps were identified. New geotechnical explorations were included in the work plan to address the data gaps and provide additional stratigraphy and laboratory testing data in several areas: in the general vicinity of the planned deadman anchor, in the general vicinity of the planned Northwest Extension bulkhead wall, and in the off-shore area between the North Boat Slip and the South Boat Slip. The information collected will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (e.g., settlement).

Additionally, some test pits were performed at various locations around the Site where support of excavation (SOE) may be used during remedial construction (i.e., excavation locations that are 6 feet bgs or greater). The purpose of the test pits was to gather information on soil conditions, excavation effort, existing foundations and potential obstructions that could affect the design or construction of the SOE walls.

Results and any work plan adjustments are discussed in Section 3.7.

2.8 BENCH TESTING

The design will include management of saturated soils and sediment, treatment of water during construction and long-term treatment of groundwater as part of a groundwater management system. To support these design tasks, a series of bench-scale treatability tests have been performed to allow identification of effective treatment technologies and design parameters for the potential full scale system. These technologies include:

- Solids Dewatering: Methods and basic design parameters for the dewatering of water-laden excavated soils and dredged sediments;
- Stabilization: Methods and basic design parameters for the stabilization of onsite excavated soils / sediment to be re-used on-site for various purposes;
- Construction Water Treatment: Methods and basic design parameters for the potential treatment of various metals and PCBs in water generated during construction activities (e.g., solids dewatering supernatant and on-shore excavation dewatering); and
- Long-Term Groundwater Treatment: Initial testing of treatment methods for residual groundwater to support screening technologies and provide basic design parameters for further testing, if needed.

Results and any work plan adjustments are discussed in Section 3.8.

3. Investigation Results

3.1 PHASE 1 PDI INVESTIGATION

The objective of the Phase 1 PDI was to:

- Locate subsurface features using GPR
- Locate site surface features and update topographic survey
- Install groundwater level data loggers in select monitoring wells.

The collected data will be used to:

- Design subsequent subsurface structure investigations
- Document current site topographic conditions
- Support the groundwater model.

3.1.1 Ground Penetrating Radar Survey

As indicated in the work plan, a pilot test GPR survey was conducted during April and May 2013 by Naeva Geophysics, Inc. and observed by Antea Group (Antea). The results of the GPR survey indicated that significant voids were present throughout the site. Based on these results, a subsequent voids survey was completed at select locations as recommended by the GPR contractor to calibrate the GPR data interpretation with actual measured data. The results of the voids surveys (which are described in Section 3.2.1) did not corroborate the conclusions of the GPR. Therefore, the site-wide GPR survey was removed from the scope. The GPR report is provided in Attachment A.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.1.2 Surveys

Topographic Survey

Upland survey activities were performed by Wendel Architecture, Engineering, Surveying & Landscape Architecture, PC (Wendel). The survey was completed by a licensed New York State surveyor in May 2013 and June 2014 in general accordance with the work plan. The updated survey is provided in Figure 3.1A.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

Bathymetric Survey

Bathymetric survey activities were completed by Ocean Surveys, Inc. (OSI) in December of 2012 as part of the baseline sampling for the development of a Site Management Plan. The bathymetric survey data was recorded using an interferometric swath bathymetry system utilizing a multibeam echosounder and generated a bathymetric surface with a contour resolution of 1-foot. The updated bathymetry contours are shown on Figure 3.1B.

3.1.3 Groundwater Level Data

Groundwater level data discussed in Section 3.2.1 of this report.

3.2 OU-1 SUPPLEMENTAL INVESTIGATION

The objective of the OU-1 Supplemental Investigation was to obtain additional information to support the final remedy design. The following tasks were performed:

- Install groundwater wells and deploy pressure transducer data loggers;
- Sample site groundwater for the purpose of establishing a baseline;
- Evaluate voids adjacent to the shoreline;
- Investigate subsurface anomalies;
- Investigate Buildings 15 and 52 outfalls; and
- Confirm and/or document significant existing underground utilities.

3.2.1 Groundwater Levels

Monitoring Well Installation

Shallow monitoring wells were installed in the Fill stratigraphic unit and deep monitoring wells were installed in the Basal Sand stratigraphic unit. Monitoring well locations installed for transducer deployment are shown on Figure 3.2A and logs are provided in Attachment B. Monitoring wells were installed during November 2013 by Cascade Drilling, L.P. of Schofield, Wisconsin (Cascade Drilling) using minisonic drilling techniques as generally described in the work plan.

The results of the water level monitoring will be incorporated into the site groundwater model during design of the remedy. This will lead to a better understanding of tidal influences on the groundwater beneath the Site and variations of hydraulic gradients east of the river.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities, as described below.

<u>Modifications</u>

Actual monitoring well installation locations for the purpose of transducer deployment deviated from the approved work plan due to field conditions as described below.

- PDMW-20D: this well was proposed to be installed and screened within the Basal Sand. During completion of the well, the Marine Silt confining layer was not apparently encountered. Based on the description of the 10 to 15 ft interval, the Marine Silt at this location may have been located in the 5 to 10 ft interval which was documented as no recovery. Because of the potential absence of the Marine Silt in this location, a well was not installed. Even without installation of this well, the number and locations of deep groundwater monitoring wells is sufficient to complete the groundwater model. Therefore a well was not installed at this location.

- PDMW-23S: during installation of this well in the proposed location, a four foot void (which appeared to be a subsurface structure) containing black liquid was encountered. The hole in the structure was plugged, the borehole abandoned, and the well was relocated. The void was added to the subsurface anomalies investigation. This is further discussed in Section 3.2.4 of this report.

Transducer Deployment

Groundwater level loggers were deployed for up to 18 months, starting in May 2013 (as described in Table 3.2A) with final removal in November 2014. Flush mount wells in the groundwater elevation monitoring network were retrofitted with protective stick-up casings to eliminate potential influences on data due to surface water leaking into the well. Modifications to the proposed transducer deployment locations within the existing monitoring well network were made due to field conditions (eight locations were removed from the network because they could not be located or had unsatisfactory ground conditions as described below). Based on discussions with NYSDEC, three wells were added to the network to provide coverage sufficient to meet the objectives of the work plan. Locations of monitoring wells in which transducers were installed are shown on Figure 3.2A, and a summary of data logger results is provided in Table 3.2B. Hourly groundwater level measurements are not included in this report but will be incorporated in an updated groundwater model for the Site.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities, as described below.

Modifications

Actual monitoring wells used for transducer deployment were modified as described below.

Network locations	**Removed from network**	**Added to network**	**Reason removed/added from network**
PDMW-17S	X		Unable to locate
PDMW-15	X		Well underwater due to settling concrete slab adjacent to shore line
MW-07	X		Well underwater due to settling concrete slab adjacent to shore line
PDMW-13	X		Unable to locate
MW-14A	X		Unable to locate
MW-04	X		Well no longer exists
PDMW-19S/D	X		Well located in high traffic area, stick up riser could not be installed
MW-08	X		Well located in high traffic area, stick up riser could not be installed
PDMW-13A		X	Added to provide adequate coverage
PDMW-15A		X	Added to provide adequate coverage
MW-09		X	Added to provide adequate coverage

3.2.3 Groundwater Sampling

As indicated in the work plan, the first yearly groundwater sampling was conducted by Antea in August 2014. Results from PDMW-19S (upgradient well) indicated concentrations of PCBs that exceeded drinking water standards. Based on the upgradient exceedance, approval was given by NYSDEC for the 8 October 2014 request to install an additional monitoring well (PDMW-27S) in the northeast corner of the site, which was sampled in December 2014. Sample results from PDMW-27S also indicated an exceedance of drinking water standards for PCBs. Evaluation of the need for additional well installation is deferred to the future so that additional yearly sampling can be considered in identifying the appropriate action. Refer to Attachment B for boring log and well construction details. Refer to Table 3.2C and Figure 3.2B for groundwater sampling results and locations of the wells.

As indicated in the work plan, baseline groundwater sampling will continue after the PDI annually until the beginning of construction. Results for future events in 2015 and beyond will be included in future submittals.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities, as described above.

3.2.4 Voids Assessment

As indicated in the work plan, an assessment of potential voids was conducted to obtain a better understanding of the depth and extent of void spaces beneath the various surface cover concrete slabs. The investigation was completed during September, November and December of 2013 by American Environmental Assessment Corp. (AEAC) and overseen by the Antea Group (Antea) under the direction of Haley & Aldrich. Void extents were evaluated at approximately 127 locations along portions of the western shoreline including concrete slab areas that contained existing holes that exhibited voids and in concrete slab areas that were recommended by Naeva Geophysics, Inc. based on the initial GPR pilot test.

Refer to Table 3.2D and Figure 3.2C for details of the void survey results and probe locations. Results of the voids survey are described briefly below.

- Expansive voids do not appear to be present in areas where existing holes are present in the surface concrete slab.
- Initial GPR survey results that indicated large areas containing significant voids were generally not corroborated by the confirmation probes completed during the voids assessment.
- Based on the GPR survey, large voids do not appear to be present in areas along the shore line.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.2.5 Subsurface Anomalies

As described in the work plan, the potential presence of other relevant subsurface features (such as sumps and pits, potential NAPL locations) were investigated using a combination of techniques. Field work included coring the surface slab and using a down hole camera, lifting subsurface covers and lids for visual and photo-ionization detector (PID) inspection, and/or completion of soil borings. Results of the investigation and any modifications to the work plan are described below. Refer to boring logs in Attachment B and Figures 3.2D and 3.2E for additional details and locations of the investigations.

Potential Basements

During past site investigations, three subsurface structures (possible vaults or basements) have been identified. During the PDI, these areas were investigated from the ground surface by removing large cover plates to make observations or by using a downhole camera lowered into a smaller existing hole in the concrete. The below grade spaces were not physically entered because of the risks associated with entering a confined space with unknown hazards. In all locations, subsurface structures appeared visually to be in good condition (i.e. cracks in the walls were not observed) and environmental impacts were not observed by visual, olfactory or PID data.

Potential NAPL

During past site investigations and based on information from onsite personnel, two areas of "Potential NAPL" were identified (adjacent to the South Boat Slip and east of the North Boat Slip). These locations were investigated during the PDI and are shown on Figure 3.2D. Minisonic drilling techniques were used to evaluate the potential presence of NAPL at these two locations. Oily material was observed at the investigation location adjacent to the South Boat Slip. NAPL was not observed at the location east of the North Boat Slip. Soil samples that coincided with oily material were submitted for analysis of PCBs. Results indicate PCB results in these areas are less than 10 mg/kg and further subsurface investigation is not required. Refer to Table 3.2E and Figure 3.2D for details.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities, as described below.

<u>Modifications</u>

Based on clarified information from site personnel, the boring to investigate the "Potential NAPL" location which was previously identified in the work plan to exist north of the South Boat Slip was moved south of the South Boat Slip as shown on Figure 3.2D.

Additionally, in other borings completed as part of the PDI (OU-1 Supplemental Investigation and Extension Alignment Investigation; Sections 3.3 and 3.4), evidence of separate phase product was identified at depths that generally coincided with the water table in several areas of the site. Soil samples were collected from select borings at intervals coinciding with material generally described in boring logs as an oily material, oil-like material, or separate phase product to evaluate whether observed LNAPL is a PCB source (e.g. greater than 500 mg/kg). LNAPL was generally reported as being present in the form of oily droplets on the soil, water, or on the sampling bag.

Locations that exhibited evidence of LNAPL are shown on Figure 3.2E, data resulting from field observations is shown in Table 3.2E, and boring logs are located in Attachment B.

With the exception of one location (WB-301), PCB concentrations within or adjacent to borings containing evidence of LNAPL indicated that the material observed is not a source of high concentration PCBs. WB-301 indicated a concentration of PCBs in the soil matrix of 890 mg/kg. This boring was collected during the OU-1 Supplemental Investigation and is included in Section 3.3 of this report. Interpretation of results and evaluations of data are discussed in Section 4.1.

Potential Production Wells

As indicated in the work plan and based on review of historical site drawings, two production wells were identified as being potentially present at the Site at the locations shown in Figure 3.2D. A public records search was performed to identify the locations of potential production wells and to determine whether additional production wells may be present on the site. The results of a public records search confirmed two production wells were potentially located on the site but these records did not provide enough information to locate the two identified site wells. The records also did not indicate the presence of additional wells. Site reconnaissance was completed to locate the wells based on locations shown on historical documents. One of the two potential production wells was located by AEAC and a determination was made that, while the well was disconnected from service, it had not been abandoned. The Westchester County Health Department and NYSDEC were notified and the well was properly abandoned. The well research documentation and well abandonment report are located in Attachment C. The second well could not be located. Further investigation is not required in this area.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

Building 17 Pad

As described in the work plan, a historic concrete core sample (completed in 2009) exhibited concentrations of PCBs greater than 10 mg/kg, at the location shown on Figure 3.2D. Historic drawings indicated the presence of former wastewater conveyances (trenches) in this former building; however historic soil borings had not been completed in this area. During the PDI, two soil borings were completed adjacent to these former trenches. Analytical results from both soil sampling locations indicated the presence of PCBs greater than 10 mg/kg. Based on these results, the area was added to the OU-1 Excavation Pre-delineation investigation, and offsets and step outs were completed to delineate PCBs in this area. This pre-delineation program and its results are described in Sections 2.3 and 3.3, respectively.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.2.6 Outfall Investigation

During the PDI, five potential Building 52 outfalls and one outfall from Building 15 were evaluated through historical document review and field investigations. The Building 52 outfall investigation was performed in July 2014 by AEAC and Haley & Aldrich. Results of the outfall investigation are described below (from north to south) and shown on Figure 3.2F.

- Outfall 5 – Based on results of the OU-1 Excavation Pre-delineation Investigation (Section 3.3 of this report), the entire outfall alignment will be removed during remedial construction; therefore further investigation via test pitting of this outfall was not completed.
- Outfall 4 - Investigation of this outfall included a document review to confirm the location of the outfall alignment. Previous document reviews indicted a single discharge pipe from Building 52, which was the basis of the work described in the work plan. However, subsequent additional

historical document review, completed as part of this investigation, indicated the presence of two pipes in close proximity in the vicinity of Outfall 4. Based on this review, one outfall appears to be sewerage from the Former Building 53 wash house and extends from the east edge of Building 53 west to the Hudson River (labeled Outfall 4 on Figure 3.2F). This does not appear to be an outfall associated with process waste from Building 52 and a test pit was not completed. A second outfall appears to extend from the former locker rooms within Former Building 52A, west to the edge of the Building 52 pad, then south to connect with Outfall 3, which may have been a historical source of PCBs. This outfall has been labeled Outfall 3A as shown in Figure 3.2F and is further described below.

- Outfall 3A – As described above, Outfall 3A was identified based on a historical drawing review. The sufficiency of OU-1 Excavation Pre-Delineation investigation data to characterize this pipe will be evaluated during the design. Therefore a test pit was not completed at this newly identified outfall.

- Outfall 3– Based on results of the OU-1 Excavation Pre-Delineation investigation (Section 3.3 of this report), the entire outfall alignment will be removed during remedial construction; therefore an investigation via test pitting of this outfall was not completed.

- Outfall 2 – A test pit (TP-6) was completed on 1 July 2014 by AEAC and Haley & Aldrich, to locate the potential Building 52 Outfall 2. Three pipes were identified in the test pit depths ranging from 14 inches bgs to 4.5 feet bgs. During completion of the test pit, the bedding associated with the pipe identified as being the most likely Building 52 outfall was sampled; results indicated the presence of PCBs at 56 mg/kg. This area was subsequently added to the OU-1 Excavation Delineation investigation program, which is discussed in Section 3.3 of this document. Refer to the test pit log in Attachment B for details. The location of TP-6 is shown on Figure 3.2F.

  Further historical document evaluation indicated that two of the pipes encountered in TP-6 (the southernmost 6-inch cast iron pipe and northern 4-inch cast iron pipe identified on the log) appear to be associated with the abandoned cooling water system from equipment located in Building 52B. This system was installed in 1956 (after cessation of PCB manufacturing operations at the site) and therefore these outfalls are not associated with process wastewater. Additional historical document evaluation indicated the following regarding the third pipe (identified at the time the test pit as the potential Building 52 outfall):

    - This pipe appeared in historical documents in 1918 and appears to be connected to a building labeled as “water closet”.
    - The location of the Former Saturant House is north of the former “water closet” which was identified in the 1918 drawing.
    - Design drawings associated with Building 59 (Saturant Pump House) did not indicate discharge lines.

  Based on these observations and historical document review, the piping designated as Outfall 2 identified in OU-1 Supplemental Investigation is likely not a Building 52 outfall.

- Outfall 1– Based on results of the OU-1 Excavation Pre-Delineation investigation (Section 3.3 of this document), the entire outfall alignment will be removed during remedial construction; therefore an investigation via test pitting of this outfall was not completed.

- Outfall 6 – The footprint of this outfall is likely within the excavation that will be required during remedial construction to establish the sloped shore in this location; therefore OU-1 Supplemental Investigation was not completed.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. The sufficiency of OU-1 Excavation Pre-delineation data to characterize Outfalls 3 and 3A will be evaluated during design of the remedy.

3.2.7 Existing Underground Utilities

The presence, locations, and general condition of select existing utilities were evaluated for the purposes of determining utilities that pass through the site from offsite origins. Additionally, abandoned public utilities or public utility connections no longer in service were also documented, if observed. The focus of this investigation was to confirm the locations of existing, active utilities that will remain on site after completion of the remedy. These utilities will be evaluated during the design of the remedy to determine which existing utilities will be removed or abandoned during completion of the remedy, be re-located in support of site redevelopment plans, or be protected during construction. Collected data will be incorporated into the design and may form the basis for future easements and storm discharge permits.

Investigation activities were completed in July and October of 2014 by Haley & Aldrich personnel with support from Antea, AEAC and Wendel. The investigation used a combination of historical document review, direct visual observation (e.g. opening manholes), invert surveying, and utility tracer equipment to refine utility locations. The locations of the utilities that were investigated are shown on Figure 3.2G.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities, as described below.

<u>Modification:</u>

According to historical site plans, there is a storm water pipe which originates from Washington Street, extends east-west across the Site below Former Buildings 22 and 15, and outfalls to the Hudson River. During the PDI, attempts that were made to locate this pipe were unsuccessful. Because it is well documented on historical plans, there is enough data regarding the existence of this storm water utility to move forward with the design.

3.3 OU-1 EXCAVATION PRE-DELINEATION

The purpose of the OU-1 soil sampling was to pre-delineate on-shore excavation areas which will be completed during remedial construction. Excavation limits were delineated in both lateral and vertical directions, to determine where PCBs and/or lead exceeded removal criteria. Establishing excavation limits (area and depth) in this manner will allow for a focused design, reduce uncertainty and increase worker safety during construction, as well as reduce changes in the field which may result from completing excavation confirmation sampling during remedial construction.

For the ease of identifying delineation areas, the site was divided into three sections: north, northwest, and south as described below. Boring locations are found on Figures 3.3A and 3.3B.

1. The southern portion of the site extends from the southern property boundary northward to the south wall of Former Building 51 between the eastern property boundary and the Hudson River. Investigation areas in this portion of the site are denoted with an “S” in the boring naming convention and are generally to be excavated per the removal criteria up to a maximum depth of 12 ft. except in the Northern Shoreline Area. The Northern Shoreline Area is depicted on Figure 2 of the OU-1 ROD Amendment.
2. The northern portion of the site extends from the south wall of Former Building 51 northward to the northern property boundary between the eastern property boundary and the west edge of the Building 52B pad. Investigation areas in this portion of the site are denoted with an “N” in the boring naming convention and are to be excavated per the removal criteria up to a maximum depth of 12 ft except in the Northern Shoreline Area.
3. The northwest portion of the site is entirely within the Northern Shoreline Area extending from the water tower north to the north boundary of the northwest corner between the western property boundary (Hudson River) and the west edge of the Building 52B pad. Investigation areas in this portion of the site are denoted with a “W” in the boring naming convention and are to be excavated per the removal criteria up to a maximum depth of 9 feet.

The first round of soil sampling associated with the excavation pre-delineation program was conducted between September and November 2013. Based on the results, subsequent sampling events (May through July 2014 and October through November 2014) were conducted to further define vertical and lateral extents of PCBs present greater than removal criteria. Based on the suspected presence of utilities, some exploration locations were pre-cleared to 6.5 feet bgs using an air knife or hand auger to avoid encountering utilities with drilling equipment. Samples that were required to be collected within intervals that were pre-cleared were obtained using a hand auger. Pre-clearing and associated sample collection was completed by AEAC and Antea. Drilling was completed by Cascade Drilling, using a mini-sonic drilling rig model BL 100C. Continuous sampling was generally performed in 2 foot segments using a 4-inch diameter core sampler.

Soil samples were collected at two foot intervals to a maximum depth of 14 feet bgs. Sampling locations were modified as required due to field conditions (i.e. thick foundations, obstructions, utilities, etc.) as was provided for in the work plan. Soil borings were visually examined for evidence of impacts (i.e. visual, olfactory or PID observations) and physically described on the boring logs immediately after extraction. Collected samples were then placed in laboratory grade glassware, packed on ice, and typically transported to the laboratory via courier, with accompanying chain of custody forms. Sampling equipment was decontaminated between samples and drilling equipment was decontaminated between borings. Borings were backfilled to the ground surface with sand upon completion of drilling. Details are provided on the individual boring logs in Attachment B.

Approximately 500 borings were completed and over 2,500 samples were collected and analyzed to determine PCB and/or lead concentrations including quality control samples analyzed to comply with the QAPP. Results of the PCB soil analyses are summarized in Table 3.3A and maximum PCB concentration results are shown on Figure 3.3A. Historical PCB soil results are provided for reference in Table 3.3B. Results of lead soil analyses are included in Table 3.3B and shown on Figure 3.3C. With respect to lead, as required in the ROD, additional samples were collected for copper and zinc analysis from borings that established the final excavation limits and are summarized in Table 3.3D. Interpretation of the on-shore PCB and lead OU-1 Excavation Pre-Delineation Program results are discussed in Section 4.2.

As described in the work plan, select existing historical data points were resampled due to insufficiency of data. These locations are summarized in the following table and results replaced the historical data for the purposes of pre-delineation.

Historic Location	Resample Location	Resampled with 2 ft Intervals
PDSB-36 (5-7 ft)	SG-002	4-8 ft
EE-04 (5-7 ft)	SG-006	4-8 ft
HB-01 (0-1 ft)	SA-002	0-2 ft
SB-093 (0-2 ft) (4-8 ft)	SP-001	0-2, 4-8 ft
SB-082 (6-10 ft)	NB-001	6-10 ft
SB-153 (2-6 ft)	NC-004	2-6 ft
SB-079 (2-6 ft)	NH-001	2-6 ft
SB-084 (2-14 ft)	NI-001	2-14 ft
SB-154 (2-6 ft)	NN-002	2-6 ft

In addition to those locations specifically resampled as part of the work plan, two sampling locations were considered to be resamples while conducting fieldwork. These PDI locations were in the immediate vicinity of existing locations and replace previous results for the purposes of delineation and interpretation in Section 4.2.

Existing Location	Resample Location	Resampled (2 ft Intervals)
PDSB-16 (4-6)	NF-101	4-6 ft
SP-102 (0-2)	SP-201	0-2 ft

The work was performed in compliance with procedures described in the work plan except as detailed below. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities and were generally the result of field conditions. Modifications are detailed below.

<u>Modifications:</u>

Based on borings completed as part of the OU-1 Supplemental Investigation (Section 3.2), two additional investigation areas were added to the Excavation Pre-Delineation program as described below.

- Results of the pipe bedding samples at Outfall 2 indicated the presence of PCBs greater than removal criteria (as discussed in Section 3.2).
- Results of soil samples beneath Building 17 indicated the presence of PCBs greater than removal criteria (as discussed in Section 3.2).

Samples collected for other PDI activities were analyzed for some locations and the results were used for excavation pre-delineation.

- PD2-GL-002
- PDMW-22S and PDMW-24S
- PDMW-22S-01, PDMW-22S-03, PDMW-22S-04, PDWM-22S-10

Initial sampling locations were completed on-shore as described in the work plan except for the following:

- Proposed locations not completed where the drill rig could not access the locations (e.g. proximity to property boundary, retaining wall, shoreline, buildings, etc.) Locations with no result as shown on Figure 3.3A and include: SA-101, SA-102, SA-109, SA-110, NR-001, NR-101 to 103, NC-110, NF-101, NF-103, WA-155, and WE-101 to 104.
- Proposed locations not completed because they became obsolete based on results of other sampling. Locations with no result as shown on Figure 3.3A and include: SG-003, SG-005, NB-101, NB-102, NC-106, NC-107, NC-109, NC-111 to 113, NH-102 to 104, WA-109, WA-111, WA-150, WA-151, WD-101 to 103 and intervals of NC-102.
- Proposed locations not completed because they were deferred based on anticipated construction activities associated with an upgraded sanitary force main. Locations with no result as shown on Figure 3.3A and include: NO-001, NO-101, and NO-102.
- Samples not completed or not completed to full depth based on the presence of potentially active utilities that could not be pre-cleared. Some of these samples became obsolete based on sampling locations added to the program. Locations include: SM borings and some NC borings.

Similarly, offset and step-out sampling locations were completed on-shore as described in the work plan except for the following:

- Step-out locations not completed where the drill rig could not access the locations (e.g. proximity to shoreline). Locations include: west of SR and SI locations.
- Inadequate soil recovery due to concrete and sampling could not be completed: NH-102, NH-103, NH-104, NH-303, NH-317, and SQ-302
- Delineation of exceedances remaining incomplete are discussed in Section 4.2 (see Figure 3.3A) and include the following:
    - Area around Job Trailers
    - Areas adjacent to Building 52
    - Vicinity of SS and SM locations

Additional pre-delineation sampling may be completed in these areas after structures are moved (i.e. site job trailers), demolished (i.e. Building 52), or upgraded (i.e. sanitary force main). The design will specify requirements for confirmation or documentation sampling during construction for areas without complete pre-delineation.

PCB sample analysis hold time specified in the QAPP was conservatively specified as six months. However, the analytical method guidance allows holding times of up to approximately one year after collection. Based on the extensive nature of the pre-delineation process and extended timeframe of the sampling events, some hold times were exceeded at some locations. Specifically, some samples were released after the QAPP-specified six month hold time but within one year after collection. Refer to Section 5.2 for further information.

3.4 EXTENSION ALIGNMENT INVESTIGATION

The purpose of the PCBM and obstruction probes was to evaluate the presence of both PCBM and obstructions along the alignments of the proposed bulkhead extension wall and deadman. To accomplish this, a phased approach of land and water based probes was completed in the vicinity of the proposed bulkhead extension wall and deadman.

The 2013 probes were performed in a phased approach, as described in the work plan. In 2014, additional off-shore probes were performed in select locations to better define areas where 2013 probes encountered obstructions, or where PCBM data gaps remained.

The explorations performed for the extension alignment are described in the following sections.

3.4.1 Off-Shore Probes

2013 Probe Explorations

Thirty water-based probes (locations designated WP) were drilled during October and November 2013 at the locations shown on Figure 3.4A. The probes were drilled by Cascade Drilling using a track mounted drilling rig that was operated from a barge. The barge was owned and operated by Northstar Marine, Inc. (Northstar) of Clermont, New Jersey. Monitoring of the test borings was conducted by Haley & Aldrich personnel.

The drilling barge was positioned over the drill-hole using a GPS unit on the drilling rig. The barge was held in position by two spuds but was free to move vertically with the tide level. Sampling depth control was achieved using tide boards and tape measurements to mudline within the casing. Tide board water level was monitored and corresponding adjustments to the drill string length were made during drilling, to account for the changing tide level. Surveyed tideboard elevations were then used to relate sampling depth to elevation.

The probes were advanced using rotary wash (mud rotary) drilling methods. Soil sampling was performed using a 3-in. diameter split-spoon sampler driven ahead of the casing with an automatic hammer. Sampling was generally performed continuously (i.e., at approximately 2 ft intervals) where possible, except that when obstructions were encountered, a roller bit was used to advance the boring and no samples were obtained within that interval. When PCBM was observed, bag samples were collected, transferred to shore, and stored for future observation by NYSDEC representatives. Otherwise, samples were not retained and were discarded after recording observations on the boring log. In some instances, glass jar samples were collected where petroleum-like odors were detected. Details are provided on the individual boring logs in Attachment B and Figure 3.4A.

The probes were generally terminated at least 5 ft below top of Marine Silt depending on whether obstructions or semi-solid PCBM were encountered. Sampling equipment was decontaminated between samples and drilling equipment was decontaminated between borings. Probes were grouted to the mudline with cement bentonite grout upon completion of drilling. Locations of the water-based probes are shown on Figure 3.4A, and a summary of the probe explorations is provided in Table 3.4A.

Results of the probes are described briefly below. Refer to the individual boring logs, Table 3.4A, and Figure 3.4A for details.

- Five probes encountered semi-solid PCBM;
- Six probes encountered trace PCBM;
- No liquid PCBM was encountered;

- Four probes encountered refusal on wood and/or riprap obstructions; and
- Petroleum-like odor was also observed at some locations, which generally coincided with probes where PCBM was observed.

2014 Probe Explorations

Eleven additional water-based probes (also designated WP) were drilled in August 2014 by Cascade Drilling. The probes were drilled with a track mounted drilling rig that was operated from a jack-up barge owned and operated by Northstar. The probes were completed as a follow up to the 2013 explorations, to further explore the areas where data gaps concerning PCBM presence and/or obstructions existed. The probes were monitored in the field by Haley & Aldrich personnel. Logs of the 2014 water-based probes are provided in Attachment B.

The probes were performed similarly to as described for the 2013 probes, except that because a jack-up barge was used, elevation corrections related to the changing tide were not required.

Seven of the 2014 water-based probes encountered obstructions at various depths. The obstructions encountered consisted of probable concrete, riprap, rubble, and cobbles, as interpreted by the driller based on drilling action. In most cases, the roller bit was able to be advanced through the obstructions. When refusal was encountered, an alternative location was completed to better define the obstruction. No PCBM was observed. Refer to the individual boring logs, Table 3.4A, and Figure 3.4A for details.

2014 Vibracore Explorations

Vibracore sampling consists of a vibrating mechanism called a "vibrahead" attached to a core tube, which is configured with a 4 in OD steel core barrel with 3½-in. ID Lexan (plastic) clear liner material. The core tube is vibrated into sediment and aided by the force of gravity to collect a sediment core to the target depth or refusal. When the core tube is pushed to completion, the vibracorer is turned off, and the core tube is withdrawn with the aid of hoist equipment.

Vibracores were drilled in the Old Marina to obtain PCBM information as close as possible to the property line. Probes using a drilling barge were not possible in this area, due to the access restrictions (such as the low draft, and the presence of the existing piles and dock structures). The vibracores were advanced using a small vessel which was able to gain closer access to the shoreline, compared to a drilling barge.

Eight vibracore explorations, designated VC-1A, VC-2B, and VC-4A to VC-9A, were drilled in the area of the Old Marina during October 2014. Two vibracore explorations, designated VC-311A and VC-311B, were drilled in the west area of the extension alignment as part of the off-shore pre-delineation PDI activities which are described in Section 3.6. The locations of the vibracores are shown on Figure 3.4A and individual logs are provided in Attachment B.

The vibracores were drilled by CR Environmental of East Falmouth, Massachusetts using vibracore equipment mounted on a 26-ft aluminum work boat. The vibracores extended to depths ranging between 9 to 20 ft below mudline. Sampling equipment was decontaminated with alconox soap between samples and a new acrylic liner was used for each sample. Haley & Aldrich personnel observed and documented the samples obtained from the vibracore explorations.

Results of the probes are described briefly below. Refer to the individual boring logs, Table 3.4A, and Figure 3.4A for details.

- Two vibracores along the extension wall alignment encountered semi-solid PCBM;
- None of the vibracores along the Old Marina encountered PCBM; and
- No liquid PCBM was encountered.

Findings

Figure 3.4A shows the currently assumed bulkhead wall and deadman anchor alignment, based on the results of the probe explorations completed in 2013 and 2014. The exploration markers are color-coded depending on the conditions encountered (e.g., blue for trace PCBM, gray for no PCBM or obstructions).

Note that the potential alignment shown on Figure 3.4A passes through VC-311B, where semi-solid PCBM was observed to a depth of 8 ft. It also passes through some locations where obstructions were encountered. The current assumption is that excavation of PCBM and obstructions is feasible in these locations and could be removed prior to construction of the bulkhead. The preference is to avoid further outboard alignment adjustments while avoiding obstructions and PCBM.

The PCBM and riprap probes were performed in general accordance with the procedures described in the work plan, and no significant variances were made. Based on the findings of the extension alignment investigation, a corridor has been identified where no PCB Material (either as DNAPL or semi-solid), or major obstructions exist. Therefore the objective of the work plan has been met, for the western portion of the alignment. Along the Old Marina, explorations were limited by the physical site access restrictions (such as the existing piles and dock structures). The Preliminary Design will identify any additional information that may be required prior to construction or additional data collection that may be planned during construction.

The potential wall and deadman alignments, while sufficiently defined for design (at least along the western edge), are still subject to change during Final Design and construction, based on construction tolerances and actual conditions encountered (such as large obstructions which may exist but were not located during the pre-design explorations).

3.4.2 On-Shore Probe Explorations

Seventeen land-based probes (locations designated LP and PLP) were drilled along the approximate deadman and extension wall continuation alignments, and along the north property line, to detect visual evidence of PCBM.

The property line probes were drilled south of the property line at a 59 degree angle from the horizontal, except for PLP-4 which was drilled at a 25 degree angle from the horizontal. The location and angle of each probe was determined with the objective that the Fill/Marine Silt interface would be encountered about 5 feet inboard from the location of the wooden bulkhead that is suspected to exist along the property line (i.e., the geometry was chosen with the objective to investigate the Fill/Marine Silt interface as close as possible to the property line, without drilling through the existing bulkhead which is thought to exist at the property line and may be acting as a barrier to PCBM migration toward the north.)

The probes were drilled by Cascade Drilling using a mini-sonic drilling rig model BL 100C. Continuous sampling was generally performed in 5 ft segments using a 4-in. diameter core sampler. Samples were examined and logged by Haley & Aldrich personnel immediately after extraction. The probes were drilled during October and November 2013. Logs for the on-shore probes are provided in Attachment B.

Results of the probes are described briefly below. Refer to the individual boring logs, Table 3.4B, and Figure 3.4A for details.

- Six probes encountered semi-solid PCBM;
- Three probes encountered trace PCBM; and
- No liquid PCBM was encountered.
- Petroleum-like odor and/or oily material (two locations) were observed at some locations, which mostly did not coincide with the probes where PCBM was observed.

Drilling equipment was decontaminated between borings. Borings were grouted to the ground surface with cement bentonite grout upon completion of drilling.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.5 DEEPWATER INVESTIGATION

The purpose of the deepwater sediment sampling was to gather additional data where PCBs in excess of 50 mg/kg are known or suspected to be present, for making decisions regarding remedial action and to provide information for delineation of potential dredge areas. This investigation addressed areas in the proximity of existing exceedances and areas between existing borings EB-10 and EB-14, and used a phased approach to refine contamination extents to further understand lateral and vertical PCB contamination, within specific regions of the Deepwater Area, as shown on Figures 3.5A through 3.5F.

Fifty vibracore explorations were advanced during August and September 2014 at the locations shown on Figures 3.5A through 3.5F. The ponar and vibracore explorations were advanced by CR Environmental using an aluminum work boat fitted with winch operated ponar and vibracore equipment and field screening. Sampling and observations were performed by Haley & Aldrich.

The vibracore vessel was positioned over the drill-hole using a DGPS unit on the vessel. The vessel was held in position by a three point anchoring system. Sampling depth control was achieved using tide boards and a depth sounder to mudline (top of sediment surface). Sampling locations were modified as required due to field conditions (i.e. obstructions, current, etc.) as was provided for in the work plan.

Prior to the advancement of borings, where required, a surface sediment sample was collected using a petite ponar sampler. After the sampler was brought to the surface, samples were collected using a sterilized disposable scoop and transferred to the appropriate sampling containers. After grab sampling was completed at each location (excluding variability locations), a boring was advanced using vibracore drilling methods as previously described. The vibracore was advanced to the required depth or until refusal. Vibracore equipment was decontaminated between borings. A portion of each sediment sample was field screened using a PID.

Visual and/or olfactory observations of impacts to the sediment or presence of PCBM was also documented. Sediment samples for laboratory analyses were obtained from specific depths and homogenized. Samples were then placed in laboratory grade glassware, packed on ice, and transported to the laboratory via courier, with accompanying chain of custody form. Surface and subsurface sediments were analyzed for PCB aroclors, following EPA Method 8082A. Details are provided on the individual vibracore logs in Attachment B.

This sediment contamination investigation is comprised of four tasks which are described in the following sections.

3.5.1 Resampling Specific Locations (PCBs >50 mg/kg)

Vibracore borings VC-101 through VC-103 were advanced proximate to historical borings EB-10, EB-14, and CS-19, respectively. The vibracore borings were advanced to a total depth of 8 ft below mudline (bml). Sediment samples were collected for PCB analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, and 3 to 4 ft bml, 4 to 6 ft bml, and 6 to 8 ft bml, then analyzed as necessary, to delineate the extents of PCBs greater than 50 mg/kg.

PCBs were detected at concentrations in excess of 50 mg/kg in only one of the three vibracore locations collected for Task 1 (VC-103 at 3 to 4 ft bml). Sediment sample results are summarized below and presented in Table 3.5A. Sampling locations are illustrated on Figures 3.5A through 3.5F.

Historical Sample Locations and Dates	Sample Depth Interval (feet)	PCB Concentration (mg/kg)	PDI Sample Locations and Dates	Sample Depth Interval (feet)	PCB Concentration (mg/kg)
EB-10 (May 2001)	0-0.5	2.1	**VC-101**	0 - 0.5	0.5
				0.5 - 1	0.2
	1-2	**97**		1-2	0.4
	2.3-4	ND		2-3 3-4	0.6 1.7
	4-6	ND			
EB-14 (May 2001)	0-0.5	ND	**VC-102**	0 - 0.5	0.2
				0.5 - 1	0.3
	1-2	**260**		1-2	0.3
	2-4	2.4		2-3 3-4	2.5 24
	4.5-6.5	ND			
	7.5-8.5	ND			
	8.5-10.5	0.94			
	11-12.5	ND			
CS-19 (October 1999)	0-0	ND	**VC-103**	0 - 0.5	0.8
	0.5-2	ND		0.5 - 1 1-2	0.8 1.7
	2-2.7 2.7-3.2	**380** **140**		2-3	1.3
				3-4	**71**
				4-6	9.9

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.5.3 Investigation Unit Sampling - Area between EB-10 and EB-14

Vibracore borings VC-104 through VC-108 were advanced on a 160-foot triangulation grid between historical borings EB-10 and EB-14. The vibracore borings were advanced to a total depth of 8 ft bml. Sediment samples were collected for PCB analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, and 3 to 4 ft bml, 4 to 6 ft bml, and 6 to 8 feet bml, then analyzed as necessary, to delineate the extents of PCBs greater than 50 mg/kg.

PCBs were detected at concentrations in excess of 50 mg/kg in only one of the five vibracore locations collected for Task 2 (VC-108 at 2 to 3 ft bml). Sediment sample results are presented in Table 3.5A and are illustrated on Figures 3.5A through 3.5F.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.5.4 Decision Unit Sampling - Including Step-out Investigation

Vibracore borings VC-109 through VC-126 were advanced to assess the nature and extent of PCB concentrations greater than 50 mg/kg at historical borings EB-10, EB-14, CS-10. Vibracore borings VC-127 through VC-132 were advanced and samples initially held and analyzed as necessary to refine adjacent PCB exceedances. Additionally VC-133 through VC-141 were advanced to assess the PCB concentrations at VC-108 (identified during Task 2), VC-110, VC-123, and VC-130. The vibracore borings were advanced to a total depth of 8 ft bml. Sediment samples were collected for PCB analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, and 3 to 4 ft bml, 4 to 6 ft bml, and 6 to 8 feet bml, then released for analysis as necessary, to delineate the extents of PCBs greater than 50 mg/kg.

PCBs were detected at concentrations in excess of 50 mg/kg in four of the thirty three vibracore locations collected for Task 3 (VC-110, VC-123, VC-130, and VC-139) and only at the 3 to 4 ft bml interval. Sediment sample results are presented in Table 3.5A and are illustrated on Figures 3.5A through 3.5F.

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met.

3.5.5 Variability of Sediment Concentrations

Vibracore borings VC-101A through VC-101C, VC-102A through VC-102C, and VC-103A through VC-103C were advanced within close proximity to VC-101, VC-102, and VC-103, respectively, to assess the contaminant mass distribution proximate to the historical locations EB-10, EB-14 and CS-19. The vibracore borings were advanced to a total depth of 8 ft bml. Sediment samples were collected for PCBs from the depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, and 3 to 4 ft bml, 4 to 6 ft bml, and 6 to 8 feet bml.

PCBs were detected at concentrations in excess of 50 mg/kg in the 3 to 4 ft interval at three of the nine vibracore locations collected for Task 4 (VC-101B, VC-102A, and VC-103B) and at the 4 to 6 ft interval in one location (VC-103B). Sediment sample results summarized in the following table and presented in Table 3.5A. Sediment sampling locations are illustrated on Figure 3.5G.

Location	Variability Results (PCBs in mg/kg)					
	0-0.5	0.5-1	1-2	2-3	3-4	4-6
VC-101	0.5	0.2	0.4	0.6	1.7	-
VC-101A	-	*0.3*	*0.5*	*0.8*	*3.7*	*0.7*
VC-101B	-	*0.3*	*0.6*	*0.7*	70	ND
VC-101C	-	*0.3*	*0.4*	*0.6*	4.5	0.1
Avg.	-	0.3	0.5	0.7	20	-
VC-102	0.2	0.3	0.3	2.5	24	-
VC-102A	-	*0.2*	*0.3*	*1.1*	91	ND
VC-102B	-	*0.4*	*0.9*	*5.1*	9.1	ND
VC-102C	-	*0.4*	*0.7*	*0.1*	ND	ND
Avg.	-	0.3	0.6	2.2	31	-
VC-103	0.8	0.8	1.7	1.3	71	9.9
VC-103A	-	*0.4*	*1.2*	*17*	10	21
VC-103B	-	*0.6*	*0.6*	*2.5*	70	95
VC-103C	-	*0.4*	*0.6*	*2.7*	*0.1*	*ND*
Avg.	-	0.6	1.0	5.8	38	32

The work was performed in compliance with procedures described in the work plan. Based on the results of this investigation, the objectives of the program were met. Some adjustments to the work plan were required during implementation of field activities due to strong currents. Locations for VC-103A through VC-103C were greater than 10 ft away from VC-103 but still within the decision unit.

3.6 OFF-SHORE PRE-DELINEATION

The purpose of this Off-shore Pre-Delineation investigation was to examine specific off-shore areas where PCBs or metals in excess of remedial criteria are known or suspected to be present, in order to gather supplementary data for making decisions regarding remedial action and to provide information for delineation of dredge areas. In compliance with the work plan, off-shore sediment sampling was conducted in three separate areas at the Site: Nearshore Area, Backwater Areas, and Northwest Area within the Deepwater Area.

Vibracore explorations were advanced between the end of August 2014 and the beginning of November 2014. The vibracore explorations were advanced by CR Environmental of East Falmouth, MA using an aluminum work boat fitted with winch operated vibracore equipment and observed by Haley & Aldrich.

The vibracore vessel was positioned over the drill-hole using a DGPS unit on vessel. The vessel was held in position by a three point anchoring system. Sampling depth control was achieved using tide boards and a depth sounder to mudline. Sampling locations were modified as required due to field conditions (i.e. obstructions, current, etc.) as was provided for in the work plan.

Prior to the advancement of borings off-shore delineation borings, an undisturbed surface sediment grab sample was collected using a petite ponar sampler. After the sampler was brought to the surface, samples were collected using sterilized disposable scoop and transferred to the appropriate sampling containers. After grab sampling was completed, as necessary, a boring was advanced using vibracore drilling methods as previously described. The vibracore was advanced to the required depth or until refusal. Vibracore equipment was decontaminated between borings. A portion of each sediment sample was field screened using a PID.

Visual and/or olfactory observations of impacts to the sediment or presence of PCBM was also documented. Sediment samples for laboratory analyses were obtained from specific depths and composited for delineation purposes. Samples were then placed in laboratory grade glassware, packed on ice, and transported to the laboratory via courier, with accompanying chain of custody form. Surface and subsurface sediments were analyzed for PCB aroclors, following EPA Method 8082A and/or metals by EPA Method 6010C. Details are provided on the individual vibracore logs in Attachment B.

This sediment investigation performed for the Nearshore Area, Backwater Areas, and Northwest Area are described in the following sections.

3.6.1 Nearshore Area Results

Vibracore borings, VC-401 through VC-423, were advanced along the Site shoreline defined by the expected silt curtain alignment on the west and the OU-1/OU-2 boundary on the east. The vibracore borings were advanced to a total depth of 8 ft below the mudline. Sediment samples were collected for PCB and metals (copper, lead, and zinc) analyzed from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, 3 to 4 ft bml, 4 to 5 bml, 5 to 6 ft bml and 6 to 8 ft bml.

PCB and select metals greater than remedial criteria were varied up to and exceeding 6 ft in depth. Refer to the individual vibracore logs, Tables 3.6B through 3.6D, and Figures 3.6I through 3.6P for PCBs and Figures 3.6Q through 3.6U for metals.

Compliance with procedures described in the work plan was maintained during completion of the work. Based on the results of this investigation, the objectives of the program were met, except as detailed below. PCBs and metals were detected at levels exceeding remedial criteria at multiple intervals at VC-422. Sampling was not collected further south of the property line.

3.6.2 Backwater Areas Results

Old Marina Area

Vibracore borings, VC-501 through VC-511, were advanced in the North Boat Slip area. The vibracore borings were advanced to a total depth of 10 ft below the mudline. Additionally VC-512 through VC-516 were advanced to assess the PCB and metals concentrations at initial northern locations. Sediment samples were collected for PCBs and metals (copper, lead, and zinc) analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, 3 to 4 ft bml, 4 to 5 ft bml, 5 to 6 ft bml, 6 to 8 ft bml, and 8 to 10 feet bml, then analyzed as necessary, to delineate the extents of PCB or metals exceedances.

Refer to the individual vibracore logs, Tables 3.6B through 3.6D, and Figures 3.6I through 3.6P for PCBs and Figures 3.6Q through 3.6U for metals.

Compliance with procedures described in the work plan was maintained through work completion. Based on the results of this investigation, additional data needs to be collected further north of the step out locations VC-512 through VC-516 to support the design of the remedy.

North Boat Slip

Vibracore borings, VC-601 through VC-603, were advanced in the North Boat Slip area. The vibracore borings were advanced to a total depth of 10 ft below the mudline. Additionally VC-604 and VC-605 were advanced to assess the PCB and metals concentrations south of VC-603 greater than remedial criteria. Sediment samples were collected for PCB and metals (copper, lead, and zinc) analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, 3 to 4 ft bml, 4 to 5 ft bml, 5 to 6 ft bml, 6 to 8 ft bml, and 8 to 10 feet bml, then analyzed as necessary, to delineate the extents of PCB or metals exceedances.

Refer to the individual vibracore logs, Tables 3.6B through 3.6D, and Figures 3.6I through 3.6P for PCBs and Figures 3.6Q through 3.6U for metals.

North boat slip area sediment sampling was performed in general accordance with the procedures described in the work plan. Data collected is sufficient for use during the design, and therefore, the objectives of the program were met.

South Boat Slip Area

Vibracore borings VC-701 through VC-705, were advanced in the south boat slip area. The vibracore borings were advanced to a total depth of 8 ft below the mudline. Sediment samples were collected for lead analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, 3 to 4 ft bml, 4 to 5 ft bml, 5 to 6 ft bml, and 6 to 8 ft bml, then analyzed as necessary, to delineate the extents of lead exceedances.

Refer to the individual vibracore logs, Table 3.6C, and Figures 3.6Q through 3.6U.

South boat slip area sediment sampling was performed in general accordance with the procedures described in the work plan with the exception of no offset east of VC-703 due to access issues (i.e. water depth) and presence of the shoreline. Data collected is sufficient for use during the design, and therefore, the objectives of the program were met

3.6.3 Northwest Area Results

Approximately seventy eight vibracore borings were advanced adjacent to the Northwest Off-shore Area. The vibracore borings were advanced to a total depth of 8 ft below the mudline. Sediment samples were collected from sample locations VC-366, VC-369 through VC-371, and VC-376 and VC-379, but were not analyzed because they were determined to be unnecessary for delineation. Sediment samples were collected for PCB analysis from depth intervals of surface to 0.5 ft bml, 0.5 to 1 ft bml, 1 to 2 ft bml, 2 to 3 ft bml, 3 to 4 ft bml, 4 to 5 ft bml, 5 to 6 ft bml, and 6 to 8 ft bml, then analyzed as necessary, to delineate the extents of PCB greater than 50 mg/kg.

Details are provided on the individual boring logs in Attachment B, Table 3.6A and Figures 3.6A through 3.6H.

As described in the work plan, select existing data points were resampled. The locations are summarized below and supplemented or replaced the historic data for the purposes of pre-delineation.

Historical Sample Locations	Sample Depth Interval (feet)	PCB Concentration (mg/kg)	PDI Sample Locations	Sample Depth Interval (feet)	PCB Concentration (mg/kg)
RB-43	0-0.5	1.4	**VC-330**	0 - 0.5	25
	0.5-2	**490**		0.5 - 1	**900**
				1-2	**250**
	2-4	5.2		2-3	**72**
				3-4	**150**
	4-6	-		4-5	31
				5-6	-
	6-8	ND		6-8	-
RB-12/RB-22	0-2	**69**	**VC-311**	0 - 0.5	0.5
				0.5 - 1	2.1
				1-2	15
	2-4	2.2		2-3	20
				3-4	2.2
	4-6	ND		4-5	ND
				5-6	**9,800**
SD-53	0-2	**2,000**	**VC-307**	0 - 0.5	1.3
				0.5 - 1	**900**
				1-2	**61**
	2-4	25		2-3	1.0
				3-4	-
	4-6	9.5		4-5	-
				5-6	-
	6-8	4.5		6-8	-
RB-11	0-2	**5,200**	**VC-304**	0 - 0.5	3.4
				0.5 - 1	4.5
				1-2	12
	2-4	-		2-3	**330**
				3-4	**6400**
	4-6	-		4-5	**250**
				5-6	3.3
	6-8	**170**		6-8	1.1
SD-52	0-2	**150**	**VC-301**	0 - 0.5	8.3
				0.5 - 1	0.2
				1-2	0.6
	2-4	31		2-3	0.7
				3-4	Obstruction
	4-6	**290**		4-6	n/a
	6-8	34		6-8	n/a
RB-14	0-0.5	**120**	**VC-322**	0 - 0.5	0.3
	0.5-3	0.058		0.5 - 1	0.3
				1-2	**57**
				2-3	ND
	3-6	ND		3-4	-
				4-5	-
				5-6	-
	6-8	0.085		6-8	-

Historical Sample Locations	Sample Depth Interval (feet)	PCB Concentration (mg/kg)	PDI Sample Locations	Sample Depth Interval (feet)	PCB Concentration (mg/kg)
CS-12	0-0.5	**170**	**VC-319**	0 - 0.5	0.3
	0.5-2.4	ND		0.5 - 1	0.6
				1-2	0.5
	2.4-2.9	ND		2-3	ND
RB-42	0-0.5	0.42	**VC-326**	0 - 0.5	7.1
	0.5-2	0.24		0.5 - 1	0.6
				1-2	0.5
	2-3	7.9		2-3	0.8
	4	**420**		3-4	16
				4-5	5.6
	-	-		5-6	ND
	6-8	0.074		6-8	0.5
RB-21	0-0.5	13	**VC-315**	0 - 0.5	4.3
	0.5-2	30		0.5 - 1	1.1
				1-2	1.1
	2-3	15		2-3	3.2
	-	-		3-4	**61**
	4-5	**1,400**		4-5	**85**
	5-6	6.9		5-6	0.1
	-	-		6-8	ND

Adjustments to the work plan were required during implementation of field activities and are detailed below. While not all areas were completely delineated, the data collected is sufficient to move forward with the design, and therefore, the objectives of the program were met.

Modifications:

- Due to PCB exceedances greater than remedial criteria at initial vibracore locations, additional locations VC-334 through VC-375 were added to the program.
- Vibracore location VC-301 was only able to be advanced to 4 ft due to obstructions and debris after multiple attempts.
- Vibracore location VC-333 was unable to advance due to obstructions or debris after multiple attempts.
- Additional sample locations, VC-334 through VC-379, were advanced to define lateral and vertical extent of PCB impacts.

3.7 GEOTECHNICAL EXPLORATION

The geotechnical portion of the PDI consisted of soil borings, test pits, and geotechnical laboratory testing to evaluate subsurface conditions. The purpose of the geotechnical explorations is to provide additional stratigraphy information in several areas: in the general vicinity of the planned deadman anchor (which will be located west of Building 52), in the general vicinity of the planned Northwest Extension bulkhead wall, and in the general off-shore area between the North Boat Slip and the South Boat Slip. The information will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (such as settlement). Additionally, test pits were excavated at select locations around the site where support of excavation (SOE) may be used during construction (i.e. excavation locations that are about 6 ft bgs or deeper). The purpose of the test pits is to gather information on soil conditions, excavation effort, and potential obstructions that could affect the design and/or construction of the SOE walls.

3.7.1 Geotechnical Test Borings

2013 On-Shore Geotechnical Test Borings

Two test borings, designated PD2-GL-001 and PD2-GL-002, were drilled on land between 2 and 10 October 2013 in the general vicinity of the planned deadman and anchor alignment (west of Building 52) shown on Figure 3.7A. The borings were drilled by Cascade Drilling using a truck mounted drill rig. The borings were advanced using a roller bit and 4-in. casing.

The boring locations were pre-excavated with an air knife to 6.5 feet prior to beginning sampling, to clear for utilities. Soil sampling was performed in general accordance with ASTM D1586 using an automatic hammer. Sampling was generally performed continuously through the Fill and at 5 ft intervals thereafter. Undisturbed samples of fine-grained soils were obtained with a 3-in. diameter Shelby tube using direct push methods. In boring PD2-GL-002, rock was cored using an NX size core barrel.

Sampling equipment was decontaminated between samples and drilling equipment was decontaminated between borings. Borings were grouted to the ground surface upon completion with cement bentonite grout.

Monitoring of the test borings was conducted by a representative from Haley & Aldrich. Logs of the borings are presented in Attachment B. The soil descriptions on the boring logs are based on the Unified Soils Classification System (USCS), as described in the first two pages in Attachment B. Test borings locations and ground surface elevations were determined in the field by site survey, which was performed by Wendel.

2014 Off-Shore Geotechnical Test Borings

Ten (10) test borings, designated PD2-GR-001 through PD2-GR-009 (including PD2-GR-002A), were drilled between 3 June and 4 August 2014 at the locations shown on Figure 3.7A. The borings were drilled by Cascade Drilling using a skid mounted drilling rig operated from a jack-up barge. The barge was owned and operated by Northstar Marine.

The drilling barge was positioned over the drill-hole using a GPS unit on the drilling rig. Sampling depth control was achieved using tide boards and tape measurements to mudline within the casing. Surveyed tideboard elevations were then used to relate sampling depth to elevation.

The borings were advanced using rotary wash drilling methods, with 4-in. and 3-in. casing. Soil sampling was performed in general accordance with ASTM D1586 using an automatic hammer. Sampling was generally performed at 5 to 10-ft intervals. Undisturbed samples of fine-grained soils were obtained with a 3-in. diameter Shelby tube using direct push methods; however, once low/no sample recovery was experienced with this method, a hydraulic piston assembly was used to push most of the remainder of the tubes. Rock was cored at 4 of the boring locations using an NQ size core barrel.

Sampling equipment was decontaminated between samples and drilling equipment was decontaminated between borings. Borings were grouted to mudline upon completion with cement bentonite grout.

Boring PD2-GR-002 was terminated shallower than planned, because semi-solid PCBM was observed in samples taken at 11 feet and 27 feet below mudline. The boring was offset and re-drilled approximately 13 ft outboard from the original location, at PD2-GR-002A.

Monitoring of the test borings was conducted by a representative from Haley & Aldrich. Logs of the borings are presented in Attachment B.

3.7.2 2014 Geotechnical Test Pits

Six (6) test pits, designated PD2-TP-1 through PD2-TP-6, were excavated at the locations shown on Figure 3.7A. The test pits were excavated between 25 June and 1 July 2014 in the vicinity of potential support of excavation (SOE) locations around the site. The test pits were excavated by American Environmental Assessment Corporation (AEAC) using a John Deere track-mounted excavator, Model 200 CL. The test pits were between about 12 ft to 25 ft long, 5 ft to 8.5 ft wide, and 4 ft to 12 ft deep. Soils were excavated in lifts and segregated by depth on plastic sheeting. Backfilling was performed in the reverse order of excavation so that soils were returned to the approximate depth from which they were excavated. Photographs were taken of the open pits and spoils piles. Test pits were backfilled on the same day they were excavated. Test pits were monitored in the field by a representative of Haley & Aldrich. Logs and photographs of the test pits are included in Attachment B.

The test pits encountered miscellaneous fill soils, along with non-soil materials such as brick, pipes (PVC, cast iron, and concrete), steel and concrete pieces, copper wire, concrete slabs, granite blocks, roofing materials, wood, railroad ties, steel structures, and glass. Water infiltration was observed in the deeper pits, generally at about 5.5 to 7.5 ft bgs.

Refer to the individual test pit logs in Attachment B for information on conditions encountered in the test pits.

3.7.3 Subsurface Conditions

At the site, the stratigraphy encountered during the PDI consisted of man-placed Fill over fine-grained Marine Deposits (Marine Silt) overlying coarser Marine Deposits (Basal Sand). The Fill was encountered at the on-shore boring locations PD2-GL-001 and PD2-GL-002, and at all of the test pit locations.

A generalized description of the strata encountered in the recent borings is provided below. Refer to the individual logs for a detailed description of each test boring.

<u>Concrete</u> – The land borings, PD2-GL-001 and PD2-GL-002, encountered an approximate 15 in. thick concrete slab.

<u>Miscellaneous Fill</u> – Miscellaneous Fill (Fill) was encountered underlying the surface layer in the land borings. The Fill descriptions varied widely, but the layer is generally classified as very loose to medium dense silty SAND (SM), poorly graded SAND (SP), clayey SAND (SC), with varying amounts of silt, clay, and gravel. The Fill contains miscellaneous debris with varying amounts of non-soil materials such as

wood, brick, concrete with reinforcing bars, ash and cinders, glass, plastic, slag, shells, asphalt, and copper wire. The Fill generally became less dense with depth, and at boring location PD2-GL-001, the Fill appeared to be intermixed with the underlying Marine Silt layer at depth. Sample recoveries in the Fill were often poor.

In the land borings PD2-GL-001 and PD2-GL-002, the Fill was approximately 21 ft thick.

Marine Silt – A stratum of soft Marine Deposits was encountered at the mudline in the water borings and underlying the Fill in the land borings. The layer was generally gray and very soft (with blowcounts typically weight of rods or weight of hammer in 24 in.). The Marine Silt typically consisted of SILT (ML), with some samples of ORGANIC SOILS (OL/OH), lean CLAY (CL), fat CLAY (CH), silty SAND (SM), or clayey SAND (SC) with varying amounts of silt, clay, and sand.

Eleven (11) of the 12 borings penetrated through this stratum and into the underlying sand unit. In some borings the Marine Silt gradually became sandier with depth, evidenced by higher blowcounts toward the bottom of the layer.

The thickness of the Marine Silt ranged from 42 to 71.8 ft, and, in the borings completed for this investigation, was thicker in the river than on land.

Basal Sand – A layer of sandy Marine Deposits, referred to as the Basal Sand, was encountered underlying the Marine Silt. Six (6) borings were terminated within the Basal Sand unit. This stratum was generally described as medium dense to very dense, gray to red-brown silty SAND (SM), poorly graded SAND (SP), and/or sandy SILT (ML) with varying amounts of gravel, sand, and silt. The Basal Sand was generally separated from the overlying Marine Silt by a layer of gravel.

Five (5) of the 12 borings penetrated through this stratum to the underlying bedrock. For the land boring, the Basal Sand was 45 ft thick. For the river borings in the north, the Basal Sand was about 52.5 to 55.5 ft thick. For the river boring in the south, the Basal Sand was about 32 ft thick.

Bedrock – For the borings that penetrated through the Basal Sand, bedrock was encountered underlying the Basal Sand layer. The bedrock was encountered at depths ranging from 84.5 to 120 ft beneath existing grades or mudline. In the land boring, rock was encountered at about El. -110. In the river borings in the north, rock was encountered between El. -130 to El. -140. In the river boring in the south, rock was encountered at about El. -104. Approximately 5 ft of bedrock was cored at each of the 5 borings (one on land, and 4 in the river). In the north, the bedrock was generally described as hard to very hard, fresh, medium to fine grained, light gray to black GNEISS with vertical to moderately dipping foliation. In the river boring in the south (PD2-GR-008), the rock was hard, fresh to slightly weathered, fine to medium grained, light gray to tan MARBLE with moderately dipping to high angle foliation.

3.7.4 Geotechnical Laboratory Testing

Representative samples of the Marine Silt and Basal Sand were selected for geotechnical laboratory testing. The samples were submitted to TerraSense, LLC of Totowa, New Jersey. Results of individual tests are briefly summarized below. Refer to the Table 3.7A for a more detailed summary of results of individual tests, and to Attachment D for the laboratory test data sheets.

Moisture Content

Two hundred four (204) samples were submitted for moisture content testing: 195 from the Marine Silt and 9 from the Basal Sand. Moisture content tests were performed on Shelby tube samples collected from the Marine Silt and split spoon samples collected from the Basal Sand. Testing was performed in general conformance with ASTM D2216. The water content for the Marine Silt ranged from about 21% to 102%, and the water content for the Basal Sand ranged from about 16% to 53%.

Grain Size Analysis

Forty-nine (49) samples were submitted for grain size analysis testing: 43 from the Marine Silt and 6 from the Basal Sand. A full sieve and hydrometer analysis was generally performed, except for samples with less than approximately 10% fines content, when a wash 200 was performed rather than full hydrometer analysis. Refer to Figure 3.7B for a plot of the fines content versus elevation for the Marine Silt stratum. Testing was performed in general conformance with ASTM D423.

Atterberg Limits

Forty-nine (49) samples were submitted for Atterberg Limits testing: 43 from the Marine Silt and 6 from the Basal Sand. Refer to Figure 3.7C for a plot of the Atterberg Limits results versus elevation, and corresponding water content measurements. Figure 3.7D shows a plot of the plasticity index (PI) versus elevation, and the corresponding Burmister classification. The data shows that the plasticity index generally decrease with decreasing elevation; or in other words, the Marine Silt becomes less clayey with depth. Atterberg Limits data were plotted on the USCS Plasticity Chart in Figure 3.7E. Liquidity index (LI) versus elevation was also summarized and plotted on Figure 3.7F. Testing was performed in general conformance with ASTM D4318.

Organic Content

Two (2) samples were submitted from the Marine Silt for organic content testing. The percent organic content of the samples was about 3%. Testing was performed in general conformance with ASTM D2974.

Additionally, 21 Atterberg Limit tests were completed by performing both conventional air-dried and oven-dried analyses, for an estimate of whether the soil would be classified as organic according to ASTM. The ratio of the oven-dried liquid limit to the air-dried liquid limit for these samples ranged from 0.59 to 1.03 with an average of 0.78. Accordingly, some of the tested soil is classified as organic, and some as non-organic. (Per ASTM, soil is classified as organic if the ratio of the oven-dried liquid limit to the air-dried liquid limit is less than 0.75).

Total Unit Weight

One-hundred and twenty-one (121) samples were submitted from the Marine Silt for total unit weight testing. The total unit weight ranged from approximately 89.9 to 126 pounds per cubic foot (pcf). Testing was performed in general conformance with ASTM D7263.

One-Dimensional Consolidation

Thirty-two (32) samples from the Marine Silt were submitted for one-dimensional consolidation tests. Testing was performed in general conformance with ASTM D2435.

The compression ratio CR (strain per log cycle stress) ranged from 0.12 to 0.42 , with an average of 0.24. The CR was determined from a plot which had been corrected for effects of disturbance in accordance with the method presented by Duncan and Buchignani (1976). The recompression ratio RR (strain per log cycle stress) ranged from approximately 0.003 to 0.043, with an average of 0.02. Overconsolidation ratio (OCR) was estimated using lab preconsolidation pressures, and ranged from 0.86 to 5.2 with 25 out of the 32 calculated values less than OCR=2. Refer to Figures 3.7G to 3.7I for plots of preconsolidation pressure, CR, and RR versus elevation, respectively.

Direct Simple Shear

Twenty (20) samples from the Marine Silt were submitted for direct simple shear testing (DSS). Testing was performed in general conformance with ASTM D6528.

The DSS shear strength of the samples tested ranged from 140 to 970 psf. Refer to Figure 3.7J for a plot of the DSS shear strength versus elevation.

Consolidated Undrained Triaxial

Twenty-six (26) samples from the Marine Silt were submitted for consolidated undrained (CU) Triaxial tests. Testing was performed in general conformance with ASTM D4767.

The CU undrained shear strength of the samples tested (defined as half the deviator stress at failure, corrected based on mean stress) ranged from 82 to 1705 psf. For samples that did not exhibit strain softening behavior, failure was defined at 12% strain. Refer to Figure 3.7J for a plot of the CU undrained shear strength versus elevation.

Note that the undrained shear strength shown in the figure was determined from the lab data are correcting it to account for the mean in situ effective stress. As such, the data plotted in the Figure 3.7J may vary slightly from the raw data presented on the lab results page in Attachment D.

Modifications

The number of test pits was initially planned to be between 5 and 10. During the work, some locations were shifted or deleted, to accommodate Site conditions. The changes include:

- Deleted planned test pit in the southwest corner of the site because it was close to a previous test pit excavation.
- Deleted planned test pit in footprint of former Building 72A after new delineation data indicated that only a 6 ft excavation would likely be required in that location.
- Added test pits to the west of former Building 52B and near the southwest corner of Building 52 to obtain obstruction information
- At least one geotechnical boring was originally planned in the Old Marina but was later deleted due to physical site restrictions that precluded barge access (very shallow water and the presence of existing piles and dock structures).
- Some geotechnical borings were drilled deeper than planned, due to rock being encountered deeper than expected, especially in the river borings in the north.

Compliance with procedures described in the work plan was maintained through work completion with adjustments noted above. Based on the results of this investigation the objective of the work plan has been met, except at the Old Marina, explorations were limited by the physical site access restrictions (such as the existing piles and dock structures). The design of the remedy will identify any additional information required prior to construction or additional data collection that may be planned during construction.

3.8 BENCH TESTING

The purpose of the bench testing was to evaluate various design parameters associated with the handling of residuals, for treatments that could be performed on-site to prepare the residuals for final disposition. The following bench tests were described in the work plan:

- Solids Dewatering: The ability of mechanical means to remove free water from the excavated solids in order to transport the material off-site or place on-site. The solids included both sediment and on-site soils;
- Stabilization: Identify potential additives to dewatered solids that would modify the physical properties of the solid to aid in disposal. Two types of stabilization were investigated: Bulking (to prevent the release of free liquid during transport) and solidification (to add compressive strength for future use on-site);
- Construction Water Treatment: Identify the potential contaminants in water generated during construction (groundwater removed from excavations during on-shore soil removal & water generated during sediment dewatering activities). Identify treatment technologies and design parameters that are likely to meet regulatory standards and allow the water to be discharged to the Hudson River or some other outfall.
- Long-Term Groundwater Treatment: Identify the design parameters for a long-term (post-construction) groundwater treatment system, and determine if passive treatment is possible.

The Pre-Design Bench Tests are described in the following sections. All testing has been performed by Kemron Environmental Services of Atlanta, Georgia.

3.8.1 Solids Dewatering

The solids dewatering studies occurred during two separate investigations:

- Previously in 2006, a dewatering test was performed on a composite sample of saturated soils. Soil samples were obtained from four (4) to thirteen (13) feet below ground surface (bgs), as part of test pitting investigations. Thirty gallons of soil was homogenized for testing. Gravity drainage was evaluated with both a raw sample and one with 5% diatomaceous earth added as a dewatering aid. In addition, the raw soil was tested used a Bariod filter press at various positive pressures, ranging from 25 to 100 psig. The reduction in moisture content was evaluated for both gravity drainage and filter press operations. The results of the bench test are provided in Attachment D.
- In 2014, as part of this work plan, a dewatering test was performed on a composite sample of near-shore sediments. Three sediment samples were obtained in March 2014 which were shipped to Kemron and homogenized for analysis. This sample was tested for gravity and filter press dewatering in a manner nearly identical to the 2006 test. The reduction in moisture

content was evaluated for both gravity drainage and filter press operations. The results of the bench test are provided in Attachment D.

In general, results indicated the following:

- Gravity drainage alone, even with a dewatering aid, is not sufficient to allow for the off-site transportation of either soil or sediment; and
- Filter press operations will sufficiently remove moisture from on-shore soils, but not from sediments. Additional dewatering options should be investigated for sediments.

3.8.2 Stabilization

Stabilization testing was performed based on the results of the solids dewatering tests described in Section 3.8.1, which showed that dewatering alone was not sufficient for sediments to pass the liquid release test. Additional testing was performed to identify amendments that could be added to the sediment to pass either liquid release tests (for off-site disposal) or compressive strength tests (for on-site re-use).

Vibracore sampling was conducted to collect sediment samples as discussed in Sections 3.5 and 3.6. After environmental samples were collected (approximately 4 oz per sampling interval), the remaining sediment from the sampled intervals was placed in a labeled 5 gallon bucket.

Nineteen buckets were selected in order to provide sufficient volume for sediment and pore water testing. Based on analytical from each of the sample locations contained in the buckets, the average PCB concentration in the buckets was estimated to be 50 mg/kg. Table 3.8A provides a summary of the buckets that were used of the stabilization testing. Sediment was homogenized and dewatered, using a Bariod filter press at 50 psig. The supernatant (pore water) was set aside for testing under 3.8.3, Construction Water Treatment.

In addition, 25 gallons of on-site soil was obtained from on-going test pitting operation, to determine if the highly granular on-site soils could be used as a stabilizing additive.

Testing was performed as follows:

a. Untreated Characterization: The physical characteristics of the soil and dewatered sediment were documented.
b. Mixture testing: Additive testing was performed in two phases:
    i. Five (5) stabilization agents were added separately to the sediment samples and tested for generalized observation and testing of changes in physical characteristics.
    ii. Based on the results of (b)(i) above, ten (10) additives or combinations of additives were selected, and each was added to the sediment at two or three separate addition rates. A total of twenty-one (21) combinations were evaluated additional testing.
c. Soil addition testing. Soil addition testing was also performed in two phases.
    i. Soil and sediment alone were mixed in several ratios and screened for general changes in physical characteristics that would aid in the sediment bulking and removal of water from the solid matrix.

ii. Based on the screening results of (c)(i), a total of twelve (12) additional mixtures of soil & sediment along with stabilization agents (at smaller addition rates) were evaluated with more substantial testing.
iii. During testing, results indicated to the Kemron personnel that a mixture which contained non-dewatered sediment may provide better results. As such, three (3) additional mixtures using non-dewatered sediments

In general, results indicated the following:

- Sediment can bulked with a variety of additives (including Portland cement, cement kiln dust, and lime kiln dust) and combinations of these additives and be transportable off-site without releasing water;
- Wet sediment can be stabilized with Portland cement to greater than 50 psig compressive strength, for use on-site as structural fill;
- Adding excess on-site soils alone to dewatered sediment at addition rates of at least 1:1 will likely allow the mixture to be transported off-site.; and
- Bulking or Stabilization addition rates can be reduced with the addition of on-site soils.

The bench test report and physical testing results are included as Attachment D.

3.8.3 Construction Water Treatment

Previously, filtration testing was performed in 2006 on a small amount of collected groundwater in order to determine if metals and PCBs could be removed by filtration alone. The testing was unsuccessful in removing all of the contaminants. Results are provided in Attachment D.

As part of the 2015 bench testing, both groundwater and sediment pore water were tested separately and then combined to identify a treatment train that would successfully remove PCBs and metals from the water streams. Unit operations were testing individually on the individual streams and then combined as an overall treatment train.

On 26 March 2015, 20 gallons of groundwater was collected from monitoring wells PDMW-22S, MW-10, RW-12, and HARW-1. Porewater from filter press dewatering performed on the selected sediment samples used in the stabilization testing was used for pore water.

(1) Initial Raw Water Testing: Analytical tests of the raw groundwater and pore water (from the stabilization testing) were performed as a baseline. Pore water showed little to no PCB concentrations. An additional bucket of sediment (see bucket # 20 on Table 3.8A) of high concentration sediment was sent to Kemron and filter pressed. The sediment and pore water were analyzed. This pore water was used for the filtrations test, while the initial pore water was used for all other tests.

(2) Filtration Testing: Filtration testing was performed separately on groundwater and pore water.

- Groundwater results did not pass some QC factors, but general trends showed a 90% removal at 1 micron and 97% at 0.45 micron, with no additional removal at 0.1 microns. There was very little to no metals removal, which is understandable as raw data showed most if not all of the metals in the dissolved phase.

- Pore Water showed complete removal of all PCBs at filtration of 10 microns and smaller. Metals concentrations (both total and dissolved), showed very little change, with the exception of zinc concentration when filtered to less than one micron.

(3) Carbon Adsorption Testing: Carbon adsorption testing was performed only on the groundwater, as there was not sufficient high concentration pore water to test more than filtration. All four tests (two carbon types and two empty bed contact times) removed all PCBs from the water stream.

(4) Precipitation Testing: Precipitation testing was performed separately on groundwater and pore water; however results were similar in both waters. Initial small batch testing at for different pH values (8.5, 9.5, 10.5, and 11.5) and with different additives (hydrated lime slurry, sodium hydroxide, ferric chloride, calcium chloride, sodium sulfate and sodium sulfide) was performed with strictly visual confirmation of precipitate and water quality. Six precipitation conditions were selected for analytical testing. In nearly all cases, lead and zinc were completely removed from the water streams. Copper concentrations were present in all pore water samples and two of the groundwater samples, with concentrations less than 0.10 milligrams per liter (mg/L).

(5) System Testing: After individual streams and unit operations were tested as individual units, a basic treatment train was established to treat the stream of combined water. The treatment train selected was as follows:
- Filtration to 1 micron;
- Carbon adsorption with coal-based carbon at a 10 minutes Empty Bed Contact Time (EBCT); and
- Precipitation with lime slurry to 11.5 SU, with filtration to 10 micron.

Results indicate that all PCBs and metals were removed from the combined stream.

These results indicate that treatment of either or a combined stream of waters generated at the site will be capable of removing PCBs to at least 0.010 ug/l and metals to part per billion ranges.

Testing details and all testing results are included in Attachment D.

3.8.4 Long-Term Groundwater Treatment.

The bench tests for long-term groundwater treatment have not been performed at this time. They have been deferred until the design is complete and groundwater flow and potential residual contaminant levels can be better determined.

4. Data Interpretation and Data Gaps

4.1 SUBSURFACE ANOMALIES – LNAPL

As described in Section 3.2, LNAPL was identified at several locations across the site. PCB analytical results of soil from borings that exhibited evidence of LNAPL droplets or of adjacent borings (if interval containing evidence of LNAPL was not sampled) were reviewed. Based on this review, LNAPL identified in soil borings is not a source of PCBs in the interval analyzed (i.e. PCBs were less than 500 mg/kg), with the exception of one boring (WB-301). An assessment of borings containing evidence of LNAPL with respect to removal areas (discussed in Section 4.2) resulted in the following applicable categories:

- Evidence of LNAPL is present at locations and depths that coincide with excavation limits identified in the OU-1 Excavation Pre-delineation investigation and will removed upon implementation of the remedy.
- Evidence of LNAPL is present outside excavation limits; however adjacent boring logs or wells do not indicate the presence of LNAPL; this potential LNAPL is isolated and not significant.
- Evidence of LNAPL is present outside excavation limits and the extents are not well defined.

An evaluation of soil borings indicating evidence of LNAPL is detailed in Table 4.1A and shown on Figure 4.1A.

Measurable LNAPL has not been identified in shallow onsite monitoring wells with the exception of LNAPL present in the Water Tower area and in PDMW-22S. Therefore, the on-shore remedy selected in the ROD (excavation of soil containing PCBs > 10 mg/kg and capping), provides adequate protection of human health and the environment. Therefore, further investigation or remedial action is not required in these areas.

4.2 OU-1 EXCAVATION PRE-DELINEATION INVESTIGATION

Delineation of areas within OU-1 that that exceeded removal criteria was performed as described in Section 2.3 of this document. The removal criteria for PCBs is 10 mg/kg in soils with excavation up to a maximum depth of 9 or 12 feet based on location. This criteria is also applicable to soils between surface and two feet since surface soils will not be present after the remedy implemented site cover. For Lead Hotspots the removal criteria used was lateral confirmation samples which were less than 1,000 mg/kg. In general, delineation was completed surrounding existing historical data points where PCB concentrations exceeded removal criteria. Resample of historical and other locations used for delineation are tabulated in section 3.3.

The vertical and lateral extents of these areas were developed using guidance for excavation verification sampling requirements described in DER-10 5.4(b)5ii (one sample per 30 feet of linear sidewall and one sample per 900 square feet of excavation bottom area). Based on this guidance and analytical results, the maximum excavation depth of each area was determined based on the deepest interval in which an exceedance of removal criteria was reported (e.g. in a given boring, if a sample from 6 to 8 feet was reported to exceed criteria, however the deeper sample from 8 to 10 feet did not exceed criteria, a maximum excavation depth of 8 feet would be assigned).

Approximately 500 borings were completed and over 2,500 samples were collected and analyzed to determine PCB and/or lead concentrations including quality control samples analyzed to comply with the QAPP. Results of the PCB soil analyses are summarized in Table 3.3A. Historical PCB soil results are provided for reference in Table 3.3B. Results of lead soil analyses are included in Table 3.3B.

Many excavation areas have been completed, by satisfying both sidewall and bottom area minimum sampling frequency requirements as per DER-10. In a few select areas, these requirements were not met due to either the forced lateral termination of excavation (e.g. excavation abuts a building or other structure), or the lack of adequate data to bound an excavation side wall. In cases where the excavation will not extend laterally due to the existence of a building or other obstruction, documentation sampling, as defined by DER-10 5.4(b)1, will be conducted during remedial implementation.

As described in the work plan, PCBs are present at concentrations that exceed removal criteria beneath Building 52, as identified in the CSM. Delineation of excavation areas adjacent to Building 52 was halted adjacent to the footprint of the building due to the uncertainty regarding the remedy implementation within Building 52. In the event that soil remediation under Building 52 is determined to be required, the work plan will be amended or a separate work plan submitted.

4.2.1 Partial Delineation Areas

Areas in which the maximum extents of excavation could not be delineated due to insufficient or unavailable data are summarized below. Typically, the delineation could not be completed due to exceedances of criteria in samples which were collected during the PDI, but released afterwards and therefore offsets were not drilled, or the area in which sampling was required could not be feasibly accessed during the investigation.

- Job Trailers: This area is adjacent to the area currently occupied by semi-permanent job trailers is not yet fully delineated due to the inability to advance borings below or in close proximity to the trailers. Excavation areas bound the job trailers on all sides at various depths. Excavation areas N-10, N-14, N-5, N-6, and N-7 are therefore only partially delineated having incomplete sidewall delineation.
- Areas adjacent to Building 52: These areas adjacent to Building 52 are not yet fully delineated due to the inability to advance borings below or in close proximity to the building. Excavation areas adjacent to building 52 are delineated to various depths. Excavation areas N-8, N-16, N-17, N-18, N-22, N-23, N-36, N-39, N-44, N-45, and N-48 are therefore only partially delineated having incomplete sidewall delineation.
- Vicinity of SS and SM locations: The area is not yet fully delineated due to criteria exceedances at various locations and depths of 6, 8, and 10 feet bgs. The lateral bounds for the 10 to 12 foot depth interval of excavation S-15 are well defined but results at various locations around the perimeter at shallower depths make sidewall samples incomplete. Excavation areas S-15, S-16, S-17, S-18, and S-20 are only partially delineated having incomplete sidewall delineation. PDI Location SS-232 was collected but results are not currently required for delineation.
- Limited Access near shoreline: Two excavation areas near the South Boat Slip are not yet fully delineated due to access limitations near the shoreline. Excavation areas L-2 and L-3 are extended laterally up to the shoreline for the purposes of delineation. Additionally, two historical locations were directly adjacent to the shoreline and were not delineated due to access restrictions. These areas will be removed by the construction of the sloped shoreline and therefore no delineation was required. Historical samples where this is applicable include HB-006 at a Lead Hotspot and PDSB-38.

- Obstructions to delineation: The area north and adjacent to excavation area S-27 is not yet fully delineated due to the existence of subsurface vaults, the size and extents of which are unconfirmed. Delineation is deferred to design or implementation and is recommended to extend to the southern edge of the vault and then be terminated.
- WC-202: The area north of excavation area N-28 is not yet fully delineated due to criteria exceedances at depths between surface and 2 feet bgs. Delineation is deferred to design or implementation.
- Minor deviations from DER-10: Areas include:
    - Excavation area N-37 is bounded using samples from both the 8-10 and 10-12 ft intervals.
    - Excavation area S-14 bottom sample at SC-302 is slightly above 10 mg/kg.
    - Excavation area N-48 bottom sample at NN-301 is slightly above 10 mg/kg.
    - Excavation area N-31 bottom sample at NJ-305 (8 to 10 feet bgs) is not available and the excavation was assigned the maximum excavation depth of 9 ft. Documentation samples will be collected during implementation.
- Area under additional review: PD2-GL-002 was collected as part of a different PDI activity and has not been delineated. Delineation is deferred to design or implementation.

4.2.2 Excavation Boundary Suitability

The lateral excavation area limits, developed using the method as described in DER-10 5.4(b)5ii, established sufficient delineation for calculation of a minimum excavation volume for remediation. Lateral area boundary geometry may be modified during design of the remedy to realize construction efficiencies while maintaining extents of recommended removal.

4.2.3 Excavation Delineation

The data provided on tables and figures show that sufficient sampling exists for adequate delineation of on-shore contamination, with only minimal deviations from DER-10 guidance, as necessary. Sample intervals with concentrations which exceed removal criteria are displayed on Figures 4.2B through 4.2H, as laterally contained within one or more defined excavation area boundaries at depths equal to or shallower than the removal depth. All lateral excavation boundaries are delineated by sidewall samples at the interval at the bottom of removal (shaded red on Figures 4.2B-H). However, where two or more boundaries are adjacent, sidewall samples are not required for the shallower excavation area, as the sidewall does not exist laterally due to the continuation of excavation towards the deeper area (shaded gray on Figures 4.2B-H). The following sample interval below the maximum removal depth (shaded green on Figures 4.2B-H) includes the bottom sample intervals, which confirm the concentrations below the maximum removal depth do not exceed criteria. Results of the PCB soil analyses and maximum PCB concentration results are shown on Figure 3.3A. Historical PCB soil results are provided for reference in Table 3.3B. Results of lead soil analyses are included in Table 3.3B and shown on Figure 3.3C.

Any samples within the excavation that indicate the potential presence of a horizon are identified as such. Where a potential horizon may extend to the lateral excavation limit and is not captured by an adjacent excavation, supporting and sufficient data is provided to indicate that the horizon does not extend beyond the lateral excavation limits.

Conclusions

Remedial action is recommended in areas with complete delineation as shown on figures 4.2A. Remedial action would be removal of soils within each delineation area up to the depth specified.

Additional pre-delineation sampling may be completed in select areas after structures are moved (i.e. site job trailers), demolished (i.e. Building 52), or upgraded (i.e. sanitary force main). The design will specify requirements for confirmation or documentation sampling during construction for areas without complete pre-delineation. Documentation sampling for removal adjacent to property boundaries will be completed during construction where locations completed in close proximity to property boundaries are not available.

4.3 DEEPWATER INVESTIGATION REMOVAL EVALUATION

Section 2.5 provided the rationale and techniques for the deepwater investigation. The purpose of the deepwater sediment sampling was to gather additional data where PCBs in excess of 50 mg/kg are known or suspected to be present, for making decisions regarding design of the remedy and to provide information for delineation of dredge areas. This investigation addressed areas in the proximity of existing exceedances and areas between existing borings EB-10 and EB-14, and used a phased approach to refine contamination extents to further understand lateral and vertical PCB contamination. As described in Section 3.5, the investigation results are summarized below and included the following four tasks.

- *Resampling* (EB-10, EB-14, CS-19) - Results indicated the following:
    - PDI resample intervals corresponding to historical results greater than 50 mg/kg PCBs ranged from 0.2 to 1.3 mg/kg.
    - PCBs were detected at concentrations in excess of 50 mg/kg in one of the three vibracore locations (VC-103 at 3-4 ft) collected but at an interval deeper than the corresponding historical sample (CS-19 at 2-3.2 ft).
    - These data points provide replacement results of the historical data for the purposes of removal evaluation and provide similar depth intervals that can be evaluated uniformly throughout the data set.
- *Investigation Unit Sampling* - PCBs were detected at concentrations in excess of 50 mg/kg in one of the five vibracore locations (VC-108 at 2-3 ft).
- *Decision Unit Sampling* - In addition to VC-103 and VC-108 (see above), PCB concentrations in excess of 50 mg/kg were detected in four of the thirty three additional vibracore locations (VC-110, VC-123, VC-130, and VC-139) and only at the 3-4 ft bml interval.
- *Variability Sampling* - PCBs were detected at concentrations in excess of 50 mg/kg in the 3-4 ft interval at three of the nine vibracore locations (VC-101B, VC-102A, and VC-103B) and at the 4-6 ft interval at VC-103B.

Sampling Grid

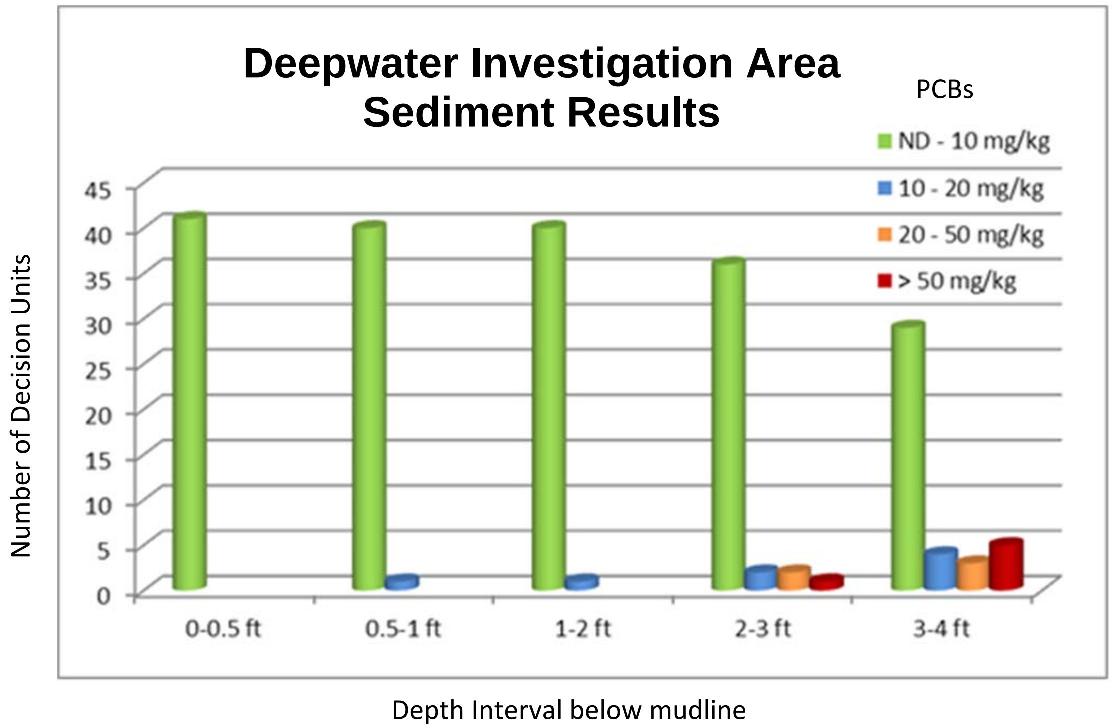
As discussed in previous sections and in the work plan, the investigation program employed a 160-foot triangulation grid for investigation areas and an 80-foot triangulation grid for delineation of extents of contamination. This grid system creates hexagonal areas referred to as Investigation Units and Decision Units, with areas of approximately 0.5 and 0.13 acres, respectively.

This grid system was applied uniformly because the investigation area is not directly adjacent to suspected on-shore point sources and the sediment is uniform across this site. Previous grain size analysis data indicated that sediments are predominantly fine grained material of similar properties and direct observations of sediments during the PDI were consistent with these data.

Variability Evaluation

The variability sampling within the surface to 3 ft intervals showed PCB concentrations consistent with VC-101, VC-102 and VC-103. The variability sampling at the 3-4 ft interval and the 4-6 ft interval at VC-103 showed varied concentrations with some results that exceed action limits However, if the samples are averaged, the PCB concentration are less than 50 mg/kg PCBs.

Variability was also considered for the entire investigation area by reviewing all decision units. The histogram below provides a summary of the findings:



Variability near the surface is very low and generally increases with depth. Only a very small fraction of samples exceed 10 mg/kg PCBs in the upper 3 feet of sediment. While there were some results greater than 50 mg/kg PCBs in the 3-4 ft interval, a very small fraction of samples exceed 50 mg/kg PCBs when considering all samples collected between surface and a depth of 4 feet. The following is a summary of these results:

- Surface to 3 ft interval of sediment: 96% of results are less than 10 mg/kg PCBs.

- Surface to 4 ft interval of sediment: 98% of results are less than 50 mg/kg PCBs.
- While there is an increase in variability in the 3 to 4 foot depth interval, greater than 70% of results are less than 10 mg/kg PCBs.

Decision Unit Data Evaluation

An evaluation of the collected data is provided below to determine the appropriate remedial action and define any removal that may be required. Actions are based on the primary sample results for each decision unit unless otherwise specified to include variability sampling. The following factors for determining the appropriate remedial action are specified in the ROD and considered hereafter:

"The additional delineation sampling data from the deepwater areas to be collected during the remedial design will be further evaluated and the following factors will be considered in determining the final deepwater dredge area: 1) depth of PCB contamination, 2) type of environment (erosional or depositional), 3) contiguous areas of contamination, 4) thickness of clean sediment above the PCB contamination, 5) duration of dredging and associated potential for migration of resuspended sediments, and 6) the area weighted surface concentration of PCBs."

- *Depth of PCB contamination*

  Five of the six sample results that exceeded 50 mg/kg were isolated to within the 3-4 foot interval. The sampling results indicated PCB concentrations greater than 50 mg/kg were found in only one shallower location (VC-108 at 2 to 3 ft).

- *Type of environment (erosional or depositional)*

  The Hudson River Estuary Sediment Environment Map (NYS DEC, 2006) determined that the majority of OU-2 is within a depositional area. This report defined the area adjacent to the site as thick deposition meaning a layer of sediment accumulation greater than 50 centimeters (cm) in thickness. The limits of the dynamic and depositional areas with respect to sediment sampling locations are shown on Figure 4.3A.

- *Contiguous areas of contamination*

  Areas of PCB results greater than 50 mg/kg are isolated except for at the 3-4 ft interval. There are two separate areas where there are adjoining decision units greater than 50 mg/kg. The first location is VC-130 & VC-139 where concentrations are 1,090 and 857 mg/kg PCBs, respectively. The second location is VC-103 & VC-123 where concentrations are 70.6 and 108 mg/kg PCBs, respectively. Variability sampling location VC-103C lies between VC-103 and VC-123 and was < 1 mg/kg PCBs at the 3-4 ft interval. Approximately 425 ft south to north, separate VC-130 and VC-103. Each of these two areas accounts for approximately 0.25 acres.

- *Thickness of clean sediment above the PCB contamination*

  All 6 decision units with PCB contamination greater than 50 mg/kg have a minimum of 2 feet of sediment cover that is less than 50 mg/kg. Specifically, all cover sediment sample results were less than 2.3 mg/kg PCBs. Results are summarized below:

	Depth Intervals (feet)					
Sample Locations Results in mg/kg	0 - 0.5	0.5 - 1	1-2	2-3	3-4	4-6
VC-103	0.75	0.80	1.7	1.3	71	9.9
VC-108	0.15	0.19	0.40	490	11	-
VC-110	0.21	0.27	0.36	0.57	110	9.0
VC-123	0.32	0.16	0.45	2.3	380	ND
VC-130	0.80	0.25	0.36	0.97	1,100	32
VC-139	0.17	0.20	0.33	1.5	860	0.11

- *Duration of dredging and associated potential for migration of re-suspended sediments*

  While the duration of dredging up to 6 decision units is not insignificant, it is also not a driving factor for consideration. However, these Decision Units are located in water depths of 30-35 feet and as indicated in the Revised Feasibility Study 2011, "Effective turbidity control in deepwater is not feasible and dredging without turbidity control will result in mobilizing contaminated sediments to extensive areas located downstream. While the intent of dredging is to remove contaminated sediments from the Deepwater Area, the long-term impact of the suspended sediment migration poses a more significant threat than the in-situ sediments because the resulting areas impacted would far exceed the existing extents of Deepwater Area contaminated sediments. This increase of areal distribution would result in increased short- and long-term impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain." The ROD acknowledged that "dredging without turbidity control … could mobilize contaminated sediment to other areas" and therefore potential for migration of re-suspended sediments remains an important factor in determining the remedial action that is most protective of human health and the environment.
- *Area weighted surface concentrations of PCBs*

  Area weighted surface concentrations were calculated over the entire investigation area with all sediment samples being equally weighted since each sample characterizes a decision unit and decision units are of equal area.

  Surface samples (0-0.5 ft) are near background conditions with an Area Weighted Average (AWA) concentration of 0.44 mg/kg PCBs. Additionally, Figure 3.6I provides results for all historical surface samples throughout the Deepwater Area for review and consideration.

  Samples in the upper sediments (0.5 - 2 ft) AWA concentrations of 0.98 mg/kg PCBs for the 0.5-1 ft interval and 1.34 mg/kg PCBs for the 1-2 ft interval. While not near the surface, average concentration for the 2-3 ft interval remains significantly less than 50 mg/kg regardless of whether VC-108 is included in the average.

<u>Conclusions</u>

The description of the Selected Remedy in the OU-2 ROD includes the following statement about removal of sediment: "Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging."

The basis for selection of the Remedy in the OU-2 ROD also states that "The majority of targeted PCB dredging areas identified in the deepwater are within the top two feet. Therefore, the targeted dredging will remove sediments which have the highest levels of PCBs and the greatest potential to migrate and be an ongoing source to the environment." Additional discussion about the remediation of deepwater sediments is found in Response 62 of the OU-2 ROD.

Based on the guidance above and an evaluation of the six factors discuss previously, dredging in this area is not consistent with the basis for remedy selection, is not feasible and may pose a greater risk to the environment than leaving the limited number of isolated sediments in place. Therefore removal is not recommended as the remedial action for this area.

The following evaluation factors specifically support this conclusion:

1. Sediments greater than 50 mg/kg PCBs are at least 2-3 feet below the sediment surface and are well below the bioturbation layer.
2. All of these Decision Units are located in a thick deposition zone and have already been buried by natural deposition.
3. Impacted sediments are found only in small isolated areas that are well below the surface.
4. There is at least 2-3 feet of cover less than 50 mg/kg at all of these locations
5. Potential for migration of re-suspended sediments poses a threat to the environment that currently does not exist and based on the factors above would be sequestered in perpetuity.
6. Area weighted surface concentrations of PCBs are at or near 1 mg/kg for the upper two feet of the investigation area.

4.4 NEARSHORE, BACKWATER AND NORTHWEST AREA REMOVAL EVALUATION

The purpose of this evaluation is to examine the various off-shore areas where PCBs and/or metals are known or suspected to be present in excess of removal criteria. Sample collection in these areas provides supplementary data for making decisions regarding remedial action and to provide information for delineation of dredge areas. In compliance with the work plan, off-shore sediment sampling was conducted in three separate areas at the Site: Nearshore Area, Backwater Areas, and deeper waters adjacent to the Northwest Off-shore Area referred to as the Northwest Area.

The scope and results of the work completed in these areas is summarized in Sections 2.6 and 3.6. Interpretation of the data provides a basis for recommended remedial action or identifies the need for additional delineation which may be completed as part of the design or remedial construction. An evaluation is discussed for each of the three investigation areas.

The OU-2 ROD calls for removing sediment containing greater than 1 mg/kg PCBs and metals exceeding background from the Nearshore and Backwater Areas, where the potential for public health and environmental exposures are most likely. For the deepwater areas where dredging activities cannot be fully contained, the ROD indicates that the selected remedy removes PCBs in targeted areas at a higher threshold. Specifically, the ROD states:

Removal of sediment and fill that contains PCB concentrations greater than 1 ppm and/or copper, zinc and lead concentrations above the background concentrations listed in Table 2 of Exhibit A, to a maximum excavation depth of 6 feet within the area where sediment resuspension controls, such as a fixed silt curtain, are feasible. This area generally corresponds to a water depth of 15 feet and a distance from the shoreline into the river of approximately 60 to 80 feet and along approximately 2000 feet of shoreline.

Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging.

4.4.1 Nearshore Area Evaluation

The nearshore portion of the program consisted of sampling in the areas along the site shoreline bounded by the expected silt curtain alignment on the west and the OU-1/OU-2 boundary on the east (i.e., river area where mudline is shallower than El. -15). Historical information was sufficient in areas north of the North Boat Slip to indicate that removal to the maximum depth of six feet would be recommended. Samples were collected in areas adjacent to and south of the North Boat Slip in order to provide more uniform sampling information on which to base remedial action. Additional information about the sampling grid is provided below.

<u>Sampling</u>

The sampling program employed a sampling grid in order to fill data gaps or address uneven distribution of existing data. Sample spacing of approximately 80 feet on centers produces uniform data to better understand the distribution of contaminants in the sediment and provide a basis for design of the remedy. Twenty two vibracore borings were advanced in the Nearshore Area.

<u>Analysis</u>

The sampling results indicated that PCB concentrations ranged from Non-Detect to over 100 mg/kg. The average concentration was approximately 5 mg/kg between the surface and six feet below mudline for the 22 VC-400 series sample locations. Individual locations averaged between less than 1 mg/kg up to approximately 20 mg/kg PCBs with about one third of the locations having an average concentration of less than 2 mg/kg between the surface and 6 feet below mudline. There were three samples collected having results greater than 50 mg/kg PCBs.

The sampling results showed Copper, Lead and Zinc concentrations greater than background were often co-located and the results ranged from less than background to more than 10 times background. While surface sediments (0-0.5 ft bml) were predominantly less than background for all metals, concentrations generally increased with depth with the highest values between 2 and 5 feet below mudline.

Table 4.4A and Figure 4.4G shows vibracore locations and maximum concentrations between surface and six feet bml with Figures 3.6I thru 3.6U showing results for each sampling interval. Table 4.4A presents PCB results and indicates which metals are greater than background. Tables 3.6B, 3.6C and 3.6D provide analytical results for contaminants of potential concern.

Sampling locations VC-413 thru VC-416 were near background for all contaminants of potential concern for sediments between the surface and 3-4 feet below mudline. Sampling locations VC-406 thru VC-408 contained the highest concentrations of metals.

Conclusions

Removal is the recommended remedial action in the nearshore between VC-301 and the proposed bulkhead alignment based on the results of historical sampling. Removal is also recommended at locations VC-301 thru VC-412 and VC-417 thru VC-422 based on PDI sample results. Removal of these sediments up to the maximum depth of six feet is warranted. Remedial action is not recommended at locations VC-413, VC-414, VC-415 and VC-416 based on PCB and metals results being less than or near background for both sediments between the surface and three feet bml and for the overall average for sediments between surface and six feet bml. Recommended removal areas are shown on Figure 4.4H and Residuals are shown on Figure 4.4I where applicable.

4.4.2 Backwater Areas Evaluation

This portion of the program consisted of sampling in the Old Marina, North Boat Slip, and South Boat Slip. The Backwater Areas are characterized by slower river velocities and increased deposition. Samples were collected in portions of each of the Backwater Areas with additional borings added to the program as needed to delineate the extents of known or suspected contamination and in order to provide more uniform sampling information on which to base remedial action. Additional information about sampling, analysis and conclusions is provided below for each area.

Old Marina

A uniform grid was applied to this area with samples spaced at approximately 80 feet on center. Eleven Old Marina delineation sampling locations were chosen based on existing sampling locations and data, the potential source of criteria exceedance located in the southeastern portion of the Old Marina area near a potential Building 52 outfall and where data gaps have been identified within this area. Specifically, historical sample location RB-37 at the southeast corner of the Old Marina had PCB results significantly higher than other samples collected in this area and was proximate to the potential Building 52 outfall. PDI sample location VC-501 was also located in the southeast corner of the Old Marina and likewise had PCB results higher than any other location. Five additional locations were added to the grid based on results from VC-503, VC-507 and VC-510. Figure 4.4G shows vibracore locations and maximum concentrations between surface and six feet bml with Figures 3.6I thru 3.6U showing results for each sampling interval. Table 4.4A presents PCB results and indicates which metals are greater than background. Tables 3.6B, 3.6C and 3.6D provide analytical results for contaminants of potential concern.

Concentrations of PCBs and metals are generally less than or near background in the sediments near the surface. Samples in deeper sediments between three and six feet bml have PCB concentrations near 4 mg/kg with metals predominantly near or slightly greater than background with the exception of VC-501. Figure 4.4H provides a depiction of all PDI PCB results within the Old Marina.

Further evaluation and potential additional sampling may be warranted in this area. Therefore, determination of remedial action is deferred to Preliminary Design. Factors for further evaluation include potential future use, presence of depositional sediments with concentrations less than or near background throughout the near-surface sediments, potential collection of additional data north and/or west of the PDI data, and sediments in the proximity to VC-501 near the potential Building 52 outfall.

North Boat Slip

A uniform grid was applied to this area parallel to the Nearshore Area sampling with locations spaced at approximately 80 feet on center. Initially, three delineation sampling locations were chosen to focus on the northern portion of this boat slip. Two additional locations were added to the grid based on results from VC-603 and VC-604 sequentially.

Sampling results showed PCBs and metals are generally less than or near background in the sediments near the surface with slightly higher concentrations in the north portion of the boat slip as anticipated based on historical results nearby. Concentrations increase with depth until they consistently exceed background at five to six feet bml. Samples in sediments between three and six feet bml have PCB concentrations near 3 mg/kg with metals predominantly near or slightly greater than background with the exception of one sample between five and six feet bml at location VC-604. Figure 4.4G shows vibracore locations and maximum concentrations between surface and six feet bml with Figures 3.6I thru 3.6U showing results for each sampling interval. Table 4.4A presents PCB results and indicates which metals are greater than background. Tables 3.6B, 3.6C and 3.6D provide analytical results for contaminants of potential concern.

Remedial action is recommended in the entirety of the North Boat Slip consistent with the removal recommended for adjacent nearshore locations VC-401 thru VC-405. Removal of these sediments up to the maximum depth of six feet is warranted. Recommended removal area is shown on Figure 4.4H.

South Boat Slip

The purpose of sampling in the South Boat Slip was to delineate a historical sample (CS-38) which identified a significant lead exceedance within the 0-2 foot interval. A step-out sampling program was used to delineate CS-38. Specifically, CS-38 was resampled with 4 surrounding samples placed at 20 foot offsets. Sampling and analysis was conducted for lead in sediments. Additional step-out locations were not required or could not be sampled due to access restrictions. Additional sampling east of VC-703, toward the shoreline, was not completed due to river conditions. Figure 4.4G shows vibracore locations and maximum concentrations between surface and six feet bml with Figures 3.6Q thru 3.6U showing metals results for each sampling interval. Tables 3.6C provides analytical results for lead.

Remedial action is recommended at locations VC-701 and VC-703 extending east toward the shoreline. Removal of these sediments to a depth of four feet is warranted. Recommended removal area is shown on Figure 4.4H.

4.4.3 Northwest Area Evaluation

Section 2.6 provided the rationale and techniques for the deepwater delineation. The purpose of this deepwater sediment sampling was to gather additional data where dredging has been specified by the ROD where PCBs in excess of 50 mg/kg are known or suspected to be present in a localized off-shore area west of the bulkhead extension. Data will be used for making decisions regarding remedial action and to provide information for delineation of dredge areas. This investigation addressed areas in the proximity of existing exceedances and used offsets to provide further delineation. Results of this investigation are provided in Section 3.6 and interpretation of that data is provided below.

Sampling

The Northwest Area is located off-shore immediately west and southwest of the Northwest Off-shore area portion of OU-2 up to approximately 225 feet from the shoreline, as shown in the ROD, and was further divided into the two following areas:

- **Shallow Contamination Area (up to 2 feet)** – Where historical results indicated the need to dredge approximately 2 feet of sediment. These areas were evaluated to a 3 foot depth and further delineated for PCB concentrations greater than 50 mg/kg.
- **Deep Contamination Area (up to 6 feet)** – Where historical results indicated the need to dredge up to 6 feet of sediment. These areas were evaluated up to an 8 foot depth and further delineated for PCB concentrations greater than 50 mg/kg.

Resampling was completed at historical locations with results greater than 50 mg/kg to confirm depth and concentration data, to provide reference for additional sampling, and to provide a more accurate representation of current conditions. Initial sample locations were established on a step-out system where three to four locations were sampled within approximately 25 feet of the original impacted sampling locations. Additional step-out sample locations were added throughout the program with locations selected based on results and proximity to other samples. Due to river dynamics and debris in the vicinity of the sampling, final locations varied from proposed. For the purposes of evaluation of remedial action and delineation of dredge areas, a grid system with cells measuring 30 ft by 30 ft was applied to the data. As described in Section 3.6, the investigation results are summarized below and included the following four tasks.

PDI resample intervals corresponding to historical results greater than 50 mg/kg PCBs are highlighted in the table provided within Section 3.6.3. Inconsistencies in results were encountered between the historic sample locations and resampled locations, potentially due to sediment deposition since the previous sampling at some locations.

Northwest Area Data Evaluation

An evaluation of the collected data is provided below to determine the appropriate remedial action and define any removal that may be required. Actions are based on the sample results for each grid cell. Similar to other deepwater areas, the following factors for determining the appropriate remedial action were considered as specified in the ROD:

"The additional delineation sampling data from the deepwater areas to be collected during the remedial design will be further evaluated and the following factors will be considered in determining the final deepwater dredge area: 1) depth of PCB contamination, 2) type of environment (erosional or depositional), 3) contiguous areas of contamination, 4) thickness of clean sediment above the PCB contamination, 5) duration of dredging and associated potential for migration of resuspended sediments, and 6) the area weighted surface concentration of PCBs."

Cells with PCB results greater than 50 mg/kg within the top 2 ft are recommended to be removed and are excluded from the following evaluation. All other locations are evaluated below using the six factors described above.

- *Depth of PCB contamination*

  Approximately half of the sample locations contained results greater than 50 mg/kg. These results were found at all depth intervals as shown in the following table:

Initial Sample Locations	**Depth Intervals (feet)**							
	0-0.5	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-6**	**6-8**
Results > 50 mg/kg	1	4	8	15	13	11	7	5

- *Type of environment (erosional or depositional)*

  The Hudson River Estuary Sediment Environment Map (NYS DEC, 2006) determined that the majority of OU-2 is within a depositional area. This report defined the area adjacent to the site as thick deposition meaning as a layer of sediment accumulation greater than 50 centimeters (cm) in thickness. The limits of the depositional area with respect to sediment sampling locations in shown on Figures 4.4A through 4.4F. Some locations are near the transition between depositional and dynamic river environments.

- *Contiguous areas of contamination*

  Areas of PCB results greater than 50 mg/kg are sporadic throughout the sampling area and vary by depth, thickness, and concentration.

- *Thickness of clean sediment above the PCB contamination*
  - There are 13 locations that have 2 ft of sediment cover over samples greater than 50 mg/kg as shown in the excerpt of Table 3.6A below. It should be noted that while sampling locations VC-312 and VC-339 are overlain by 2 ft of sediment cover, both locations are in the dynamic river environment.

Sample Locations	**Depth Interval**							
Results in mg/kg	0 - 0.5 (ft)	0.5 - 1 (ft)	1 - 2 (ft)	2 - 3 (ft)	3 - 4 (ft)	4 - 5 (ft)	5 - 6 (ft)	6 - 8 (ft)
VC-302	0.21	0.29	0.77	58	130	23	-	-
VC-303	0.27	4.7	1.7	1000	44	340	31	-
VC-304	3.4	4.5	12	330	6400	250	3.3	1.1
VC-305	0.79	2.1	24	560	6200	5900	49	-
VC-306	0.23	0.46	11	1500	560	110	200	0.92
VC-309	6.3	16	38	470	800	430	2100	59
VC-312	1.1	0.17	0.23	120	39	-	-	-
VC-316	0.83	1.4	9.4	770	12	3.1	0.91	46
VC-318	2.1	0.26	0.44	720	13	0.2	110	1000
VC-327	1.2	0.54	3.7	310	0.38	1.8	ND	1.3
VC-332	0.47	21	25	58	270	29	-	-
VC-355	4.1	4.3	27	590	140	1.1	-	-
VC-359	0.27	1.6	2.9	83	16	-	-	-

  - There are 14 locations with at least 3 ft of sediment cover over samples greater than 50 mg/kg PCBs as shown in the excerpt of Table 3.6A below and are all located in the depositional river environment.

Sample Locations	Depth Interval							
Results in mg/kg	0 - 0.5 (ft)	0.5 - 1 (ft)	1 - 2 (ft)	2 - 3 (ft)	3 - 4 (ft)	4 - 5 (ft)	5 - 6 (ft)	6 - 8 (ft)
VC-329	0.15	0.2	0.4	0.47	53	5.6	0.27	ND
VC-349	-	6.6	11	21	370	0.24	-	-
VC-315	4.3	1.1	1.1	3.2	61	85	0.11	ND
VC-370	0.39	0.21	0.53	0.78	58	93	-	-
VC-317	1.1	0.46	3.7	1	20	530	0.068 J	ND
VC-344	0.16	0.33	1	4.1	6.1	100	-	-
VC-347	0.87	0.35	1.2	23	0.72	1200	0.14	-
VC-363	3.2	0.98	0.75	0.56	11	200	0.21	-
VC-328	0.28	0.33	1.2	0.72	1.8	13	6900	0.61
VC-311	0.53	2.1	15	20	2.2	ND	9800	-
VC-341	33	0.41	0.28	0.79	0.73	41	55	-
VC-346	14	0.97	0.92	0.93	6.7	27	8500	6300
VC-338	0.39	ND	ND	9.9	0.63	0.17	ND	700
VC-342	9.6	6.2	1	0.37	0.34	0.33	ND	66

- *Duration of dredging and associated potential for migration of re-suspended sediments*

  While the duration of dredging cells is not insignificant, it is also not a driving factor for consideration. However, these cells are located in water depths of up to 35 feet and as indicated in the Revised Feasibility Study 2011, "Effective turbidity control in deepwater is not feasible and dredging without turbidity control will result in mobilizing contaminated sediments to extensive areas located downstream. While the intent of dredging is to remove contaminated sediments from the Deepwater Area, the long-term impact of the suspended sediment migration poses a more significant threat than the in-situ sediments because the resulting areas impacted would far exceed the existing extents of Deepwater Area contaminated sediments. This increase of areal distribution would result in increased short- and long-term impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain." The ROD acknowledged that "dredging without turbidity control … could mobilize contaminated sediment to other areas" and therefore potential for migration of re-suspended sediments remains an important factor in determining the remedial action that is most protective of human health and the environment.

- *Area weighted surface concentrations of PCBs*

  Average concentrations were calculated over the entire investigation area with all sediment samples being equally weighted for simplicity. For comparison, the average concentrations near the surface are provided for two options. Option 1 removal does not include cells that have 2 feet of cover and Option 2 removal does not include cells that have 3 feet of cover. Removal is assumed to continue up to the maximum depth of six feet for cells with continuous results greater than 50 mg/kg.

Average PCB concentrations (mg/kg)

Depth	Cells	Existing	Option 1	Option 2
0 - 0.5 (ft)	64	7.9	3.1	2.7
0.5 - 1 (ft)	65	52	2.2	1.4
1 - 2 (ft)	66	49	5.3	2.9
2 - 3 (ft)	62	110	110	21
0 - 3 (ft)	*~ 64*	*64*	*40*	*2.9*
Removal	-		*9-10 cells*	*22 cells*

PDI surface results (0-0.5 ft) are less than 50 mg/kg PCBs except at VC-337. Average concentration is 7.9 mg/kg PCBs as shown in the table above and is reduced to approximately 3 mg/kg assuming the removal of sediments within the cell at VC-337. Figure 3.6A provides results for surface samples.

PDI results in the upper sediment (0.5 - 2 ft) are less than 50 mg/kg PCBs at all except 9 cell locations. Cell average would be reduced from about 50 mg/kg PCBs to less than 10 mg/kg PCBs as shown in the table above with either option

Residual contamination in the 2-3 ft interval would be reduced to less than 10 mg/kg PCBs only for removal option 2.

Conclusions

Remedial action is recommended in areas with PCBs greater than 50 mg/kg within the top 2 ft. Additionally, based on the evaluation of the six factors discuss previously, remedial action is recommended for cells that do not provide a minimum of three feet of cover. Remedial action would be removal of sediments within each cells up to a depth where results are no longer greater than 50 mg/kg and where backfill would provide at least three feet of cover up to a maximum depth of 6 ft.

Recommended removal is shown on Figures 4.4A through 4.4F. Average concentrations based on the recommended remedial action are provided in the following table.

Average PCB concentrations (mg/kg)

Depth	Cells	Existing	Residual
0 - 0.5 (ft)	64	7.9	2.7
0.5 - 1 (ft)	65	52	1.4
1 - 2 (ft)	66	49	2.9
2 - 3 (ft)	62	110	21
3 - 4 (ft)	50	310	19
4 - 5 (ft)	40	240	70
5 - 6 (ft)	32	870	800
6 - 8 (ft)	14	580	580
0 - 3 (ft)	*~ 64*	*64*	*2.9*
Removal	-		*22 cells*

It should be noted that the Northwest area is not yet fully delineated. Additional sampling areas are recommended to resolve data gaps including sampling near RB-19, VC-344, and VC-336.

5. Data validation

Analytical results for environmental samples collected as part of the PDI were reviewed by Environmental Standards, Inc. (ESI), an independent the data management subcontractor, to determine the data usability in accordance with the procedures outlined in the project specific quality assurance project plan (QAPP).

During the data validation process, the following quality control/quality assurance (QA/QC) criteria were reviewed:

- Sample Data Reporting Format
- Holding Time and Sample Preservation Compliance
- GC/MS Instrument Performance Check (where applicable)
- Initial Calibration and Continuing Calibration Procedures
- Field/Method/Preparation Blank Sample Analysis
- System Monitoring Compound Recoveries (where applicable)
- Laboratory Control Samples, Matrix Spike/Matrix Spike Duplicate Recoveries
- Internal Standard Recoveries (where applicable)
- Field Duplicate Sample Analysis
- ICP Interference Check Sample Performance (where applicable)
- ICP Serial Dilution Replicate Percent Difference (where applicable)

Below is a brief description of the procedures used in the evaluation and example corrective actions implemented as a result of the assessment. The intent of this summary is to assist the data user with an understanding of the data qualification procedures implemented for their use in the evaluation of the current site conditions.

5.1 SAMPLE DATA REPORTING PROCEDURES

The reported results for each project sample were provided in a NYSDEC Analytical Services Protocol (ASP) Category B deliverables format. The data reporting format was evaluated within each SDG and when found to be non-compliant with the project data quality objectives (DQOs) additional documentation was requested and received from the laboratory as part of the validation process.

5.2 HOLDING TIME AND SAMPLE PRESERVATION COMPLIANCE

Maximum allowable holding times, for each parameter, were measured from the time of sample collection to the time of sample preparation or analysis for each project sample. When a project sample was identified as analyzed after the expiration of the USEPA recommended maximum holding time, the reported sample results were qualified with a “J” as estimated and non-detected parameters were qualified with an “R” as rejected.

5.3 GC/MS INSTRUMENT PERFORMANCE CHECK

GC/MS instrument performance checks were evaluated to ensure proper tuning of the instrument for mass resolution, compound identification, and sensitivity. It was determined that the analysis of the instrument performance solutions was performed at the beginning of each 12-hour period during which samples or standards were analyzed, and that the instrument performance check met the ion abundance criteria specified by the promulgated USEPA method. In all instances, the GC/MS instrument performance checks for the instruments used in the analysis of project samples fell within method specific criteria without exception.

5.4 INITIAL CALIBRATION AND CONTINUING CALIBRATION PROCEDURES

Instrument calibration procedures for the analysis of project samples were evaluated based on the requirements of the National Functional Guidelines and/or prescribed by the laboratory standard operating procedures (SOPs) when not directly addressed by the guidelines. Generally, the calibration procedures implemented by the laboratory were consistent with USEPA guidance. However, during the analysis of organic parameters by EPA Methods 8260B and 8270C, the continuing calibration acceptance criteria for several target compounds were greater than the EPA guidance criteria of 25 percent difference (%D) from the initial calibration relative response factor (RRF).

In cases where target compounds were detected and reported using a RRF from a non-compliant continuing calibration standard, the result was flagged with a “J” and the reporting limits for non-detect samples were flagged with a “UJ” indicating that the reported values and reporting limits are estimated.

5.5 FIELD/METHOD/PREPARATION BLANK SAMPLE ANALYSES

The presence of target compounds in associated method and/or trip blank samples prepared and analyzed concurrently with the project samples was determined as part of each laboratory sample data package. If target compounds were reported at a concentration greater than the method detection limit (MDL) for organic parameter analyses or the instrument detection limit (IDL) for inorganic parameter analyses, the associated sample results were qualified.

In the case of method blank samples for organic parameter analyses, if the target compound detected was identified as a “common laboratory contaminant” by the USEPA Functional Guidelines, an action level of 10 times (10x) the blank contamination level was calculated. For all other parameters an action level of 5 times (5x) the blank contamination level was calculated. In the case of inorganic method blank sample analyses, an action level of 10 times (10X) the blank contamination level was calculated. In accordance with EPA guidance, if the detection of the blank contaminant in the associated project samples was reported at a concentration between the MDL and the action level, the result was flagged with a “U”. This data qualification indicates that the parameter was not present in the sample at a concentration greater than the adjusted reporting level.

5.6 SYSTEM MONITORING/SURROGATE COMPOUND RECOVERIES

System monitoring/surrogate compounds were added to each sample prior to analysis of organic parameters by EPA Method 8082 to confirm the efficiency of the sample preparation procedures. The calculated recovery for each surrogate compound was evaluated to confirm the accuracy of the reported results.

Generally, the calculated recovery of these compounds fell within the laboratory specific quality control criteria. In a few instances, sample extracts prepared for the analysis of polychlorinated biphenyls (PCBs) by EPA Method 8082 required dilution prior to analysis. This dilution procedure was implemented by the laboratory to enable quantification of the detected target analytes within the instrument calibration range. Where applicable, the laboratory qualified the reported results indicating the system monitoring compound recovery could not be calculated due to a sample extract dilution.

In cases where the surrogate recovery fell outside the laboratory acceptance criteria, the results greater than the reporting limit were qualified "J", and the reporting limits for non-detect samples were flagged "UJ", as estimated.

5.7 LABORATORY CONTROL SAMPLES, MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES

Analytical precision and accuracy were evaluated based on the laboratory control (LCS) and matrix spike (MS/MSD) sample analyses performed concurrently with the project samples. For LCS analyses, after the addition of a known amount of each target analyte into laboratory reagent water, the LCS was analyzed to confirm the ability of the analytical system to accurately quantify the target analytes. For MS/MSD samples, after the addition of a known amount of each target analyte to the sample matrix, the MS/MSD samples were analyzed to confirm the ability of the analytical system to identify the target analytes within the sample matrix.

The percent recovery calculated for each target analyte was evaluated for compliance with method specific criteria. Generally the reported recovery of MS and LCS analyses fell within the laboratory QA acceptance criteria. However, if the LCS recovery fell below the acceptance criteria, the result for the non-compliant target analyte from the project samples analyzed concurrently was qualified with a "J" as estimated or "UJ" if reported as non-detect.

5.8 INTERNAL STANDARD (IS) COMPOUND RECOVERIES

Internal Standard (IS) compounds were added to each sample prior to the analysis of organic parameters by EPA Methods 8260B, and 8270C to quantify the amount of the target compounds detected within the sample matrix. The response of each IS compound was confirmed to be within the QA/QC criteria of +100% and – 50% of the corresponding 12 hour continuing calibration verification (CCV) standard. If the IS response fell below the –50% acceptance criteria, the target compound concentrations calculated within this sample were qualified with a "J" as estimated. If the IS response fell to below –90% the corresponding CCV standard, the reported results in the project sample were flagged with an "R" as rejected.

5.9 FIELD DUPLICATE SAMPLE ANALYSIS

Field duplicate samples were collected and analyzed to determine the precision for the sampling and analysis process through calculation of the relative percent difference (RPD) between the original and duplicate sample target analyte concentrations. If the calculated RPD for analytes detected at concentrations greater than five times (5X) the reporting limit exceeded the RPD criteria, the reported results were qualified "J" as estimated.

5.10 ICP INTERFERENCE CHECK SAMPLE PERFORMANCE

The results of the ICP Interference Check Samples analyzed concurrently with the project samples were evaluated versus an acceptance criteria prescribed by USEPA guidance. If the calculated recovery an analyte fell outside these criteria, the analyte result for the project samples analyzed concurrently within the analytical batch was flagged with a "J" as estimated.

5.11 ICP SERIAL DILUTION REPLICATE PERCENT DIFFERENCE (RPD)

The results of the ICP Serial Dilution samples analyzed concurrently with the project samples were evaluated for compliance with the USEPA protocol criteria of less than 10% replicate percent difference (RPD) between the diluted and undiluted sample, if the analyte concentration was greater than fifty times (50X) the method detection limit in the original sample. If an analyte exhibited a serial dilution RPD greater than 10%, the corresponding sample result was qualified with a "J" as estimated.

Data Usability Reports prepared by ESI are included in Attachment E.

5.12 VALIDATION COMPLETENESS

Based on the iterative nature of the program completed during three mobilizations, sample validation is not complete. Based on DURs provided by ESI to date, data validation has resulted in only minor changes in results or flags. Upon completion of validation, updated tables will be provided to NYSDEC and the EQUIS data base will be uploaded. Any changes to conclusions or interpretations resulting from completion of the validation process will be provided as an addendum.

6. Site Management

6.1 HEALTH & SAFETY

The Site Health, Safety, Security and Environment Plan (HSSE Plan) was developed by Haley & Aldrich to establish the health and safety procedures required to minimize potential risk to personnel or the environment during PDI activities.

The provisions of the HSSE plan applied to all persons entering the Site or involved in field activities that may be exposed to safety and/or health hazards related to activities performed during the PDI. The HSSE Plan was prepared in accordance with Health and Safety requirements set forth by AR and in accordance with the requirements for Hazardous Waste Operations and Emergency Response (HAZWOPER) 29 CFR1910.120 or 29 CFR 1926.65.

6.2 AIR MONITORING PROGRAM

Perimeter air monitoring was conducted during on-shore ground intrusion activities (i.e. drilling, air knife, and test pitting) associated with three field events conducted between September 2013 and October 2014 in accordance with the PDI Community Air Monitoring Plan (Haley & Aldrich, 2014). Prior to the beginning of each field event, a baseline monitoring event was conducted for two days prior to beginning intrusive activities (24-25 September 2013, 12-13 May 2014, and 15-17 October 2014) to determine background dust and PCB concentrations. Data was provided to NYSDEC on a weekly basis indicating the orientation of dust and PCB monitoring equipment and results. Based on the absence of PCB-detections in air samples collected for analysis during completion of air knife and drilling activities, PCB sampling was reduced to twice per week and then discontinued for these activities after 7 November 2013. Subsequent air monitoring for PCBs was conducted during test pitting activities.

PCBs were not detected in air samples collected during completion of PDI activities. Exceedances noted for dust are listed in in Table 6.2A. Weekly CAMP and PCB Summary tables and figures submitted to the DEC are included in Attachment F.

6.3 WASTE MANAGEMENT

Investigation Derived Wastes (IDW) (soil, sediment, and fluids resulting from investigation activities, sampling equipment decontamination, PPE, and sampling supplies (e.g., gloves, paper towels, foil, etc.)) were placed into appropriate containers and staged on-Site for disposal. In general, waste was managed in drums, roll offs, and frac tanks. Waste was appropriately profiled and shipped to Waste Management located in Model City, NY for appropriate disposal. As described in the work plan, spoils resulting from test pit activities were returned to the point of collection. Prior to returning spoils resulting from test pitting activities, visual observations were made confirm the absence of DNAPL, LNAPL, or obvious signs of semi-solid PCBM.

7. Summary & Conclusions

The PDI was performed in general accordance with the work plan, Former Anaconda Wire & Cable Plant Site, prepared by Haley & Aldrich of New York (Haley & Aldrich) for AR, dated July 2014. The work plan was completed and implemented as required by the OU-1 and OU-2 RODs and the Amended Order on Consent. The purpose of completing the PDI and the PDI Data Summary Report was to collect data that will support completion of the design, to provide data to NYSDEC, and to gain acceptance of interpretations of extents of remedial actions, which will be the basis of the design of the remedy. All work was performed in compliance with procedures described in the work plan. Some adjustments to the work plan were required during implementation of field activities and were generally the result of field conditions as documented in previous sections of this report.

As described in this document, collected data is sufficient to establish extents of remedial actions and complete the Preliminary Design with the exception of two areas in which structures inhibited access to complete explorations (beneath site trailers and within Building 52). Additional data will be collected once the structures are demolished or relocated. Upon acceptance of this PDI Summary Data Report by NYSDEC, AR plans to begin the Preliminary Design as required by the ROD.

7.1 PHASE 1 PDI INVESTIGATION

The purpose of Phase 1 of the PDI investigation was to collect site related data that could be used to complete the work plan and design of the remedy. The scope and results of this phase of work is described below.

- Ground Penetrating Radar (GPR)

  A GPR pilot was completed to evaluate the presence of subsurface structures, voids, and utilities. If successful, the program would be expanded. However, based on results of the pilot, this technology was ineffective due to site conditions such and the program was not expanded.

- Site Survey

  A site survey was completed to update site topography and site features for the purposes.

- Bathymetric Survey (completed as part of the baseline sampling)

  A bathymetric survey was completed to document bathymetric and shoreline elevations.

7.2 OU-1 SUPPLEMENTAL INVESTIGATION

<u>Groundwater Levels</u>

Groundwater level loggers were installed in 13 existing site wells and in 7 newly installed wells for up to 18 months to monitor hydraulic gradient and tidal influence in the Fill and Basal Sand hydrostratigraphic units for the purpose of constructing a groundwater model.

<u>Groundwater Sampling</u>

Baseline groundwater sampling was completed in 4 monitoring wells up gradient and 3 monitoring wells located on the western shoreline to monitor shallow groundwater prior to remedial construction, to evaluate the long term effectiveness of the remedy. The results indicated the presence of PCBs in one of the upgradient wells greater than drinking water standards. A new monitoring well was installed further upgradient indicated the presence of PCBs greater than drinking water standards. Additional action is deferred until additional sampling rounds are completed. Groundwater sampling will continue annually until the beginning of construction.

Void Assessment

There are several areas of the Site, especially in areas adjacent to the Hudson River, where evidence of soil erosion or subsidence beneath concrete slabs, including voids, has been observed. An assessment of potential voids was conducted to obtain a better understanding of the depth and extent of the void spaces beneath the various surface cover concrete slabs. Void extents were evaluated at approximately 127 locations along portions of the western shoreline including concrete slab areas that contained existing holes that exhibited voids and in concrete slab areas that were indicated based on the initial GPR pilot test. Results indicated that expansive voids are not present at the site.

Subsurface Anomalies

There are several areas of the Site in which subsurface anomalies were identified during previous investigations and during routine site work as described below.

Potential basements

Potential basements were investigated to determine whether historic operations resulted in environmental impacts and the footprints of these structures. Results of the investigation indicated a large basement, trench, and former storm sewer with no evidence of environmental impacts. Their locations will be documented and addressed during the design (i.e. backfilling, etc.). Remedial action is not required in these areas.

Potential NAPL

There were two areas on the site in which site employees indicated that NAPL was observed during previous intrusive activities (i.e. installing utility poles, etc.). Borings were completed in these areas and samples collected at horizons. NAPL as previously described was not observed and samples indicated that PCBs were present less than removal criteria. Additional remedial action is not required in these areas.

Additionally, during completion of subsurface investigations or monitoring well installations, evidence of LNAPL was observed at or near the water table at on-shore locations of the Site. Many of these areas coincide either partially or entirely with excavation areas. Implementation of remedy specified in the ROD will either eliminate any LNAPL in the subsurface or potential exposure pathways for areas of the site in which evidence of LNAPL was observed and is therefore protective of human health and the environment. Remedial actions for potential LNAPL in addition to those required by the ROD to remove PCBs and lead are not required.

Potential production wells

As described in the work plan and based on review of historical site drawings, two production wells were identified as being potentially present at the Site. A public records search was performed to identify the locations of potential production wells and to determine whether additional wells may be present on the site. Site reconnaissance indicated the presence of one of the wells; the second well was not located. The located former production well was accessed and while the well was disconnected from service, it had not been abandoned. The Westchester County Health Department and NYSDEC were notified and the well was properly abandoned.

Building 17 concrete slab

A historic concrete core sample (completed in 2009) exhibited concentrations of PCBs greater than 50 mg/kg. Historic drawings indicated the presence of former wastewater conveyances (trenches) in this former building; however historical soil borings were not completed in this area. During the PDI, two soil borings were completed adjacent to these former trenches. Analytical results from both soil sampling locations indicated the presence of PCBs above 10 mg/kg. Based on these results, the area was added to the OU-1 Excavation Pre-delineation investigation, and offsets and step outs were completed to delineate PCBs in this area.

Building 52 Outfall Investigations

During the PDI, five potential Building 52 outfalls and one outfall from Building 15 were evaluated through historical document review and/or field investigations to determine whether the pipes were a source of PCB impacts. The results generally indicated the following:

- Many of the Building 52 outfalls will be completely removed during excavation activities to remove PCBs present above removal criteria as part of the on-shore excavation program.
- The Building 15 outfall will be completely removed during excavation of the shoreline.
- Based on historical document review, two of the potential outfalls identified in the work plan were associated with non-process piping and do not require investigation.
- One test pit was completed. PCB analytical results of suspected Building 52 pipe outfall pipe bedding indicated results not sufficiently high to indicate the presence of PCB source material.
- Further evaluation of one of the potential Building 52 outfalls may be required during the design to determine the sufficiency of the current data set.

Existing Underground Utilities

During prior site investigation activities, storm sewers and other utilities were identified but not well defined with respect to alignments and outfall locations. During the PDI, the presence, locations, and general conditions of existing utilities were evaluated for the purposes of determining utilities that cross the site from offsite locations. This information will be incorporated into the design and may impact future easements and required discharge permits. The investigation used a combination of historical document review, direct visual observation (e.g. opening manholes), invert surveying, and utility tracer equipment to refine locations of utilities. Results indicated the presence of several utilities that will require protection during construction and have been documented on the site utilities drawings.

7.3 OU-1 EXCAVATION PRE-DELINEATION

The purpose of the OU-1 soil sampling was to pre-delineate on-shore excavation areas which will be completed during remedial construction. Excavation limits were delineated in both lateral and vertical directions, to determine where PCB and/or lead exceeded removal criteria. Establishing excavation limits (area and depth) in this manner will allow a focused design, reduce uncertainty and increase worker safety during construction, and reduce changes in the field which may result from completing excavation confirmation sampling during remedial construction.

The work was completed as described in the work plan with some exceptions resulting from field conditions. The results of the investigation indicate that vertical and horizontal extents of PCBs have been delineated in general accordance with DER-10 with exceptions identified in Section 3.3 of this report. Deviations from DER-10 were generally due to relocating borings due to field conditions and deviations which generally are a result of excavations adjacent to property boundaries or in the vicinity of active utilities. Delineation of three areas of the site could not be completed due to the presence of structures: within Building 52, underneath existing site trailers, or were in the vicinity of an active utility. Additionally, one excavation area was not investigated. These areas will be further investigated either during design of the remedy or during construction.

Based on data collected and evaluations conducted, delineations described in this report adequately describe the required limits of remedial action and will be the basis of excavation design.

7.4 EXTENSION ALIGNMENT INVESTIGATION

The purpose of the PCBM and obstruction probes was to evaluate the presence of both PCBM and obstructions along the alignments of the proposed bulkhead extension wall and deadman. Confirmation that semi-solid or liquid PCBM does not exist along the alignment is important since this material could be dragged down to the Basal Sand aquifer during construction of the wall. Confirmation that obstructions do not exist along the alignment is important since they could impede the ability to construct the wall. Land and water based probes were completed in the vicinity of the proposed bulkhead extension wall and deadman anchor.

Fifty-one probes were completed off-shore (41 using mud rotary and 10 using vibracore (PCBM evaluation only)) and 17 probes were completed on shore. Based on the findings of the extension alignment investigation, a corridor has been identified where no PCB Material (either as DNAPL or semi-solid), or major obstructions exist. This corridor will be the basis of the alignment during the design.

7.5 DEEPWATER INVESTIGATION

The goal of this investigation is to examine deepwater areas where PCBs in excess of 50 mg/kg are known or suspected to be present in order to gather data for making decisions regarding remedial action.

The following factors were considered for the evaluation of the deepwater dredge area: 1) depth of PCB contamination, 2) type of environment (erosional or depositional), 3) contiguous areas of contamination, 4) thickness of clean sediment above the PCB contamination, 5) duration of dredging and associated potential for migration of resuspended sediments, and 6) the area weighted surface concentration of PCBs.

Based on the evaluation of the data with respect to the above six factors, dredging in this area is not consistent with the basis for selection, is not feasible and may pose a greater risk to the environment than to leave the limited number of isolated sediments in place and therefore is not recommended.

The following factors specifically support this conclusion:

1. Sediments greater than 50 mg/kg are at least 2-3 feet below the sediment surface and are well below the bioturbation layer.

2. All of these Decision Units are located in a thick deposition zone and have already been buried by natural deposition.
3. Impacted sediments are found only in small isolated areas that are well below the surface.
4. There is at least 2-3 feet of clean cover at all of these locations
5. Potential for migration of re-suspended sediments poses a threat to the environment that currently does not exist and based on the factors above would be sequestered in perpetuity.
6. Area weighted surface concentrations of PCBs are at or near 1 mg/kg for the upper two feet of the investigation area.

7.6 OFF-SHORE PRE-DELINEATION

The purpose of this Off-shore Pre-Delineation investigation was to examine the various off-shore areas where PCBs or metals in excess of remedial criteria are known or suspected to be present (as specified in the ROD), in order to gather supplementary data for making decisions regarding remedial action and to provide information for delineation of dredge areas. The following conclusions were made based on an evaluation of additional data collected

- Near shore: A majority of the nearshore sediments will be removed to a maximum depth of depth of 6 ft in the vast majority of the area.
- Old Marina: Determination of remedial action is deferred to design of the remedy and the results of additional sampling, potential future use, and presence of deposition below or near background throughout the sediments near the surface and potential collection of additional data north of the Old Marina. Additional sampling will require coordination with the property owner. Design of the remedy will specifically address the sediments in the proximity to VC-501.
- North Boat Slip: Remedial action is recommended in the entirety of the North Boat Slip consistent with the removal recommended for adjacent nearshore locations VC-401 thru VC-405. Removal of these sediments up to the maximum depth of six feet will be completed.
- South Boat Slip: Remedial action is recommended at locations VC-701 and VC-703 extending east toward the shoreline in order to remove lead present at historical locations at concentrations greater than removal criteria.
- Northwest Area: Remedial action is recommended in various locations to remove sediments greater than 50 mg/kg up to three feet bml and deeper where contiguous contamination greater than 50 mg/kg exists up to a maximum depth of 6 ft. Remaining locations were evaluated with the six factors and were will remain covered in place.

7.7 GEOTECHNICAL EXPLORATION

The geotechnical portion of the PDI consisted of soil borings, test pits, and geotechnical laboratory testing to evaluate subsurface conditions. The purpose of the geotechnical explorations is to provide additional stratigraphy information in several areas: in the general vicinity of the planned deadman anchor (which will be located west of Building 52), in the general vicinity of the planned Northwest Extension bulkhead wall, and in the general off-shore area between the North Boat Slip and the South Boat Slip. The information will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (such as settlement). Additionally, test pits were excavated at select locations around the site where support of excavation (SOE) may be used during construction (i.e., “hot spot” excavation locations that are about 6 ft bgs or greater). The purpose of the test pits is to gather information on soil conditions, excavation effort, and potential obstructions that could affect the design and/or construction of the SOE walls. The results of the investigation provided geotechnical data required to complete the Preliminary Design.

7.8 BENCH TESTING

The purpose of the bench testing was to evaluate various design parameters associated with the handling of residuals, for treatments that could be performed on-site to prepare the residuals for final disposition. Specific tests and conclusions are provided below.

Solids Dewatering

Results indicate that gravity draining onsite soils is not sufficient to allow for transport off site. Filter presses will be required to reduce the sufficiently reduce the water content for on-shore soils. Gravity drainage or filter presses will not be adequate for sediments dewatering; additional dewatering technologies are required to be evaluated for sediments.

Stabilization

Stabilization testing was performed based on the results of the solids dewatering test which indicated that dewatering alone will not be sufficient for sediments to pass the liquid release test. Stabilization testing results indicate that numerous additives will allow the sediments to be transported off-site. If sediment can be used on-site, there are very limited amendments that will provide 50 psi of compressive strength.

Construction Water Treatment

In 2006, filtration testing alone was performed on a small amount of collected groundwater in order to determine if metals and PCBs could be removed by filtration alone. The testing was unsuccessful in removing all of the contaminants.

As part of the 2015 bench testing, both groundwater and sediment pore water were tested separately and then combined to identify a treatment train that would successfully remove PCBs and metals from the water streams. Unit operations were testing individually on the individual streams and then combined as an overall treatment train.

Results of this testing indicated that a treatment train of filtration, carbon adsorption and metals precipitation (through pH adjustment) is capable of removing PCBs and metals to very low levels, anticipated to be below discharge requirements.

Long Term Groundwater Treatment

The long-term groundwater treatment bench tests were not performed. Completion of this work has been deferred until the design of the remedy is complete and groundwater flow and potential residual contaminant levels can be better determined.

8. References

1. 50% Design Report for Operable Unit No.1 (OU1), Former Anaconda Wire and Cable Plant Site, NYSDEC Site # 3-60-22, Volumes I-III, Haley & Aldrich of New York, July 2006

2. Modified Conceptual Site Model, Harbor at Hastings Site, Haley & Aldrich of New York, October 2008

3. Supplemental Northwest Corner Investigation Findings Report, NYSDEC Site # 3-60-22, Haley & Aldrich of New York, January 2009

4. DER-10: Technical Guidance for Site Investigation and Remediation, NYSDEC, May 2010.

5. DNAPL IRM Recover Well Installation Memorandum, Former Anaconda Wire and Cable Plant Site, Haley & Aldrich of New York, November 2010.

6. Rip Rap Field Investigation Data Report, Former Anaconda Wire and Cable Plant Site, Haley & Aldrich of New York, December 2010

7. Geotechnical Discussion Appendix H, Revised Feasibility Study, Former Anaconda Wire & Cable Plant Site, NYSDEC Site # 3-60-22, Haley & Aldrich of New York, October 2011

8. Record of Decision Amendment for the Harbor at Hastings site, Operable Unit No.1, NYSDEC, March 2012

9. Record of Decision for the Harbor at Hastings site, Operable Unit No.2, NYSDEC, March 2012

10. Revised Feasibility Study, Former Anaconda Wire & Cable Plant Site, NYSDEC Site # 3-60-22, Haley & Aldrich of New York, October 2011

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/324_PDI Completion/PDI Data Report/Text/2015_0727_PDI Data Report_Final.docx

ATTACHMENT A

GPR REPORT

ATTACHMENT B

FIELD LOGS

ATTACHMENT C

WELL ABANDONMENT REPORT

ATTACHMENT D

LABORATORY REPORTS

ATTACHMENT E

DATA USABILITY REPORTS

ATTACHMENT F

CAMP SUMMARY DATA