Final Engineering Report

The DeLaval Property
202-204 Rinaldi Boulevard
City of Poughkeepsie,
Dutchess County, New York

NYSDEC Site No. B00190-3

CHA Project Number: 14357

Prepared for:

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December 18, 2013

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CERTIFICATION

I, the undersigned, am currently a registered professional engineer licensed by the State of New York, I had primary direct responsibility for implementation of the remedial program activities, and I certify that the Remedial Design was implemented and that all construction activities were completed in substantial conformance with the Department-approved Remedial Design. The primary deviations from the Contract Documents are summarized in Sections 4.10 & 4.11 of this FER.

I certify that the data submitted to the Department with this Final Engineering Report demonstrates that the remediation requirements set forth in the Remedial Design and in all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in for the remedy.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and/or any operation and maintenance requirements applicable to the Site are contained in an environmental easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded.

I certify that a Site Management Plan (SMP) has been submitted for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by Department.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, the undersigned, of Clough Harbour & Associates LLP am certifying as Owner's Designated Site Representative for the Site.

For Clough Harbour & Associates LLP:

(Professional Seal)

Michael E. Hollowood
Printed Name of Certifying Engineer

Signature of Certifying Engineer

12/17/13
Date of Certification

068351
NYS Professional Engineer Registration Number

Clough Harbour & Associates LLP
Company

Vice President
Title

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES
(Continued)

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LIST OF ACRONYMS & ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACM	Asbestos-Containing Material
ACOE	Army Corps of Engineers
AmeriSci	American Science Team New York, Inc.
AMSL	Above Mean Sea Level
AOBE	As Ordered by Engineer
AOC	Area of Concern
Approx.	Approximately
ASTM	American Society of Testing & Materials
BGS	Below the Ground Surface
BM	Benchmark
C&D	Construction & Demolition
CAB	Concrete Anchor Blocks
CAMP	Community Air Monitoring Plan
CB	Catch Basin
CCR	Construction Completion Report
CHA	Clough Harbour & Associates LLP
CIP	Cast-In-Place
CLF	Chain Link Fence
Clr.	Clearance
CMP	Corrugated Metal Pipe
Conc.	Concrete
Cont.	Continuous
CPI	Corrosion Probe, Inc.
CPP	Citizen Participation Plan
CQAP	Construction Quality Assurance Plan
CT	Connecticut
CY	Cubic Yard
D	Diameter
Dbls.	Doubles
DEC	Department of Environmental Conservation
Dia.	Diameter
DRO	Diesel Range Organics
DUSR	Data Usability Summary Report
DVD	Digital Video Disk (or Digital Versatile Disk)
EC	Engineering Control
ECB	Erosion Control Blanket
El.	Elevation
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
EPS	Environmental Products & Services
ERP	Environmental Restoration Program
Ex.	Existing
ESC	Erosion and Sediment Control

f/cc	Fibers per Cubic Centimeter
FBE	Fusion Bonded Epoxy
FER	Final Engineering Report
Ft.	Feet
Ga.	Gauge
Galv.	Galvanized
GRO	Gasoline Range Organics
H	Horizontal
HASP	Health & Safety Plan
HDPE	High Density Polyethylene
HVAC	Heating, Ventilation & Air Conditioning
Hyd.	Hydrant
IC	Institutional Control
ID	Identification
I.D.	Inside Diameter
IN.	Inches
Inc.	Incorporated
Inv.	Invert
IRM	Interim Remedial Measures
KSI	Kips per Square Inch
L	Length
LAWES	Land, Air, Water Environmental Services, Inc.
LLC	Limited Liability Company
LLP	Limited Liability Partnership
LF	Lineal Feet
Lg.	Long
LNAPL	Light Non-Aqueous Phase Liquid
MA	Massachusetts
Max.	Maximum
mg/Kg	Milligrams per Kilogram
MH	Manhole
MHW	Mean High Water
Min.	Minimum
MLW	Mean Low Water
MOSF	Major Oil Storage Facility
MPI	Magnetic Particle Inspection
MPT	Maintenance & Protection of Traffic
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSW	Municipal Solid Waste
MTA	Metropolitan Transportation Authority (of New York City)
MW	Monitoring Well
NAD	No Asbestos Detected
NAD	North American Datum
NAD83	North American Datum, 1983 (horizontal)
NAPL	Non-Aqueous Phase Liquid
NAVD	North American Vertical Datum

NAVD88	North American Vertical Datum, 1988
NIOSH	National Institute for Occupational Safety and Health
No.	Number
NTD	Non-Destructive Testing
NTS	Not to Scale
NTU	Nephelometric Turbidity Unit
NY	New York
NYCRR	New York Code, Rules & Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOL	New York State Department of Labor
NYSDOT	New York State Department of Transportation
OC	On-Center
OCC	Ocean & Coastal Consultants, Inc.
O.D.	Outside Diameter
OHW	Overhead Wires
Opp.	Opposite
OSHA	Occupational Safety & Health Administration
OZ.	Ounce
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PCM	Phase Contrast Microscopy
PCS	Petroleum-Contaminated Soil
PDF	Portable Document Format
PE	Professional Engineer
PID	Photoionization Detector
Pl.	Plate
PLM	Polarized Light Microscopy
PLS	Professional Land Surveyor
PPL	Priority Pollutant List
ppm	Parts per Million
ppt	Parts per Thousand
PRAP	Proposed Remedial Action Plan
PSI	Pounds Per Square Inch
PSF	Pounds Per Square Foot
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QEP	Qualified Environmental Professional
R	Radius
RA	Remedial Action
RAO	Remedial Action Objective
RAW	Regulated Asbestos Waste

RCP	Reinforced Concrete Pipe
RDWP	Remedial Design Work Plan
RFI	Request for Information
ROD	Record of Decision
S/MMP	Soils/Materials Management Plan
SAC	State Assistance Contract
SCO	Soil Cleanup Objective
Sec.	Second
SMI	Seneca Meadows Inc.
SMP	Site Management Plan
SOP	Standard Operating Procedure
SS	Stainless Steel
SSD	Sub-slab Depressurization
SSDS	Sub-slab Depressurization System
SSP	Steel Sheet Pile
STP	Sewage Treatment Plant
SVOC	Semivolatile Organic Compound
SWC	Stamford Wrecking Company
SWPPP	Stormwater Pollution Prevention Plan
TAGM	Technical & Administrative Guidance Memorandum
TBD	To be Determined
TCC	The Chazen Companies
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
Tilcon	Tilcon New York, Inc.
TEM	Transmission Electron Microscopy
TMP	Tax Map Parcel
TOGS	Technical & Operational Guidance Series
Typ.	Typical
µg/kg	Micrograms per Kilogram
UFPO	Underground Facilities Protective Organization (Dig Safely)
UNO	Unless Noted Otherwise
UP	Utility Pole
UPL	Utility Pole with Light
US	United States
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
Util.	Utility
UV	Ultraviolet
V	Vertical
VCCI	Village Construction Company, Inc.
VOC	Volatile Organic Compound
WC	Water Column
WCD	Work Change Directive
Yd.	Yard

1.0 BACKGROUND & SITE DESCRIPTION

1.1 INTRODUCTION

The City of Poughkeepsie entered into a State Assistance Contract (SAC) with the New York State Department of Environmental Conservation (NYSDEC) in November 2005 (SAC No. C302762) to allow the City to seek reimbursement for a portion of the costs (up to 90 percent of eligible items) required to perform additional investigation, complete a remedial alternative analysis and coordinate the remedy selection with the NYSDEC through the New York State (NYS) Environmental Restoration Program (ERP) for a 14.04-acre property located in the City of Poughkeepsie, New York. The State added the City's eligibility for reimbursement for portion of incurred costs for remedial design and remedial action to the SAC through Amendment No. 1. The Hudson River Waterfront - DeLaval Property, hereinafter referred to as the "Site" (also referred to as NYSDEC Site No. B00190-3), was remediated to commercial use levels only, which includes passive recreation uses. This Final Engineering Report (FER) document is required as an element of the remedial program for the Site under the State ERP administered by the NYSDEC and documents the remedial construction and other associated Site preparation activities undertaken at the Site from March 2008 through January 2012.

The Site is located in the County of Dutchess, New York and is identified as Tax Map Parcel (TMP) No. 131300-6061-43-752749-0000 on the City of Poughkeepsie Tax Map. The address for the Site is 202-204 Rinaldi Boulevard, Poughkeepsie, New York, 12601 and is accessed at the intersection of Pine Street and Rinaldi Boulevard. The approximate centroid of the Site is located at 41º 41' 40" N and 73º 56' 20" W. A vicinity location map of the Site is included as Figure 1. A figure showing the location and boundaries of this 14.04-acre property, which includes an 11.46-acre area for redevelopment and a 2.58-acre area that is dedicated parkland along the waterfront is provided in Figure 2 and a full survey map of the Site is included in Appendix A.

It should be noted that the Site identified for investigation and remediation was originally a 13.95-acre parcel; however, due to some design modifications during the course of construction that resulted in the need to shift the bulkheads along the shoreline slightly further west into the Hudson

River, the City was required to obtain an additional approximately 0.09-acres of land from the State of New York Office of General Services (OGS) under a submerged land acquisition application process. Additionally, due to accessibility issues during construction (a steep slope on a rock outcrop near the northeast corner of the Site), the soil cover system could not be practically placed across the entire property, and thus, a portion of the property was left in its original state and is not included as part of the Site. Specifically, the "Site" includes the 14.04-acre parcel less 0.40-acres near the northeastern corner of the parcel as shown on Figure 2, or a total of 13.64-acres. This exclusion area has been separated from the Site by a chain link fence to serve as a physical boundary.

The boundaries of the Site are more fully described in Appendix A – Site Metes and Bounds.

The Site is bounded by the Shadows on the Hudson restaurant/catering facility and The Grandview banquet facility (formerly the City Sewage Treatment Plant (STP) site) to the north, Love/Effron, a major oil storage facility (MOSF) to the south, a MTA Metro-North Railroad (an agency of the Metropolitan Transportation Authority (MTA) of New York City)-owned concrete retaining wall with an elevated railroad corridor utilized by Metro North, Amtrak and Conrail to the east, and the Hudson River to the west (see Figure 2).

An electronic copy of this FER with all supporting documentation is included as Appendix B.

1.2 REPORT ORGANIZATION

This FER has been prepared by Clough Harbour and Associates LLP (CHA) as the "Engineer" for the project. The FER is divided into five (5) major sections, including:

Section 1: Provides an introduction of the project along with a brief description and Site background for the project.

Section 2: Provides a summary of the selected Site remedy.

Section 3: Provides a description of any interim remedial measures performed as part of the overall Site remedy, a description of the individual operable units that

make up the overall Site, and a summary of the separate construction contracts that were part of the overall remedial action for the Site, as applicable.

Section 4: Provides a detailed description of the remedial action performed at the Site as well as other related Site preparation items.

Section 5: Provides a summary of the project financials.

The text portion of the FER along with all figures and appendices has been included in its entirety on a Digital Video Disk (DVD) in Appendix B. It should be noted that all appendices, with the exception of the metes and bounds survey map, the bulkhead record drawings and the environmental easement, referenced in this FER are included electronically only. The text portions of the FER, the FER figures, and the referenced appendices have also been provided in hard copy at the direction of the NYSDEC.

1.3 SITE BACKGROUND

1.3.1 Brief Site History

The Site has a long history of former industrial use based upon review of available Sanborn Mapping and other historical documents. Early Sanborn maps indicated that much of the DeLaval Site was under water and part of the Hudson River in the late 1800s, but also indicate the industrial development had begun on the Site by that time (at least as early as 1887). The DeLaval Separator Company reportedly started operations on the Site in 1890 and a review of aerial photographs indicated that operations likely ceased in the early 1960s, followed by the razing the majority of the Site structures sometime between 1962 and 1967.

In a 1970 aerial photograph, there were two structures remaining on the Site, including a structure south of the former machine shop adjacent to the waterfront, and a small structure near the intersection of Pine Street and Rinaldi Boulevard that may have been the former "employment office" shown on the Sanborn maps. There were no visible structures on the Site by 1980 based upon review of the available aerial photography maintained by the Dutchess County GIS Department. The Site remained vacant until 2007 (with the exception of construction of various

paved and unpaved parking lots) when a pump station was installed along the eastern boundary of the Site, and a parking lot was constructed at the north end of the Site.

Several types of industrial operations and processes were conducted on the Site prior to 1970, including, but not limited to:

- Manufacturing of milking machinery/cream separators used in the dairy industry, including the following types of operations:
    - Pickling
    - Tinning operations
    - Annealing, machining, and forge shops
    - Clarifying operations (i.e. surface finishing)
    - Tooling and machining
    - Casting operations
- Storage of lime, cement and coal
- Operation of a coal-fired power/steam plant and later oil-fired power plant
- Storage of hides and operation of a tannery at the north end of the Site.

According to a title at the Dutchess County Real Property Tax Office, the DeLaval Separator Company sold the Site to the Roger H. Corbetta Corporation in December of 1965, who in turn sold the land to the City of Poughkeepsie in 1968. It appears, based upon a review of historical aerial photographs that the Roger H. Corbetta Corporation may have razed some of the remaining Site buildings during their ownership, but there is no indication that the Site was actively utilized during their relatively brief ownership. The City has owned the Site since 1968 and the Site has remained undeveloped since that time. However, a gravel parking lot and partially paved entrance/driveway to the parking areas were installed at the north end of the Site prior to CHA's involvement with the project in 2001. The exact year in which the parking lot areas and driveways were installed is unknown, but occurred sometime after the City took possession of the Site in 1968. The parking lot was utilized for both City events such as festivals and non-City related events, such as access to the Hudson River for fishing.

Numerous environmental assessments and investigations were conducted at the Site between 1999 and 2005. The City executed a Contract for the Site remediation with a Contractor in December 2007. By the time this Contract was executed, the Developer of the DeLaval Site had already reached an agreement with the City to install a new gravel parking lot, a stormwater drainage system, and lighting at the north end of the Site (north of the Site entrance) to provide additional parking for events at the facility adjacent to the north end of the Site as well as parking for nearby hospital workers.

This parking area was later paved with asphalt in 2010, prior to the completion of the remedial and Site preparation construction at the Site. Curbing and landscaped islands were also installed as part of the completion of redevelopment of the north end of the Site in 2010. Additionally, The City installed a concrete sidewalk along the Hudson River waterfront as part of the redevelopment of this portion of the Site.

Since the Developer coordinated the installation of the soil cover system and parking lot at the north end of the Site directly with the City prior to the execution of the December 2007 construction Contract, this area was avoided by the Contractor, with the exception of the western side near the waterfront where the installation of riprap revetment was required. More specifically, the Contractor maintained their work zone area along the waterfront to an area approximately 100-feet wide and parallel to the Hudson River and off of the waterfront. Though minor tracking did occasionally extend further east of the shoreline, the Contractor was required to scrape off any tracked material from these areas and was instructed to maintain activities closer to the shoreline. Following the completion of the waterfront construction activities (e.g. riprap revetment installation), the Contractor scraped the surface of the area that had been tracked on prior to the City's final installation of additional subbase material and a concrete sidewalk and the Developer's preparation for paving of the parking lot and landscaping areas.

The remedial action described in this document commenced in March of 2008 and was completed in January of 2012. Since the City of Poughkeepsie had already negotiated the redevelopment of the Site with a Developer by this time, some redevelopment activities also occurred within this

timeframe. Specifically, the Developer (and/or the Developer's contractor) completed grading activities and installed a number of underground utilities/subsurface structures (e.g. light pole foundations) prior to the completion of the final step of the remedial action, which was the installation of a soil cover system across the Site.

1.3.2 Areas of Concern

Based upon the subsurface investigations previously completed at the Site by CHA and The Chazen Companies (TCC) as well as findings during the construction, the following five (5) areas of concern (AOCs) associated with the Site as well as small areas of contamination encountered along the waterfront have been identified and are illustrated on Figure 3.

- **AOC-1:** An area of petroleum-impacted soil and groundwater near the southern end of the Site that paralleled the Hudson River, approximately 0.8-acres in size. An industrial landfill/construction & demolition debris disposal area that extended eastward of the petroleum-impacted soils to a bedrock outcrop along the east side of the Site was located above the petroleum-impacted area.

- **AOC-2/3:** An area of petroleum-impacted soil and groundwater in the central portion of the Site that paralleled the Hudson River, approximately 2.4-acres in size. An abandoned 14-inch oil pipeline and an approximately 400-gallon underground storage tank (UST) were also present in this AOC and likely contributed to the contamination in this area.

- **AOC-4:** An area adjacent to a former Paint Shop along the eastern border of the Site where solvent-like odors were observed during one of the investigations and several semivolatile organic compounds (SVOCs) were detected in the soil samples. This AOC was initially discovered during TCC's investigation. However, CHA was unable to find any evidence of solvent-like odors in this area during the supplemental investigation, and therefore, no remediation was planned for this area as part of the overall construction. However, the contamination found in AOC-4A (discussed below) may have been related to the contamination previously documented by TCC.

- **AOC-4A:** An area measuring approximately 32-feet wide by 50-feet long of petroleum contamination that was encountered adjacent to the western side of AOC-4 while investigating for the potential presence of additional oil pipelines extending southward on the Site from AOC-2/3 during the construction activities at the Site. Migration of the contamination in this area appeared to

have been hindered by the presence of several subsurface concrete foundation walls.

- **AOC-5:** A small area of petroleum contamination encountered near the south end of the Site immediately adjacent to the eastern concrete retaining wall that runs parallel to the Site during the installation of Storm Manhole No. STMH-1. Sanborn mapping indicated the presence of a former "oil house" in this location which likely contributed to the contamination encountered in this area.

- **Revetment:** Two small areas of petroleum contamination were encountered during the subgrade excavation for the revetment in Zone 2. Similarly, two small areas of petroleum contamination were also encountered in Zone 4 during the revetment subgrade excavation. The limits of the petroleum contamination were reached as the excavations were advanced inland. However, based upon test excavations beyond the limit of the revetment stone, the contamination in Zone 2 extended further into the river. Delineation of the limit of impacted sediment within the Hudson River was not required as part of the construction requirements for this project, and thus, is not discussed further in this FER.

1.3.3 Nature & Extent of Contamination

The following types of contaminants were identified on the DeLaval Site during the Site investigations and during the remedial action:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Polychlorinated biphenyls (PCBs)
- Heavy metals
- Asbestos-containing materials (ACMs) [discovered during remedial action phase only]

The primary contaminants in each Site media are briefly described below:

- **Surface Soils:** The primary contaminants in the surface soil of the Site were heavy metals and a subset of the SVOCs, known as polynuclear aromatic hydrocarbons (PAHs). Additionally, elevated levels of PCBs (ranging from 1 to 13 parts per million (ppm)) were encountered at the south end of the Site (AOC-1), and near the northeast corner of the Site.

- **Subsurface soils:** While several contaminants were identified in the subsurface soils, the primary group of contaminants addressed by the remedial action was the elevated levels of PAHs and presence of light non-aqueous phase liquids (LNAPLs)/free product in the AOCs.

- **Groundwater:** Based on analytical data from the investigations at the Site, chemical impacts to groundwater were minimal. Four (4) VOCs and lead were detected at elevated concentrations in the samples collected from the monitoring wells at the Site. Additionally, elevated PCBs levels were detected in one well in AOC-1. PAHs were not detected at elevated concentrations in the groundwater, suggesting that most of the product in the AOCs consisted of a LNAPL floating on the groundwater surface, rather than being in the dissolved phase.

- **Soil gas:** No active methane gas generation was detected in the vicinity of the former landfill area at the south end of the Site (AOC-1).

2.0 SUMMARY OF SITE REMEDY

This section summarizes the Remedial Action Objectives (RAOs) established for the Site as well as provides a brief description of the selected remedy for the Site.

2.1 REMEDIAL ACTION OBJECTIVES

Based on the results of the Supplemental Investigation, the following RAOs were identified for this Site, as described in Section 6 of the NYSDEC's Record of Decision (ROD), dated March 2005.

2.1.1 Soil RAOs

RAOs for Public Health Protection:

- Eliminate or reduce to the extent practicable exposures of persons at or around the Site to contaminated soils.

RAOs for Environmental Protection:

- Eliminate or reduce to the extent practicable the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards.
- Eliminate or reduce to the extent practicable the release of contaminated vapors from the subsurface soils into ambient air through excavation.
- Eliminate or reduce to the extent practicable the potential for contaminated vapor intrusion into any future buildings constructed at the Site.
- Eliminate or reduce to the extent practicable the sources of soil contamination.
- Attaining to the extent practicable the restoration of the subsurface soil to an acceptable standard consistent with the proposed use of the Site.

2.1.2 Groundwater RAOs

RAOs for Public Health Protection:

- Eliminate or reduce to the extent practicable exposures of persons at or around the Site to contaminated groundwater.

RAOs for Environmental Protection:

- Eliminate or reduce to the extent practicable the possible migration of contamination to off-site media, notably the Hudson River's water and sediments.

- Eliminate or reduce to the extent practicable the sources of groundwater contamination.
- Attaining to the extent practicable ambient groundwater quality standards.

2.2 DESCRIPTION OF SELECTED REMEDY

The Site was remediated in accordance with the remedy selected by the NYSDEC in the Record of Decision (ROD) dated March 2005 and the Remedial Design Work Plan (RDWP) dated November 15, 2005.

The factors considered during the selection of the remedy were those listed in Title 6 of the New York Code, Rules & Regulations (NYCRR), Part 375-1.8. The following are the components of the selected remedy as identified in the ROD and RDWP:

1. A bulkhead consisting of steel sheet piling was constructed at the shoreline adjacent to AOC-1 and AOC-2/3 to serve as a barrier in order to preclude contamination in the soils and groundwater from impacting the Hudson River during and following the construction. AOC-1 was anticipated to require a 370-foot long bulkhead, but ultimately ended up being approximately 331-foot long based upon field conditions. Similarly, the bulkhead for AOC-2/3 was anticipated to be approximately 720 feet long, but was ultimately constructed as an approximately 658-long bulkhead based upon actual field conditions.

2. Approximately 12,900 cubic yards of material representing grossly-contaminated soil from AOC-1 and AOC-2/3 was anticipated to be excavated for off-site for disposal based upon early feasibility studies. Based upon actual Site conditions, a total of approximately 34,262 tons of petroleum-contaminated soil and approximately 10,312 tons of petroleum-contaminated soil containing asbestos were disposed of off-site. An UST and a buried pipeline in AOC-2/3 were also removed along with the grossly impacted soil. Excavations were backfilled with the material derived from Site grading as well as clean imported fill.

3. The Site was cleared of heavy vegetation and graded to allow placement of a cover consisting of either a minimum of 12 inches of clean imported fill or impervious features such as paved parking areas, walkways, and buildings pads, as appropriate for the planned redevelopment of the Site. Any surplus surface soil resulting from the grading was used as backfill for the excavations in AOC-1 and AOC-2/3 and placed beneath the soil cover system. Prior to placement of the clean fill, a geotextile fabric was placed over the Site to serve as a demarcation barrier for any future ground-intrusive activities at the Site following development. Additionally, a vapor barrier and active sub-slab depressurization system will be constructed beneath future buildings.

4. Since the remedy has resulted in contamination above unrestricted levels remaining at the Site, a Site Management Plan (SMP) has been developed and implemented. The SMP includes the institutional controls and engineering controls necessary to (a) address residual contaminated soils that may be excavated from the Site during future redevelopment, including soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations, (b) provide for the operation and maintenance of the components of the remedy, including the active sub-slab depressurization systems required to be installed during the construction of future buildings, (c) monitor the groundwater, and (d) identify any restrictions of on-Site redevelopment to recreational or commercial reuse or groundwater use.

5. The SMP requires the property owner to provide an Institutional Control/Engineering Control (IC/EC) certification, prepared and submitted by a professional engineer that will certify that the institutional controls and engineering controls put in place are unchanged from the previous certification and nothing has occurred that will impair the ability of the control to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or SMP. The requirements for a periodic review of the ICs/ECs at the Site, including operational, maintenance, and monitoring requirements, are further described in the SMP document submitted to NYSDEC under a separate cover.

6. Imposition of an Institutional Control in the form of an Environmental Easement that (a) requires compliance with the approved SMP, (b) limits the use and redevelopment of the Site to commercial or passive recreational uses only, (c) restricts use of groundwater as a source of potable or process water without necessary water quality treatment as determined by the Dutchess County Department of Health, and (d) requires the Site owner to complete and submit to the NYSDEC an IC/EC certification on a periodic basis determined by the NYSDEC and further described in the SMP.

ICs and ECs are generally designed to reduce or eliminate exposure to contaminants of concern. An IC is a non-physical restriction on the use of the Site, such as the Environmental Easement that allows the Site to be suitable for redevelopment for some uses, but not all uses, due to the remaining contamination on the Site. An EC is a physical barrier or method implemented to manage the contamination, such as the shoreline bulkheads and the soil cover system installed at the DeLaval Site.

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3.0 IRMS, OPERABLE UNITS & REMEDIAL CONTRACTS

The purpose of this section is to summarize work performed as interim remedial measures (IRMs), operable units or under separate remedial construction contracts that were previously documented in individual Construction Completion Reports (CCRs), and to summarize the major project team members that were involved with the construction phase of the project.

3.1 INTERIM REMEDIAL MEASURES

No IRMs were performed as part of the DeLaval ERP project. However, based upon the discovery of the presence of an UST and a petroleum pipeline in AOC-2/3 during CHA's supplemental investigation conducted between July 2004 and October 2004, the NYSDEC requested CHA prepare an IRM work plan for the removal of the tank and pipeline. CHA submitted the IRM plan to the NYSDEC on August 23, 2004. However, after NYSDEC's review of the IRM plan, it was determined that due to the complexity and the number of site controls required to perform the removal operations, that the removal operations should be conducted as part of the overall Site remedy rather than performed as an IRM. Additionally, no individual CCRs were prepared for the DeLaval Site.

3.2 OPERABLE UNITS

The remedy for the DeLaval Site was performed as a single operable unit. No separate operable units were developed for the DeLaval project. However, the Site was divided into five (5) work zones referred to as Zones 1 through 5. These zones are briefly described as follows and are identified on Figures 3 through 6:

- Zone 1: The southern-most portion of the DeLaval property, extending approximately 381 lineal feet northward of the southern property boundary. This Zone includes the Zone 1 bulkhead and all of AOC-1.

- Zone 2: An approximately 848 lineal foot long section of the DeLaval property located north of Zone 1 and south of Zone 3. Zone 2 is located between AOC-1 and AOC-2/3 and no significant remediation was planned for this area. However, a relatively small amount of petroleum-impacted soils were disposed off-site from the Zone 2 waterfront during the course of preparing the subgrade for riprap revetment installation as well as from AOC-4A during a test pit investigation to locate potential existing subsurface oil pipelines on the Site.

- Zone 3: This zone is approximately 658 lineal feet long and includes the Zone 3 bulkhead and all of AOC-2/3.

- Zone 4: This zone is approximately 730 lineal feet long and includes the northernmost portion of the DeLaval Site along with a portion of the Grandview Development property to the north of the DeLaval property. Specifically, the southernmost 370 lineal feet of Zone 4 is part of the DeLaval Site and the northernmost 360 lineal feet is part of another City-owned waterfront strip of land adjacent to the Grandview/Shadows facility that was developed prior to the commencement of the DeLaval construction. While no active remedial work was anticipated for this area, a relatively small amount of petroleum-impacted soils were disposed of off-site from this area during the course of preparing the subgrade for riprap revetment installation. The primary activity conducted in this zone was the installation of riprap revetment along the shoreline and the extension of or replacement of existing stormwater and combined sewer overflow outfalls.

- Zone 5: This zone is approximately 311 lineal feet in length and is completely off the DeLaval property. However, the installation of riprap revetment was conducted in this Zone. This zone was similar to Zone 4; however, the primary difference is that a series of live stakes were installed in Zone 5 to attempt to soften the riprap hardscape with a green, more natural vegetative surface.

3.3 REMEDIAL CONTRACTS

The City initially held two separate contracts associated with the implementation of the remedy. Specifically, CHA was the consultant engineer selected by the City to provide construction oversight and administration during the construction (Site preparation and remediation) and serve as the certifying engineer through an extension of an existing contract dated December 10, 2001 to perform a remedial alternative analysis for the Site.

The City entered into a construction contract (hereinafter referred to as the "Contract") in December 2007 with the Stamford Wrecking Company (SWC) of Trumbull, Connecticut (Bid No. 09-06-27) to complete the remedial action and other related construction activities through a public competitive bid process. Finally, the City entered into a third agreement in September 2010 with the Developer to utilize the Developer's contractor to install the soil cover system at the Site.

3.3.1 Engineering Consultant

CHA's contract with the City of Poughkeepsie was extended on July 15, 2005 to include engineering design services, bidding phase services, construction observation and construction administration

phase services, and preparation of a construction certification report. Table 3-1 summarizes the contact information for key engineering personnel involved with the DeLaval project. Ocean & Coastal Consultants, Inc. (OCC) was retained as an engineering subconsultant to CHA to provide permitting, design and construction phase services associated with the waterfront elements of the project (e.g. steel sheet pile bulkhead systems, riprap shoreline stabilization, outfall structure design, and live stake installation). It should be noted that references to the "Engineer" in this FER refers to CHA and/or their subconsultant engineer, OCC.

Table 3-1. Engineering Consultant Key Personnel

Personnel	Title/Role	Responsibility/Authority
Prime Consultant: **Clough Harbour & Associates LLP** III Winners Circle Albany, New York 12205 Phone: (518) 453-4500		
Michael E. Hollowood, P.E.	Vice President	Responsible for final review and certification of the Site Management Plan (SMP) and Final Engineering Report (FER). Also provided support for problem resolution throughout the construction phase of the project.
Keith J. Ziobron, P.E.	Project Manager	Overall project manager for CHA, managing all aspects of the project including technical and financial tasks. Provided quality assurance/quality control (QA/QC) reviews of remedial design documents and was the signing engineer for the final design Contract Documents.
Scott M. Smith, P.E.	Project Engineer	Lead designer, responsible for the development of the remedial design documents, preparation of bid documents, coordinating oversight of the construction, reviewing Contractor submittals for compliance with the Contract Documents, conducting progress review meetings, preparation of the SMP and this FER, and problem resolution.
Aaron Hollenbeck	On-Site Representative	On-Site representative overseeing Contractor work on full-time basis through August 2009, and responsible for documenting daily progress/activities, discussing progress and/or issues with the Project Engineer, and observing QA/QC testing in the field performed by the Contractor for substantial compliance with the Contract Documents.

Personnel	Title/Role	Responsibility/Authority
CHA Subconsultant: **Ocean & Coastal Consultants, Inc.** 35 Corporate Drive Trumbull, Connecticut 06611 (203) 268-5007		
Stanley White, P.E.	President/Owner	Responsible for final review and professional sealing of the final design documents and assisted OCC with problem resolution periodically throughout the project.
Azure-Dee Sleicher, P.E.	Project Manager/Permits	Responsible for obtaining permits from NYSDEC and Army Corps of Engineers (ACOE) for shoreline work. Also assisted with preparation/coordination of design documents.
Alex I. Mora, P.E.	Lead Design Engineer	Primary design engineer responsible for structural analyses associated with the bulkheads and design modifications during the course of construction due to deflections caused by the Contractor's means and methods and unforeseen conditions.
John Bazzoni	Senior Construction Specialist	Coordinated oversight of shoreline work during construction and provided technical guidance relative to the construction of the shoreline bulkheads and revetment. Served as OCC's project manager during construction and was the primary person from OCC involved with problem resolution during the construction phase of the project.
Stuart Lewis, I.E.	On-Site Representative	On-Site representative overseeing Contractor work on full-time basis during the installation of the bulkheads and riprap revetment (through January 2009), and responsible for documenting daily progress/activities, discussing progress and/or issues with the Project Engineer, and observing QA/QC testing in the field performed by the Contractor for substantial compliance with the Contract Documents.

The Engineer's primary responsibilities under the referenced contract with the City included the following:

1. Preparation of an ERP application for the remedial design and construction phase services.
2. Preparation of a Remedial Design Work Plan & Conceptual Design.
3. Preparation of Remedial & Shoreline Stabilization Design documents.
4. Bidding Phase Services, including:

- Distribution of the Contract Drawings and Specifications to potential bidders and builder exchanges.
- Conducting a pre-bid meeting and issuance of appropriate addenda to answer contractor questions.
- Review and evaluation of bids.
- Assistance to City in preparation of formal Contract Documents.

5. Contract Administration Services, including:

- Arranging and attending the preconstruction meeting, including the preparation of a meeting agenda and meeting minutes.
- Reviewing detailed construction shop drawings and submittals from the Contractor.
- Revising remedial and shoreline stabilization design.
- Reviewing the Contractor's payment applications
- Conducting project progress meetings
- Assisting the City with negotiations and implementation of Contractor change orders
- Performing final Site reconnaissance to verify conformance with Contract Documents.

6. Construction Observation Services, including:

- Observing, in the City's interest, that the materials furnished and work completed is in general compliance with the Construction Documents.
- Informing the project engineer/City if any work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required.
- Advising the project engineer of work that should be corrected or rejected or should be uncovered for observation or requires special testing, inspection or approval.
- Communicating with the Contractor, project engineer, and City, as necessary, and serving as the Engineer's and City's liaison with the Contractor. Also responsible for serving as the Engineer's liaison with the NYSDEC when representatives of the Department visited the Site.
- Reviewing schedules.
- Attending meetings with the Contractor.
- Advising the project engineer and Contractor of the commencement of work requiring a Shop Drawing or sample if the submittal has not been approved.

- Reporting to the project engineer when clarifications and interpretations of the Contract Documents are needed and transmitting to the Contractor clarifications and interpretations as issued by the project engineer.
- Evaluating suggestions by the Contractor for modifications in Drawings or Specifications, reporting to the project engineer and transmitting to the Contractor decisions issued by the project engineer.
- Maintaining a daily observation reports recording the Contractor's hours on the job site, weather conditions, data relative to questions of Work Change Directives (WCDs), Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general and specific observations in more details as in the case of observing test procedures.
- Recording the names, addresses and telephone numbers of all Contractors, Subcontractors on the job Site and major suppliers of materials and equipment used to complete the construction.
- Providing the project engineer with periodic reports as required of progress of the work and of the Contractor's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.
- Preparing draft proposed Change Orders and WCDs.
- Reporting immediately to the project engineer and City upon the occurrence of any accident.
- Reviewing applications for payment with the Contractor for compliance and forwarding with recommendations to the project engineer.
- Verifying that certificates, maintenance and operation manuals and other data required to be assembled and furnished by the Contractor are applicable to the items actually installed and in accordance with the Contract Documents.
- Submitting a list of observed items requiring completion or correction prior to the Engineer issuing a Certificate of Substantial Completion. (Note: a Certificate of Substantial Completion was never issued to the Contractor prior to the City terminating their Contract with SWC).

7. Preparing a construction certification report/Final Engineering Report.
8. Installation of post-remediation groundwater monitoring well network (per a separate Extra Work Authorization).

3.3.2 City's Contractor

In December 2007, the City executed a Contract with SWC to implement the remedy and complete a number of shoreline stabilization activities associated with the project (specific requirements are provide in the Contract Documents included in Appendix C).

The following table summarizes the contact information of key SWC personnel involved with the DeLaval project:

Table 3-2. Prime Contractor Key Personnel

Personnel	Title/Role	Responsibility/Authority
Prime Contractor: **Stamford Wrecking Company** 30 Nutmeg Drive Trumbull, Connecticut 06611 (203) 380-8300		
Stephen Goldblum	President/ Owner	Primarily involved in conflict resolution discussions, negotiation of change orders, and the closeout of the construction contract (prior to Contract termination).
Gregory Paquin	Vice President/ Project Manager	SWC's overall project manager. Mr. Paquin met regularly with field superintendents to review progress and discuss upcoming activities. Also responsible for coordinating submittals, payment applications, change order requests, RFIs, submittal of analytical results, submittal of field testing results (e.g. in-place density testing results),etc.
Thomas Buchino, Kenneth Warga, Brett Northrop, Dave Counyers, Walter Wang, et al.	Superintendent(s)	Responsible for overseeing and directing all on-Site activities. Coordinated activities of field crews, Site logistics, delivery of materials, retrieval of air monitoring data, etc. SWC established the Superintendent as the primary point of contact for the Engineer when questions or concerns arose in the field.

While SWC was the prime Contractor for the construction at the DeLaval Site, numerous subcontractors and vendors were utilized by SWC to complete the project. The key subcontractors are summarized in the Table 3-3. Reference to the "Contractor" in this FER refers to SWC and/or their subcontractors.

Table 3-3. Key Subcontractors for DeLaval Project

Contractor	Project Manager	Responsibility
G. Donaldson Construction Co., A Division of Hayward Baker, Inc. - 9 Whipple St., Unit I Cumberland, Rhode Island 02864 (401) 334-2565	Alan Watka, P.E. (now separated) /Scott Nichols	Installation of the Zone 1 and 3 steel sheet pile (SSP) bulkheads. The Zone 1 bulkhead activities included installation of a steel sheet pile deadman, installation of a wale on the rear side of the bulkhead and installation of tie-rods between the bulkhead and deadman. Also responsible for demolition of deep obstructions encountered near the center of the Zone 3 bulkhead.
American Steel Coatings, LLC – 689 Hopkins Hill Road West Greenwich, Rhode Island 02817 (401) 397-9154	Eric Greene	Retained by G. Donaldson to apply the epoxy coating on the steel sheet piles. Also responsible for a number of coating repairs associated with "map cracking" in 2010. (Map cracking described later in this report). A sister company, American Welding Company, welded the sheet pile interlocks at a fabrication shop (not permitted per Contract as discussed elsewhere in FER) to create "doubles".
Environmental Products & Services of Vermont, Inc. (EPS) – 40 Hamilton Lane Glenmont, New York 12077 (518) 465-4000	Donna Saleh	Provided vacuum trucks and equipment to assist SWC in the removal of free product from the AOC excavations. Also removed water from the decontamination pad and containment pad periodically.

During the course of the construction work, the City elected to remove the installation of the soil cover system from SWC's contract due to performance factors and coordination considerations associated with the Developer's activities. The Construction Contract between City and SWC was terminated on May 27, 2011.

Since the City already had an existing agreement with a Developer to redevelop the Site following the construction, the City retained the Developer's contractor to install the soil cover system. This work was performed in accordance with the same technical requirements as the contract previously executed between the City and SWC. This was a logical progression of the construction activities, since the Developer was already responsible for completing Site grading activities and the installation of subsurface utilities prior to the installation of the soil cover system. The following

table summarizes the contact information of key personnel involved with the final Site grading, installation of subsurface utilities and construction of the soil cover system.

Table 3-4. Soil Cover System Contractor Key Personnel

Personnel	Title/Role	Responsibility/Authority
Developer's Contractor: **Village Construction Company, Inc. (VCCI)** 2517 Route 44 Salt Point, New York 12578 (203) 380-8300		
Michael A. Volino	Executive Vice President/Director of Site Work Division	Overall responsibility for construction activities completed at Site by VCCI.
Edward Norman	Superintendent	Responsible for overseeing and directing all on-Site activities. Coordinated activities of field crews, Site logistics, delivery of materials, retrieval of air monitoring data, etc.

During the course of the Developer's work (e.g. subsurface utility installation, rough grading of Site & soil cover system installation), the engineering staff of the City of Poughkeepsie provided oversight of the activities. Table 3-5 summarizes the contact information of key City personnel involved with the oversight of the final Site grading, installation of subsurface utilities and construction of the soil cover system.

Table 3-5. City Key Personnel

Personnel	Title/Role	Responsibility/Authority
City of Poughkeepsie 62 Civic Center Plaza P.O. Box 300 Poughkeepsie, New York 12602 (845) 451-4074		
Richard L. Dupilka, P.E.	City Engineer/ Commissioner of Public Works	Primary representative for the City as Owner for the project, including resolution of issues as they arise, review and approval of change orders, review of payment applications, etc. Also provided review and professional certification of the soil cover system installation activities conducted by the Developer.
Joseph A. Chenier	Assistant City Engineer	Primary on-Site representative for the City. Attended majority of the site progress meetings, reviewed change orders, RFIs, payment applications, completed budget forecasts, and provided oversight of certain activities (e.g. bulkhead repairs). Also provided and/or coordinated with other City personnel to provide oversight for the soil cover system installation.

Following the completion of the soil cover system installation, the City of Poughkeepsie Engineer, Mr. Richard Dupilka, P.E. certified to the Engineer that all work done by the Developer was in substantial compliance with the Contract Documents. Along with a certification letter, the City provided the following documents to the Engineer for inclusion in the FER (see Appendix D):

1. Sub-Appendix COP-A: A digital photograph of key activities and milestones.
2. Sub-Appendix COP-B: A drawing indicating the locations of various types of soil cover systems on the site.
3. Sub-Appendix COP-C: Analytical testing results for prequalification testing of imported fill materials. Certifications for the fill materials are discussed in Section 4.5 of the FER).
4. Sub-Appendix COP-D: In-place density testing results for soil cover system.
5. Sub-Appendix COP-E: Weight tickets for imported fill materials.
6. Sub-Appendix COP-F: Thickness/depth check results for soil cover system (verification of minimum thickness).

7. Sub-Appendix COP-G: Daily field reports.

8. Sub-Appendix COP-H: CAMP/Dust monitoring results (in graphical format).

9. A copy of the Contract/agreement between the City and the Developer.

10. A copy of the Village Construction Company, Inc. HASP (refer to Section 4.1.2).

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4.0 DESCRIPTION OF REMEDIAL ACTION PERFORMED

Remedial activities completed at the Site were conducted in accordance with the NYSDEC-approved Remedial Design Work Plan (RDWP) for the Hudson River Waterfront - DeLaval Property Site, dated November 15, 2005. All deviations from the RDWP are noted in Sections 4.10 & 4.11 of this FER. This section provides a more detailed summary of the remedial and non-remedial work performed during the construction phase of the project. It should be noted that the City of Poughkeepsie was not eligible for reimbursement under the NYSDEC's ERP program for completing the non-remedial work elements performed under the construction Contract.

4.1 GOVERNING DOCUMENTS

4.1.1 Contract Documents

The Site was remediated in accordance with the NYSDEC-approved Remedial Design dated July 2007 and the Contract Documents dated August 8, 2007. The Contract Drawings and Project Manual (which includes technical specifications and other contractual requirements) have been included in Appendix C. A total of six (6) addenda were issued during the bid phase of the project and have been included in Appendix E. The addenda are summarized as follows:

- Addendum No. 1, dated August 22, 2007
  - Extended the deadline for submittal of sealed bids
  - Changed the date of the pre-bid meeting
  - Added requirements for apprenticeship agreements
  - Added non-collusive bidding certification requirements
  - Added standard clauses for New York State contracts

- Addendum No. 2, dated September 14, 2007
  - Added soil boring logs to Information Available to Bidders
  - Added three line items to the Contract, including the installation of a sheet pile cut-off wall (was only required if the mud line in the river was too steep to facilitate proper installation of the riprap revetment or the toe protection stone on the waterward side of the bulkheads, but was ultimately not necessary), offsite disposal of construction and demolition (C&D) debris, and offsite disposal of solid waste
  - Extended Developer time to grade Site/ install utilities from 45 days to 90 days
  - Extended the completion date for the end of the project until the end of 2008
  - Revised the description of two payment line items in the contract
  - Modified the required overlaps for the demarcation barrier geotextile

  - Revised the specifications for the bulkhead waterstop material
  - Extended the length of the Zone 1 outfall such that it extended beyond the deadman
  - Added an alternate for the backflow preventers for the weep hole drainage system
  - Clarified requirements for retainage
  - Clarified requirements of contractors to apply for dispensation for overtime work
  - Clarified that welding of bulkhead interlocks was not permitted
  - Extended the question period for contractors bidding on project
  - Provided a revised bid form to reflect the new items added to the contract

- Addendum No. 3, dated September 21, 2007
  - Provided a revised bid form to reduce the number of steel sheet pile (SSP) toe pins
  - Added alternate anchor plate assemblies to the contract
  - Revised the description of two payment line items in contract
  - Revised the specification for the gradation of the riprap stone along shoreline
  - Revised the specification for the bulkhead waterstop and steel sheet piles
  - Permitted use of fabricated corner pieces for steel bulkheads
  - Provided clarifications for which bulkhead pieces required epoxy coating
  - Revised the concrete cap shear key detail note
  - Clarified the placement of toe pins
  - Clarified role of Contractor and Developer when Developer on-Site
  - Clarified that Contractor must also unload salvaged materials at City garage
  - Clarified permit requirements for the tank closure(s)
  - Again clarified no welding of interlocks
  - Clarified that burning holes through sheet piles for bolt holes was not permitted

- Addendum No. 4, dated September 26, 2007
  - Provided a revised bid form to add the potential need for a revetment cutoff wall
  - Divided the bulkhead work items into three separate payment items

- Addendum No. 5, dated September 27, 2007
  - Extended the deadline for submitting bids one additional week
  - Removed topsoil and seed alternate from base bid
  - Revised specifications for threadbars and nuts associated with the bulkheads

- Addendum No. 6, dated September 28, 2007
  - Revised specifications for threadbars and nuts associated with the bulkheads

During the course of the construction, a number of contract modifications were made via executed change orders, as summarized in Table 4-1. Copies of each change order are provided in Appendix F, with the exception of Change Order Nos. 27, 28, 29, 30, 32, and 33, which were never executed by SWC and returned to the Engineer, as required by the Contract Documents.

Table 4-1. Summary of Change Orders

Change Order No.	Date Executed	Description/Reason for Change
1	03/10/08	Contractor was required to obtain railroad insurance, but draft permit indicating requirements and costs associated with the insurance not issued until after signing of the construction contract.
2	05/16/08	Replacement of existing 54-inch combined sewer overflow outfall. Was not part of the remedy, but requested to be included in the contract by the City of Poughkeepsie following the opening of the bids.
3	05/16/08	Due to the changes in grade along the waterfront, the initially installed silt fence had to be removed and replaced. The replacement due to grade changes was beyond maintenance requirements specified in the Contract.
4	05/30/08	Four (4) drums were encountered in AOC-1 just beneath the Site surface and the removal of drums was not included in the original Contract.
5	06/09/08	Installation of a temporary soil containment pad to temporarily stage contaminated river sediments encountered in Zone 2 on-Site. No remedial work was included in the construction contract in Zone 2 and no investigation of the river sediments was included as part of the initial investigations of the Site.
6	06/09/08	Hauling of contaminated river sediments encountered in Zone 2, as handling of river sediments was not included in the original contract. While excavation, handling & disposal of petroleum-contaminated material were included in the contract, additional handling was required to haul the material to the containment pad for drying. The loading and handling of the material multiple times was not required by the original construction contract.
7	06/10/08	Coarse aggregate (2 to 3-inch diameter stone) required to fill in large sink holes along the shoreline. During the course of clearing and grubbing the Site, several large sink holes were discovered beneath the root balls of the trees associated with scour from the river. The scour holes had to be backfilled to provide safe work area from which to install the bulkheads and riprap revetment. A larger volume of coarse aggregate was also used for backfill beneath the water table in AOC-1 and AOC-2/3. Since dewatering the AOCs was determined to be impractical during construction, a backfill material with no "fines" was required to avoid the entrapment of pore pressure during placement, particularly since compaction testing beneath the water table was not feasible and extensive dewatering was deemed impractical.
8	08/06/08	Screening of debris out of soil for AOC-1 was not part of the original contract, but the intent of this change order was to have the Contractor provide screening of the excavated material to minimize the amount of material requiring offsite disposal and also reduce the amount of material that needed to be imported back to the Site for restoration activities.

Change Order No.	Date Executed	Description/Reason for Change
9	09/29/08	Additional investigation and demolition activities associated with the Zone 3 bulkhead due to the excessive subsurface obstructions encountered while driving sheet piles in this area. The work included probing the limits of a large subsurface obstruction as well as time to construct a large demolition probe/H-pile and use it to prepare a path for the sheet piles to be driven through the obstruction.
10	09/29/08	Timber pile disposal. Several waste disposal line items were included in the Contract; however, there was no line item to specifically dispose of creosote-coated timber piles removed as part of the shoreline reconstruction work. As described later in the FER, the Contractor had difficulty in finding a construction and demolition (C&D) debris disposal facility in eastern New York to accept this waste without significant processing.
11	12/12/08	The Contractor utilized a number of absorbent materials to manage the petroleum-impacted sediments along the Zone 2 shoreline, but again, removal of impacted materials from Zone 2 was not a part of the original contract, so absorbents utilized in this Zone 2 were in addition to those required by the Contract.
12	12/12/08	Tire disposal. Given the number of buried tires encountered at the Site, a line item was required to address the specific disposal of a waste tire stream. Additionally, the tires were partially cleaned (e.g. removal of large soil clods and quick washing) and sorted in preparation of disposal.
13	12/23/08	The handling and removal of an unforeseen 14-inch oil pipeline in Zone 3 partially filled with oil.
14	02/16/09	Renewal of insurances for the project. Most of the premiums were paid on an annual basis. Since the change orders extended the completions dates beyond a one-year construction schedule, additional compensation was provided to the Contractor for renewal of the insurance.
15	02/05/09	Additional geotextile fabric was used in the AOC excavations to control fines migration between the coarse stone material placed beneath the water table and the finer-grained on-Site soils placed on-top of the stone. The fabric was the same as the demarcation barrier geotextile; however, this change order was prepared to compensate the Contractor for the additional material utilized in the AOCs.
16	03/12/09	Similar to CO-14, this change was associated with the costs to renew the railroad insurance in accordance with the extended schedule for the construction contract.
17	03/26/09	Excavation, loading, and disposal of materials contaminated by unforeseen asbestos-containing materials (ACM) encountered in Zone 1. Specifically, this material had already been screened and was stockpiled in Zone 2.
18	03/26/09	Setup and preparation for the ACM removal activities in CO-17.

Change Order No.	Date Executed	Description/Reason for Change
19	04/07/09	The Developer of the DeLaval Site had previously installed a temporary fence along the north side of the Site. However, the City's Contractor utilized the fence to provide security along the north side of the site and had damaged it during the course of construction, particularly at the west end where a portion of the fence was removed to gain access to the Zone 4 & 5 waterfront work. The Developer submitted an invoice for the fencing to the City following review of the damage. The City decided that rather than pay the invoice directly, they preferred to issue a change order to the Contractor and have them pay the invoice since they were the ones that caused the damage.
20	04/07/09	Following the clearing of trees and vegetation along the southeast corner of the DeLaval Site, MetroNorth requested that the City have a temporary fence installed to control potential trespassers.
21	05/22/09	Disposal of soils impacted by both petroleum contamination and ACM in Zone 1, specifically the area between the bulkhead and the deadman where excavation was more difficult and production was slower.
22	05/22/09	Disposal of soils impacted by both petroleum contamination and ACM in Zone 1, specifically the area east of the bulkhead deadman. Also, included spot removals along shoreline in Zone 2 where some ACM-impacted material had been placed prior to discovery of the presence of ACM.
23	05/22/09	Setup and preparation for the ACM removal activities in Zone 1.
24	06/29/09	Setup and preparation for the ACM removal activities in Zone 2.
25	06/29/09	Modifications to the weep hole drainage system associated with the existing retaining wall along the east side of the DeLaval property. Specifically, this change order dealt with the additional costs associated with design modifications associated with final grade changes established by the Developer, such as an increased pipe diameter, longer pipe runs, etc.
26	06/29/09	Based upon the Site grades established by the Developer in the southeast corner of the DeLaval property, erosion control blankets (ECBs) were required to provide slope stabilization for slopes of 33 percent and greater until vegetation could be established.
31	02/24/10	Modifications to the concrete anchor blocks (deadman) required to help support the southern end of the Zone 1 bulkhead. The modifications were prepared based upon actual field conditions encountered at the location of each block.

In addition to the executed change orders, a total of eight (8) Work Change Directives (WCDs) were issued during the course of the construction. WCDs were issued to provide a modification to the original Contract documents in writing or provide clarification to the Contractor in absence of a

Request of Information (RFI). The WCDs are summarized in the table below and copies of each have been included in Appendix G.

Table 4-2. Summary of Work Change Directives

WCD No.	Date Issued	Associated Change Order(s)	Description/Reason for Change
01	05/23/08	None	Revised coordinates of AOC-2/3, specifically the corners of the future building pad, to accommodate changes made by the Developer of the Site.
02	09/12/08	31	Due to depth to bedrock at the south end of the Zone 1 bulkhead, a steel sheet pile deadman was not possible, and therefore, SWC was required to install an alternative concrete anchor block deadman in this area.
03	09/16/08	None	Revised coordinates of AOC-2/3, specifically the corners of the future building pad, to accommodate changes made by the Developer of the Site.
04	12/15/08	25	Revised weep hole drainage system along MTA retaining wall due to grading changes made by the Developer for the Site.
05	05/06/09	None	The inverts of the weep hole drainage system manholes was modified to accommodate the Contractor's use of Z-Lok rubber boots casted into the concrete.
06	05/18/09	22 & 24	The Contractor was directed as to which areas in Zone 2 required removal of the material potentially containing ACM.
07	06/23/09	21, 22, & 23	The Contractor was directed as to which areas in Zone 1 required removal of the material potentially containing ACM.
08	07/31/09	26	The Contractor was provided direction for grading and installing a geogrid demarcation barrier in the southeast corner of the Site due to steep slopes resulting from a collapse of an old brick retaining wall.

Finally, the Contractor submitted a number of written RFIs during the course of the project. The Engineer then provided written response to the RFIs, at which point the written clarifications became part of the contractual requirements for the project. Copies of all RFIs responded to by the Engineer for the project are included in Appendix H. RFI Nos. 4, 40, 41, 42, 45 & 48 were never received by the Engineer, and therefore, no responses were provided or included in the appendix. The Engineer inquired on the status of these missing RFIs with the Contractor, but never received any response.

CHA also notes that responses to RFI Nos. 5 & 22 were never issued to the Contractor, as described further below:

- **RFI No. 5:** The Contractor was attempting to schedule a site visit the week of January 28, 2008 to review the riprap and stone products with the Engineer at the Tilcon New York, Inc. (Tilcon) Clinton Point Quarry. Since this meeting was conducted as requested, there was no formal response required.

- **RFI No. 22:** The Contractor requested the Engineer to provide a sketch of the slope reconstruction for the bedrock outcropping near the northeast corner of the Site. Since a resolution was not made with respect to installing or not installing the soil cover system in this area of the Site prior to the Contractor's demobilization from the Site and subsequent termination by the City, no formal response was issued for this RFI.

4.1.2 Site-Specific Health & Safety Plan

The Contractor, SWC, was responsible for developing a Site-specific Health & Safety Plan (HASP) and implementing the HASP as part of their Contract. A copy of the Contractor's HASP document has been included in Appendix I. The Contractor and all subcontractors, the City of Poughkeepsie officials, NYSDEC officials, and Engineer all observed the requirements of this HASP during the implementation of the remedy.

Additionally, the Engineer prepared a Site-specific HASP for the installation of the monitoring well network that was installed between November 7 and November 16, 2011, which has been included in Appendix I. The Engineer was responsible for developing this HASP as the monitoring well network was installed through the Engineer's subcontracted drilling contractor as further described in Section 4.8.3 of the FER.

Finally, Village Construction also prepared their own HASP for the installation of subsurface utilities, Site grading activities, and the installation of the soil cover system. A copy of this HASP has also been included in Appendix I.

All remedial work performed under this Remedial Action was generally in compliance with governmental requirements, including Site and worker safety requirements mandated by the Federal

Occupational Safety & Health Administration (OSHA). The HASP was generally complied with for all remedial and invasive work performed at the Site.

4.1.3 Construction Quality Assurance Plan

A standalone Construction Quality Assurance Plan (CQAP) was not prepared for the DeLaval project because it was not required at the time the project was initiated. However, construction quality assurance requirements were stipulated for the Remedial Action tasks in the Contract Documents, namely the technical specifications for the project. The Contract Documents managed performance of the Remedial Action tasks through designed and documented QA/QC methodologies applied in the field and in the lab. In addition to construction oversight, the Contract Documents provided a detailed description of the observation and testing activities that were used to monitor construction quality and confirm that construction was in conformance with the remediation objectives and specifications. As previously indicated, a complete set of the Contract Documents (e.g. remedial action plans and specifications) has been included in Appendix C.

4.1.3.1 Design Engineer

CHA was retained by the City of Poughkeepsie to prepare the remedial design documents for the DeLaval Site and provide construction observation and Contract administration services during the construction phase of the project. While CHA was the overall design Engineer for the project, Ocean & Coastal Consultants, Inc. (OCC) was a subconsultant to CHA on this project and was responsible for the design of the steel sheet pile bulkheads and riprap revetment systems along the shoreline. Similarly, OCC was retained to provide construction observation and Contract administration phase services during the construction for the project.

CHA's QA/QC for the project included the following:

- Reviewing Contractor submittals for compliance with the Contract Documents
- Conducting progress review meetings to discuss deviations from the Contract and solutions to problems encountered at the Site
- Providing an on-Site representative overseeing the Contractor on a fulltime basis through August 2009

- Observing QA/QC testing in the field performed by the Contractor for substantial compliance with the Contract Documents

OCC's QA/QC for the project included the following:

- Reviewing Contractor submittals associated with the waterfront construction for compliance with the Contract Documents

- Providing an on-Site representative overseeing the Contractor on a fulltime basis during the installation of the bulkheads and riprap revetment (full time through January 2009 and periodically thereafter)

- Observing QA/QC testing in the field performed by the Contractor for substantial compliance with the Contract Documents

- Under water reviews of steel sheet pile bulkheads (e.g. weld and coating condition) and the riprap stone placement

- Coordinating the investigation of the bulkhead coating failure(s) on the steel sheet piles

4.1.3.2 Contractor

All on-Site remedial and Site preparation work, with the exception of the soil cover system was performed by the City of Poughkeepsie's Contractor, Stamford Wrecking Company (SWC), and their subcontractors. SWC performed QA/QC activities as outlined in the Contract Documents including providing the required information relative to shop drawing submittals, collection of documentation samples and submittal of the results, and collection and submittal of field testing results (e.g. in-place density testing of imported fill).

4.1.3.3 Quality Assurance Requirements & Testing

The project specifications and drawings, as provided in Appendix C, identify the quality assurance testing requirements established for the project. In addition, routine construction oversight by the Engineer, periodic progress meetings, and testing were utilized to provide quality assurance for the project. In further detail than previously described, the quality assurance activities included:

- Full-time oversight by CHA of Site activities between March 25, 2008 and August 28, 2009. Part-time oversight was then provided through March 8, 2010. Additionally, CHA provided limited oversight of the Developer's activities, including the installation of the soil cover

system. A final Site walkthrough was completed on January 17, 2012 following installation of soil cover system across the Site. While CHA had anticipated that this would be the final Site visit following the completion of the remedial action, an updated Site visit was required by the NYSDEC in a June 6, 2013 letter to the City given that nearly two years of time had lapsed between this final Site walkthrough and the filing of the Environmental Easement. Therefore, CHA completed another Site visit on November 7, 2013 to document the condition of the Site and the condition of the engineering controls.

- Full-time oversight was provided by OCC between June 4, 2008 and January 22, 2009. OCC's primary focus was to oversee the construction of the Zone 1 and Zone 3 bulkheads as well as the riprap revetment along the shoreline. Part-time oversight was then provided through December 2010 on an as-needed basis to oversee punch list work, with the primary focus being the coating repairs to the steel sheet piles.

- Engineering staff from the City of Poughkeepsie provided periodic oversight for the project, particularly in 2010 when activities were limited to the completion of punch list work (primarily the completion of the concrete anchor blocks installed at the south end of the Zone 1 bulkhead and bulkhead coating repairs) and progress was slow. Additionally, City personnel provided oversight of the Developer's activities relative to the subsurface utility installation and the installation of the soil cover system.

- Regularly scheduled progress meetings (typically once per week) were held on-Site between April 3, 2008 and January 12, 2010 to review progress, discuss upcoming work and schedule, Site logistics, issues or problems encountered, project modifications, etc. These meetings typically included the following types of individuals:

    - Contractor project manager and Site superintendent
    - Subcontractor foreman's and project managers as appropriate
    - CHA's project engineer and Site representative
    - OCC's project manager and Site representative
    - NYSDEC's project manager
    - City of Poughkeepsie's project manager/engineer

  Additional individuals, such as various vendors or representatives from MetroNorth, were brought into the weekly progress meetings on an as-needed basis. Copies of the meeting minutes from all progress meetings have been included in Appendix J. In addition to minutes from the progress meetings, a copy of the meeting minutes from the following meetings have been included in the appendix because they pertain to conversations with Contractor in regard to items associated with the bulkheads:

    - April 14, 2008 – Meeting with Engineer & Contractor to discuss the shop welding of the interlocks on the AZ-26 sheeting
    - January 22, 2009 – Meeting with Engineer, Contractor, City & NYSDEC to discuss a number of issues associated with the bulkheads

In addition to the oversight and progress meetings, the following list provides a summary of the major testing and sampling activities that were conducted to monitor the construction:

1. **Imported fill material** (excluding large stone such as riprap and toe protection stone):
    a. Preconstruction Qualification Testing:
        i. One (1) particle size analysis in accordance with the American Society of Testing & Materials (ASTM) ASTM D422 per source.

        ii. One (1) maximum density determination in accordance with ASTM D698 per source.

        iii. A certification from the borrow pit source indicating that material is virgin material from areas not having previously supported any known industrial, commercial, or agricultural use.

        iv. One (1) composite soil sample per every 5,000 cubic yards (CY) of material imported sampled for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyl's (PCBs), arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide. Soil was considered acceptable if all parameters detected were at levels below the recommended soil cleanup objective concentrations specified in NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) 4046.

    b. Field Quality Control Testing:
        i. In-place relative density testing was performed in accordance with the American Association of State Highway and Transportation Officials (AASHTO's) Method T238 (nuclear density method) at a rate of six (6) tests per acre per twelve (12)-inch vertical lift. The minimal acceptable density was 95 percent of the maximum dry density for the material.

2. **Soil Cover Layer:**
    a. Preconstruction Qualification Testing:
        i. Three (3) particle size analyses in accordance with ASTM D422 per source.

        ii. Three (3) maximum density determination in accordance with ASTM D698 per source

        iii. A certification from the borrow pit source indicating that material is virgin material from areas not having previously supported any known industrial, commercial, or agricultural use.

iv. One (1) composite soil sample per every 5,000 CY of material imported sampled for TCL VOCs, TCL SVOCs, pesticides, PCBs, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide. Soil was considered acceptable if all parameters detected were at levels below the recommended soil cleanup objective concentrations specified in NYSDEC's TAGM 4046.

b. Field Quality Control Testing:

i. In-place relative density testing was performed in accordance with the ASTM D6938 (nuclear density method) at a rate of nine (9) tests per acre per twelve (12)-inch vertical lift. The minimal acceptable density was 95 percent of the maximum dry density for the material.

3. **Topsoil:**

a. Preconstruction Qualification Testing:

i. Three (3) particle size analyses in accordance with ASTM D422 per source.

ii. Three (3) pH determination in accordance with ASTM D4972 per source.

iii. Three (3) tests for moisture, ash, and organic matter of peat and other organic soils in accordance with ASTM D2974 per source.

iv. A certification from the borrow pit source indicating that material is virgin material from areas not having previously supported any known industrial, commercial, or agricultural use.

v. One (1) composite soil sample per every 5,000 CY of material imported sampled for TCL VOCs, TCL SVOCs, pesticides, PCBs, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide. Soil was considered acceptable if all parameters detected were at levels below the recommended soil cleanup objective concentrations specified in NYSDEC's TAGM 4046.

b. Field Quality Control Testing:

i. One (1) test for particle size analysis (ASTM D422), pH (ASTM D4972), and moisture, ash, and organic content of peat and other organic soils (ASTM D2974) per every 1,000 cubic yards of topsoil imported.

4. **Confirmatory Soil Sampling:** Twelve (12) confirmatory soil samples, including samples from both the bottom and side walls of the excavations, were collected from each major AOC excavation to confirm the limits of the soil removal operation from each AOC. Fewer samples were collected from smaller AOCs, but typically included one (1) sample from each side wall of the excavation and at least one (1) sample from the bottom of the excavation.

The samples were submitted to a certified laboratory for analysis of TCL VOCs, TCL SVOCs, PCBs, TAL Metals, ignitability, pH, and reactivity (cyanide/sulfide).

5. **Demarcation Barrier:** Visual observation was conducted to ensure that the Contractor maintained the specified overlaps of the fabric during placement.

6. **Riprap:** The Engineer (OCC) visited Tilcon's Clinton Point Quarry in New Hamburg, New York to review and accept stone sizing prior to delivery to the Site. Visual observation was utilized to ensure continued use of properly sized stone, the use of a woven geotextile fabric beneath the stone, appropriate stone thickness, and the placement/interlocking of the stone. Additionally, the Engineer completed an underwater inspection August 2009 to examine the placement of stone beneath the low tide elevation in the river.

7. **Steel Sheet Piles:** In addition to shop drawing reviews and observation of the sheet pile driving observations, the following checks were conducted to check for conformity of the steel with the contract documents:

    a. Inspection of welded interlocks: Welding of the sheet pile interlocks to form a "double" sheet was not permitted per the Contract. However, since the Contractor had already welded the interlocks prior to informing the Engineer and in the Engineer's effort to reduce further delays in starting the bulkhead work per request of the City, the welding of interlocks was permitted with the following special inspections:

        i. Pre-driving inspections: The Engineer (OCC) visited the fabrication shop in West Greenwich, Rhode Island on May 7, 2008 and July 16, 2008 to examine the quality of the welds and complete magnetic particle inspection (MPI)/testing, a form of non-destructive testing (NDT), on approximately ten (10) percent of the welds.

        ii. Post-driving inspections: Following the installation of the bulkheads, the Engineer completed a visual inspection of the portion of the welds visible above the mud line and toe protection stone. The welds above the waterline were reviewed from a boat while those below the waterline were inspected with underwater divers between August 10 and 17, 2009.

    b. Plumbness checks: The Engineer (OCC) completed post-driving plumbness checks in several locations on each bulkhead to verify the maximum deviation from the longitudinal axis. While a few small sections of the Zone 1 bulkhead were in excess of the allowable ¼-inch per foot out of plumb, the Engineer was able to verify that this was not a structural concern by rechecking the design calculations. Since there were no structural concerns with the plumbness of the bulkhead, the City ultimately accepted the bulkheads as further described in Section 4.10 of this FER.

c. Numerous inspections of the bulkhead coating materials were performed in 2009 and 2010. Numerous defects in the coating materials were identified, as discussed later in this document. While substantial time was spent by the Contractor attempting to repair the coating material, the final coating did not meet the requirements of the Contract Documents, as described in Section 4.10 of this FER.

8. **Cast-in-Place Concrete:** Given the anticipated minimal need for cast-in-place concrete for the DeLaval project, no testing of the concrete was specified. However, since the concrete anchor blocks installed at the south end of the Zone 1 bulkhead were critical structural members for the support of the bulkhead, testing of the concrete for the anchor blocks was ultimately required. This testing included confirmation of air entrainment and slump in the field as well as 28-day compressive strength cylinder breaks.

The Contractor was responsible for completing and/or procuring testing services identified above, with the exception of the concrete testing which was performed by a City-procured testing laboratory. The Engineer was responsible for providing the Contractor with reminders for completing the testing and observing such testing. All results were submitted to the Engineer and have been appended to the FER as described further in subsequent sections of this document.

4.1.4 Soils/Materials Management Plan

Specification Section 02221 – Site Management Plan (SMP) included in Appendix C (also referred to as a Soils/Materials Management Plan (S/MMP)), provides the SMP that was required to be implemented as part of the Contract. The plan provided project requirements for:

- Project phasing
- Pre-excavation soil characterization sampling (for disposal purposes)
- Erosion and sediment controls
- Site access and work zones
- Implementation of a Community Air Monitoring Plan (CAMP)
- Loading and handling of Site soils for re-use and soils requiring offsite disposal
- Transportation and disposal of grossly-contaminated soils
- Construction wastewater management
- Confirmatory soil sampling following removal activities
- Site restoration

Detailed information relative to the project requirements are discussed in the referenced SMP. As discussed in subsequent sections of this FER, some issues were encountered with the implementation of the Site controls during the completion of the construction.

4.1.5 Storm-Water Pollution Prevention Plan

The erosion and sediment controls for all remedial construction were generally performed in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control and the Site-specific Storm Water Pollution Prevention Plan (SWPPP) dated September 2006 and included with Section 02271 – Temporary Soil Erosion and Water Pollution Control of the Contract Specifications (see Appendix C). CHA's construction observer performed daily inspections of the erosion and sediments controls (ESCs) at the Site when on-Site full time. The temporary ESCs employed at the Site during the implementation of the construction are discussed in Section 4.2.2.6 of the FER.

4.1.6 Community Air Monitoring Plan

The Community Air Monitoring Plan (CAMP) for the DeLaval project was included in Specification Section 02221 – Site Management Plan (Section 3.3.3 – Community Air Monitoring Plan) included in Appendix C. The CAMP included monitoring of both fugitive dust and organic vapors. While the details of the CAMP are included in the specification, the following list summarizes the major elements of the CAMP:

1. Fugitive Dust Control:

    a. Monitoring approach: Instruments placed upwind and downwind of the active work zones. In addition to the requirements of the CAMP as specified in the construction Contract, upwind monitoring became important during the project execution to confirm/deny the assertions by the Contractor that action level exceedances during construction were often attributable to upwind sources rather than the Contractor's activities.

    b. Instruments: The Contractor utilized DataRam dust monitors as manufactured by Thermo Scientific and HAZ-DUST Environmental Particulate Air Monitor EPAM-5000 monitors as manufactured by Environmental Devices Corporation to monitor dust levels during construction.

c. Action level: The primary action level utilized during construction was a concentration of 150 µg/m^3 integrated over a period of 15 minutes.

d. Response measures: Response measures typically included wetting of the Site with potable water obtained from a City-owned fire hydrant.

2. Organic Vapor Control:

a. Monitoring approach: Instruments were placed downwind of the work zones where intrusive activities were performed and within the exclusion zone when contaminated soils were being handled.

b. Instruments: All CAMP monitoring was performed using MiniRAE 2000's photoionization detectors (PIDs), as manufactured by RAE Systems and a Photovac PID as manufactured by Photovac, Inc. These instruments were also utilized to monitor VOC levels within the active work zones for health and safety purposes as well as to screen samples.

c. Action level: The primary action level utilized during intrusive activities was a downwind concentration in excess of 5 parts per million (ppm) above background levels for a 15-minute average.

d. Response measures: While there were very occasional elevated VOC levels during the course of the construction, the 15-minute average action level was not exceeded and most readings were below 2 ppm. Nevertheless, when nuisance odors were noted, response measures typically included the covering of stockpiles and the reduction in open excavation areas to minimize odor concerns.

As a result of the discovery of asbestos-containing materials in Zone 1 (see Section 4.3.2 for further details), daily air samples were collected during all asbestos removal work (e.g. removal of debris stockpiles, AOC-1 excavation activities, etc.) in addition to the CAMP requirements. The air samples were collected using high flow sampling pumps and phase contrast microscopy (PCM) filter cassettes. All samples were analyzed using National Institute for Occupational Safety and Health (NIOSH) Method 7402. Daily samples were located based on the requirements of New York Code, Rules & Regulations (NYCRR) 56 (Code Rule 56) and the Site-specific variance approved for the project. The daily samples typically included a total of seven samples. The seven samples typically included one inside the work area, two barrier samples (less than 10 feet from the regulated area), two samples at the personal and waste decontamination units and two ambient samples (greater than 10 feet from the regulated area).

4.1.7 Contractors Site Operations Plans & Submittals

With the exception of a Site-specific HASP, the Contractor had no written Site Operation Plans (SOPs) for this project. However, CHA and/or OCC reviewed all shop drawing plans and submittals for the project and confirmed that they were in compliance with the minimum requirements of the RDWP and the Contract Documents. All remedial documents were submitted to NYSDEC as appropriate and/or upon request. The NYSDEC forwarded any submittals and/or field data to the New York State Department of Health (NYSDOH) as they determined appropriate. The following table summarizes the submittals made by the Contractor and a copy of each accepted/approved submittal has been included in Appendix K:

Table 4-3. Summary of Submittals

CHA ID	Date Accepted	Specification/ Drawing No.	Description
14357-01	01/18/08	01700	Schedule of Values
14357-02	01/18/08	01700	Project Schedule (initial draft)
14357-03	01/18/08	02271	Silt Fence
14357-04	01/28/08	02721	Drainage Structures
14357-05	01/28/08	02614	High Density Polyethylene Pipe (HDPE) Pipe
14357-06	See Note 1	02272	Turbidity Curtain
14357-07A	04/03/08	05110	Bulkhead Steel Sheet Piling
14357-07B	07/01/08	W-26/W-27	Wale Shop Drawings
14357-07C	07/23/08	W-26/W-27	Additional Wale Shop Drawings
14357-07D	10/21/08	N/A	Patching of Lifting Eye Holes in Sheet Piles
14357-07E	05/27/09	N/A	Precast Concrete Filler Beam Concrete Mix
14357-07F	05/27/09	N/A	Precast Concrete Filler Beam Repair Procedure
14357-08	04/03/08	09905	Bulkhead Protective Coating
14357-09	04/03/08	09910	Bulkhead Waterstop
14357-10	02/12/08	02241	Geotextile Fabric – Shoreline Work
14357-11	01/31/08	02240	Geotextile Fabric – Demarcation Barrier
14357-12	01/31/08	02221	Decontamination Pad
14357-13	See Note 2	02241	Geotextile Fabric Sample – Shoreline Work
14357-14	02/08/08	02240	Geotextile Fabric Sample – Demarcation Barrier
14357-15	02/13/08	01320	Schedule of Submittals
14357-16	02/08/08	02612	Polyvinyl Chloride (PVC) Pipe
14357-17	See Note 1	02221	Contractor Health and Safety Plan
14357-18	03/06/08	02270	Riprap Revetment Bedding Stone
14357-19A	04/04/08	02270	Riprap Revetment Armor Stone
14357-19B	04/04/08	02270	Riprap Revetment Toe Stone
14357-20	05/06/09	02271	Drainage Structures (Final)
14357-21	See Note 1	N/A	Railroad Insurance and Permit Information

CHA ID	Date Accepted	Specification/ Drawing No.	Description
14357-22	05/09/08	EV-15	Backflow Preventers for New Outfalls
14357-23	See Note 1	02672	Monitoring Well Abandonment Documentation
14357-24	05/19/08	09905	Alternative Epoxy Coating for Bulkheads
14357-25	See Note 1	02270	Underwater Slope for Riprap Revetment Zones
14357-26	05/30/08	N/A	54" Outfall and Headwall Replacement
14357-27	See Note 3	02208	Soil Cover Layer
14357-28	06/10/08	02611	Reinforced Concrete Pipe
14357-29	See Note 4	02221	Management Procedures for Free Product
14357-30	See Note 5	02221	Disposal Facilities for Contaminated Soil
14357-31	See Note 1	02222	Pipe Bedding Stone
14357-32	10/08/08	03300	Cast-In-Place Concrete
14357-33	See Note 1	02270	Bulkhead Toe Protection Stone Placement
14357-34	12/19/08	02221	AOC Excavation Procedures
14357-35	11/24/08	01570	Off-site Haul Routes for Trucks
14357-36	11/24/08	02221	Preliminary Part 364 Permits for Trucking
14357-37	11/24/08	02220	Compaction Equipment for Fill Placement
14357-38	See Note 4	02721	Concrete Manhole Riser Masonry Blocks
14357-39	Varies	02221	Disposal Facilities (preliminary only)
14357-40	See Note 1	02270	Bulkhead Toe Protection Stone Placement
14357-41	12/19/08	02220	Imported Clean Fill – Item 4
14357-42	Varies	02221	ACM/PCS Disposal Procedures & Facilities
14357-43	04/14/09	02900	Live States (Zone 5 Revetment)
14357-44	05/29/09	02930	Seeding (Zone 1, Southeast Slope)
14357-45	06/24/09	Varies	Weep Hole Drainage System (excludes manholes)
14357-46	See Note 1	02221	Disposal of Oil-Soaked Booms
14357-47	See Note 1	N/A	Procedures for toe protection stone in Zone 1 and proximity of excavator to the bulkhead
14357-48	07/31/09	02271	Erosion Control Blankets (Southeast Slope)
14357-49	08/05/09	05110	Threaded Bars for Concrete Anchor Blocks (CABs)
14357-50	07/31/09	02721	Drainage Manhole Castings
14357-51	09/29/09	02920	Topsoil for Southeast Slope Soil Cover Layer
14357-52	10/26/09	09905	Preliminary Coating Repairs Below +2.0' NAVD 88
14357-53	09/29/09	N/A	Precast Concrete Manhole Riser – 54" Outfall
14357-54	10/20/09	N/A	Threaded Rod – CAB Rock Anchors
14357-55A	11/02/09	N/A	Patching CABs – Five Star Product (not used)
14357-55B	11/06/09	N/A	Patching CABs – Speed Crete Product
14357-56	See Note 1	N/A	Use of Fox FX-764 Product for Leaking Interlocks
14357-57	02/04/10	N/A	Revised Procedures for CAB Rock Anchor Install
14357-58	See Note 1	02221	Waste Oil Drum Waste Profile
14357-59	See Note 6	N/A	Precast Concrete Cap Repairs for Bulkheads

CHA ID	Date Accepted	Specification/ Drawing No.	Description
14357-60A	04/09/10	N/A	Bulkhead Coating Repairs – Repairs Above Elevation +2.0' NAVD 88
14357-60B	04/21/10	N/A	Bulkhead Coating Repairs – Repairs Below Elevation +2.0' NAVD 88 (map cracking only)
14357-60C	06/16/10	N/A	Bulkhead Coating Repairs – Repairs Below Elevation +2.0' NAVD 88 (mechanical damage)

Notes:

1. *This submittal was considered an information submittal that did not require formal acceptance by the Engineer.*
2. *This submittal was not accepted as the Contractor provided a sample of a different material than the literature previously submitted and accepted by the Engineer. The Contractor never resubmitted the correct material sample, but this was not a significant concern given that the Contractor had selected the specified material and the Engineer was already familiar with the product.*
3. *The Contractor made a number of preliminary submittals for the soil cover material (namely particle size analysis); however, a complete submittal was never received from the Contractor or accepted.*
4. *This submittal was never accepted by the Engineer.*
5. *This submittal provided preliminary information only, but was not accepted by the Engineer.*
6. *The cap repairs were not structural in nature and primary concern was aesthetics. Thus this submittal was accepted by the City of Poughkeepsie rather than the Engineer.*

4.1.8 Community Participation Plan

CHA prepared a Citizen Participation Plan (CPP) in November 2004 for the DeLaval remediation project. The primary form of public participation for the project was a public meeting held on February 17, 2005 at City Hall to discuss the results of the Site investigations and the Proposed Remedial Action Plan (PRAP), as well as provide an opportunity for the public to ask questions and raise concerns. The public comment period extended to March 18, 2005 to provide additional time for concerned residents and/or organizations to comment on the remedy. Responses to all questions and comments were provided in Appendix A – Responsiveness Summary of the final Record of Decision (ROD), dated March 2005.

While not originally included in the CPP, another public meeting was held on March 17, 2008 to provide an update to the community on the pending start of construction at the Site. While the meeting provided a summary of the overall project and elements of the remedy, the presentation also provided another opportunity for the public to ask questions. The major areas of public concerned addressed during this meeting, included:

- Truck traffic/haul routes
- Tracking onto public roadways
- Dust, vapor and odor controls
- Noise control
- Safety precautions
- Temporary unsightliness issues for new residents immediately east of the Site

Additionally, the NYSDEC coordinated a press event at the Site on July 25, 2008.

4.2 REMEDIAL PROGRAM ELEMENTS

4.2.1 Project Preparation

4.2.1.1 Preconstruction Meeting

Prior to the commencement of the construction, a series of two preconstruction meetings were held. Representatives from the City of Poughkeepsie, CHA, OCC, SWC and the NYSDEC were invited to both meetings. The first meeting was held on December 20, 2007 at the City Engineer's office located in the City of Poughkeepsie, New York, following signing of an Agreement and execution of the Contract. The primary purpose of this meeting was to identify key individuals that would be involved with the construction activities and to discuss the construction schedule and work sequencing, labor and equal opportunity requirements of the project, a schedule for holding progress meetings, submittal requirements, payment application requirements, Contract changes, etc.

Since the Contractor did not begin mobilization until March 2008, a second preconstruction meeting was held on February 29, 2008 for the Contractor to provide an update on the project schedule and review current concerns and logistical issues.

4.2.1.2 Approvals and Permits

Documentation of agency approvals required by the Remedial Design is included in Appendix L. Specifically, the Remedial Design documents (plans and specifications) were approved by the NYSDEC on July 31, 2007. Minor edits were made per NYSDEC comments and the Construction

Documents were released for bidding on August 8, 2007. The following permits were required for the project:

- United States Army Corps of Engineers (USACOE) Permit for shoreline work (e.g. bulkhead and revetment installation). Application No. 2006-387-WSC was approved by the USACOE on December 27, 2007 under Department of Army Nationwide General Permit No. 38. A two (2)-year extension to this permit was granted on February 22, 2010.

- NYSDEC Permit No. 3-1313-00109/00003 was granted on July 25, 2007 for the shoreline work, including the installation of the steel sheet pile bulkheads down-gradient of the primary AOC excavations in Zones 1 and 3 and the installation of riprap revetment in Zones 2, 4 and 5.

- MTA Metro-North Railroad (Agency of the Metropolitan Transportation Authority) Access Permit No. M-C-416 for access a small strip of land along the eastern side of the Site to clear and grub an area adjacent to the railroad tracks, complete grading activities in the southeast corner of the Site, install the soil cover system on a portion of the MTA property (i.e. areas where the Site boundary is actually west of the existing retaining wall, but capping up to the wall was preferable to maintain positive drainage), and to install a weep hole drainage system that will convey stormwater collected from the weeps holes to a closed drainage system since fill placement against the retaining wall for the installation of the soil cover system would bury some of these outlets.

Additionally, all SEQRA requirements and all substantive compliance requirements for attainment of applicable natural resource or other permits were achieved during this Remedial Action.

4.2.1.3 Utility Clearance

Prior to the start of construction activities on the Site, the Contractor contacted Dig Safely New York (1-800-962-7962) to obtain a mark out of public utilities at the Site. Additionally, the City of Poughkeepsie provided the Contractor information on utilities associated with the City-owned pump stations (one along the east side of the Site and one north of the Site in Zone 4) and the sewer outfalls. Other than the utilities near the pump stations and the outfalls, no other in-use or "active" utilities were present on the Site at the time the construction commenced. Several underground utilities and pipelines were encountered during the excavation of the AOCs; however, these utilities were abandoned and were not marked as part of the utility clearance because no record drawings documenting their existence and/or location was made available at the time of construction.

4.2.1.4 Mobilization

The Contractor began mobilization of equipment to the Site in mid-March 2008. At that time, the primary equipment mobilized to the Site included a hydraulic excavator that was being used to clear and grub the Site surface. Job trailers, additional excavators, a dump truck and other small equipment were mobilized in April 2008 as Site activity levels began to increase. However, mobilization and demobilization of equipment was on-going throughout the duration of the project due to the budgeting and/or scheduling by the Contractor.

Two of the large pieces of equipment mobilized to the Site as part of the construction included a crawler-type crane that was utilized to lift the pneumatic hammer and drive the steel sheet piles for the bulkhead installations and a Komatsu 1250 hydraulic excavator equipped with a seven (7) cubic yard bucket utilized for the mass soil removals in AOC-1 and AOC-2/3. Both machines were delivered to the Site in sections and then assembled on-Site using a small mobile crane.

4.2.2 General Site Controls & Site Preparation

4.2.2.1 Jobsite Record Keeping

While detailed project records were maintained by the Engineer, long-term jobsite record keeping was generally kept to a minimum to reduce the potential loss of information and/or data. Rather, most files were stored at the Engineer's offices and scanned for electronic storage in a Portable Document Format (PDF). The types of records kept on-Site, typically included the following:

- A set of the Contract Documents, including both the plans and specifications.
- Copies of approved shop drawings.
- Health and Safety Plan along with copies of Site personnel 40-Hour HAZWOPER training certificates and current 8-hour refresher certificates.
- A daily sign-in/sign-out log for visitors.
- A set of plans and sketches marked up with field derived information (e.g. the location of underground pipelines).
- Copies of field notes (e.g. field survey notes) and daily observation reports.

- Air monitoring data (dust and organic vapor).
- Trip tickets for materials imported to the Site and shipped off-site.
- Recent daily observation reports and digital photographs.
- Field measurements and notes (e.g. survey data).

4.2.2.2 Site Security

Site security was provided by a number of means, including the following:

- **North Side:** Chain link fencing and an existing swing gate were present at the commencement of the construction near the north end of the Site. While the northernmost end of the Site was not secured, a gravel parking lot and soil cover system had already been installed at the far north end by the Developer of the Site and no further activities were planned in this area as part of the construction.

  The existing swing gate at the Site entrance provided little deterrence for pedestrians, so the Contractor attached sections of chain link fencing to the existing swing gate in lieu of replacing the gate in its entirety as required by the Contract Documents. To provide access to Zones 4 and 5, the Contractor replaced a portion of the chain link fencing near the northwest corner of the Site with temporary orange construction and concrete jersey barriers that could be moved routinely to facilitate the movement of equipment and materials to and from this area. Signs indicating "Do Not Enter" and "No Trespassing" were attached to the fencing system along the north end of the Site. Routine maintenance of the fencing system along the north end of the Site was required throughout the duration of the construction, although the Contractor was not always quick to make the required repairs and often needed to be reminded several times to address concerns identified by the Engineer.

- **East Side:** Most of the eastern side of the Site is bordered by a Metro-North/MTA concrete retaining wall that provides a significant grade change between the Site and the railroad tracks. Therefore, the need for additional security measures along the east side of the Site was limited to a tunnel that crossed under the railroad tracks near the middle of the Site and the southeast corner of the Site. Fencing and swing gates had already been installed across the tunnel opening by the developer of the residential housing east of the Site at the time construction commenced. As a result, it was only necessary to install a padlock to secure this access point to the Site. The existing fencing in the southeast corner of the Site was left in place for the first year of construction. Following the clearing of this area, temporary orange construction fencing was installed along the Site boundary to provide a limited deterrent to pedestrians attempting to enter the Site.

- **South Side:** Two rows of chain link fencing were present along the south side of the Site at the commencement of the construction. The northernmost fence line was dilapidated and

removed during the Site clearing activities. The southernmost fence line was owned and maintained by Love/Effron, the property owner to the south of the Site. During the course of the construction, Love/Effron replaced this fence with a new chain link fencing system. Given that the Zone 1 bulkhead was not extended to the southern property line of the Site as initially anticipated, the temporary construction easement onto the Love/Effron property south of the Site was not utilized and the Contractor was not required to install any temporary fencing in this area.

- **West Side:** The west side of the Site is bordered by the Hudson River. Since there was no apparent attraction to the Site from boaters on the River, and given the planned shoreline work, it was determined that no fencing needed to be installed along the west side of the Site. However, in lieu of fencing, the Contractor was required to install "No Trespassing" signs along the waterfront at a spacing of 250 lineal feet. The signs along the waterfront were not installed until after the completion of the shoreline work due to the conflict between the signs and the movement of heavy equipment required to complete the shoreline work. These signs were not well maintained by the Contractor and were only present along the shoreline for a short period of time.

4.2.2.3 Project Sign

A NYSDEC approved project sign was erected at the project entrance in July 2004 following the execution of the SAC agreement and the commencement of the supplemental investigation in July 2004. The sign was installed near the northeast corner of the Site facing both Pine Street and Rinaldi Boulevard. The bracing and supports to the sign were repaired several times during the course of the project; however, the sign remained in place during all phases of the Remedial Action. By the conclusion of the Remedial Action, most of credits and personnel listed on the project sign were outdated due to changes in administration and other personnel at both the State and City level; however, updating the project sign to reflect these changes in administration was not required as part of the construction Contract.

4.2.2.4 Site Clearing & Grubbing

Site clearing and grubbing began in mid-March 2008 and continued in to early April 2008. The Contractor used a hydraulic excavator to first knock the trees to the ground and then to also remove the stumps. Initially, the trees and stumps were stockpiled on-Site for several months. SWC eventually made arrangements for a subcontractor to chip much of trees and dispose some of the wood chips and all of the stumps off-site. It should be noted that the southeast corner of the Site was not cleared until late April 2009. This area was not cleared during the initial clearing and grubbing

activities due the Contractor's difficulty in procuring a permit from MetroNorth in a timely fashion as well as some on-going grading discussions with the Developer of the Site that made the scope of grading in this area indeterminate until mid-2009 following the clearing of the area and review with MetroNorth officials.

Prior to commencing with off-site disposal of the timber waste, the Contractor used some of the wood chips as a means to stabilize the Site surface as well as a corridor along the shoreline in Zones 4 & 5 north of the Site. The Engineer directed the Contractor to immediately stop this activity upon discovery as further described in Section 4.11.1 of the FER.

4.2.2.5 Monitoring Well Abandonment

The existing monitoring well network was abandoned during the construction phase due to the proposed grade changes at the Site and conflicts with the Developer's work. Five (5) of the six (6) on-Site monitoring wells were abandoned in accordance with specification Section 02672 – Monitoring Well Abandonment (refer to Project Manual in Appendix C) and SWC submittal 14357-23 (refer to Appendix K) on March 20, 2008 by Land, Air, Water Environmental Services, Inc. (LAWES), New York State Registration No. NYRD01469. Specifically, LAWES reported that a majority of the wells were pulled and tremie grouted, but wells that could not be pulled were tremie grouted from the bottom to the surface with a neat cement/bentonite grout, cut three (3) feet below the existing surface, and capped with a 2-inch PVC dome cap solvent-welded onto the remaining well riser. A one (1) foot thick layer of grout and a one (1) foot thick layer of bentonite were then placed over the wells to provide additional sealing. The hydrated bentonite was then covered with on-Site soils.

It should be noted that the original monitoring well MW-2 was not abandoned by LAWES on March 20, 2008, as the Contractor claimed that they could not find the well. The Engineer suspected that the well riser and casing may have been damaged during the Site clearing activities, but could not confirm this during construction. The well remains were later discovered during the installation of the Zone 1 bulkhead anchor wall. The well screen was observed to be located in one of the "bellies" of the sheet piling. Most of the well, with the exception of a short section of the well screen, was

removed by SWC during excavations around the anchor wall. The remaining well screen was not considered a significant concern because it was in an overburden aquifer and the bottom of the screen was at the approximate depth of the bottom of the AOC-1 excavation (estimated to extend only approximately 2 to 3 feet into the groundwater table at a low tide).

4.2.2.6 Erosion & Sedimentation Controls

Erosion and sediments controls (ESCs) for this project were specified in the Contract Documents, including specification Section 02271 – Temporary Soil Erosion and Water Pollution, Contract Drawings EV-12 and EV-13, and the Stormwater Pollution Prevention Plan (SWPPP) prepared for the Site (refer to Appendix C). The major ESC elements of the remediation phase of the project included the following:

- Installation of silt fence along the waterfront following clearing of the Site. The silt fence had to be replaced in some areas due to the grade changes between existing elevations and proposed elevations along the waterfront. Final silt fencing was installed in all revetment zones to provide erosion and sediment control until the final Site surface is complete. However, in Zones 1 and 3, the bulkhead caps were elevated a minimum of one (1) foot above the subgrade surface and served as a physical barrier to the transport of sediment into the Hudson River prior to the redevelopment activities.

- Hay bales behind silt fence in some low points where discharge quantities were higher.

- A turbidity curtain was utilized during the excavation of the subgrade along the waterfront and during the installation of the bulkhead waterfront sheet piles and revetment (at least until the revetment was above the tide level and could be placed in dry conditions). The turbidity curtains included a floating boom structure with a geotextile fabric that was draped to the mud line/sediment beneath the boom. The curtain was then placed in front of the active work zone and anchor at a minimum of two points along the shoreline. The curtain was moved periodically as the work progressed.

- A tracking pad was installed near the Site entrance to reduce tracking of sediment and mud onto local roadways.

- As areas were backfilled and the Site grades were restored, the remediation Contractor seeded areas in attempt to stabilize the Site surface.

During the course of the remediation project, the Contractor experienced some problems with the erosion and sediment controls, as further described in Section 4.11.1 of the FER.

4.2.2.7 Decontamination Pad

A decontamination pad was constructed in April 2008 near the Site entrance to provide a place for decontaminating heavy equipment coming into contact with contaminated soils on-Site. The pad consisted of gravel surface underlain by polyethylene sheeting. A low point was formed in the center of the pad to direct all decon water to a precast concrete sump. As the sump filled with water, it was then manually pumped to a precast concrete manhole structure staged adjacent to the pad for temporary storage. Finally, a combination of precast concrete jersey barriers and tarps placed over span wires were utilized to create side shields on the pad to capture most of the overspray.

After allowing sufficient time for settlement of most of the solids within the wash water, the stored wash water was extracted from the temporary sump via a vacuum truck and then treated and an off-site facility by a SWC retained vendor, Environmental Products and Services (EPS) of Vermont. Section 4.3.5 describes the disposal details for the impacted water and free product disposed of off-site.

In addition to the equipment decontamination pad, a second smaller decontamination pad was built adjacent to the southwest face of the bedrock outcropping near the northeast corner of the Site (at the toe of the slope). This pad was used for the purpose of collecting the wash water from the decontamination of the 14-inch oil-covered pipelines and the 400-gallon UST removed from AOC-2/3. The collected wash water was then treated on-Site by pumping it through drums of activated carbon and then allowing it to discharge on-Site. A sample of the on-Site treated water was analyzed to confirm the efficiency of the treatment system and the results have been included in Appendix M.

As indicated in the Appendix, no VOCs, SVOCs or PCBs were detected and all metals were detected at concentrations below the NYSDEC's *Technical and Operational Guidance Series (TOGS) 1.1.1 of "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" for fresh (Class GA) Groundwater (1998).* After the discharge water quality was confirmed to be within allowable levels established by NYSDEC in TOGS 1.1.1, the treated water was discharged on-Site. To minimize the potential for erosion and scour, the Contractor excavated a small hole and discharged the treated water into the excavation to allow the water to percolate into the ground.

4.2.2.8 Soil Screening Results

In addition to visual and olfactory indicators of contamination, a handheld photoionization detector (PID) was utilized during the excavation of the AOCs to screen the Site soils. Based upon the screening processes, the upper soil layers (typically 4 to 6 feet) were able to be segregated and stockpiled for re-use as backfill. Soil screening was also conducted throughout project during other intrusive excavation activities at the Site. As a result, AOC-4A and AOC-5 were discovered during construction, as described in Section 1.3.2. Additionally, small areas of petroleum contaminated material were encountered in Zones 2 and 4 during the excavation to establish subgrade elevations for the shoreline revetment installation. The excavated material from these areas was also staged, characterized, and disposed of off-site. Screening in these areas also revealed that the limits of the impacted material were reached as the excavation extended eastward into the Site and away from the River.

4.2.2.9 Stockpiling Methods

To minimize the need for stockpiling on-Site, the Contractor was required to collect a series of pre-characterization soil samples and obtain authorization from disposal facilities prior to the commencement of the soil excavation activities. However, during construction, the AOC excavations were extended beneath the water table and some stockpiling was warranted to allow some gravity dewatering of the material prior to hauling it off-site for disposal. As required by the Contract, the Contractor setup temporary containment pads to stockpile the materials whenever materials were stockpiled outside areas requiring no further removal of impacted soil. This was done to minimize the potential for grossly-impacted soils to come into contact with soils that were remaining on-Site. To reduce the need to construct several temporary containment pads, the Contractor often stockpiled soils requiring offsite disposal on other impacted areas still requiring eventual excavation and offsite disposal.

When temporary containment pads were utilized, the containment pads were lined with 10-mil polyethylene sheeting and raised earthen berms were created along the sides to provide containment. The stockpiles were also covered with 10-mil polyethylene to limit volatilization and control odors.

In addition to the small soil containment pads, the Contractor constructed an approximately 50-foot by 100-foot lined containment pad in Zone 2 to temporarily stage, dewater, and characterize impacted sediment from the Hudson River that was encountered while the Contractor was excavating the subgrade for the Zone 2 revetment (and eventually Zone 4). This containment pad was lined with a 20-mil plastic liner 1 to 3-foot high soil berms along the sides. The Contractor positioned a truck entrance at the south end of the pad and sloped the containment pad to the north towards an evaporation pool. The Contractor had hoped that most of the water from the sediment would evaporate and water treatment could be avoided. However, with ongoing precipitation and limited evaporation, this approach was ineffective. As a result, the Contractor retained EPS to pump the water out from this pad using a vacuum truck and disposed of it off-site along with the water from the decontamination pad.

After the evaporative pool system proved unsuccessful, the Contractor later used this section of the containment pad for additional sediment storage. Additional materials were also staged on this pad during the course of the construction, including impacted sediments from Zone 4, other small "hot spots" soil excavations, and spill cleanups associated with the Contractor's maintenance of equipment and poor housekeeping.

Several other materials were stockpiled on-Site from time to time throughout the construction phase, including, but not limited to the following:

- Timber (trees, wood chips, and timber piles removed from the waterfront)
- Tires
- Crushed concrete
- Construction & demolition (C&D) debris from screening operation
- "Fines" stockpile consisting of finer-grained soils from screening operation
- Steel scrap from bulkhead construction
- Damaged turbidity curtain/boom
- Imported materials (e.g. riprap, crushed stone, topsoil, etc.)

Based upon the types of materials listed above and limited (or no) potential for VOC emissions, these types of stockpiles were not placed on lined containment pads or covered.

4.2.3 Nuisance Controls

4.2.3.1 Truck Wash and Egress Housekeeping

As described in Section 4.2.2.7, a decontamination pad was constructed in the vicinity of the Site entrance immediately adjacent to the access road. In addition to using the pad for decontaminating on-Site equipment, the pad was also used a truck wash on an as-needed basis. For majority of the construction work, the Contractor maintained truck traffic on "clean" access roadways or on imported fill already placed to minimize the potential for contact with impacted Site soils. Additionally, the Contractor attempted to keep trucks from becoming contaminated by keeping trucks from driving over the grossly-contaminated materials and using care when loading the trucks to avoid spillage on the sides of the trucks. Thus, truck washing was often not required for trucks/vehicles exiting the Site.

All trucks that were washed were cleaned using a gas-powered pressure washer, although a fire hose connected to a City hydrant was used occasionally as well, particularly during the early stages of construction. All wash water was collected on the decontamination pad and treated as previously described. During times when the ambient air temperatures were below freezing (32 degrees Fahrenheit), the Contractor used a propane torch to heat a 55-gallon drum of potable water to utilize for the pressure washer and keep the unit from freezing. In addition to the truck wash at the decontamination pad, the Contractor also installed a large "tracking pad" with 2-½" crushed stone near the Site entrance.

4.2.3.2 Dust Control

The primary form of dust control for the project was the use of potable water to wet roadways and portions of the Site. The Contractor applied water to the Site using an approximately 250-gallon tote container installed in the bed of a pickup truck. The water was dispersed through a PVC header pipe with several holes drilled in it and running the width of the truck. This method of applying water did not provide the best dispersion of the water and with such a small storage volume, the Contractor often struggled to keep up with the rate of evaporation, even after repeated complaints by the

Engineer and the NYSDEC that the dust control was insufficient, as discussed further in Section 4.11.1 of the FER.

Additionally, the Contractor wetted equipment and excavation faces during excavation activities and sprayed stockpiles with a fire hose when dumping imported materials onto the Site to further reduce dust. In 2009, some attempt was made to re-establish vegetation (e.g. grass) on the Site to reduce the amount of area requiring daily wetting for dust control. The Contractor also attempted to enforce a speed limit at the Site, although new drivers at the Site had to be continuously warned by the Contractor not to exceed 10 miles per hour.

4.2.3.3 Odor Control

No chemical/foam odor suppressants were used during the construction. Rather, simple engineering controls were used when strong odors emanating from excavation areas were noted, such as reducing the size of the open, active excavation area, reducing the rate of excavation and material transfer, etc. While strong petroleum odors were sometimes identifiable in close proximity to the AOC excavations, odors downwind and/or off-site were noted only a few times and were addressed with engineering controls as described. The Engineer was made aware of only one complaint of odors during the construction, which was from the owner of the Shadows restaurant adjacent to the north end of the Site. Again, measures (e.g. covering of stockpiles and reducing the working face in the AOC excavations) were immediately taken to try to reduce odors on that day to address the neighbor's concerns.

4.2.3.4 Noise Levels

In February 2008, the NYSDEC raised concern over potential noise levels during construction given the proximity of the new residential development, Hudson Pointe, located east of the Site. During the public meeting on March 17, 2008, a few residents also voiced their concerns over potential noise levels during construction, particularly the proposed vibratory driving of the steel sheet piles for the bulkheads. While residents understood there would be normal noise associated with construction equipment, they were primarily concerned about working hours and the bulkhead installation. To address concerns regarding noise, the Contract restricted working hours from 7:00

AM to 7:00 PM Monday through Friday and from 8:00 AM to 5:00 PM on Saturday per the Contract. Exceptions are discussed in Section 4.11.1 of the FER.

As for the noise associated with the installation of the bulkheads, concern was expressed about the noise levels potentially generated by the sheet pile driving equipment. While the Contractor had proposed a somewhat quieter vibratory hammer as opposed to an impact hammer, the Engineer completed a noise survey during the initial startup phase of the bulkhead installation (June 14 to June 17, 2008) to monitor actual noise levels. The Engineer measured the average noise level immediately adjacent to the pile driving hammer to be approximately 85 to 90 decibels. However, noise levels dropped to approximately 75 decibels along the eastern Site boundary and adjacent to the concrete retaining wall. For comparison purposes, the Engineer also measured the noise levels emanating from the Amtrak passenger trains passing along the tracks east of the Site throughout the day and night. Standing at the bottom of the retaining wall on the DeLaval Site, the Engineer measured that the noise level from the trains to be approximately 98 decibels. Since the trains were closer to the residential development and producing significantly more noise than the vibratory pile driving hammer, noise monitoring ceased after four days of monitoring.

4.2.3.5 Truck Routing

The primary truck route to the Site was US Route 9 to Rinaldi Boulevard and then to the Site entrance at the south end of Rinaldi Boulevard. The Contractor was repeatedly reminded during construction that no truck traffic was permitted on Pine Street. While most drivers who made repeated trips to the Site were aware of the approved truck routes, first time drivers to the Site often had to be instructed on the roadway restrictions.

Truck routing on-Site was mostly along the access road running north-south along the Site. The road was temporarily removed for a couple of weeks during the AOC-2/3 excavation to remove the material beneath the roadway, but was later restored as the AOC-2/3 excavation was backfilled.

Internal truck routing was difficult at the Site given the long, slender shape of the property and limited room for stockpiling equipment and materials. However, it was made more difficult by the

Contractor's sequencing of events and delays with disposing materials off-site properly and removing unused equipment/machinery.

4.2.3.6 Response to Complaints

The greatest number of complaints received by the City during the course of the Remedial Action (RA) construction came from the residents in the Hudson Pointe townhouses located east of the Site, particularly from January to March 2009 during the excavations activities associated with AOC-2/3. Most of these complaints were relative to construction equipment operating too early in the morning, as the Contractor had attempted to start prior to 5:00 AM to load trucks with contaminated soils and give the truckers sufficient time to make two trips to the disposal facility before the disposal facilities closed for the day. While most residents complained about the noise from the engines and backup alarms on the heavy equipment, at least one resident complained that the Contractor was shining lights into their townhouse unit. Due to the number of complaints received by the City, the City required the Contractor to resume the 7:00 AM start time specified in the Contract.

In addition to the noise complaints, the owner of the Shadows restaurant located immediately north of the Site contacted the City on two or three occasions to complain of dust levels visible at the Site and at least once to complain of odors in March 2009 while AOC-2/3 was being excavated. Additional water was applied to the Site surface to attempt to address the dust issues. As previously discussed, odors were addressed by the covering of stockpiles and reducing the area of the soil excavation working face, as previously described.

Finally, the only complaint referred from the City to the Engineer was from a resident in Hudson Pointe, on May 12, 2008, prior to the start of significant intrusive work. The individual expressed concerns about the potential exposure to airborne contamination during the upcoming intrusive activities. The Engineer explained the elements of the project CAMP and explained some of the contingencies that would be enacted if the action levels in the CAMP were reached. The Engineer made an effort to answer all of this person's questions and left contact information should the individual have further questions.

4.2.4 CAMP Results

As previously indicated, a CAMP was implemented throughout the intrusive Site activities at the Site. During construction activities, the air monitoring readings were made available for review by both the NYSDEC and NYSDOH. The CAMP included monitoring of both fugitive dust and organic vapors. Air monitoring was conducted both upwind and downwind of the construction areas and compared to assess if the construction activities were causing potential airborne migration of contaminants. Continuous monitoring was generally performed for all ground intrusive activities, such as soil excavation and handling, and test pitting or trenching.

4.2.4.1 Contractor CAMP Results

Copies of all field data sheets, logs, and sketches relating to the CAMP are provided in electronic format in Appendix N. Air monitoring was conducted from April 29, 2008 after much of the Site surface had been disturbed and continued through December 17, 2009, at which time the ground was starting to freeze and some of the Site was covered with snow. During the early period of construction, only dust was monitored for because excavation of the PCS soils had not yet commenced. Prior to the AOC excavation activities, VOCs were monitored periodically with a PID in the immediate work zone for the following purposes:

- September to October 2008: Provide soil screen and worker protection air monitoring during the excavation of test pits to collect waste characterization soil samples.
- November 2008: To provide monitoring of the oil cleanup activities associated with the 14-inch diameter oil pipelines present in AOC-2/3.

VOCs were also monitored by the Contractor from January 2009 to July 2009 at the downwind perimeter of the immediate work areas (i.e. the exclusion zone) associated with the AOC excavations on a continuous basis or as otherwise specified when the potential for VOC emissions existed. While some of the organic vapor monitoring data is missing (namely the data for the AOC-2/3 excavation from January 5 to January 9, 2009), no significant exceedances were recorded and only occasional nuisance odors were noted 100 feet or more away from the work zone during the intrusive activities.

The Contractor did not conduct any air monitoring in 2010; however most of the work completed in 2010 was limited to coating repairs on the bulkheads. The other primary activity was the completion of the concrete anchor blocks used for support of the southern end of the Zone 1 bulkhead. However, this work entailed drilling rock through water and grouting in anchor rods, which had little potential for generating dust.

Based upon the data provided by the Contractor, there were a fair number of action level exceedances during the construction, particularly relative to the dust monitoring. While observable levels of dust were noted on occasion, the dust data does indicate that the exceedances were somewhat frequent. While there were some elevated VOCs readings periodically, these occurrences typically occurred for less than two minutes and were not sustained over the 15-minute period included in the action level. Overall, the Contractor experienced a number of issues with implementation of the CAMP as discussed in Section 4.11.1 of the FER. Issues raised by the Engineer and the NYSDEC with respect air monitoring protocol were addressed with the Contractor numerous times at progress meetings and through e-mail notifications.

4.2.4.2 Developer CAMP Results

Since the developer commenced activities following the completion of the AOC excavations and the only intrusive activity proposed by the Developer was the excavation of relatively small trenches for the installation of subsurface utilities, the Developer's contractor was permitted to monitor for dust only. However, NYSDEC required that the Developer's contractor maintain a PID on-Site during all trenching activities and be prepared to immediately screen soils and implement a CAMP with VOC monitoring, should any stained soils or strong odors be encountered with the excavation activities.

No stained soils or strong odors were encountered by the Developer's contractor during their activities, and therefore, only dust monitoring was required. The results are included in Sub-Appendix COP-H of the City's report included in Appendix D of the FER. As opposed to the raw data provided by the City's Contractor, the Developer's contractor provided the results in graphical format. As indicated in the graphs, the Developer's contractor did have some occasional exceedances of the dust action levels during the course of their construction; however these

exceedances were relatively short in duration and were addressed by applying additional water to the Site and reducing vehicle speeds. While the Developer's contractor was able to control their own vehicle speeds, the issue with excessive vehicle speeds creating dust was typically associated with various trucking companies delivery imported fill to the Site and MetroNorth officials. Dust monitoring was terminated after December 30, 2011 after all Site soils were cover by the soil cover system; however, visual monitoring for dust and dust suppression measures (as needed) continued into 2012 until the final Site walkthrough was conducted by the City, CHA and the NYSDEC on January 17, 2012.

4.2.4.3 ACM Air Monitoring Results

In addition to the air monitoring set forth under the CAMP, daily air samples were collected during all asbestos removal work (e.g. removal of debris stockpiles, AOC-1 excavation activities, etc.), as previously described. The daily samples typically included a total of seven samples, as previously described in Section 4.1.6.

Daily asbestos air samples were collected on forty-one (41) days between May 8, 2009 and July 10, 2009. The daily air sample results were compared to the regulatory limit of < 0.01 fibers per cubic centimeter (f/cc). With the exception of one sample all sample results were less than the regulatory limit of 0.01 f/cc. The single sample that had an elevated result of 0.013 f/cc was collected on June 9, 2009 at the waste decontamination unit door. The sample at the same location on the following day was below the detection limit (<0.002 f/cc). The asbestos air sample results confirmed that there was no offsite migration of fibers resulting from the asbestos abatement work completed at the Site. Asbestos air monitoring/project monitor results and associated daily reports are included in Appendix O.

4.2.5 Reporting

CHA and OCC completed daily observation reports for the DeLaval project for each day spent on-Site during the course of the construction. No monthly reports were required or completed for this project. All daily reports are included in electronic format in Appendix P. The digital photograph log required by the RDWP is included in electronic format in Appendix Q. However, this

photograph log only includes photographs representative of the Contractor's work. Photographs associated with the subsurface utility work and the installation of the soil cover system by the Developer have been included with the report provided by the City in Appendix D, specifically, Sub-Appendix COP-A of the City's documentation.

During the first approximately two years of construction, field observation reports and progress photographs were submitted to the NYSDEC and the City of Poughkeepsie on a monthly basis. Given the significant reduction in activity at the Site during 2010, less frequent submittals were made to the NYSDEC thereafter.

Following the completion of all construction activities by the Contractor (excludes final coating repairs to the bulkheads and the placement of the soil cover system), the Developer retained Village Construction Company, Inc. (VCCI) to commence with the installation of subsurface utilities and grading activities. During the installation of the subsurface utilities and grading activities, the City Engineer and/or assistant City engineering staff made routine visits to the Site to observe progress and implementation of Site controls. During the installation of the utilities, the City focused on ensuring that the Contractor was lining utility trenches with a demarcation barrier and backfilling the trenches with imported material. The City's observation reports and representative photographs have been included in Appendix D. More specifically, the City's observation reports are included in Sub-Appendix COP-G of the City-provided documentation and the photographic log has been included in Sub-Appendix COP-A.

During the installation of the soil cover system, the City made periodic visits to the Site to observe progress of the construction and take photographs of the activities to document that appropriate soil cover layer materials were being used. The City also coordinated with the Contractor to ensure that the environmental sampling was being performed on imported soil materials as appropriate (e.g. topsoil & Item 4 run-of-crush). No environmental sampling was performed on crushed stone materials with little to no fines (e.g. ¾-inch crushed stone, riprap materials, etc.).

4.3 CONTAMINATED MATERIALS REMOVAL

As indicated in Section 2.2 of this FER, the ROD called for removal of grossly-contaminated soils. While no specific soil cleanup objective (SCO) concentrations were established for this project, the goal was two remove source areas or grossly-contaminated soils from the Site. It should be noted that grossly-contaminated soils, referred to throughout the document , are defined as soil, fill or debris, sediment, surface water, or groundwater which contains LNAPL/free product or mobile contamination that is identifiable either visually, through strong odors, by elevated vapor levels as indicated by field instrumentation, or is otherwise readily detectable without laboratory analysis.

As discussed in more detail in subsequent subsections of the FER, numerous other contaminated media were encountered during the construction that resulted in the disposal of additional material. Table 4-4 shows the total quantities of each category of material removed from the Site and the origin of the material.

Table 4-4. Summary of Materials Disposed From Site

Material	Origin	Quantity
Petroleum-Contaminated Soils (PCS)	AOC-1 AOC-2/3, 4A & 5, Revetment Areas	220.62 Tons 34,041.24 Tons
PCS with ACM	AOC-1	10,312.03 Tons
ACM-contaminated debris	AOC-1	7,668.38 Tons
Timber Piles	Waterfront	660.54 Tons
Petroleum-contaminated groundwater	AOC-2/3	29,602.4 Gallons
LNAPL/Free Product	AOC-2/3	1,443.6 Gallons
14-Inch Oil Pipeline	AOC-2/3	315 Lineal Feet
400-gallon UST	AOC-2/3	1 Each
Drums of waste hydraulic oil	AOC-1	2 Each
Drums of debris contaminated with oil	AOC-1	2 Each
Waste Tires	AOC-1 (Primarily)	942 Each
Scrap Steel	Site-wide	146.1 Tons[1]

Note: 1.This includes Site-derived scrap steel only with the exception of scrap steel that was included in specific Contract line items. It should be noted that an additional 8.31 tons of steel (Ticket No. 184083, dated June 26, 2009) was associated with the disposal of the UST and 14-inch oil pipeline from AOC-2/3 (e.g. lump sum Item Nos. 22 & 23 in the Contract), and therefore, was not included in the payment of 146.1 tons of disposal paid to the Contractor under Item 52 of the Contract. Additionally, scrap steel associated with the bulkhead construction was included in the bulkhead line items of the Contract, and therefore, the quantity was not tracked by the Engineer. The Contractor provided one ticket associated with the scrap generated from the bulkhead construction(Ticket No. 193697 dated September 23, 2009 for 15.9 tons), and while included with the FER, the weight associated with this ticket is not included in summary table, nor was it included in the payment to the Contractor.

The following subsections provide additional detail on each material removed during the course of the construction for the Site. CHA notes that the following items were disposed of off-site during the course of the project, but quantities of these items were not tracked because they were not direct pay items within the Contract:

- Municipal solid waste (MSW) generated by the Contractor during construction (e.g. meal packaging, empty containers of coating materials).

- Project-derived construction & demolition debris (e.g. waste building materials generated by Contractor), such as scrap wood from formwork, geotextiles scraps, scrap lengths of piping, etc.

- Vegetation from clearing and grubbing activities (part disposed off-site, but some chipped and used on DeLaval site or in Zones 4 & 5 north of the Site for temporary erosion protection and tracking control against the direction of the Engineer and the NYSDEC as discussed in Section 4.11.1 of the FER.

- Site-derived concrete (e.g. buried on-Site or along former waterfront). To reduce the amount of material requiring offsite disposal and also reduce the volume of material required to be imported to the Site, approximately 6,484.8 cubic yards of concrete was crushed on-Site and reused as fill.

4.3.1 Petroleum-Contaminated Soil

Petroleum-contaminated soil (PCS) was removed from several locations on Site, as shown on Figure 4. This figure also depicts the bottom elevations of the excavations based upon a grid established in the field.

4.3.1.1 Waste Characterization Sampling

In an effort to reduce the total amount of on-Site stockpiling of the PCS, particularly given the limited storage space at the Site, the Contractor was required to complete pre-excavation characterization sampling of both AOC-1 and AOC-2/3. Pre-excavation characterization sampling allowed trucks to be direct loaded from the AOC excavations during the construction and reduced the amount of material being required to be handled more than once. The parameters requiring analysis for the waste characterization samples was expected to vary some for each disposal facility and left to the responsibility of the Contractor to verify with each disposal facility per the July 2007

SMP in the construction Contract. However, the SMP noted that the pre-characterization samples were to be analyzed for the following parameters at a minimum:

- Target Compound List (TCL) Volatile Organic Compounds (VOCs)
- TCL Semivolatile Organic Compounds (SVOCs)
- TCL Polychlorinated Biphenyls (PCBs)
- Metals
- Toxicity Leaching Characteristic Procedure (TCLP) Volatiles
- TCLP Herbicides
- TCLP Pesticides
- TCLP Metals
- pH
- Ignitability
- Reactivity (sulfide and cyanide)

Table 1 in the July 2007 Site Management Plan (included in the Contract Documents in Appendix C, specifically Section of 02221 of the Specifications) specified the minimum sampling frequency for the project, including both grab samples and composites. CHA had originally anticipated excavating approximately 35,500 tons of petroleum-impacted soils for offsite disposal during the design process, or approximately 20,300 cubic yards of soil at an approximate unit weight of 130 pounds per cubic foot (or 1.75 tons/cubic yard). While this unit weight utilized was on the higher end of the normal range for unit weights of soil, CHA selected this value to be conservative, particularly given that the soils observed during the supplemental investigation were moist to wet. Based upon the anticipated volume of soil requiring disposal, CHA had initially budgeted for up to 14 characterization samples to be collected from each of the major AOCs (AOC-1 & AOC-2/3) while developing the Engineer's estimate for the project.

Following award of the construction contract, discussions were held with the NYSDEC that led to CHA understanding that the excavations may be advanced deeper beneath the water table than originally contemplated in the design phase to remove grossly-impacted soils. The original

estimates were based upon limiting the depths of the excavation to the depth of groundwater or to the bottom of the smear zone at low tide. However, the NYSDEC clarified that the goal of the remedy was to remove all grossly-impacted soils to the extent practical regardless of total depth, thickness of the smear zone, or the depth to groundwater. As a result, CHA instructed the Contractor to provide characterization for an additional quantity of soil to be removed so that delays during the excavation activities could be avoided if more soil than originally included in the Contract did indeed require disposal.

To provide a uniform distribution of the waste characterization samples, the Contractor initially divided AOC-1 into nine (9) approximately equal size areas and AOC-2/3 into forty (40) equal size areas, for a total of forty-nine (49) sample areas. Each approximately 50-foot by 50-foot sample area was reported to represent approximately 1,000 cubic yards of soil requiring off-site disposal and the Contractor had planned to collect one (1) grab sample and one (1) composite sample from each area for a total of forty-nine (49) samples. Later, the Contractor reported that they intended to dispose some of the PCS in landfills located in Massachusetts and these landfills required a sampling frequency of one (1) sample per every 500 cubic yards of material disposed.

As a result, the Contractor reported that they would collect two (2) grab samples and (1) composite sample from each grid area. Thus, CHA anticipated receiving ninety-eight (98) grab samples and forty-nine (49) composite samples for the major AOCs. Because the actual depths of the excavations could only be estimated, CHA had agreed to the Contractor's justification for needing additional samples at the time of construction and increased the total expected quantity of soil to 49,000 cubic yards. The Contractor failed to exclude the overburden material that was planned for reuse as backfill from this expected quantity and the Engineer did not catch this mistake. Additionally, the Contractor may have collected ninety-eight (98) soil samples in the field, but ultimately provided analytical data for fewer samples. As a result of this discovery, the Engineer later recommended to the City that additional payment previously made to the Contractor for samples that were never submitted to the Engineer be considered as a possible deduction to any future settlements with Contractor as the retainage on the project was not released at the time of the Contract termination (see Section 5 for further discussion on the termination of the construction Contract). Additionally,

the NYSDEC has already disallowed the City to seek reimbursement for fifty-two (52) of the samples paid to the Contractor.

The Contractor actually submitted analytical data for a total of seventy-four (74) waste characterization samples, including both grab and composite samples. Of this total, a total of fourteen (14) waste characterization samples were collected for AOC-1 (nine (9) grab samples and five (5) composite sample) and sixty (60) characterization samples were collected form AOC-2/3 (forty (40) grab samples and twenty (20) composite samples). Material for composite samples were collected from two separate test pits and compiled into one sample. The actual amount of test pits installed and samples collected for the composites totaled 49 (9 from AOC-1 and 40 from AOC-2/3). Only 25 samples (5 from AOC-1 and 20 from AOC-2/3) were submitted for analyses due to the compositing of two zones in each sample. During construction, SWC sought payment based upon the amount of test pits and samples collected (i.e. 98 samples) versus the seventy-four (74) samples actually analyzed by the laboratory. Based upon different sampling analyses required by different disposal facilities located in multiple states, the Contractor characterized both the grab and composite soils for a different set of parameters, including the following:

Grab Sample Analyses:

- VOCs
- SVOCs
- PCBs
- Diesel Range Organics (DRO)
- Gasoline Range Organics (GRO)
- Metals
- Hazardous Waste Characteristics (pH, flash point, reactivity)
- TCLP VOCs

Composite Sample Analyses:

- TCLP SVOCs
- TCLP Herbicides
- TCLP Pesticides
- TCLP Metals
- PCBs
- Dioxin Screen
- Asbestos (AOC-1)

In addition to the major AOC excavations, pre-disposal characterization samples were collected from a portion of the materials removed from the revetment subgrade excavations in Zone 2 as well as isolated PCS “hot spots” discovered on the Site during the course of the construction. These samples included the following:

- Two (2) characterization samples from Zone 2 revetment subgrade
- One (1) sample from the toe protection subgrade excavation associated with the Zone 1 bulkhead.
- One (1) sample from AOC-4A
- One (1) sample from AOC-5

The original analytical data packages submitted to the Engineer from the Contractor for the waste characterization samples have been included in Appendix R. The results of the pre-excavation characterization samples are summarized in Appendix S, and include the following:

Table S-1:	AOC-1 Pre-Excavation Characterization Grab Sample Summary
Table S-2:	AOC-1 Pre-Excavation Characterization Composite Sample Summary
Table S-3:	AOC-2/3 Pre-Excavation Characterization Grab Sample Summary
Table S-4:	AOC-2/3 Pre-Excavation Characterization Composite Sample Summary
Table S-5:	Zone 1 & 2 River Sediment Characterization Sample Summary
Table S-6:	AOC-4A & AOC-5 Characterization Sample Summary

CHA notes that some of the analytical data for the composite samples collected in AOC-2/3 are not included in Appendix R; specifically, samples Area No. 24 & 31 Composite and Area No. 25 & 30 Composite are missing. While CHA has included the data in Table S-4, the analytical package was not formally submitted to the Engineer by the Contractor. Rather, the Engineer had initially prepared these summary tables from a hard copy package that was provided in the field, but this copy of the analytical was not found and was not available for inclusion in the FER.

Finally, CHA notes that the Contractor also collected four (4) samples from AOC-1 and two (2) samples from AOC-2/3 on May 28, 2008; however, these samples were not included in the pre-characterization summary because they were not collected for all parameters specified in the SMP and were collected by the Contractor solely for their internal purposes to begin discussions with potential disposal facilities.

4.3.1.2 Disposal Details

The Contractor struggled with maintaining segregation of PCS material from each of the various locations at the Site and combined the weight tickets and manifests for the material disposed. Therefore, it is impossible for the Engineer to determine the exact distribution of PCS disposed off-site from each location, particularly relative to the material removed along the shoreline during the subgrade excavation for the revetment. Based upon the information maintained by the Engineer and size of these excavations from field measurements, CHA estimates the disposal distribution as follows:

Table 4-5. Distribution of PCS Removed From Site

Origin	Approximate Timeframe Material Excavated	Approximate Volume (CY)	Approximate Weight (Tons)
Zone 2 Revetment – South Area	07/08/2008 to 07/14/2008	350	630
Zone 2 Revetment – North Area	07/28/2008 to 08/04/2008	222	400
Zone 4 Revetment	11/14/2008 to 11/18/2008	100	180
Zone 5 Revetment	12/03/2008 to 12/16/2008	333	600
AOC-2/3	01/05/2009 to 04/24/2009	17,706	31,870
Zone 1 Toe Protection	06/25/2009 to 06/26/2009	123	221
AOC-4A	08/10/2009 to 08/18/2009	100	180
AOC-5	08/03/2009 to 08/05/2009	80	144
AOC-1 (Concrete Anchor Blocks)	10/06/2009 to 10/14/2009	21	37
Total			**34,262±**

Figure 4 has been included to show the approximate limits of each of the areas where PCS was removed from the Site. Additionally, this figure depicts a grid over the large AOCs (AOC-1 & AOC-2/3) and includes the approximate bottom elevation of the excavation in each grid cell.

Copies of the disposal facilities' approval to accept the material and applicable waste profiles have been included in Appendix T. It should be noted that letters from all disposal facilities utilized accepting the waste were not provided from the Contractor after repeated requests by the Engineer. However, the waste profiles were submitted and approved for each facility. Additionally, the fact that each facility signed the waste manifests for the material disposed at their respective facilities after review and approval of the included waste profiles is considered documentation of their acceptance of the PCS material.

CHA has also included correspondence relative to the acceptance of PCS disposal at the Middle Smithfield Materials, Inc. facility in Bushkill, Pennsylvania and conversations that the Engineer had with the Pennsylvania Department of Environmental Protection (PADEP) with regard to accepting disposal of the PCS at this mine reclamation facility in Appendix T. Finally, it should be noted that the Seneca Meadows Inc. (SMI) landfill accepted a small amount of PCS near the end of the excavation activities, which was generated from the excavation for the concrete anchor blocks at the south end of Zone 1 bulkhead (36.64 tons disposed on October 14, 2009). This material was accepted based upon the Contractor's previous waste profiles for material containing both ACMs and PCS. The waste profile for this combined waste is discussed in Section 4.3.2 of this FER.

In addition to analyzing where on-Site the PCS requiring off-site disposal was generated from, CHA has summarized the quantity of PCS disposed at each disposal facility and by which transporter in Table 4-6, per the request of NYSDEC.

Table 4-6. Summary of PCS Removal by Disposal Facility & Transporter

Disposal Facility Name	Disposal Facility Permit No.	Waste Transporter	Transporter Part 364 Permit No.	Weight Disposed (Tons)
Albany/Rapp Road Landfill, Albany, NY	4-0101-00171	Riccelli Enterprises, Inc.	7A-402	3,683.84
Middle Smithfield Materials, Inc., Bushkill, PA	Not Required[1]	Mangiardi Brothers Trucking, Inc.	4A-209	2,135.33
		Environmental Transport Group, Inc.	NJ-057	1,887.35
Seneca Meadows Inc., Waterloo, NY	8-4532-00023	Riccelli Enterprises, Inc.	7A-402	1,045.96
South Hadley Landfill, South Hadley, MA	172936	Central Construction Services LLC[2,3]	CT-194	7,781.97
Greenwood Street Landfill, Worchester, MA	WO45668	SRS National, LLC	CT-154	17,727.41
		Landeen Transport LLC	CT-166	
Total				**34,261.86**

1. *On March 10, 2009, Mr. Dean Fisher of the Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waste Management (Bethlehem District Office), indicated to the Engineer that no permits were required for disposing the material at the Middle Smithfield Materials, Inc. facility because the material contamination levels were below the thresholds established in Tables FP-1a and FP-1b of Policy 258-2182-773, dated April 24, 2004.*
2. *Central Auto & Transport (weight ticket customer) is the parent company of Central Construction Services, LLC (Part 364 permit issued to).*
3. *Brandon Kelly Trucking, LLC was a subcontractor to Central Construction Services, LLC. Therefore, weight disposed by Brandon Kelly Trucking is included with Central Construction Services, LLC.*

Copies of all available waste transporters Title 6 of NYCRR Part 364 Permits have been included in Appendix U. Table 4-7 summarizes the status of the permits for each trucking company used by the Contractor to haul PCS soils from the Site.

Table 4-7. Summary of Part 364 Permits for Waste Transporters

Waste Transporter/Hauler	Part 364 Permit No.	Status of Permits
Riccelli Enterprises, Inc. – Syracuse, New York	7A-402	A permit effective 08/01/2008 was submitted for Seneca Meadows Landfill and a modified permit effective 10/24/2008 was submitted for Albany/Rapp Road Landfill.
Mangiardi Brothers Trucking, Inc. – Castleton, New York	4A-209	A permit effective 02/29/2008 and an updated permit effective 04/02/2009 have been provided. However, the permits do not identify Bushkill, Pennsylvania as a permitted destination facility because the material was transported to this facility as "clean fill" in accordance with PADEP's Management of Fill Policy Document No. 258-2182-773 dated April 24, 2004, as contaminant levels were below thresholds in Tables FP-1a and FP-1b.
Environmental Transport Group, Inc. – Flanders, New Jersey	NJ-057	A permit effective 02/11/2008 and an updated permit effective 01/30/2009 have been provided. However, the permits do not identify Bushkill, Pennsylvania as a permitted destination facility because the material was transported to this facility as "clean fill" in accordance with PADEP's Management of Fill Policy.
Central Construction Services LLC – Hartford, Connecticut	CT-194	A permit effective 12/12/2008 was submitted for the South Hadley Landfill and a modified permit effective 05/5/2009 was submitted for hauling PCS and asbestos to Sunny Farms Landfill in Fostoria, Ohio for the material described in Section 4.3.2 of the FER.
Brandon Kelly Trucking, LLC – Hadley, Massachusetts	MA-154	A permit effective 12/11/2008 was submitted for the South Hadley Landfill. Brandon Kelly Trucking, LLC was a subcontracted hauler through Central Construction Services LLC.
SRS National, LLC – Southing, Connecticut	CT-154	A permit effective 01/12/2009 was submitted for the Greenwood Street Landfill. However, the effective date of this permit is subsequent to 01/06/2009 when hauling of PCS commenced. CHA contacted the NYSDEC Bureau of Permitting & Planning to obtain copies of an older permit, but the NYSDEC indicated that Greenwood Street Landfill was not identified as a permitted destination facility on the prior permit.

Waste Transporter/Hauler	Part 364 Permit No.	Status of Permits
Landeen Transport, LLC – Wolcott, Connecticut	CT-166	A permit effective 11/26/2008 was submitted; however, this permit did not identify Greenwood Street Landfill as a permitted destination facility. A second permit effective 01/09/2009 was submitted that does show Greenwood as a permitted destination; however, the effective date of this permit is subsequent to 01/08/2009 when hauling of PCS by Landeen commenced. CHA again contacted NYSDEC to research prior records, but the Department indicated that Greenwood Street Landfill was not identified as a permitted destination facility on the prior permit.

Materials transported to the Middle Smithfield Materials, Inc. facility located near Bushkill, Pennsylvania were not subject to the Title 6 NYCRR Part 364 permitting requirements since the material was classified as "clean fill" per PADEP's Management of Fill Policy Document No. 258-2182-773, dated April 24, 2004. Even though the source of this fill material from the DeLaval Site was subject to a spill or release, it was considered "clean" due to contaminant concentrations being less than the thresholds specified in Tables FP-1a and FP-1b of the document for material to be classified as clean fill. Thus, Part 364 permits for Mangiardi Brothers Trucking, Inc. and Environmental Transport Group, Inc. have been included in Appendix U for reference only to demonstrate that the trucking companies were permitted for hauling waste in New York State and aware of the Part 364 requirements.

As indicated in Table 4-7, there are data gaps associated with the Part 364 permits for SRS National, LLC (SRS) and Landeen Transport, LLC (Landeen). SRS was not permitted to haul waste to the Greenwood Street Landfill prior to January 12, 2009; however, the weight tickets provided in Appendix T indicate that SRS began hauling PCS to this facility on January 6, 2009. Although SRS had a Part 364 permit in place prior to January 6, 2009, it appears that material was hauled to the Greenwood Street Landfill on January 6 & 8, 2009 was done without an appropriate Part 364 permit. CHA notes that SRS did not haul PCS on January 7, 9, 10 & 11, 2009. When SRS resumed hauling on January 16, 2009, the appropriate Part 364 permit was in place.

Landeen began hauling PCS to the Greenwood Street Landfill on January 8, 2009, one day prior to their permit modification that was effective January 9, 2009. As shown in Table 4-7, Landeen had a Part 364 permit in-place prior to January 8, 2009, but the permit did not include Greenwood Street Landfill as a permitted destination facility prior to the January 9, 2009 modification.

The Engineer did conduct periodic checks of the Part 364 permits during the excavation activities. However, the Engineer did not identify these data gaps that occurred during the first week of excavation of PCS for off-site disposal in AOC-2/3. This was in part contributable to the extensive time the Engineer's field representative spent addressing a number of other issues that were encountered during the first week of AOC-2/3 excavation activities, including items such as issues with implementing the CAMP, proper segregation of overburden material for reuse, poor management of free product and petroleum-impacted water, etc. Additionally, the Contractor had issues with providing the proper Part 364 permits to the Engineer in a timely manner because they were utilizing a brokerage company, Pro-Teck LLC of New Haven, Connecticut. Pro-Teck LCC had assured the Engineer that all necessary permits were in place, but was slow in submitting the documentation to the Contractor for submittal to the Engineer.

Copies of all weight tickets and/or waste manifests (as applicable) associated with the off-site disposal of PCS have been included in Appendix V. The Contractor provided waste tracking logs to summarize the PCS disposal; however, these logs were unreliable due to missing loads and/or double counting loads, and therefore, have not been included in the FER. The weight tickets and manifests have been sorted by facility and date, and are in the following order:

1. Albany/Rapp Road Landfill
2. Middle Smithfield Materials, Inc.
3. Seneca Meadows Inc.
4. South Hadley Landfill
5. Greenwood Street Landfill

4.3.1.3 On-Site Re-Use

None of the grossly-contaminated soils were re-used on-Site. However, overburden soil that had no visual (beyond presence of C&D debris), olfactory, or photoionic evidence of contamination was

stripped from each AOC excavation and stockpiled on-Site for reuse. No analytical testing of this material was required during the remedial action. This approach was accepted by NYSDEC based upon the data from the prior Site investigations as well as the engineering and institutional controls being placed on the Site as part of the remedy (i.e. soil cover, environmental easement and the Site Management Plan).

4.3.2 Petroleum-Contaminated Soil with Asbestos-Containing Material

Prior to removing the "grossly-contaminated" soils from AOC-1, several feet of lesser-impacted, overburden materials were removed from the Site surface and stockpiled for reuse as backfill. While some C&D debris had previously been encountered during the 2004 Supplemental Investigation test pits, the thickness of soil/debris layer was found to be more extensive during the actual removal activities. Since disposing of all of this overburden material off-site and replacing it with imported clean fill appeared cost prohibitive during the early stages of the project, it was collectively decided by all parties (e.g. the Engineer, the City and NYSDEC) in the field that the best option was to attempt to screen the debris materials from the soil using a Keestrack mobile screen unit to separate the debris from the soil.

As a result of the screening operation, the excavated materials were divided into three separate streams. The first material stream included all debris greater than four (4) inches in diameter, which included concrete, brick, steel, wood and various other large items of debris and waste. The second material stream consisted of material less than four (4) inches in diameter which included many of the same type of materials (namely brick and concrete), just of smaller size and with less waste materials. The final waste stream was described as "fines", which were the finest soils generated from the screening operation and generally less than one –quarter (¼)-inch in diameter (e.g. silty sand). Each of these material streams were stockpiled along the eastern side of Zone 2 and a portion of the less than four (4)-inch material stockpile was placed in the vicinity of shoreline in Zone 2.

4.3.2.1 ACM Discovery & Sampling

After several days of screening, the Contractor identified a small piece of a suspect transite material near the screening operation. The screening operation was immediately halted and on October 9,

2008, the Engineer mobilized a New York State Department of Labor (NYSDOL) certified asbestos inspector to the Site to collect samples of various materials for laboratory analysis, including suspect transite pieces, firebrick, flooring material and roofing materials. The samples were analyzed by the America Science Team New York, Inc. (AmeriSci) laboratory, an Environmental Laboratory Approval Program (ELAP)-certified laboratory (Laboratory No. 11091) using of a combination of polarized light microscopy (PLM) and transmission electron microscopy (TEM) methods.

Of the fourteen (14) samples collected form the Site, five (5) of the samples were found to contain asbestos at greater than 1.0 percent (ranged from 13.2 to 57.1 percent asbestos), and therefore, were determined to be ACMs. The sample results of are summarized in Table 4-8 and the original laboratory results have been included in Appendix W.

Table 4-8. Summary of ACM Results

Sample Number	Description	PLM/TEM Result	Percent Asbestos
S-1	Debris Pile - Suspect Transite Panel	**YES**	**16%**
S-2	Debris Pile - Suspect Fire Brick (white/gray)	NAD	-
S-3	Debris Pile - Suspect black cove base	NAD	-
S-4	Debris Pile - Suspect blue cove base	NAD	-
S-5	Debris Pile - Black caulk	NAD	-
S-6	Debris Pile - Suspect Roofing Felt	NAD	-
S-7	Debris Pile - Black coating with white fibrous filling	**YES**	**13.2%**
S-8	Debris Pile - Grey fibrous felt paper material	**YES**	**57.1%**
S-9	Debris Pile - Suspect Fire Brick (tan)	NAD	-
S-10	Debris Pile - Presumed built up roofing material	NAD	-
S-11	Debris Pile - Suspect Fire Brick (orange)	NAD	-
S-12	Debris Pile - White plastic with possible fibrous filling	NAD	-
S-13	Debris Pile - Black/grey fabric material	**YES**	**25.8%**
S-14	Debris Pile - Suspect Transite Panel	**YES**	**18.2%**
AS102508SF-01A-C	AOC-1, Location 1, 6"/12"/15"	NAD	-
AS102508SF-02A-C	AOC-1, Location 2, 6"/12"/15"	NAD	-
AS102508SF-03A-C	AOC-1, Location 3, 6"/12"/20"	NAD	-
AS102508SF-04A-C	AOC-1, Location 4, 6"/12"/15"	NAD	-
AS102508SF-05A-C	AOC-1, Location 5, 6"/12"/18"	NAD	-
AS102508SF-06A-C	AOC-1, Location 6, 6"/8"/10"	NAD	-
AS102508SF-07A	AOC-1, Location 7, 6"	NAD	
AS102508SF-07B	AOC-1, Location 7, 8"	**YES**	Trace
AS102508SF-07C	AOC-1, Location 7, 10"	NAD	-
AS102508SF-08A-C	AOC-1, Location 8, 6"/12"/20"	NAD	-

Sample Number	Description	PLM/TEM Result	Percent Asbestos
AS102508SF-09A-C	AOC-1, Location 9, 6"/12"/20"	NAD	-
AS102508SF-10 A-C	AOC-1, Location 10, 6"/12"/18"	NAD	-
AS102508SF-11 A-C	AOC-1, Location 11, 6"/12"/15"	NAD	--
AS102508SF-12 A-C	AOC-1, Location 12, 6"/12"/15"	NAD	-
AS102508SF-B01	Bulk Material - Location 1 - Brown Paper	NAD	-
AS102508SF-B02	Bulk Material - Location 11 - Stringy Material	NAD	-
AS102508SF-B03	Bulk Material - Location 12 - Coated Blue Paper	NAD	-
AS102508SF-B04	Bulk Material - Zone 3 - Brown Paper Roofing	NAD	-
AS102508SF-S01-S07	Soil Samples - Fine Pile (Seven Samples)	NAD	
AS102508SF-S08	Soil Sample - Fine Pile (East Side/North End)	**YES**	Trace

Notes: NAD = No Asbestos Detected
Trace = <0.25%

Upon the determination that there were confirmed ACMs in two of the streams (the two debris streams) generated from the screening operation performed with material from AOC-1, a number of soil samples were then collected from the excavated area of AOC-1, to determine if the soil in that area contained asbestos. This investigation was performed on October 24, 2008 and all samples were submitted to AmeriSci for analysis. While it appeared that the depth of the disposal/debris layer had been reached, the remediation project required additional excavation in this area to a depth of 1 to 2 feet below the water table to remove petroleum-contaminated soils and it was necessary to determine if additional precautions were necessary when excavating the remaining petroleum-contaminated soils in this area.

Since this area had most of the visible waste/fill material removed, the first sampling event completed involved the collection of twelve (12) hand augers samples installed in a grid pattern across AOC-1. Three samples at varying depths (typically 6, 8, and 12 inches below ground surface) were collected from each hand augered location. The sample analytical results are also summarized in Table 4-8 as samples 01A-C through 12A-C, with the "A" samples being collected closest to the surface and the "C" samples being collected the deepest. Of the 36 soil samples analyzed, only one (1) was found to contain asbestos and the result for that sample was reported as less than 0.25 percent asbestos. There were also four (4) suspect materials identified in four (4) different hand auger samples that were submitted for analysis. Each of these materials had no asbestos detected. These samples are shown in the summary as B01 through B04.

Finally, since the greater than 4-inch diameter and less than 4-inch diameter waste piles had already been confirmed or assumed to have asbestos containing materials present, the fines pile was also sampled. There were no discernible suspect asbestos materials in this pile due to the sorting and screening of the waste/debris stream from AOC-1. The "fines" stockpile was generally the fine silty sand soil from the excavation. Eight soil samples were collected from 0 to 6 inches of the surface of the pile. Four (4) samples were collected along the top of the pile from north to south and four (4) samples were collected from the side of the pile, two (2) each from the east and west sides, one (1) toward the north end and one (1) towards the south end. These samples are summarized in Table 4-8 as Sample S01 through S08. All but one of the samples had no asbestos detected and a single sample (Sample S08) was reported as less than 0.25 percent. Therefore, the "fines" stockpile was determined to be asbestos free.

Based upon these results, the Engineer filed a variance petition to procure relief from Code Rule 56-11.5, "*Controlled Demolition with Asbestos in Place*" and allow for the handling and removal of the two (2) construction and demolition debris piles (greater than 4-inch diameter debris pile and less than 4-inch diameter debris pile) and the material from the less than 4-inch diameter debris pile that was placed along the shoreline in Zone 2 that have been found to contain regulated asbestos containing material. A copy of the variance, as approved by the NYSDOL on November 18, 2008, has been included Appendix X.

On March 25, 2009, the Engineer filed an asbestos petition variance re-opener with the NYSDOL to further clarify the intended scope of work at the Site. At that time, the Engineer requested to limit the removal of the less than 4-inch diameter material that had already been placed along the western limit of Zone 2. Rather, the revised scoped indicated that the Zone 2 material would remain in-place and be covered with two (2) feet of clean cover, except for locations where the proposed grades could not be met and locations of future light pole foundations. In these locations, the soil/waste was removed to a depth necessary to allow for at least two (2) feet of clean cover and the excavated material was disposed off-site in accordance with the previously approved variance.

Additionally, it had been determined that ACM may be encountered in areas of additional petroleum contaminated soil excavation that were planned for the AOC-1 area at the south end of the Site. Soil removal between the bulkhead and the deadman was planned to be removed as petroleum-contaminated soil only; however, the removal of soil approximately 45-feet east of the Zone 1 bulkhead (east of the steel deadman) was to be disposed of as petroleum-contaminated soils containing regulated levels of asbestos. Finally, the NYSDEC wanted the Engineer to clarify to the NYSDOL that the excavation may extend further east than originally planned for the removal of petroleum-contaminated soils depending upon the actual field conditions encountered. This re-opening was approved by NYSDOL on April 21, 2009 and a copy of the approval document has been included in Appendix Y.

As the actual startup of the excavation activities in AOC-1 approached, the Engineer had discussed trying to further segregate soils contaminated with petroleum only from those that were classified as petroleum- contaminated soils with regulated asbestos to reduce off-site disposal costs. In an effort to determine the practicality of this approach, a number of test pits were installed in a strip of land located between 45 and 75 feet east of the bulkhead (a 30-foot wide corridor). There was no visual evidence of suspect ACM in the test pits. These field observations substantiated the sampling data that was previously collected and detailed in the Engineer's original variance petition which indicated that the soil in the western side of AOC-1 was not contaminated with asbestos.

As a result of these findings, the Engineer began to draft a second re-opening request to the NYSDOL approved variance on June 5, 2009. The intent of this document was to request approval from NYSDOL to move the boundary of regulated asbestos from a distance of 45 feet east of the bulkhead to a location 75-feet east of the bulkhead, such that only soils 75-feet or more east of the bulkhead would be treated as petroleum-contaminated soils with ACM; all soil west of this boundary would be disposed of as petroleum-contaminated soil only. However, the second re-opening request was never submitted to NYSDOL for consideration as the Contractor reported the discovery of additional suspect transite fragments in the referenced zone before issuance of the letter. As a result of the discovery of additional suspect ACM materials between the Zone 1 bulkhead and deadman as

well as east of the bulkhead, almost all of the material removed from AOC-1 was disposed of off-site as PCS with regulated ACM.

The following list summarizes the final ACM removal areas:

- With the exception of a small area at the south end of AOC-1 (near the area of the concrete anchor blocks at the south end of the Zone 1 bulkhead), all material disposed of from AOC-1 was disposed of off-site as petroleum-contaminated soil (PCS) containing regulated asbestos waste (RAW) between June 1 and June 25, 2009. While a second NYSDOH variance re-opener had been considered by the Engineer to attempt to reduce the amount of material requiring disposal as regulated ACM, the discovery of additional suspect transite fragments resulted in almost all of the material being disposed of PCS with regulated levels of ACM.

- Greater than 4-inch debris stockpile & less than 4-inch debris stockpile: Disposed off-site as RAW only between May 11 and May 29, 2009.

- Additional cuts were made along the eastern bank of AOC-1 to accommodate the future grades for redevelopment of the Site. This material was disposed of off-site as RAW only between June 29 and July 8, 2009.

- Less than 4-inch debris placed along west side of Zone 2 (adjacent to the east side of the concrete jersey barriers) was disposed off-site as RAW only where material had to be removed to meet grading requirements for the installation of a 2-foot soil cover or for future structures. This material was disposed between July 9 and July 10, 2009.

- Fines stockpile: Reused on-Site as fill since no RAW identified.

- While not characterized as RAW, CHA again notes that a small area of soil at the south end of AOC-1 near the location of the anchor blocks was removed as PCS only (approximately 220 tons between June 25 and 26, 2009) from Zone 1, following the removal of the PCS with ACM in this area and clearance of the regulated area by the certified asbestos project monitor.

While not required by the NYSDOL variance, the Site soil located immediately beneath the stockpiled ACM (greater than 4-inch and less than 4-inch stockpiles) was excavated to a depth of approximately 4 to 6 inches beneath the stockpile and disposed off-site as a RAW due to the contact with the ACM debris and the potential cross-contamination of the existing subgrade material.

4.3.2.2 Disposal Details

The soils originating in AOC-1 had been initially characterized as discussed in Section 4.3.1.1. In addition, the ACM characterization was previously described in Section 4.3.2.1. A total of 10,312.03 tons of PCS with ACM was disposed of off-site. Of this total, 4,878.99 tons was hauled by Riccelli Enterprises, Inc. to the Seneca Meadows, Inc. landfill in Waterloo, New York for disposal between June 1 and June 25, 2009 (Note: one final weight ticket and manifest for PCS with ACM (last set in Appendix Z) was submitted with the October 2009 payment application, but was actually for a load disposed off-site on June 17, 2009 as part of the AOC-1 excavation activities).

The remaining 5,433.04 tons was hauled by Central Construction Services LLC between June 2 and June 24, 2009 to the Sepaug Waste Rail transfer station in Newtown, Connecticut operated by Strategic Disposal LLC and loaded into rail cars. Once a sufficient number of rail cars were filled, the material was shipped to the Sunny Farms Landfill, LLC in Fostoria, Ohio by the Housatonic Railroad Company, Inc. for final disposal. The necessary waste hauler Part 364 permits are included in Appendix U and the weight tickets and executed waste manifests are included in Appendix Z. The waste profile sheets and landfill approval information is included in Appendix AA.

It should be noted that the waste profile for "oil soaked booms" and absorbents was included in Submittal No. 46 included in Appendix K and that while a minor amount of absorbents were mixed in with some of the contaminated soils, a majority were collected in a dedicated "roll-off" container during the AOC excavations and ultimately disposed of at the Sunny Farms Landfill. The waste manifest for this material was grouped with the PCS-ACM manifest documentation included in Appendix Z.

4.3.2.3 On-Site Re-Use

None of the petroleum contaminated soils with ACM material were re-used on-Site.

4.3.3 ACM Debris

4.3.3.1 Disposal Details

In total, 7,668.38 tons of ACM/RAW was disposed of off-site. Of this total, 4,195.73 tons of RAW was generated from the greater than 4-inch debris and less than 4-inch debris stockpiles was disposed of off-site between May 11 and May 29, 2009, prior to the commencement of the AOC-1 excavation to address the petroleum-related contamination. Of this total, Central Construction Services LLC disposed of 3,932.61 tons at Sunny Farms Landfill, LLC between May 11 and May 29, 2009, while Riccelli Enterprises, Inc. disposed 263.12 tons at the Seneca Meadows, Inc. landfill between May 28 and May 29, 2009 (started hauling material just prior to the commencement of the AOC-1 excavation). As previously discussed in Section 4.3.2.2, the material ultimately disposed of at the Sunny Farms landfill in Fostoria, Ohio was first shipped from the Site by Central Construction Service s LLC to the Sepaug Waste Rail transfer station in Newtown, Connecticut for transfer into rail cars.

Following the removal of the ACM-PCS material from AOC-1, the Contractor commenced the excavation of ACM debris (RAW only) in the embankment remaining on the east side of AOC-1 to accommodate future grading needs for the redevelopment. A total of 2,943.29 tons of material was disposed of from this area. Of this total, Central Construction Services LLC disposed of 1,856.12 tons at Sunny Farms Landfill, LLC between June 29 and July 8, 2009, while Riccelli Enterprises, Inc. disposed 1,087.17 tons at the Seneca Meadows, Inc. landfill between July 1 and July 8, 2009. Finally, a total of 529.36 tons of ACM debris from behind the Zone 2 jersey barrier was disposed of at Sunny Farms Landfill, LLC and hauled by Central Construction Services LLC between July 9 and July 10, 2009.

In summary, Riccelli Enterprises, Inc. hauled a total of 1,350.29 tons to the Seneca Meadows, Inc. landfill in Waterloo, New York and Central Construction Services LLC hauled a total of 6,318.09 tons of material to the Sepaug Waste Rail transfer station in Newtown, Connecticut for ultimate disposal at the Sunny Farms landfill in Fostoria, Ohio, as previously described in Section 4.3.2.1.

4.3.3.2 On-Site Re-Use

None of the ACM material, after identified, was re-used on-Site. However, as described in Section 4.6.1.5, some ACM-contaminated material was placed along the western edge of Zone 2 prior to the discovery of the ACM and was left in-place. A minimum of a 2-foot thick soil cover system was installed over the remaining material.

4.3.4 Timber Piles

4.3.4.1 Disposal Details

During the demolition of the existing waterfront structures in preparation for the installation of the bulkheads and riprap revetment, a number of timber piles were extracted from the Hudson River and the Site subsurface in close proximity to the waterfront. Since these piles appeared to be coated in a tar-like preservative material (e.g. creosote), the piles had to be disposed of off-site. Item No. 52 was added to the construction contract via Addendum No. 2 to include the off-site disposal of C&D materials, including those waste materials generated from the demolition of the existing shoreline structures.

Article 27, Title 25 of New York State Law requires that all creosote-treated wood be disposed of in a NYSDEC permitted C&D landfill or municipal solid waste landfill properly lined to prevent groundwater contamination, or burned in a properly permitted facility design to burn the specific type of creosote waste. At the time of construction, there were twelve (12) active C&D landfills in New York State. The Contractor reportedly contacted three of the C&D facilities located in NYSDEC Regions 4 & 5 to discuss disposal options. However, the facilities contacted reportedly indicated that they would not accept this volume of creosote-treated lumber or would not accept the size timbers generated at the DeLaval Site without further processing (e.g. cutting the material into smaller pieces prior to shipping) as they had concerns with placement of the large timber piles and potential future subsidence resulting from void spaces left between the timbers if not carefully placed. Unlike the timber resulting from the Site clearing activities, the presence of the creosote prevented the Contractor from being permitted to chip the timber piles or process them on-Site.

Following conversations with a representative number of C&D facilities that would not accept the timber piles from the Site, the Contractor requested a change order to ship the piles off-site as creosote-preserved timber only (not mixed with other C&D) to a disposal facility located in Ohio. The Engineer initially rejected this request after short consideration given that Item 52 had been added to the Contract for such disposal. However, the Contractor contested this decision stating that all other C&D material was accepted at a least one of three active C&D landfills closest to the Site and since none of the facilities in eastern New York would accept the creosote timber waste, there would be an additional cost to ship the material to a disposal facility further from the Site.

After discussions with the City, the decision was made to execute Change Order No. 10 for the disposal of this material and avoid further delays. Change Order No. 10 was executed for a unit cost of $92 per ton. This was slightly higher than the Contractor's bid price of $84 per ton for the disposal of C&D material (Item No. 52), but less than the bid price of $95.20 per ton for the disposal of solid waste (Item No. 53), and therefore was accepted by the Engineer and the City.

A total of 660.54 tons of creosote-coated timber piles and former utility poles were disposed from the Site, which based upon Change Order No. 10, resulted in an increased cost to the project of $5,284.32 compared to the cost of disposing the material per the original Contract Item No. 52 (C&D debris only). Of this quantity, 558.41 tons of timbers were transported to the Minerva Enterprises, LLC landfill in Waynesburg, Ohio. The remaining 102.13 tons of timbers were transported to Newtown, Connecticut and transferred to a railcar where they were then transported to the Sunny Farms landfill in Fostoria, Ohio for disposal. While these facilities were permitted, no special waste profiling or characterization was required prior to each facility accepting this waste stream. All waste shipments records for this material have been included in Appendix AB. The timber piles were disposed over a timeframe ranging from October 29, 2008 to June 26, 2009.

4.3.4.2 On-Site Re-Use

No timber piles extracted from the river were re-used at the Site.

4.3.5 Petroleum-Contaminated Groundwater & Free Product

4.3.5.1 Disposal Details

The AOC excavations were extended beneath the groundwater table to remove the limits of the grossly-contaminated soils. Upon opening large excavations, free product (a light non-aqueous phase liquid (LNAPL)) was encountered, with the most significant levels encountered near the center of AOC-2/3. The Contractor proposed a number of alternatives for managing the free product, but ultimately relied upon the use of vacuum trucks to attempt to remove the free product from the water surface in AOC-2/3 (absorbents were used for AOC-1 as previously described). The Contractor also utilized fans and booms to try to push/pull the product to the extraction point.

One of the primary issues associated with the free product management is that the AOC-2/3 excavation was completed during the winter months (January through March 2009). The formation of ice in the excavations made it difficult to control the movement of the product because the spill booms were shifted or even lifted out of the water upon the water surface freezing. Additionally, the Contractor elected to send the soil to a number of different disposal facilities, which resulted in them creating a number of small spot excavations for soil that was acceptable at the various disposal facilities. Having multiple excavations open at the same time resulted in the Contractor attempting to manage product in all excavations at one time rather than in one larger excavation.

Based upon the Contractor's selected means of managing the free product, the vacuum truck extracted both free product and petroleum-impacted groundwater from the excavation areas. To determine the volume of free product versus the volume impacted groundwater in the vacuum truck storage vessel, the access manways were opened and the tank was gauged prior to leaving the Site each time. Specifically, the following procedure was utilized to calculate the volumes of free product and impacted groundwater:

1. The total depth of liquid was measured inside the tank vessel.
2. The thickness of the free product layer was measured.

3. The depth of the impacted groundwater was calculated by subtracting the free product layer thickness from the total depth of liquid in the vessel.

4. A gauging chart (with a known tank length and diameter) was utilized to determine the total volume of liquid in the tank as well as the volume of impacted groundwater (non-product).

5. The volume of free product was calculated by subtracting the volume of impacted groundwater from the total volume of liquid in the vessel.

A total of 29,602.4 gallons of impacted groundwater and 1,443.6 gallons of free product were disposed/treated off-site. All liquid waste was transported by EPS of Vermont, Inc. of Glenmont, New York. Bill of ladings for the management of the groundwater and free product have been included in Appendix AC. The manifests between November 6 and November 10, 2008 were associated with the discovery of the 14-inch oil pipelines within AOC-2/3 and the resulting cleanup. The manifests between January 7 and March 26, 2009 were mostly associated with the management of free product in the AOC-2/3 excavation, although small additional small quantity of contaminated water was removed from the decontamination pad as well and included in the same shipments.

4.3.5.2 On-Site Re-Use

Contaminated groundwater and free product collected were not re-used on-Site. The absorbents (e.g. pads and booms) used for controlling the oil to the excavation process were disposed of with the petroleum-contaminated soil.

4.3.6 14-Inch Pipeline & UST

4.3.6.1 Disposal Details

A UST thought to contain an unknown oil product was discovered near the center of AOC-2/3 during the Site investigation. The tank was thought to be an approximately 4,000 gallon UST at the time of the investigation; however, upon the actual removal of the UST it was found to be a heavily damaged 400-gallon UST containing some petroleum-impacted soil only.

Additionally, a 6-inch petroleum pipeline was found running east-west across AOC-2/3 between the UST and the river during the 2004 Supplemental Investigation. While a 6-inch pipeline and other

smaller diameter oil pipelines were discovered in this vicinity, two 14-inch diameter pipelines were also discovered during the AOC-2/3 excavation. A total of approximately 315 lineal feet of 14-inch diameter oil pipeline was removed from the Site under Change Order No. 13. The pipeline and UST were removed between November 6 and November 10, 2008. Additional investigation, consisting of the excavation of several test pits by the Contractor, was performed at the Site on August 10, 2009 in attempt to trace these pipelines, but no further oil pipelines were found outside the limits of AOC-2/3.

The UST and pipeline were cleaned via the use of a steam cleaner prior to being shipped off-site for recycling. The limited volume of decon water collected from this process was treated on-Site, as discussed in Section 4.2.2.7 of the FER. The cleaned steel was disposed off-site at Charles Effron & Son (a scrap metal recycling facility) on June 26, 2009. The weight ticket documenting offsite disposal is included in Appendix AD (first weight ticket), and the total weight of the UST and all pipe disposed of was 16,620 pounds or 8.31 tons.

4.3.6.2 On-Site Re-Use

The UST and petroleum pipelines were not re-used on-Site.

4.3.7 Scrap Steel

4.3.7.1 Disposal Details

During the course of the construction activities, a number of pieces of buried scrap steel were discovered on the Site in addition to the pipeline and tank described in the previous section. Additionally, a significant amount of reinforced concrete was discovered and crushed on-Site. While the crushed concrete was reused as fill on-Site, the scrap reinforcing steel was disposed off-site (as scrap steel for recycling). Specifically, a total of approximately 146.1 tons of scrap steel were disposed off-site in addition to the scrap pipe and UST between March 27 and October 23, 2009. Additionally, CHA notes that a significant quantity of scrap steel was generated at the Site during the construction of the Zone 1 and Zone 3 bulkheads. However, this quantity of scrap steel was not tracked by the Engineer as these costs were included as part of the bulkhead items of the

Contract. While most scrap steel was not classified as contaminated, the scrap pipeline and UST were decontaminated prior to offsite shipment for recycling.

A copy of the weight tickets documenting the offsite disposal of the scrap is included in Appendix AD. It should be noted that there were three weight tickets for June 22, 2009, all with the same ticket number on the initial submission from SWC. In December 2011, the Engineer contacted the recycling facility directly to inquire on the disposal tickets for this day. The facility indicated that there must have been a glitch in their computer system, as that had never happened before and that their records showed three distinct ticket numbers (Nos. 183582, 183583, & 183608) for that date. The facility agreed to send copies of the correct weight tickets to the Engineer and the corrected tickets have been included in the appendix.

4.3.7.2 On-Site Re-Use

The scrap steel was not re-used on-Site.

4.3.8 Concrete Disposal

4.3.8.1 Disposal Details

No concrete, other than a few small pieces that got mixed in with the petroleum-contaminated soils, was disposed off-site. The Contractor mobilized a crushing unit to the Site and crushed all of the concrete on-Site. The reinforcing steel that was removed from the concrete was recycled off-site as scrap steel as described in the previous section.

4.3.8.2 On-Site Re-Use

A total of approximately 6,484.8 cubic yards of concrete were crushed on-Site and reused as backfill on the Site, beneath the demarcation barrier. Approximately 4,484.8 cubic yards of concrete was crushed between August 2008 and April 2009 while the final approximately 2,000 cubic yards was crushed between August and September 2009.

4.3.9 Drum Disposal

4.3.9.1 Disposal Details

On March 28, 2008, the Contractor discovered four (4) 55-gallon abandoned drums in Zone 1, two (2) of which were heavily damaged, during the clearing and grubbing activities. The drums were overpacked, characterized and disposed of off-site. Based upon the characterization performed, two (2) of the drums were determined to contain waste hydraulic oil and two (2) of the drums were found to contain debris contaminated with oil. The analytical report summarizing the characterization, as prepared by York Analytical Laboratories, Inc., has been included in Appendix AE. All drums were transported off-site by Triumvirate Environmental of Somerville, Massachusetts (United States Environmental Protection Agency (USEPA) ID No. 1MAD985286988) to Enviro-Safe Corporation in Lowell, Massachusetts (USEPA ID No. 1MAD047075734) for disposal and/or treatment on August 4, 2008. A copy of the waste manifest has been included in Appendix AF.

4.3.9.2 On-Site Re-Use

The drums were not re-used on-Site.

4.3.10 Tires

4.3.10.1 Disposal Details

During the course of the AOC excavations, a number of buried tires were found on-Site, with the majority being discovered in AOC-1. A total of 942 tires (847 passenger car ties, 75 passenger car tires on rims, and 20 truck tires) were disposed off-site by Casings, Inc. of Catskill, New York on October 13, 2009. A copy of the weight ticket documenting the offsite disposal of the tires is included in Appendix AG.

4.3.10.2 On-Site Re-Use

The buried tires were not re-used on-Site.

4.4 CONSTRUCTION PERFORMANCE/DOCUMENTATION SAMPLING

4.4.1 Environmental End Point Sampling

4.4.1.1 AOC Confirmatory Samples

Following completion of the excavation activities, a total of twelve (12) confirmatory/end-point samples were collected from each major AOC, including AOC-1 and AOC-2/3. The location of each confirmatory sample is identified on Figure 5. These samples were analyzed for the following parameters:

- VOCs via Environmental Protection Agency (EPA) Method 8260
- SVOCs via EPA Method 8270
- Herbicides via EPA Method 8151
- Pesticides via EPA Method 8081
- PCBs via EPA Method 8082
- Metals – Priority Pollutant List (PPL) via EPA Methods 6010-7471
- Conductivity
- Flash Point
- pH
- Reactivity (cyanide and sulfide)

The end-point samples were collected as the AOC excavations progressed so that these large excavations could be backfilled as the construction work progressed. Since the samples were collected over a period of several days and there were no requirements specified in the Contract for additional QA/QC samples to be collected (e.g. trip blanks, field blanks, matrix spike/matrix spike duplicate (MS/MSD) samples, etc.), no QA/QC samples were collected by the Contractor. Furthermore, Data Usability Reports (DUSRs) were not required for this project.

All original laboratory data, as submitted by the Contractor, is included in Appendix AH, while analytical summary tables are included in Appendix AI. Table AI-1 summarizes the confirmatory results for AOC-1 while Table AI-2 summarizes the confirmatory results for AOC-2/3. Although

the original Site investigations, the ROD, and design documents were based upon the NYSDEC's "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels", the Department enacted 6 NYCRR Subpart 375-6 "Remedial Program Soil Cleanup Objectives" on December 14, 2006. Therefore, the results in the summary table were compared to the Unrestricted Use Soil Cleanup Objectives (SCOs) specified in Table 375.6.8(a) rather than TAGM 4046 cleanup objective concentrations, and all exceedances of SCOs are highlighted. The results are discussed in Section 4.6 of this FER.

4.4.1.2 Confirmatory Samples from Non-Major AOCs

In addition to the AOC-1 and AOC-2/3 confirmatory samples, a number of other confirmatory samples were collected during the course of the construction due to the observation of additional AOCs during construction activities, including the following (see Appendix AH for laboratory analytical packages and Appendix AI for analytical summary tables):

- Three (3) confirmatory soil samples were collected from AOC-4A, including one (1) bottom sample and one (1) sample from both the north and east side walls of the excavation. Analytical results for AOC-4A are summarized in Table AI-3 in Appendix AI. Confirmatory soil samples were not collected from the west or south side walls of the excavation as the excavation was advanced to solid foundation walls. Test pits were excavated on the opposite side of the foundation walls in both directions to confirm that the limits of the grossly-impacted soils had been removed. The locations of these confirmatory samples are identified on Figure 5.

- Four (4) confirmatory soil samples were collected from AOC-5, including one (1) bottom sample and one (1) sample from the north, west and south side walls of the excavation. Analytical results for AOC-5 are summarized in Table AI-4 in Appendix AI. As previously indicated, no confirmatory soil samples was collected from the eastern side of the excavation as the soil removal extended to the concrete retaining wall leaving insufficient soil to sample. The locations these confirmatory samples are identified on Figure 5.

In addition to the AOC confirmatory samples, the Contractor was required, at their expense, to collect a number of additional confirmatory samples during the course of construction activities due to mismanagement/slow response to spills caused by the Contractor. These samples included the following (see Appendix AH):

- The Contractor was required to remove approximately 0.1-cubic yards of material from Item 4 building pad in Zone 3 due to a small spill of hydraulic fluid on the pad. On June 11, 2009, a confirmatory sample was collected from the Item 4 pad to document that sufficient material had been removed from the pad to clean up the spill.

- Four (4) confirmatory samples were collected on June 29, 2009 from the Item 4 building pad in Zone 3 following the cleanup of small oil spills observed on the pad.

- One (1) confirmatory sample was collected from beneath the former fuel truck containment pad in Zone 4 following removal of the pad and stained soil beneath the pad.

- One (1) confirmatory soil sample was collected near the northeast bedrock outcropping following the removal of the pipe/UST decontamination pad to document cleanup of this area.

4.4.1.3 ACM Endpoint Sampling

During the ACM removal activities at the Site, a NYSDOL-certified project monitor was required to be on-Site and to collect air samples to confirm that asbestos fibers were not migrating outside the abatement zone. The project monitor, Envirologic of New York, Inc. was retained independently of the Contractor. Most of the air samples collected had no detectable levels of asbestos fibers, but a few had levels ranging up to 0.003 fibers per milliliter, which was within acceptable limits. The final air monitoring analytical results were considered the final endpoint samples for completing the ACM removals by NYSDOL. The complete laboratory results as well as the project monitor's daily field reports are included in Appendix O.

4.4.2 Non-Environmental Performance Testing Results

As previously indicated, prequalification testing and field quality control testing were performed in addition to the environmental end point sampling. The following subsections summarize the major categories of testing completed for the project.

4.4.2.1 Imported Fill – Item 4 Run-of-Crush

Item 4 run-of-crush material was the primary material imported as clean fill to the Site that required testing prequalification and field testing. The prequalification reports for the Item 4 material, including Atterberg Limits, particle size analysis, and modified Proctor results have been included in

Appendix AJ. In addition to the prequalification data, in-place density testing was required during the placement of the Item 4 material within the Zone 3 building footprint. The density testing demonstrated that the Item 4 was placed in accordance with the specifications (95 percent of the maximum dry density) and these results are included in Appendix AK. It should be noted that the Item 4 material placed within the Zone 3 building footprint is all considered part of the soil cover system in that area.

As discussed later in Section 4.5 of this FER, a number of other fill materials were imported to the Site as part of the construction. However, the testing requirements for the other imported fill items were less than that for the Item 4, which was considered a structural fill. Specifically, the only prequalification testing required for imported stone materials (e.g. riprap, bedding stone, ¾-inch stone, etc.) was a particle size analysis to confirm that the material gradation was in general conformance with the Contract documents. Since these materials were generally open-graded stones, in-place density testing was not practical in the field, and therefore, no Proctor testing was required. The Engineer also required the Contractor to submit a certification letter documenting the source of these materials was from "virgin" sources as further described in Section 4.5.

In addition to the stone materials, topsoil and a silty soil were imported as part of the soil cover system for the Site. Since it is undesirable to compact soils significantly in the areas intended to support vegetation (future green space areas), density testing was not required for these materials. Certification letters documenting these materials as "virgin" are further described in Section 4.5 and environmental testing performed on these finer-grained imported fills is discussed in Section 4.5 of the FER.

4.4.2.2 Soil Cover Layer

Southeast Corner of Zone 1

Given that this area was relatively small approximately 1,350 square feet) and in a future green-space area, no geotechnical prequalification or field testing of the topsoil or in-place density testing of the Item 4 material placed in this area was required. The analytical data results for imported soil cover materials (e.g. Item 4 run-of-crush and topsoil) are discussed in Section 4.5 of the FER.

Developer Areas

Per Section 02208 – Soil Cover Layer of the Contract Documents (see Appendix C), the Developer's contractor was required to complete field quality control testing of the soil cover materials installed over the Site. However, field quality control testing was only required for the areas where the Item 4 material was placed for the soil cover system (including future building pads, parking locations, and large pedestrian walkways). As previously indicated, there were no compaction requirements for topsoil areas where establishment of vegetation was desired. Specifically, the following field quality control testing was performed:

- One particle size analysis (ASTM D422) and one standard Proctor test (ASTM D698) was completed for every 5,000 cubic yards of Item 4 material placed as soil cover material. For this project, a total of two (2) sets of soil were tested by Atlantic Testing Laboratories, Limited (ATL) and three (3) additional prequalification samples of the Item 4 material were tested by Advance Testing. Five (5) total particle size and Proctor sets of data was sufficient for up to 25,000 cubic yards of Item 4 material placement. With a 12-inch thick soil cover for Item 4, this would be sufficient for placement of 15.5 acres, which is a larger area than the entire 14.04-acre Site. While the Item 4 soil cover is more than 12-inches thick in some areas, given that the results were relatively consistent and that Item 4 was not used in some of the future green space areas, the number of samples provided was considered sufficient.

- In-place density and moisture content tests were required to be performed at a minimum frequency of nine (9) tests per acre per lift, which in the case of the soil cover system, was placed in a single lift. Per the City's Sub-Appendix COP-D in Appendix D of the FER, a total of 135 tests were performed, which would be sufficient for up to fifteen (15) acres. This area is greater than the size of the Site. Thus, the minimum testing frequency was exceeded. All test results were in conformance within the minimum compaction requirements (minimum of 95 percent of the standard Proctor) and the couple of tests that were low were re-compacted and retested to ensure conformance.

- Depth checks were performed on the soil cover system to verify the minimum thickness of the soil layers placed conformed with the project requirements. Specifically, the soil cover was required to be a minimum of twenty-four (24) inches thick in Zones 1 & 2 were potential ACM materials remain and a minimum of twelve (12) inches thick across the remainder of the Site. A total of seventy-eight (78) depth checks were performed on the Site, as indicated in Sub-Appendix COP-F of the City's documentation provided in Appendix D of the FER. However, depth checks were not performed in the future building footprint areas because the amount of fill placed in these areas was well in excess of the minimum required. In fact, in the building pad area in Zone 3 of the Site, the thickness of the Item 4 materials is in excess of six (6) feet.

4.4.2.3 Concrete Anchor Blocks

Concrete test cylinders were collected from the concrete pour used to form the concrete anchor blocks at the south end of the Zone 1 bulkhead. The test results included in Appendix AL confirm that the concrete met the project specifications of 5,000 pounds per square inch (PSI) compressive strength.

4.5 IMPORTED FILL

Numerous soil and stone products were imported to the Site for the purposes of backfilling excavations and placing a soil cover system across the Site. Table 4-9 on the following pages and the following subsections summarize all of the fill materials that were imported to the Site as part of the construction.

All imported fill, with the exception of topsoil and the loamy silt soils installed in future green spaces areas of the Site, was imported from Tilcon's Clinton Point Quarry located off Sheafe Road in New Hamburg, New York. The Tilcon quarry is a NYSDEC permitted mine (Mine ID No. 30011). A copy of a letter from Tilcon certifying that all materials imported were "virgin" has been included in Appendix AM. Additional certification letters for other imported fills are also included in Appendix AM, and are summarized as follows:

- Topsoil for the southeast slope was imported from the Syracuse Sand & Gravel LLC (affiliated with Riccelli Enterprises, Inc.) in Phelps, New York
- Topsoil/silty loam soil imported by the Developer for non-paved areas surrounding the existing parking lot at the north end of the Site and future green space areas elsewhere on the Site was imported from the Redwing Sand & Gravel Billing's Mine, located in Billings, New York.

With the exception of run-of-crush Item 4 material, topsoil, and screening materials imported to the Site, all of the imported fill materials consisted of washed gravel and stone materials for which the NYSDEC did not require environmental sampling. Weight tickets documenting the amount of all stone/gravel materials imported to the Site by the Contractor on a tonnage basis has been included in Appendix AN. It should be noted that the Contractor provided the tickets to the Engineer organized by month rather than by the type of material. However, within each batch of monthly tickets, the

Table 4-9. Summary of Imported Fill Materials

Material	Use	Required Environmental Sampling Frequency	No. Samples Submitted	Allowable Quantity for Import (CY)	Quantity Imported
SWC Imported Fill					
Item 4 (crusher run material)	• AOC-2/3 building pad fill • Trench backfill above pipe zone bedding • Backfill around Zone 1 bulkhead tie rods • Bottom 6-inches of soil cover system on southeast slope • Decontamination pad	1 per 5,000 CY (virgin material)	4	20,000 CY	10,065 CY[1]
Coarse Stone/Gravel	Filling sink holes along shoreline	None[2]	--	No Limit	522 Tons[3]
	Backfill beneath water table in AOC excavations	None[2]	--	No Limit	30,894.35 Tons[3]
	Tracking pad at Site entrance, temporary access roads, etc.	None[2]	--	No Limit	Not Measured
Pipe Bedding Stone	Pipe bedding zone for utility trenches (e.g. weep hole drainage system)	None[2]	--	No Limit	280± CY
Bedding Stone	Bedding stone beneath riprap revetment stone and toe protection stone along shoreline	None[2]	--	No Limit	2,000± CY[4]
Riprap Stone	Zone 2, 4 & 5 revetment along shoreline	None[2]	--	No Limit	6,540± CY[5]
Toe Protection Stone	Armor and toe stone used for toe protection in front of Zone 1 & 3 bulkheads	None[2]	--	No Limit	1,450± CY[6]
Topsoil SE Slope	Topsoil (top 6 inches) for soil cover system in southeast corner of Site with slopes approximately 3:1.	1 per 5,000 CY (virgin material)	1	5,000	185

Material	Use	Required Environmental Sampling Frequency	No. Samples Submitted	Allowable Quantity for Import (CY)	Quantity Imported
VCCI Imported Fill (Developer's Contractor)					
Topsoil/Silty Loam Material in Green Space Areas	Developer placed topsoil in landscape islands and other green space at north end of Site as wells as future green space areas in Zone 1, 2 & 3.	1 per 5,000 CY (virgin material)	3	15,000 CY	5,900
Item 4 (crusher run material)	Fill for grading Site and soil cover system	1 per 5,000 CY (virgin material)	3	24,935 CY[7]	23,276 CY[8]
¾-inch Stone	Pipe bedding material for water and sewer pipes installed by the Developer.	None[2]	--	No Limit	5,052.16 Tons
Light Stone Material	Small riprap installed in a low spot on the southeast slope to provide scour protection in this area.	None[2]	--	No Limit	43.29 Tons
Screenings	Pipe bedding material for gas lines, telecommunication & electric conduits, and other miscellaneous utilities.	1 per 5,000 CY (virgin material)	Sampled as Item 4	1,707 CY[9]	1,289.3 Tons, or 668± CY

Notes:

1. *This quantity includes only the material paid directly under a separate line item in the Contract. This quantity excludes miscellaneous volumes of material utilized for the decontamination pad and the fill in utility pipe trenches, as that volume of material was tracked based upon the length of pipe installed rather than by volume.*
2. *For this project, the NYSDEC agreed that due the small percentage of "fines" in this material and because it was designated as "virgin" crushed stone from a quarry, no environmental sampling of this material was required.*
3. *This quantity excludes stone used for the Contractor's tracking pad at the Site entrance and other miscellaneous uses that were not payable to the Contractor under their agreement with the City.*
4. *The bedding layer was specified as 12-inches while the overall revetment thickness was 5 feet. This value was calculated as 20% of the total riprap stone and toe protection stone imported to the Site.*
5. *The riprap stone quantity was estimated as 80% of the overall revetment section volume for the project.*
6. *The toe protection stone quantity was estimated as 80% of the overall toe protection stone volume for the project.*
7. *Includes 15,000 CY for the Developer plus 9,935 CY available and not used by SWC.*
8. *Includes 39,200.05 tons (City Appendix E.1 in Appendix D) plus 5,641.15 tons (City Appendix E.5 in Appendix D) and 93.12 tons imported in 2013 for soil cover repairs at a unit weight of 143 pounds per cubic foot (from prequalification data).*
9. *Considered smaller sized Item 4, so this is remaining unused balance of Item 4.*

tickets were grouped by the various types of imported fills delivered each month. CHA notes that while a certification and analytical testing was provided for the topsoil received from Syracuse Sand & Gravel LLC, the Contractor did not provide the weight tickets for this material, nor was it required in the Contract Documents.

4.5.1 Item 4 Run-of-Crush Material

Item 4 run-of-crush material was utilized for a number of purposes at the Site, as described in Table 4-9. A total of four (4) environmental samples were collected by the Contractor of the run-of-crush Item 4 as part of the prequalification process, which allowed them to import up to 20,000 cubic yards of material. The samples were analyzed by York Analytical Services, Inc. (Lab ID No. 10854) for TCL VOCs, TCL SVOCs, pesticides, PCBs, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide in accordance with the Specifications (Section 02200). No organic compounds were detected in any of the samples; however, the following table summarizes the analytical results for the four (4) metals detected in the samples and compares the results to TAGM 4046 and the 6 NYCRR Part 375-6 SCO's. The complete analytical package is included in Appendix AJ.

Table 4-10. Summary of Item 4 Analytical Results - Contractor

Sample ID Units COMPOUND	Part 375 Unrestricted Use SCO	TAGM 4046 Recommended Soil Cleanup Objective Concentration	Quarry 1 mg/Kg	Quarry 2 mg/Kg	Quarry 3 mg/Kg	Quarry 4 mg/Kg
Arsenic	13	7.5 or SB	4.86	4.43	3.96	4.56
Barium	350	300 or SB	11.8	11.7	12.8	13.4
Chromium	30	10 or SB	4.53	4.57	4.76	5.60
Lead	63	SB	5.97	6.70	6.90	5.95

As indicated in Table 4-10, the metal concentrations detected in the Item 4 material were well below both the Part 375 Unrestricted Use and TAGM 4046 (used during construction) SCOs. Since the metal concentrations were below the SCOs and consistent with naturally occurring metal levels in bedrock, the Contractor was approved to import up to 20,000 cubic yards of the Item 4 material (1 sample per 5,000 cubic yards of material). The Contractor imported approximately 10,065 cubic

yards of Item 4 during the course of the construction, most of which was for the building pad located in AOC-2/3

The Developer of the Site elected to use this same Item 4 material for much of the utility work and the majority of the soil cover system, and thus, obtained the material from the same source as the Contractor. Therefore, since the Contractor only imported a total of approximately 10,065 cubic yards during their work, the Developer was permitted to import the balance of the originally approved 20,000 cubic yards for the Contractor, which was the equivalent of 9,935 cubic yards.

The Developer was responsible for additional prequalification sampling in excess of 20,000 cubic yards. The additional prequalification environmental data for the Item 4 material is included in the City's Sub-Appendix COP-C of Appendix D in the FER (includes first three samples in the appendix only). The Developer collected an additional three (3) samples which brought the total permissible imported volume for Item 4 material to 24,935 cubic yards (15,000 cubic yards based on the Developer's three samples plus the Contractor's balance of 9,935 cubic yards). The Developer ultimately imported approximately 23,228 cubic yards of Item 4 material (using an average unit weight of 143 pounds per cubic foot), which was 1,707 cubic yards less than the maximum allowable. The samples were analyzed by York Analytical Services, Inc. (Lab ID No. 10854) for TCL VOCs, TCL SVOCs, pesticides, PCBs, and TAL metals.

CHA has inserted a summary table of the analytical results into the City's Sub-Appendix COP-C in Appendix D of the FER to compare the results to both the Part 375 Unrestricted Use and TAGM 4046 SCOs. Five (5) VOCs and one (1) SVOC were detected in the grab samples, but detected at levels well below the Part 375 Unrestricted Use and TAGM 4046 SCOs, with the exception of acetone and methylene chloride. While higher concentrations of acetone and methylene chloride were detected in the samples, both compounds were detected in the laboratory blank and are common laboratory contaminants. Based upon the concentrations reported for the Item 4 analytical samples, the laboratory has flagged the elevated acetone and methylene chloride results as artifact parameters.

No pesticides or PCBs were detected in any of the samples.

A number of metals were detected in each of the three (3) environmental samples; however, the concentrations reported by the laboratory were below the Part 375 Unrestricted Use and TAGM 4046 SCOs.

The weight tickets associated with the Item 4 material imported by the Developer's contractor have been included in the City's Appendices COP-E.1 and COP-E.5, which are located in Appendix D of this FER.

Following the November 7, 2013 discovery of minor erosion of the soil cover on some of the steeper slopes in Zones 1 & 2, additional Item 4 material was imported to the Site by the City to make the required repairs to the soil cover system. The City imported approximately 48 cubic yards of Item 4 material Tilcon's Clinton Point Quarry, which was already an approved source. The total imported quantity of Item 4 was raised to a total of 23,276 cubic yards, which is still below the allowable 24,935 cubic yards as indicated in Table 4-9. Photographs documenting the repairs are included in the photograph log included in Appendix Q. The final six weight tickets associated with the additional imported Item No. 4 are included in the City's Appendices COP-E.1, which are located in Appendix D of this FER.

4.5.2 Coarse Gravel/Stone Materials

At the direction of the NYSDEC, the AOC excavations extended well beneath the water table as indicated on Figure 4, and deeper than initially contemplated during the design process. Since backfilling these excavations with on-Site, relatively fine-grained materials was not practical beneath the water table due to pore pressure within the material, imported coarse gravel was selected for backfilling the excavations beneath the water table. This material primarily consisted of a 2-1/2-inch stone, although 1-1/2 and 5-1/2-inch stone materials were utilized when supplies of the 2-1/2 stone ran low at the quarry. The coarse gravel was placed from the bottom of the AOC excavations (see Figure 4) to a depth of approximately 0.5-feet above mean sea level (AMSL) on the North American Vertical Datum, 1988 (NAVD88) . This elevation was targeted because it allowed the Contractor to

bring the stone to a level just above the water level at a low tide. A six (6) ounce non-woven geotextile fabric was placed above the coarse stone layer to minimize the potential for downward migration of fines associated with the Site backfill material and smaller-grained imported fills placed above the coarse gravel layer.

Since all gradations of the coarse gravel/stone were a washed stone with no significant amount of fines, environmental sampling was not required by NYSDEC for this material. Additionally, since this material was being placed through water, in-place density and moisture testing was not practical. Since in-place testing was not practical, no pre-qualification testing was required beyond verification of the gradation for each different size of stone imported from the same source.

4.5.3 Pipe Bedding Stone

Similar to the coarse gravel and stone, the NYSDEC did not require environmental sampling of the 2-inch washed stone utilized for pipe bedding at the Site. This material was used for bedding the pipes installed at the five (5) outfalls installed for the Developer as well as for the piping network installed for the weep hole drainage system. The pipe bedding material was typically placed up to the spring line on the drainage pipes and the remainder of the trenches was backfilled with Item 4 run-of-crush material. Given the limited amount of stone utilized under the Contract, no density testing of this material was required.

4.5.4 Revetment Bedding Stone

A 12-inch layer of bedding stone was placed over the woven geotextile in all riprap revetment stabilization areas prior to placement of the riprap stone. This material consisted of the same 2-1/2-inch coarse stone utilized for backfilling the AOC excavations beneath the water table and filling in sink holes at the Site. Relative to the revetment, this layer serves as an intermediate filtration layer helping to reduce the scour of fines beneath the revetment as well as providing a solid base for the armor stone.

Since the NYSDEC did not require environmental testing of this washed stone material, the only prequalification testing required was a particle size analysis. Copies of this documentation have

been included in Appendix K. Weight tickets for the bedding stone have been included in Appendix AN as previously described; however, the exact distribution of stone between the revetment, AOC backfill below the groundwater table, and the filling of sink holes is non-determinate because the weight tickets were submitted to the Engineer as a single submittal. That said, a total of approximately 31,416.35 tons of bedding stone was paid in the Contract for bedding stone imported to the Site. Given that an estimated 522 tons of material was utilized to fill the sink holes along the waterfront, the Engineer has estimated that the remaining 30,894.35 tons of bedding stone was utilized for filling the AOCs beneath the water table. Tickets for imported bedding stone in excess of 31,416.35 tons is presumed to be associated with non-pay items in the Contract, such as the tracking pad at the Site entrance, construction of temporary access roads, etc. or was included in another Contract item, such as the riprap revetment.

4.5.5 Riprap Armor Stone and Toe Protection Stone

A four (4)-foot layer of riprap armor stone, consisting of stones ranging from 235 to 2,125 pound stones, was placed over the bedding stone to provide a stable shoreline capable of dissipating wave energy in the river. Toe stones, range from 1,100 to 4,400 pounds were placed along the bottom of the revetment section to protect the revetment from toe scour that could potentially jeopardize the overall stability of the revetment if left unprotected. The same armor and toe protection stone were placed in front of the bulkheads as well to provide toe support to the bulkheads and reduce the potential for scour of the existing mud line in the river.

A total of approximately 1,949 lineal feet of revetment was installed along the river shoreline as part of this project (part of which was off-site), which included approximately 1,813 cubic yards of toe stone and approximately 8,176 cubic yards of armor stone. The following list summarizes the length of revetment installed in each zone:

- Zone 1: 50 lineal feet (south of the Zone 1 bulkhead)
- Zone 2: 848 lineal feet
- Zone 4: 740 lineal feet
- Zone 5: 311 lineal feet

4.5.6 Topsoil Southeast Corner of Site

Since the Developer of the Site planned no further grading activities in the southeast corner of Zone 1, the soil cover was installed in this area in 2009. The soil cover in this area included a biaxial geogrid demarcation barrier, a six (6)-inch layer of Item 4, a six (6)-inch layer of topsoil, and erosion control blankets with seeding. The analytical prequalification submittal package for the topsoil is included in Appendix AO. No in-place density testing was required for this area given that it was a relatively small area (approximately 1,350 square feet) and in a future green-space area.

4.5.7 Topsoil/Silty Loam Installed by Developer's Contractor

As part of the soil cover system for the Site, the Developer's contractor placed a minimum of a twelve (12) inch thick layer of silty loam topsoil material in all future green space areas on the Site. CHA notes that the material placement around the existing parking lot at the north end of the Site was completed prior to the balance of the soil cover system. Prior to the commencement of the construction by the Contractor, the City had negotiated approval with the NYSDEC to install a demarcation barrier and 12-inches of Item 4 material to serve as a soil cover system so that the Developer could begin utilizing that portion of the Site as a gravel parking lot area. While some material was scraped off the surface of the parking lot due to tracking, most of this material remained. Additionally, the parking lot has since been paved and the landscaped areas now include approximately 6-inches of topsoil/silty loam from the Redwing Sand & Gravel facility and/or mulch in addition the material installed prior to the commencement of construction.

A total of 8,322.50 tons of topsoil were imported for the future green space areas on the Site and an estimated additional 1,200 tons of material was imported for the existing landscaped areas surrounding the northern parking lot for a total of 9,500 tons of imported material. Using an estimated unit weight of 120 pounds per cubic foot (or approximately 1.6 tons per cubic yard), it is estimated that approximately 5,900 cubic yards of the silty loam topsoil was placed on the Site. Weight tickets for the material imported for the future green space areas have been included in the City's Sub-Appendix COP-E.3 of Appendix D in the FER. However, the Developer was unable to provide copies of the weight tickets for the material placed in the existing landscaped areas surrounding the northern parking lot area.

Three (3) environmental samples (Sample Nos. 4, 5A & 5B) were collected from this source for laboratory analysis. Grab samples were collected for VOC analysis and composite samples were collected for analysis of SVOCs, pesticides, herbicides, PCBs and metals. CHA has inserted a summary table of the analytical results into the City's Sub-Appendix COP-C in Appendix D of the FER to compare the results to both the Part 375 Unrestricted Use and TAGM 4046 SCOs. The final two analytical packages in the Appendix provide the original laboratory data packages for the three samples of topsoil/silty loam material used as part of the soil cover system for the Site.

Three VOCs were detected in Sample No. 4; however, the concentration of xylene was well below the Part 375 Unrestricted Use and TAGM 4046 SCOs and the detected concentrations of acetone and methylene chloride in the samples was attributed to laboratory contamination, and thus, not considered a significant concern. Low levels of methylene chloride were also detected in Sample Nos. 5A Grab and 5B Grab, but the results were "flagged" with a data qualifier as the methylene chloride was as detected in the laboratory blank. No SVOCs, herbicides, pesticides or PCBs were detected in the samples.

A number of metals were detected in all three samples. Arsenic, manganese and nickel were detected in Sample No. 4 in excess of the Part 375 unrestricted SCOs. Additionally, nickel was detected slightly in excess of the unrestricted SCO in Sample No. 5A. Since the metal concentrations are only slightly in excess of the Part 375 Unrestricted Use SCOs and well below the Commercial Restricted Use SCOs, the material was accepted for use at the Site.

4.5.8 ¾-Inch Stone

Since this material was an open graded stone with little to no fines, the NYSDEC did not require environmental sampling of the ¾-inch washed stone utilized as pipe bedding for the sewer and water pipelines in the utility trenches. No other conformance or in-place density testing of this material was required. A total of 5,052.16 tons of ¾-inch stone was imported to the Site per the weight tickets included in Appendices COP-E.2 & COP-E.5 located in Appendix D of the FER.

4.5.9 Light Stone Material

Light stone fill is similar in nature to the riprap materials previously described, but includes smaller sized stones. A total of 43.29 tons of this material was imported to the Site; however no analytical testing was performed on the material because it is an open-graded stone with little to no fines. Additionally, no prequalification testing or field quality control testing was required for this material given the limited quantity imported to the Site. Weight tickets for this material have been included in the City's Sub-Appendix COP-E.4 within Appendix D of the FER.

The City elected to import this material to mitigate an erosion issue associated with the soil cover system installed near the southeast corner of the Site along a steep slope. Specifically, there was an existing low spot on the MTA property immediately above the southeast slope. Water that collects at this low spot accumulates and then runs down the slope and had eroded a portion of the soil cover system previously installed by the Contractor. Since there was no obvious solution to eliminating the MTA runoff onto the Site, a small channel with light riprap stone was installed down the slope to prevent future scour an ensure a minimum of 12-inch of cover over the demarcation barrier (geogrid in this area) is maintained moving into the future. Additionally, the Developer's Contractor installed light stone along the toe of the southeast slope and diverted the water into a 4-inch diameter under-drain pipe that connects to one of the newly installed catch basins for the Site stormwater system.

4.5.10 Stone Screenings

A total of 1,289.3 tons (approximately 668 cubic yards using an average unit weight of 143 pounds per cubic foot) of stone "screenings" was imported to the Site from the Tilcon quarry, as documented by the weight tickets included in the City's Sub-Appendix COP-E.5 included in Appendix D of the FER. This material is a small stone material that is derived from the crushing of bedrock stone, and is considered a smaller gradation/particle size version of the Item 4 material (a gradation of the material and note regarding that the source of the material is 100 percent stone screenings from a crushing operation is also include in the Appendix). Since the material is derived from the same source as the Item 4 material, the unused import balance of material associated with the environmental samples analyzed for the Item 4 material was used for the screenings material. Specifically, 1,707 cubic yards of the Item 4 material remaining allowable imported volume was

unused, which is greater than the 668 cubic yards of screenings material actually imported (by 1,039 cubic yards), and therefore, no additional samples were analyzed.

This material was used as pipe bedding material for all utilities with the exception of the water and sewer lines (i.e. electrical conduits, telecommunication conduits, gas pipelines, etc.).

4.6 REMAINING CONTAMINATION

Following the completion of the AOC excavations, confirmatory samples were collected from both the bottom and side walls of the excavations to document the remaining contamination levels at the Site. A total of twelve (12) confirmatory samples were collected from each AOC, as shown on Figure 5. The complete analytical packages for the confirmatory results have been included in Appendix AH, while tables summarizing all of the analytical results of the confirmatory samples have been included in Appendix AI, as previously discussed. The subsections below summarize the data and provide a comparison to Part 375 Unrestricted SCOs.

4.6.1.1 AOC-1 Confirmatory Sample Summary

For AOC-1, four (4) of the confirmatory samples were collected from the bottom of the excavation while the remaining eight (8) samples were collected from the sidewalls of the excavation. The following characteristics for AOC-1 were noted from the confirmatory samples:

- No VOCs were detected in eleven (11) of the confirmatory samples. Naphthalene and sec-butylbenzene were detected at concentrations below the Part 375 unrestricted use SCO in Sample No. 11, collected along the southern sidewall of the excavation.

- No SVOCs were detected in seven (7) of the confirmatory samples. One (1) or more of eight (8) SVOCs, specifically PAHs, were detected in the remaining confirmatory samples collected; however, all of these PAHs were detected at concentrations below the unrestricted SCOs.

- No PCBs were detected in ten (10) of the twelve (12) confirmatory samples. However, two PCB congeners, Aroclor-1254 and Aroclor-1260, were detected in Sample Nos. 9 and 10 near the northern end of the excavation, at total PCB concentration of 0.827 milligrams per kilogram (mg/Kg) and 0.143 mg/Kg, respectively. These results are in excess of the unrestricted use SCO for PCBs, which is 0.1 parts per million (ppm), but is below the restricted commercial SCOs of 1 ppm.

- No pesticides or herbicides were detected in any of the confirmatory samples.

- Metals were detected in all of the confirmatory samples and all but one (1) had at least one metal compound detected at a concentration in excess of the Part 375 unrestricted SCO. The metals detected in excess of the unrestricted SCOs include chromium, copper, lead, nickel, and zinc. With the exception of copper and nickel, all metal concentrations were below the commercial SCOs. However, the remedy for the project did not specifically target remediation for metals beyond encapsulation beneath a soil cover system, so the remaining metals at the Site are not unexpected.

- Sheens were observed periodically on the groundwater surface in AOC-1 during the course of the removal activities and after the excavation, indicating some level of residual product remaining. Long-term groundwater monitoring will be conducted to evaluate any impacts to groundwater, as described in the SMP.

4.6.1.2 AOC-2/3 Confirmatory Sample Summary

For AOC-2/3, nine (9) of the confirmatory samples were collected from the bottom of the excavation (most near the perimeter of the excavation) while the remaining three (3) samples were collected from the sidewalls of the excavation. The following characteristics for AOC-2/3 were noted from the confirmatory samples:

- No VOCs were detected in ten (10) of the confirmatory samples. Naphthalene was detected in Sample No. 13-Bottom and tetrachloroethene (PCE) was detected in Sample No. AOC-2/3-#19; however, both compounds were detected at concentrations below the Part 375 unrestricted SCOs.

- No SVOCs were detected in ten (10) of the twelve (12) confirmatory samples. A total of ten (10) SVOCs, specifically PAHs, were detected in the remaining confirmatory samples collected; however, only benzo(a)anthracene, benzo(a)pyrene, chrysene, and indeno(1,2,3-cd)pyrene were detected at levels in excess of the unrestricted SCOs, and exceedances were only detected in Sample No. 10 (side wall) near the south end of the excavation. There were no unrestricted SCO exceedances in Sample No. AOC-2/3-#4 also collected near the south end of the excavation. Only benzo(a)pyrene in Sample No. 10 was detected at a concentration in excess of the commercial SCO (concentration of 1.5 ppm versus a SCO of 1 ppm).

- The specific detected PCB results for AOC-2/3 are summarized in the table below, as well as in Appendix AI. Sample AOC 2/3-2 contained concentrations of two PCB congeners, Aroclor-1254 and Aroclor-1260, detected at combined total concentrations below the unrestricted SCO of 0.1 ppm. Aroclor-1260 was also detected in sample #13 Bottom, #10 Side, AOC 2/3 Grid 11, and AOC 2/3 Grid 4, but was only detected in excess of the

unrestricted SCO of 0.1 ppm in Samples #13 Bottom and #10 Side. However, the total PCB concentrations in #13 Bottom and #10 Side (which is only Aroclor-1260 in this case) is well below the commercial use SCO of 1 ppm for PCBs.

Compound	Units	AOC 2/3 2	#13 Bottom	#10 Side	AOC 2/3 Grid 11	AOC 2/3 Grid 4
Aroclor-1254	mg/Kg	0.03	ND	ND	ND	ND
Aroclor-1260	mg/Kg	0.03	0.24	0.12	0.02	0.02

Note: ND = Not detected.

- No herbicides were detected in any of the confirmatory samples. A relatively low concentration of 4-4' DDT was the only pesticide detected in AOC-2/3, and was found in Sample #7 Bottom. The concentration of DDT exceeded the unrestricted use SCO; however, was well below the commercial use SCO and protection of groundwater SCO.

- Seven (7) metals were detected in excess of the unrestricted SCOs in one or more of the confirmatory samples. However, the remedy for the project did not specifically target remediation for metals, so again, it is not unexpected that somewhat elevated concentrations of some heavy metals remain at the Site.

- Sheens were observed periodically on the groundwater surface in AOC-2/3 during the course of the removal activities and after the excavation, indicating some level of residual product remaining. Long-term groundwater monitoring will be conducted to evaluate any impacts to groundwater, as described in the SMP.

4.6.1.3 AOC-4A Confirmatory Sample Summary

Three (3) confirmatory soil samples were collected from AOC-4A, including one (1) bottom sample and one (1) sample from both the north and east side walls of the excavation. Confirmatory soil samples were not collected from the west or south side walls of the excavation as the excavation was advance to solid foundation walls. As previously described, test pits were excavated on the opposite side of the foundation walls in both directions to confirm that the limits of the grossly-impacted soils had been removed. The following characteristics for AOC-4A were noted from the confirmatory samples:

- No VOCs, pesticides, herbicides, or PCBs were detected in any of the confirmatory samples.

- Two (2) SVOCs, specifically PAHs fluoranthene and pyrene, were detected in the confirmatory sample collected from the bottom of the excavation only. However, both

compounds were detected at a concentration of 210 µg/Kg, which is well beneath the unrestricted SCOs of 100,000 µg/Kg for each compound.

- Several heavy metals were detected in the confirmatory samples; however, only copper, lead & zinc were detected above the unrestricted SCOs. All three of these metals were detected at concentrations above the unrestricted SCOs in the sample collected on the north side of the excavation, while lead was detected above the unrestricted SCO in all three samples. All three metals were detected at concentration below the Restricted Use SCOs (including both residential and commercial SCOs) established in Table 375-6.8(b) of 6 NYCRR Part 375.

4.6.1.4 AOC-5 Confirmatory Sample Summary

Four (4) confirmatory soil samples were collected from AOC-5, including one (1) bottom sample and one (1) sample from the north, west and south side walls of the excavation. As previously indicated, no confirmatory samples were collected from the eastern side of the excavation as the soil removal extended to the concrete retaining wall leaving insufficient soil to sample. The following characteristics for AOC-5 were noted from the confirmatory samples:

- No VOCs, SVOCs, pesticides, herbicides, or PCBs were detected in any of the confirmatory samples.

- Several heavy metals were detected in the confirmatory at or above the Part 375 unrestricted SCOs.

4.6.1.5 ACM Remaining

Based upon the testing activities performed at the Site to date, there are two areas suspected of containing potential ACMs remaining on-Site, as shown on Figure 5. These include the eastern embankment along AOC-1 and an area along the waterfront north of the bulkhead associated with AOC-1. The eastern embankment represents a portion of the former AOC-1 landfill area that was not excavated as part of the remedy for the Site. While additional ACM-contaminated soils were removed based on the anticipated grading requirements of the Developer of the Site, soils beneath the demarcation barrier in this area may still contain ACM material. In addition to the horizontal demarcation barrier used to establish a vertical limit between the Site soils and soil cover system, a vertical demarcation barrier geotextile was placed along the eastern face of the removal area in AOC-1 to delineate the horizontal limits (generally east to west) of the area removed during the course of the construction.

Prior to the discovery of ACM at the Site, a small amount of overburden material removed from AOC-1 (near the surface) was placed as fill along the waterfront north of AOC-1, specifically behind the concrete jersey barriers associated with the revetment stone material in Zone 2. Some of this placed material was removed to account for grading transitions and to accommodate future light pole bases as shown on Figure 5, but excavations in this area outside the removal zones may encounter ACM beneath the demarcation barrier.

4.7 SOIL COVER SYSTEM

Exposure to remaining contamination in the soil/fill at the Site is prevented by a soil cover system placed over the Site. This cover system is comprised of a minimum of 12 inches of clean soil (e.g. topsoil), run-of-crush stone, riprap revetment, asphalt pavement, and concrete sidewalks. Figure 6 shows the location of each type of soil cover system and provides a description of each. Figure 7 depicts the as-built cross-section for the major cover type systems used on the Site and in critical areas where more information was needed due to the presence of more than one layer of geotextile being present. An Excavation Work Plan, which outlines the procedures required in the event the cover system and/or underlying residual contamination are disturbed, is provided in Section 6.0 of the SMP.

A demarcation barrier has been installed beneath the soil cover to provide a visual barrier between the existing Site soils and the clean, imported soil cover layer materials. The demarcation barrier consists of a six (6) ounce, continuous filament, non-woven geotextile (e.g. Skaps GT-160 and Mirafi 160N). However, in areas where steep slopes (i.e. greater than 3 Horizontal:1 Vertical) are present along the eastern side of the Site, the demarcation barrier consists of a polypropylene, integrally formed biaxial geogrid (e.g. Tensar BX-1100, as manufactured by Tensar Corporation).

The demarcation barrier was installed a minimum of twelve (12) inches below the finished surface. Redevelopment activities, including activities such as paving, or other construction activities may have resulted in the barrier being installed at a greater depth at the following locations:

- In AOC-2/3, a large stone subbase material (Item 4) pad was constructed in the area where future planned buildings intersected the AOC-2/3 excavation, as shown on Figure 6. Upon review of the as-built survey information provided by the Contractor, it was determined that the pad was approximately 20-feet short of the designed limit on the north end; however, the Contractor was required to go back and re-excavate the area to install the required additional 20-feet of pad area. In the building pad area, the demarcation layer was installed at an approximate elevation of 0.5 feet NAVD88. While imported stone material ranging from two (2) to five (5) inches in diameter was placed beneath this layer (fill placement of on-Site materials beneath the water table was deemed impractical due to compaction requirements), excavation beneath the water table would also trigger the need to implement the Excavation Work Plan discussed in the SMP. A similar geotextile was installed at elevation 0.5 feet NAVD88 in areas outside the building pad to control fines migration between the coarse stone placed beneath the water table and the finer-grained on-Site soils used as backfill. The geotextile placed at elevation 0.5 feet NAVD88outside the building pad area was installed for geotechnical purposes only, and is not considered a demarcation barrier.

- In the areas of potential remaining ACM, a minimum of a 24-inch soil cover system was required by the NYSDOL, and thus, the demarcation fabric (e.g. non-woven geotextile) is a minimum of 24-inches deep in these area (east side of AOC-1 and narrow strip of land along west side of Zone 2).

- Utility trenches at the Site have also been lined with non-woven geotextile and backfilled with clean, imported fill (e.g. pipe bedding materials and/or Item 4 crusher run material). Thus, the demarcation layer is present at a greater depth beneath the finish Site grades at the location of subsurface utilities. Although all trenches are lined with a demarcation barrier and backfilled with clean material, future modifications or repair to these utilities may still trigger the need to utilize the Excavation Work Plan as discussed in the SMP. Depending on the depth and width of the original trenches, it may not be possible to maintain the demarcation barrier in place during subsequent excavations of these utility trenches. Should the on-Site soils beneath/behind the demarcation barrier be exposed during maintenance or repair activities, the Excavation Work Plan must be implemented.

As previously noted, the various final soil cover systems are depicted in Figure 6. However, the top 12-inches of material utilized for the soil cover typically includes either silty loam topsoil or Item 4 material. Exceptions include:

- The southeast slope that includes 6-inches of topsoil over 6-inches of Item 4 (with a geogrid demarcation barrier beneath)

- The northern parking lot area that is now finished with an asphalt surface

- The concrete sidewalk area along the west side of Zone 4.

- A portion of the waterfront of the Site is actually covered by riprap revetment and/or toe protection stone and is not considered useable land for redevelopment. The revetment has a steep slope and much of the area is submerged by the Hudson River during high tides. As further described in Section 4.8.4, the revetment areas include a woven geotextile fabric, a 12-inch layer of 2-inch diameter bedding stone and a 4-foot thick layer of armor stone, exceeding the 12-inch thick minimum requirement of the ROD.

The following list summarizes the parties who completed the installation of the various soil cover systems:

- The Developer's contractor, VCCI, installed the soil cover system at the north end of the Site associated with the northern parking lot area.

- A contractor retained by Ginsberg Development (owner of the Townhouses east of the Site) was responsible for installing the pump station on the east side of the Site near the existing tunnel beneath the railroad tracks. As part of this construction, the developer was required to install a demarcation barrier and a minimum of 12-inches of Item 4 material inside the pump station fencing and in the area between the fencing and the existing railroad concrete retaining wall. Additionally, all subsurface utilities installed by this Contractor were lined with a demarcation barrier and backfilled with clean, imported material.

- The Contractor, SWC, installed the soil cover system along the steep slope in the southeast corner of the Site.

- The Contractor, SWC, installed the Zone 3 building pad area.

- The Developer's contractor, VCCI, installed the Item 4 and topsoil soil cover systems in all other areas of the Site.

As previously indicated, approximately 0.40-acres of land near the northeast corner of the host property was determined to be impractical to place soil cover over due to steep slopes and the presence of a bedrock outcropping. As a result, this area was excluded from the Site and a chain link fence was installed along the perimeter to serve as a physical boundary between the Site and host property. The exact boundary between the Site and the host property is provided in Appendix A of the FER.

4.8 OTHER ENGINEERING CONTROLS

Since remaining contaminated soil and groundwater/soil vapor exists beneath the Site, Engineering Controls (ECs) are required to protect human health and the environment. The Site has the following primary Engineering Controls, as described in the following subsections.

4.8.1 Steel Sheet Pile Bulkheads

Due to the remaining contamination in AOC-1 and AOC-2/3, steel sheet pile (SSP) bulkheads were installed along the waterfront down-gradient of each of these AOCs. While the bulkheads provided containment of the impacted soils and groundwater during the AOC excavations, they were also designed to serve as permanent down-gradient barriers for the remaining contamination in the AOCs. The location of the Zone 1 bulkhead (down-gradient of AOC-1) and Zone 3 bulkhead (down-gradient of AOC-2/3) are shown on Figures 2 through 6.

Record drawings for the bulkheads, as prepared by the Engineer (OCC), have been included in Appendix AP and provide both the layout and design details for each bulkhead. The record drawings reflect the field modifications that were made during the construction. The final set of driving logs as provided by the Contractor on May 7, 2010 have not been included; review of these logs has indicated that they are not entirely accurate following multiple revised submittals from the Contractor. All information that would have been provided on the driving logs is accurately detailed within the record drawings prepared by the Engineer and included in Appendix AP. The following lists summarize the major components of each bulkhead:

Zone 1 Bulkhead:

- 330.89-foot long, anchored bulkhead consisting of 160 (or 80 doubles) AZ26 steel sheet piles. The shallow depth to bedrock at the southern end of the Site restricted driving depths for the sheet piles and necessitated the need for an anchored bulkhead system as opposed to a cantilevered wall installation. The steel sheet piles were epoxy coated on both sides along their entire length, although only the upper portion of the sheet piles was required to be coated per the Contract. Refer to the "Product Listing" below for additional information.

- Return Walls: The southern return wall is approximately 16.53-feet long and consists of 8 (or 4 doubles) AZ26 sheet piles. The south return wall is a cantilevered wall system with no deadman support. The northern return wall is approximately 33.07-feet long and consists of

16 (or 8 doubles) AZ26 sheet piles. The northern wall is an anchored wall. The steel sheet piles were epoxy coated on both sides along their entire length, although only the upper portion of the sheet piles was required to be coated per the Contract. Refer to the "Product Listing" below for additional information.

- Waterstop: Adeka Ultra Seal A-30, as manufactured by Adeka Ultra Seal / OCM, Inc. was installed in the bulkhead sheet pile interlocks to seal the interlocks. The material is a hydrophilic material that swells in the presence of water to fill/seal the joint. Additionally, Adeka Ultra Seal P-201 sealant waterstop was applied to seal penetrations in the sheet piles. As a Contractor-requested substitution, waterstop was omitted at interlocks between shop-threaded double piles. In lieu of waterstop at these interlocks, the Contractor proposed and was permitted to shop-weld the interlocks prior to application of the epoxy protective coating.

- Anchor Walls: An approximately 285.78-foot long anchor deadman constructed of AZ13 steel sheet piles is located approximately 47 feet behind the face sheet piles along the waterfront. The anchor wall behind the northern return wall located approximately 40 feet behind the face sheets consists of 12 (or 6 doubles) AZ13 steel sheet piles. The anchor wall steel sheet piles were uncoated. It should be noted that the southernmost three anchor rods on the face sheets are anchored to concrete block deadman rather than the steel sheet pile deadman. The concrete anchor blocks consist of 5-foot long by 5-foot wide by a minimum of 5-foot high concrete blocks pinned into bedrock via five (5) one-inch diameter threaded rod rock anchors grouted in-place. Anchor plate assemblies were anchor bolted to the concrete blocks to provide a means of connecting the anchor rods to the blocks.

- Wales: A steel wale consisting of two C15x40 channels bolted together with 1-inch diameter anchor bolts was connected to both the face sheet piles and the steel anchor wall/deadman with four 1-inch diameter ASTM F1554, 60 kips per square inch (KSI) yield strength bolts, at an approximate interval of every 4.1-feet on-center (connected at each "belly" in the sheet pile doubles). The steel wale channels were epoxy coated. Refer to the "Product Listing" below for additional information.

- Anchor Rods: 1-1/4-inch diameter DYWIDAG threadbar anchor rods were installed between the waterfront sheet piles and steel deadman to provide additional anchoring support to the face sheets along the waterfront. The rods were designed to be spaced at an interval of approximately 12' 4-3/4" on-center. While accepted by the Engineer, the as-built survey revealed that the spacing on the tie rods ranged from 10'-11" to 12'-10" on the face sheets and 8'-2" to 8'-3" on the northern return wall. The anchor rods were bedded in 1.5-feet below and 1-foot above of run-of-crush stone (Item 4) material. The anchor rods were epoxy coated. Refer to the "Product Listing" below for additional information.

- Toe Protection Stone: To reduce the potential for scour of sediment in front of the bulkheads, a 4-foot thick layer of toe protection stone was placed in front of the bulkhead at a slope of 1.5 H:1 V. The toe protection stone included armor stone (235 to 2,125 pounds per stone) and toe stone (1,100 to 4,400 pounds per stone) at the mud line. The toe

protection stone was placed on a 12-inch thick layer of 1.5 to 3-inch diameter bedding stone (see Submittal No. 14357-18 in Appendix K for bedding stone gradation). A Mirafi FW-700 woven geotextile was placed beneath the bedding stone to reduce the potential for scour of the on-Site fines in the subgrade material.

- Precast concrete caps: A 30-inch wide by 12-inch precast concrete cap was installed on top of the waterfront sheet piles and on the northern and southern return walls. The caps rest on a continuous steel angle (L6" x 4" x ½") that is welded to the sheet piles and anchor bolted to the caps. In cases where the Contractor drove the sheet piles too low or the top elevations were below the design elevation of 5.5 feet NAVD88, a 5-inch high precast concrete filler beam was placed between the steel angle and final precast caps.

- Stormwater outfall: A stormwater outfall was installed through the Zone 1 bulkhead and the steel deadman as part of the redevelopment infrastructure installation. The initial installation included 60 lineal feet of a 24-inch diameter corrugated HDPE pipe. While most outfalls were initially installed with only 20 lineal feet of pipe, the Zone 1 outfall was extended behind the steel deadman sheet piles so that future excavation between the deadman and the face sheet piles could be avoided, and thus, reduce the potential for damage to the anchor rods. A cast-in-place concrete collar was installed around the pipe outfall in the bulkhead to provide a seal between the steel sheet piles, structural steel wale assembly, and the outfall pipe.

- Concrete anchor blocks: The three southernmost anchor rods on the Zone 1 bulkhead (Anchor Nos. A5, A6 & A7) were connected to cast-in-place (CIP) concrete anchor blocks (CABs) rather than the steel sheet pile deadman. Each CAB consisted of a 5-foot long by 5-foot wide by a minimum of 5-foot high up to an approximately 7.3-foot high reinforced concrete block as identified on the record drawings. It should be noted that bedrock surface was not level at the time of the installation of the CABs, and therefore, the surface of the bottom of the blocks varied to follow the contour of the bedrock. The CABs were secured to the underlying bedrock using a series of five (5) rock anchors. While the anchor rods were initially designed for 5-feet of embedment in the rock, a debris layer (e.g. sand, gravel, etc.) washed beneath the Contractor's form work prior to the placement of the concrete. To address the layer of debris, the Engineer required 10-feet of embedment into the bedrock, with the exception of Anchor 4 on CAB No. 6, which had 6.25 feet of embedment, as shown on the record drawings. The anchor rods were connected to the CABs using specially fabricated anchor plate assemblies that were anchor bolted to the CABs.

Zone 3 Bulkhead:

- 661.23-foot long, cantilevered bulkhead consisting of 318 (or 159 doubles) AZ26 steel sheet piles. Unlike the Zone 1 bulkhead, the Zone 3 bulkhead was constructed as a cantilevered bulkhead structured and no anchor/deadman were required. The steel sheet piles were epoxy coated on both sides along their entire length, although only the upper portion of the sheet piles was required to be coated per the Contract. Refer to the "Product Listing" below for additional information.

- Return Walls: The southern return wall is approximately 33.07-feet long and consists of 16 (or 8 doubles) AZ26 sheet piles. The northern return wall is approximately 24.80-feet long and consists of 12 (or 6 doubles) AZ26 sheet piles. Both return walls on the Zone 3 bulkhead are cantilevered wall structures. The steel sheet piles were epoxy coated on both sides along their entire length, although only the upper portion of the sheet piles was required to be coated per the Contract. Refer to the "Product Listing" below for additional information.

- Waterstop: Adeka Ultra Seal A-30, as manufactured by Adeka Ultra Seal / OCM, Inc. was installed in the sheet pile interlocks to seal the interlocks. The material is a hydrophilic material that swells in the presence of water to fill/seal the joint. Additionally, Adeka Ultra Seal P-201 sealant waterstop was applied to penetrations in in the sheet piles. As a Contractor-requested substitution, waterstop was omitted at interlocks between shop-threaded double piles. In lieu of waterstop at these interlocks, the Contractor proposed and was permitted to shop-weld the interlocks prior to application of the epoxy protective coating.

- Toe Protection Stone: To reduce the potential for scour of sediment in front of the bulkheads, a 4-foot thick layer of toe protection stone was placed in front of the bulkhead at a slope of 1.5 H:1 V. The toe protection stone included armor stone (235 to 2,125 pounds per stone) and toe stone (1,100 to 4,400 pounds per stone) at the mud line. The toe protection stone was placed on a 12-inch thick layer of 1.5 to 3-inch diameter bedding stone. A Mirafi FW-700 woven geotextile was placed beneath the bedding stone to reduce the potential for scour of the on-Site fines in the subgrade material.

- Precast concrete caps: A 30-inch wide by 12-inch precast concrete cap was installed on top of the waterfront sheet piles and on the northern and southern return walls. The caps rest on a continuous steel angle (L6" x 4" x ½") that is welded to the sheet piles and anchor bolted to the caps. In cases where the Contractor drove the sheet piles too low or the top elevations were below the design elevation of 5.5 feet NAVD88, a 5-inch high precast concrete filler beam was placed between the steel angle and final precast caps.

- Stormwater outfall: A stormwater outfall was installed through the Zone 3 bulkhead as part of the redevelopment infrastructure installation. The initial installation included 20 lineal feet of a 24-inch diameter corrugated HDPE pipe. A cast-in-place concrete collar was installed around the pipe outfall in the bulkhead to provide a seal between the steel sheet piles and the outfall pipe.

The following protective coating products were applied to certain structural elements of the bulkheads, as described below:

Product Listing:

- **Macropoxy 646, as manufactured by Sherwin-Williams:** A black epoxy product that was applied to all AZ26 sheet piles installed along the waterfront. This epoxy was also utilized to touchup/repair damaged areas of the coating on the landward face of the bulkhead and on the waterward face of the bulkheads from an elevation of +2.0 feet NAVD88 and above. This product was submitted as a substitute for the originally specified BAR-RUST 235 Multi-Purpose Epoxy Coating, as manufactured by Devoe Coatings.

- **FX-764 Hydro-Ester ® Splash-Zone & Underwater Paste, as manufactured by Fox Industries, Inc.:** A moisture-insensitive, two-component, 100 percent solids epoxy-resin material that was used for repairing the Macropoxy 646 coating on the waterward side of the sheet piles in the splash zone and below the waterline (elevations below +2.0 feet NAVD88). This material also used to repair a few leaking interlocks on the Zone 3 bulkhead.

- **Adeka Ultra Seal A-30, as manufactured by Adeka Ultra Seal / OCM, Inc.:** A chemical resistant hydrophilic waterstop material that swells by a factor of three (3) times its original volume when hydrated to seal the interlock sheet piles. This material was applied to all non-welded interlocks for their entire length.

- **Adeka KM String, as manufactured by Adeka Ultra Seal / OCM, Inc.:** A chemically modified natural rubber product with a chemically bonded hydrophilic agent that allows the material to expand by a factor of three (3) times its original volume when hydrated. This material was used in attempt to repair some of the leaking interlocks encountered at the Site.

- **Fusion Bonded Epoxy (FBE) Coating:** All anchor rods were factory coated with fusion bonded epoxy prior to delivery to the project Site.

- **Zinc Hot Dip Galvanizing (ASTM A153):** All bolts, anchor bolts, plate washers, and pipe spacers were hot dip galvanized for protection.

- **Tneme-Zinc 90-97, as manufactured by Tnemec, Inc.:** An advanced technology, two-component, moisture-cured, zinc-rich primer was utilized as a field touchup material for repairing cut or damage galvanized components.

- **Pro-poxy 300, as manufactured by Unitex:** A non-sag, injectable anchoring epoxy used to grout in the anchor bolts into the bottom side of the precast concrete caps.

- **Sikagrout 212, as manufactured by Sika Corporation:** A non-shrink, high strength, cementitious grout used to patch the lifting inserts location on the precast caps. This material was also dry-packed in the space between the precast concrete caps and the concrete filler beams where the top elevation of the sheet piles was too low.

- **Armatec 110 Epocem Bonding Agent, as manufactured by Sika Corporation:** A concrete bonding agent applied to the existing concrete surfaces prior to making repairs with the Sikagrout 212. This material was also used for field touchup of the fusion bonded epoxy on the anchor rods.

- **Blendcrete™, as manufactured by ProSpec:** A single component, polymer-modified, cement-based concrete patching compound used to repair spalls and voids on the precast concrete caps.

- **Sika ® Boom Expanding Polyurethane Spray Foam, as manufactured by Sika Corporation:** A polyurethane-based fast curing expanding foam material that was used to fill joints in the precast caps where field-cut ends were present.

- **Sikaflex®-2c NS TG, as manufactured by Sika Corporation:** A two-component, traffic-grade, polyurethane elastomeric sealant was used to seal all joints between adjacent precast concrete cap sections due to the fact that the Contractor did not follow the specified joint spacing requirements when installing the caps. The color "Precast" was selected for this project. SOF®ROD backer rod as manufactured by Nomaco Inc. was installed in larger joints prior to application of the sealant.

- **Speed Crete® Blue Line, as manufactured by The Euclid Chemical Company:** A fast-setting underwater, cement-based patching material used to patch large voids in the concrete anchor blocks at the south end of the Zone 1 bulkhead that were discovered at removal of the formwork.

- **Duralprep AC, as manufactured by The Euclid Chemical Company:** A priming agent applied to exposed steel and concrete surfaces prior to patching the concrete anchor blocks with Speed Crete ®.

- **Sure-Grip High Performance Grout™, as manufactured by Dayton Superior:** A high performance grout utilized to tremie grout the rock anchors for the concrete anchor blocks.

- **Five Star® Grout, as manufactured by Five Star Products, Inc.:** A non-shrink grout pressure injected beneath the concrete anchor blocks to fill in void spaces in the debris layer that sloughed beneath the concrete blocks prior to the concrete pour.

Manufacturer data sheets for these products have been included in Appendix AQ.

4.8.2 Sub-Slab Depressurization Systems

Due to presence of remaining contamination at the Site, particularly petroleum-related compounds, sub-slab depressurization (SSD) systems will be installed for all buildings constructed on the Site.

While the specific design and layout of the sub-slab depressurization systems (SSDS) will be the responsibility of architects and/or engineers designing any future structures on the Site, guidelines and minimum requirements are specified in the Site Management Plan.

4.8.3 Post-Remediation Monitoring Well Network

To provide future groundwater monitoring points and comply with the requirements of the ROD to evaluate the long-term effectiveness of the remedy, a network of new monitoring wells was installed at the Site to replace the wells that conflicted with the remediation of the Site. The Engineer retained NYEG Drilling, LLC under a subcontract agreement to install the new monitoring wells between November 7 and November 16, 2011. The Engineer provided oversight of the well installation and responsible for directing the depth at which the well screens were set and preparing well construction logs in the field.

A network of nine (9) monitoring wells (MWs) has been installed to monitor both up-gradient and down-gradient conditions at the Site, as shown on Figure 6. The network of on-Site wells has been designed based upon the following criteria:

- One (1) monitoring well has been installed up-gradient of each of the primary AOCs to provide monitoring of groundwater quality up-gradient of these areas. Specifically, well MW-4 was installed up-gradient of AOC-1 and well MW-8 was installed up-gradient of AOC-2/3.

- Two (2) monitoring wells have been installed down-gradient of each of the primary AOCs, with one being installed at each end (north and south) of each bulkhead. Given that the bulkheads were installed as containment structures, the wells were placed near the bulkhead return walls where there is the greatest potential for groundwater migration around the bulkhead and into the Hudson River. Specifically, to monitor AOC-1, wells MW-1 and MW-2 were installed at the south and north ends of the Zone 1 bulkhead, respectively. To monitor AOC-2/3, wells MW-5 and MW-6 were installed at the south and north ends of the Zone 3 bulkhead, respectively.

- One (1) monitoring well has been installed near the center of each of the primary AOCs. Specifically, well MW-3 was installed near the center of AOC-1 and well MW-7 was installed near the center of AOC-2/3. These wells will be used for gauging purposes and monitoring for the presence or absence of LNAPLs only. These wells will not be sampled annually along with the other wells in the monitoring network.

- Well MW-9 was installed along the existing concrete retaining wall up-gradient of AOC-2/3. During construction, contaminated soils were encountered in this area in close proximity to the retaining wall; however, the extent of the soil removal was terminated approximately 10-feet west of the retaining wall to avoid disturbance to the wall and foundation system. During the remediation, field evidence suggesting a potential offsite extension and/or continuation of contamination found in AOC 2/3 was observed in this area. The NYSDEC agreed with the Engineer that further excavation to the east during the remediation phase of the project may have undermined the foundation of the retaining wall; however, the State required that a well be installed at this location to monitor groundwater quality and to evaluate the need for future investigation and/or remediation up-gradient of this location. Additionally, the NYSDEC will evaluate the need to remove non-aqueous phase liquid (NAPL) from this monitoring well should free product be detected during future monitoring events.

Monitoring well construction logs and associated boring logs for each of these wells are included in Appendix AR. Since all of the wells installed during the initial investigation phases of the project conflicted with soil excavation areas and/or future structures, they were abandoned and new wells were installed during the final stages of the construction.

All of the new wells installed at the Site were installed in the uppermost water bearing unit, which is an unconfined aquifer encountered at an approximate elevation of 0 to -2 feet NAVD88. Effort was made during the installation of these monitoring wells to straddle the water table, since most of the contamination encountered at the Site was located in the "smear" zone located between the low and high water levels. While the water levels beneath the Site are significantly influenced by the tide in the Hudson River, the groundwater flow direction beneath the Site is generally westward toward the Hudson River. Since the wells were installed at a depth where wells screens would straddle the groundwater level, the wells are all screened primarily in fill material. The wells were not installed at a depth sufficient to penetrate native soils and sediments. This finding is consistent with the historical Sanborn mapping for the Site (see Section 1.3.1) that indicates that a majority of the Site consists of manmade land that encroached into the Hudson River.

All wells were constructed of two-inch Schedule 40 PVC riser pipe with a ten foot section of factory slotted, 0.010-inch (No. 10) well screen. All PVC monitoring well materials were new and remained covered until their installation. A sand filter pack was placed around the screen to a level of at least

one to two feet above the top of the screen and a minimum of a two-foot layer of bentonite pellets was placed on top of the filter pack to provide a watertight seal on top of the sandpack and prevent grout from migrating into the sandpack. The remaining borehole annulus was completed as a one to two-foot thick concrete surface seal sloped to provide positive drainage away from the well.
Since the final cover system had not been placed around each monitoring well at the time of installation, a 4 or 6-inch PVC temporary casing was placed around each well riser and a locking gripper plug was installed at the top of each riser. Following the completion of this FER and installation of final Site surface treatments (e.g. asphalt paving, concrete sidewalks, etc.), the City will be responsible for the installation of the permanent, flush-mount casings and protective concrete pads. These casings were provided to the City at the time of the well installation, but the Engineer was requested not to install the casings at that time until the grading of the Site was finalized.

After the installation of the post-remediation groundwater monitoring wells, the wells were developed via several cycles of surging and pumping until the turbidity level of the water in was reduced to below 50 Nephelometric Turbidity Units (NTUs).

All monitoring wells, except for wells MW-3 and MW-7 installed near the center of the AOCs and used for gauging and monitoring of NAPLs only, will be sampled annually as described in detail in the SMP.

4.8.4 Riprap Revetment

Riprap revetment was installed at three locations on Site, including the following:

- An approximately 50-foot long section at the end of Zone 1.
- An approximately 848-foot long section in Zone 2, between the bulkheads.
- An approximately 370-foot long section in Zone 4, north of the Zone 3 bulkhead.
- While north of the Site boundary, the balance of the Zone 4 revetment section extended another approximately 360-feet north for a total section length of 730-feet. Additionally, an approximately 311-foot long section of revetment was installed in Zone 5, north of the Zone 4 revetment.

While the revetment stone along the waterfront was not required in the ROD and is not a direct engineering control, it is essential to the overall remedy employed for the Site. Specifically, the revetment provides scour protection to the shoreline in areas where no bulkhead is present. Without the revetment, the fine-grained soils present at the Site could potentially be eroded away by the Hudson River, which could result in loss of portions of the soil cover system and/or potential migration of soils with remaining contamination behind the bulkheads into the River.

Record drawings depicting the location of the revetment as well as the details for revetment sections have been included in Appendix AP. The revetment areas generally included the following:

- A prepared subgrade set at a slope of 1.5 Horizontal:1 Vertical (1.5 H: 1 V).
- A woven geotextile fabric (Mirafi® FW700, as manufactured by Tencate) over the subgrade
- 12-inch layer of 2-inch diameter bedding stone (crushed stone)
- A 4-foot thick layer of armor stone (235 to 2,125 pounds per stone)
- Large toe stone placed at the toe of the slope (1,100 to 4,400 pounds per stone)
- Precast concrete jersey barriers were installed at the top of the slope to separate the revetment from the on-Site fill materials.

4.8.5 Weep Hole Drainage System

Through the process of modifying the Site grades to support redevelopment and the placement of the soil cover system across the Site, some of the drainage weep holes on the existing retaining wall along the east side of the Site were buried. To provide continued weep drainage for the retaining wall and reduce the potential of scour to the soil cover system, the covered weep holes were connected to a closed drainage system.

The as-built layout of the weep hole drainage system in shown on Figure 3. The as-built information was inserted into the original design drawings based upon an AutoCAD survey map submitted by the Contractor to the Engineer on January 14, 2010. Preparation of an as-built survey stamped by

New York State Professional Land Surveyor (PLS) was not required by the Contract, and therefore, was not submitted by the Contractor.

At each weep hole included in the system, a 4-inch PVC flange was bolted to the existing concrete wall using 8 anchors, as shown on Detail 5 on Figure 7. The anchors were 5/8-inch by 2-1/8" long bolts installed in drop-in anchors. However, due to issues with concrete spalling around the weep hole locations, the Contractor switched to a Hilti anchoring system (Hilti HY-150, 3/8-inch diameter anchors with 3-3/8" of embedment with HIT-HY 150 MAX adhesive) for some of the flanges. A 4-inch PVC pipe was then connected to the flange and a 10-inch diameter HDPE header pipe via a Fernco® coupling (as manufactured by Fernco, Inc.) system. The 10-inch HDPE pipe was connected to a series of precast concrete manholes with solid steel frames and covers and ultimately tied into an existing 36-inch storm sewer outfall that runs through the tunnel under the MTA/railroad retaining wall (eastern side of Site) to the river (western side of Site). Since the 36-inch storm sewer surcharges with rising tides, TideFlex backflow preventers were installed at the point of discharge into the manhole associated with the 36-inch storm sewer outfall.

4.8.6 2013 Review of Engineering Controls

Given the lapse of time between the final Site walkthrough on January 17, 2012 and the filing of the Environmental Easement, CHA completed an updated Site visit on November 7, 2013 to document more current conditions of the Site and the condition of the engineering controls at the request of the NYSDEC. CHA notes the following major observations made during the November 2013 Site inspection:

1. **Soil Cover System:** Overall, the soil cover system was in good condition. The portions of the Site covered with Item 4 material and other stone products had no evidence of disturbance or scour; however, some minor evidence of scour was observed on the steeper slopes in Zones 1 & 2 in green space areas which had been completed with topsoil. While the soil cover system is in excess of 1-foot thick in Zone 1, the demarcation barrier was visible in one area of Zone 2. These scoured areas were repaired by the City following the Site visit by filling in the scoured areas with additional imported Item 4. The City then provided photographic documentation to CHA to show the completed repairs. Photographs documenting the repairs are included in Appendix Q as previously indicated.

2. **Bulkheads:** CHA reviewed the current condition of the bulkheads from a boat provided by the City of Poughkeepsie at a low tide (approximately -0.5' AMSL). No leaking interlocks were observed and the concrete collars around the outfalls had minimal damage from past ice dams in the river.

   On the landward side of the bulkheads, CHA observed an approximately 4-inch gap between the soil cover system and the concrete caps behind the northern 2/3 of the Zone 3 bulkhead. The City indicated that they had been monitoring the movement of the bulkhead with survey equipment and provided the data to CHA/OCC for evaluation. Upon review of the survey data and photographs, no evidence of significant or progressive movement of the bulkhead was observed. The survey data indicates that the bulkhead movement is alternating between landward and waterward deflections. This limited movement/deflection was anticipated by OCC given that the structure is a cantilevered bulkhead system. The gap behind the bulkhead is associated with the settlement/consolidation of material behind the bulkhead that is exaggerated by the difficulty in achieving appropriate compaction between the "bellies" of the sheet piles. While this movement needs to be considered in the future development of the Site (including a proposed sidewalk along the waterfront), the bulkhead's ability to provide containment for residual contamination in Zone 3 has not been compromised.

3. **Sub-slab Depressurization Systems:** The Site has not yet been redeveloped. Since there are no buildings on the DeLaval property, no sub-slab depressurization systems were present for review.

4. **Monitoring Well Network:** All monitoring wells observed in good condition. The permanent well casings have not yet been installed, but the City has possession of the permanent casings and will install them following the completion of final grading of the Site during redevelopment. The monitoring wells were not sampled as part of this Site visit.

5. **Riprap Revetment:** All riprap revetment stone in Zones 2, 4 & 5 appeared in good condition at the time of the Site visit and there was no evidence of significant loss of material or scour.

6. **Weep Hole Drainage System:** The weep hole drainage system appeared operational and in good condition at the time of the Site visit.

7. **Fencing:** The fencing system installed near the Site entrance and around the northeast bedrock outcropping utilized for delineate the limits of the environmental easement was observed to be in good condition. No repairs or modifications were recommended to the City. The construction fencing and pallets located near the north end of the Site were protecting the Site from vehicular traffic, but not pedestrian traffic. However, since the soil cover system is in-place, it is no longer a requirement to keep people from entering the Site.

8. **Other:** Other observations made during the Site visit included:

a. The area between the northeast bedrock outcropping and the retaining wall along Pine Street was being used for the storage of wooden pallets, a small pleasure boat, a snow plow and salting unit sized for a pickup truck, a small storage shed, and a scaffold previously used by SWC for coating repairs on the waterward side of bulkhead were being stored by the developer of the site.

b. Some evidence of siltation was observed behind the Zone 1 bulkhead. While this material appears to be topsoil eroded from slopes up-gradient of the future sidewalk area, it appears to be associated with historic scour rather than a current Site stabilization issue. With the exception of the limited scouring previously noted in Zone 1, vegetation was well established in most green space areas.

c. There were no covers on the electrical vaults installed by the Developer and the annular spaces around the conduits installed in 2011 were not sealed. Therefore, some material around the vaults had sloughed into the structures and in one instance vegetation was growing inside the vault. While this will make future installation of electrical services difficult, it did not impact the Site remedy. The only exception was one vault in Zone 2 where there was a small sink hole along the east side of the vault that resulted in the loss of soil cover material. The City filled this hole with additional Item 4 material as the same time the scouring in Zones 1 & 2 was repaired.

d. There was evidence of prior campfires on the Site (soot and ashes in two locations). However, these campfires did not appear to have impacted the soil cover system, and therefore, were not of concern relative to the remedial components installed at the Site.

4.9 INSTITUTIONAL CONTROLS

The Site remedy requires that an environmental easement be placed on the property to (1) implement, maintain and monitor the Engineering Controls; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the Site to commercial and passive recreational uses only.

The environmental easement for the Site was executed by the Department on November 4, 2013, and recorded with the Dutchess County Clerk on November 27, 2013. The County Recording Identifier number for this filing is 0220136386. A copy of the easement and proof of filing is provided in Appendix AS.

4.10 DEVIATIONS FROM THE ROD REQUIREMENTS

Numerous deviations were made from the requirements of the ROD and the Remedial Design during the course of construction. Some of these deviations were associated with Site-specific constraints/discoveries, while others were due to issues associated with the quality of work provided by the Contractor and the lack of information provided by the Contractor to the Engineer. The following sub-sections summarize the major deviations encountered during the project:

4.10.1 AOC Excavations

4.10.1.1 Depth of the AOC Excavations

While some areas of deeper excavation were expected, the depth of the AOC excavations in most areas was anticipated to be the low-tide elevation to minimize the need for excavating beneath the water table and extensive dewatering. While low tide elevations were typically around 0 feet NAVD88, the AOC excavations had to be advanced to depths of up to approximately 4 feet below the low tide elevation to remove the material defined as "grossly-contaminated."

Since dewatering of the excavations was not practical and placement and compaction of fine-grained Site soils was not possible at depths of up to 4 feet below the water table, significant amounts of coarse gravel stone had to be imported into the Site to fill from the AOC subgrade to an elevation of +0.5 feet NAVD88. The coarse gravel had little to no pore pressure and was able to be "pushed" off to the correct elevation and tracked over with heavy machinery rather than needing to be placed and compacted in control lifts like finer-grained materials. The use of finer-grained materials in this application was determined to be impractical due to the potential pore water pressure and associated future settlement which was not conducive to redevelopment of the Site.

To reduce costs of imported material, Site materials were placed over the coarse gravel in areas outside the building footprints, and thus, resulted in the coarse gravel still needing to be under the soil cover system rather than a thicker layer of "clean" imported material. A non-woven, six-ounce geotextile was placed over the coarse gravel prior to placement of on-Site materials; however, this geotextile was installed to prevent the downward migration of finer-grained materials into the coarse gravel rather than serve as a demarcation barrier.

The coarse gravel was also utilized to backfill some large voids discovered along the shoreline during the clearing and grubbing process. As some trees along the waterfront were removed, scour holes were discovered beneath the tree roots and the trees were actually "hanging" over the river. Thus, fill was placed in a few locations along the shoreline to provide a stable surface for the Contractor to reach the shoreline work areas.

4.10.1.2 ACM in AOC-1

During the final stage of the screening operation, a suspect ACM was discovered, specifically what appeared to be a piece of transite siding material. The Engineer mobilized certified asbestos inspectors to the Site to collect samples of the transite material as well as a number of other suspect materials. The Engineer confirmed that the transite and some of the roofing materials sampled were regulated asbestos waste (RAW) containing greater than one percent asbestos. As result of this finding, all of the debris piles from the screening operation were required to be disposed of off-site as regulated asbestos waste. As previously stated, petroleum-contaminated soils had to be disposed of as petroleum-contaminated soil with asbestos present as a result of this finding as well. The costs associated with the off-site ACM disposal combined with the need for additional imported fill has had an adverse impact on the overall project budget (refer to Section 5) and schedule.

4.10.1.3 Screening of Soil in AOC-1

Prior to removing the "grossly-contaminated" soils from AOC-1, several feet of lesser-impacted, overburden materials were removed from the Site surface and stockpiled for reuse as backfill. While some C&D debris had previously been encountered during the 2004 Supplemental Investigation test pits, the thickness of soil/debris layer was found to be extensive during the actual removal activities. Since disposing of all of this overburden material off-site and replacing it with imported clean fill appeared cost prohibitive during the early stages of the project, it was collectively decided in the field that the best option was to attempt to screen the debris materials from the soil using a Keestrack mobile screen unit to separate the debris from the soil. While the screening operation was successful, most of the screened material was ultimately disposed of off-site after suspect transite material was discovered in one of the debris stockpiles.

4.10.1.4 Potential Delays with AOC-1 Excavation

On May 21, 2009, the Contractor verbally reported to the Engineer that they felt it was unsafe to continue work in the vicinity of AOC-1 and complete the excavation in accordance with the requirements of the Contract Documents due to the presence of "acid" in the open excavation. When the Engineer inquired how the Contractor knew there was acid in the excavation as opposed to just contaminated groundwater, the Site superintendent reported that he could tell "by looking at it." On May 28, 2009, the Engineer mobilized an YSI Model 63 multi-parameter water quality meter to the Site to measure the pH of the water present in the AOC-1 excavation. The Engineer measured the pH of the water on four sides of the excavation and documented the pH to range from 7.79 to 7.84, thus indicating that the water was slightly alkaline rather than acidic.

The Contractor was still concerned based upon the color of the water in the excavation, but the Engineer stated that it was suspected that the slight bluish-green color was attributable to the growth of algae given the length of time the water had been stagnant in the open excavation. The Engineer also reminded the Contractor that the color of the water could not be correlated to the pH of the water. After a lengthy discussion with the superintendent, the Contractor eventually agreed that the water was not acidic and this was not a cause to cease activities in Zone 1.

This issue ultimately had no impact on the implementation of the remedy at the Site, but did add an approximately one week delay to the excavation activities in AOC-1.

4.10.1.5 Petroleum UST and Pipeline

As previously indicated, a UST thought to contain an unknown oil product was discovered near the center of AOC-2/3 during the supplemental investigation completed by CHA. While CHA had prepared an IRM work plan to address the immediate removal of this UST, the NYSDEC elected to wait and include the UST in the overall remedial action work due to the complexity of the removal and Site logistics given the tank's proximity to the river. At the time of the investigation, the UST was not unearthed and only a portion of the top of the tank was exposed. The tank was thought to be an approximately 4,000 gallon UST at the time of the investigation; however, upon the actual

removal of the UST it was found to be a heavily damaged 400-gallon UST containing no significant quantity of product (rather it was full of petroleum-contaminated soils).

Additionally, a 6-inch petroleum pipeline was found running east-west across AOC-2/3 between the UST and the river during the Supplemental Investigation. While a 6-inch pipeline and other smaller diameter oil pipelines were discovered in this vicinity, two 14-inch diameter pipelines were also discovered during the AOC-2/3 excavation. While the management of the remaining product in these pipelines was poor and resulted in the spread of contamination due to the Contractor's delay in responding to the situation, a change order was executed for the Contractor to manage the product and the pipelines associated with the 14-inch diameter pipelines that had not been previously discovered.

The product released from the pipelines was contained by the bulkhead and temporary dams installed by the Contractor and did not impact the Hudson River. Eventually, the spilled material in the water was collected with absorbents, the impacted soil was disposed of off-site, and all of the pipelines found were removed and similarly disposed. Petroleum-impacted materials (e.g. soil & concrete) disposed off-site as a result of the Contractor's delayed response, were disposed at the Contractor's expense. Additional investigation was performed at the Site in attempt to trace these pipelines, but no further oil pipelines were found outside the limits of AOC-2/3.

4.10.2 Bulkheads

The Contractor and their subcontractors encountered numerous problems during the installation of the bulkhead systems. Some of these issues were related to unforeseen field conditions, but a number of the issues were related to the Contractor's workmanship and means and methods. The following subsections summarize the major issues and deviations encountered during the course of the bulkhead construction. Temporary deviations that were resolved at the conclusion of the project are not discussed in detail in this FER.

4.10.2.1 Bulkhead Locations

Upon completing the Zone 1 demolition and removals work, a decision was made to shift the Zone 1 bulkhead approximately 5 feet waterward/westward from its design location to avoid conflict with an existing timber bulkhead. The intent of the contract documents was to install the bulkhead in front of the existing timber bulkhead, so when the layout of the new bulkhead revealed a conflict in locations, the new bulkhead was offset westward to avoid breaching of the existing bulkhead. Avoiding the breaching of the existing timber bulkhead was desirable given the presence of up-gradient gross-contamination still present prior to the AOC excavation activities.

Similarly, the southern end of the Zone 3 bulkhead was shifted approximately 5 feet waterward/westward to avoid breaching of the existing timber structure. However, at a point approximately 220 feet north of the southern end of the bulkhead, a large obstruction was encountered several feet beneath the mud line that the Contractor could not drive the sheet piles through and ultimately damaged some piles.

Initially, this obstruction was thought to be bedrock; however, extraction of a damaged pile revealed the presence of reinforcing steel in a fracture in the sheet pile suggesting that the obstruction was actually reinforced concrete. A 5-degree bend/deflection was installed in the bulkhead alignment and another approximately 5-foot offset to the west as permitted to attempt to avoid this obstruction, as shown on the record drawings prepared by the Engineer. Ultimately, the obstruction became too large to avoid. As a result, a change order was issued to construct a large H-pile demolition probe to penetrate the concrete obstruction and provide a corridor in which the bulkhead could be installed. Specifically, the probe was used with the vibratory sheet piling hammer to fracture and/or pulverize the concrete and create a void space within the concrete to facilitate the later driving of the sheet piles for the bulkhead. The demolition was completed from approximately Sheet Pile No. 3P135 to 3P235. The installation of the northern half of the Zone 3 bulkhead steel sheet piling continued with no major additional issues.

Prior to the commencement of the construction, the City of Poughkeepsie had granted a portion of the DeLaval property to New York State to remain as lands permanently under water and part of the

river. However, the bulkhead offsets resulted in some encroachment (approximately 2 feet maximum) of the structures onto this land already granted to the State. Thus, the City was required to go through a legal process with State officials to regain ownership of the lands occupied by the bulkheads in their entirety. Specifically, the City had to obtain an additional 0.06-acres of land from the State of New York Office of General Services (OGS) under a submerged land acquisition application process. The legal description of the Site metes and bounds provided in this FER include the bulkhead, and therefore, the requirement to install bulkhead on the Site as outlined in the ROD has been met.

4.10.2.2 Shortening of the Zone 1 Bulkhead

The Zone 1 bulkhead was originally designed to be a 380.01-foot long structure that extended to the southern property boundary of the DeLaval Site. However, during the installation of the southern section of the bulkhead, bedrock was discovered to be very shallow (as little as 5 to 7 feet below the ground surface (bgs)). As a result, the bulkhead could not be installed with the steel sheet pile deadman as initially planned, and instead, concrete anchor blocks were used to anchor the southern end of the bulkhead under an alternate already included in the Contract.

The southernmost approximately 50 feet of the bulkhead presented at even greater challenge because the bulkhead sheet piles could not be driven to sufficient depth to avoid rotational forces at the bottom of the piles without toe pins and there was insufficient depth to the top of bedrock to install the concrete anchor blocks as a deadman. Since AOC-1 did not extend all the way to the south end of the Site and the bedrock was so shallow in this area, a field decision was made to shorten the bulkhead and install the return wall in a location approximately 50 feet north of the Site boundary. Given that AOC-1 did not extend to the southern boundary of the Site and that the bulkhead was still installed down-gradient of the entire length of AOC-1 along the waterfront, this change was consistent with the ROD and the conceptual depiction of the remedy therein.

4.10.2.3 Orientation of the Sheet Piles

The Contractor started the bulkhead construction with the installation of the steel sheet piles for the northern return wall on the Zone 1 bulkhead. Because the Contractor initially started driving the

sheet piles in an orientation of 180-degrees different than the shop drawings, the corner piece was incompatible which would ultimately lead to the waterstop being left on the leading edge of the sheet piles. This was not acceptable as the hydrophilic waterstop would react and swell when left in the water overnight, making it impossible to resume driving the next sheet pile during the following morning without damage to the waterstop. Ultimately, the Contractor had to extract the sheet piles from the northern return wall and return them to the shop to have the epoxy coating and waterstop re-applied to the knuckles of the sheet pile interlocks.

4.10.2.4 Driving Depths and Pile Elevations

Issues related to the sheet pile elevations were observed almost immediately upon the start of the driving operations. Specifically, the Engineer observed that the top of the sheet piles were all at different elevations and were not at an elevation of 5.5 feet NAVD as designed. Since the sheet piles were ordered to approximately the design length, this meant that the sheet piles were not being driven to the correct elevation. Per industry standard, the sheet piles are typically ordered slightly longer than required to avoid this issue. Additionally, the Engineer saw no evidence of surveying equipment being utilized to verify the elevations of the sheet piles during the first several days of the bulkhead installation. However, after review of tip elevations of the sheet piles, the depths were accepted by the Engineer.

Since a number of the sheet piles were too low in elevation, they had to be cut to an elevation of 5.08 feet NAVD88 and a 5-inch thick precast concrete filler beam had to be installed on top of the sheet piles to prepare the final precast caps to rest on a surface at elevation 5.5 feet NAVD88. Although the filler beams resulted in significantly more work and added dead load to the structure, this repair procedure was accepted by the Engineer. Additionally, in areas where the top of the sheet piles were more than 5-inches lower than the design height, additional sections of sheet pile had to be welded onto the existing sheet piles on all three sides of contact prior to installing the filler beams. The length of the sheet pile extensions was typically 2 feet or less. Following the welding of new sections of sheet piles onto the existing, the surface areas around the welds were prepared and the coating was repaired. The exact locations where additional sheet pile had to be welded on the top of

the existing sheet piles prior to the installation of the sheet piles was not recorded, but was required in approximately four to five locations total for the project.

4.10.2.5 Bulkhead Deflections & Plumbness

After the Zone 3 bulkhead was complete and both return walls had been installed, the Engineer had expressed concern to the Contractor relative to loading on the bulkhead. Specifically, the Engineer was concerned about the surcharging effect on the bulkhead due to the tidal fluctuations in water levels behind the bulkhead since the structure was not complete and the toe protection stone had not yet been installed. The Contractor ignored these warnings and on October 28, 2008, a small section of the bulkhead south of the southernmost 5-degree bend began to deflect.

The deflection occurred between pile numbers 3P245 to 3P255 and also between 3P200 and 3P206 with a maximum measured deflection of approximately 17 inches. The Contractor used hand operated cable winches and a hydraulic excavator to try to return the bulkhead to within specified plumb tolerances for several weeks. Once the bulkheads were close to plumb, the Contractor welded three steel beams onto the landward side of the bulkhead on May 21, 2009 to temporarily stabilize the bulkhead until the toe protection stone was installed. After the steel beams were removed on August 6, 2009, the residual deflection was accepted by the Engineer.

While the Zone 1 bulkhead construction commenced prior to the Zone 3 bulkhead, the south end of the Zone 1 bulkhead was not completed until after the Zone 3 bulkhead was installed. At the time of the construction of the Zone 1 bulkhead, SWC had indicated that the bulkhead could not be installed as designed due to shallow bedrock at the south end and discussion of design alternatives ensued. After weeks of discussions and review of change order requests, the southern end of the Zone 1 bulkhead was ultimately constructed with concrete anchor blocks for the deadman in a manner similar to the design included in Contract Item No. 41-B (see RFI-24 for more detail), and no change order was executed to complete the work.

After the deflection occurred in the Zone 3 bulkhead, the Engineer expressed a high level of concern to the Contractor when the Zone 1 bulkhead return walls were being installed with no temporary

shoring on any portion of the bulkhead and prior to the installation of the anchor rods or the toe protection stone required to properly support the structure as required by the Engineer's design. Since the sheet piles could not be driven to a sufficient depth to serve as a cantilevered bulkhead structure due to the shallow depth of bedrock, the bulkhead was not in a state where it could support the full design loads. Based upon the concerns raised by the Engineer, the Contractor excavated a shallow trench around one of the bulkhead return walls to attempt to reduce water surcharging behind the structure, but it proved to be insufficient. Upon returning to the Site on Monday, December 8, 2008, SWC and the Engineer discovered that a portion of the bulkhead had deflected over 3 feet out of plumb between pile numbers 1P90 and 1P131 over the weekend.

From December 8, 2008 through most of February 2009, the Contractor attempted to pull the sheet piles back to plumb using chain/cable winches ("come alongs") and a large hydraulic excavator. After repeated attempts, the Contractor was unable to return the wall to within the specified plumb tolerance. After reanalyzing the structural design calculations, the Engineer (OCC) determined that the remaining plumbness issues were not of a structural concern, only an aesthetic issue. The City ultimately accepted the sheet piles being out of tolerance for plumb.

In addition to the issues associated with the surcharging of water behind the bulkheads, the Engineer identified to the Contractor repeated concerns about the construction live loads being placed on the landward side of the bulkheads. Specifically, the Engineer had provided recommendations as to maximum loadings allowable and safe offset distances for particular pieces of equipment to the Contractor on numerous occasions. Of particular concern, the Contractor was operating a Komatsu 1250 hydraulic excavator rated at over 120 tons within less than 5 feet of the landward side of the structure. While the results of this activity appeared to be less severe than the water surcharging, movement of the structures (particularly in Zone 1) was documented when this machine was operated in close proximity of the structures.

To document the movement of the structure, the City retained their own independent third party surveyor, Berger Engineering and Surveying, to monitor movement of the structure using a total station surveying instrument and series of approximately 20 monitoring points from July 31, 2009

through at least August 27, 2009. Most of the deflections were temporary and only while the excavator was in close proximity to the bulkhead. Additionally, some minor deflection was observed both landward and waterward of plumb, but this movement was associated with the fact that backfilling behind the structure and placement of the toe protection stone had not yet been complete, and was not considered to be a major concern to the Engineer.

A final issue associated with the alignment of the Zone 1 bulkhead was the bearing between the face sheet piles and the steel wale. The design required that the wale assembly be installed in full contact with the landward face to the steel sheet piles. In many locations the wale could not be pulled tight to the sheet piles and the Contractor installed 1-¼-inch, Schedule 40, galvanized pipe spacers. While pipe spacers were acceptable for use between the two C15 steel channels used to fabricate the wales, they were not accepted by the Engineer for use between the face sheet piles and the steel wale. Therefore, the Engineer required that the pipe spacers between the face sheet piles and the steel wale be removed and the remaining space be filled with solid steel shims or an appropriate epoxy product. After additional efforts by the Contractor, gaps between the wale and the steel sheet piles were limited to two locations, one near the south end of the bulkhead and one near the northern return wall. To provide bearing between the wale and sheet piles at these locations, the Contractor chose to fill the space using the Fox FX-764 epoxy product to provide full bearing as required. This repair was accepted by the Engineer (OCC).

4.10.2.6 Leaking Interlocks

A number of the sheet pile interlocks with the hydrophilic waterstop (i.e. Adeka material) were found to be leaking during the course of the project, particularly on the Zone 3 bulkhead. Repairs were made several times using a combination of Adeka KM String and the Fox FX-764 product. This was typically accomplished by first inserting the KM String into the interlock using backer rod tools and then placing the FX-764 product directly over the entire joint. Most repairs were made on the landward side of the bulkheads prior to backfilling; however, one additional leaking interlock was discovered on the Zone 3 bulkhead on December 8, 2010 following the winter shutdown and demobilization of the Contractor.

On October 28, 2011, the City retained a marine contractor, Seaway Diving and Salvage Co., to repair two leaking interlocks on the Zone 3 bulkhead, one of which was documented in OCC's December 8, 2010 site visit to prepare a partial punch list of the waterward side of the bulkhead coating touchups above elevation +2.0 feet AMSL (discussed further in Section 4.10.2.13). The second leak was discovered by the Seaway Diving and Salvage Co. on the same date the repairs to both interlocks were made.

4.10.2.7 Welding of Interlocks

As previously indicated, the Contractor welded the sheet pile interlocks at a steel fabrication shop prior to the delivery to the Site prior to requesting a change with the Engineer, although the Contract documents explicitly indicated that welding of the interlocks was not permitted. Specifically, every second interlock was welded such that individual sheet piles we fabricated into "doubles." The remaining interlocks were sealed with the hydrophilic waterstop material as previously described. Once some of the welded sheet piles were on-Site, the Contractor stated that the rejection of welded interlocks would result in project delays.

Following discussions with the City and their desire to keep the project schedule moving forward, the sheet piles were accepted by the Engineer; however, this was contingent on the Contractor's agreeing to compensate the City for the cost (labor and expenses) for the Engineer to observe the quality of the welds and observe the Contractor complete magnetic particle testing (MPT) on a number of the welds at the fabrication shop, and to complete a post-driving inspection via underwater diving at the Site.

The Engineer (OCC) visited the fabrication shop on May 7, 2008 and July 16, 2008 to observe the progress with the welding, visually observe the quality of the welds and observed the completion the MPT testing. No significant issues with the welds were observed at the fabrication shop. The Engineer conducted the post-driving underwater inspection via diving operations to examine the welded interlocks on August 10 to August 12, 2009. The purpose of the underwater inspections was to observe the condition of all welds (portions visible above the mud line) post-installation to verify the welds were not damaged during driving. As a result of the diving operations, the Engineer

identified one welded seam (Zone 3, Pile No. 267/268, Elevation -2' AMSL) that had a small pinhole in it that was attributed to porosity during the welding process. This area was eventually repaired by the Contractor and accepted by the Engineer. As previously discussed, a number of leaking interlocks and cracking of the coating were also observed by the Engineer (OCC) during the inspection process.

4.10.2.8 Concrete Anchor Blocks

As previously indicated, the three southernmost anchor rods on the Zone 1 bulkhead were connected to cast-in-place concrete anchor blocks (CABs). Each concrete anchor block required the drilling and grouting of a series of rock anchors. The Contractor experienced multiple problems during the installation of the CABs, including but not limited to the following:

- Difficulty in drilling the rock anchor holes into the bedrock due to the selected means and methods and difficulty in keeping debris from entering the drilled holes during the advancement of the drill bit. Examples include that the drilling contractor elected to use a very small drill rig with little power, the driller did not use temporary casings to keep the drilled holes open following tool removal, and use of an air compressor with inadequate capacity and tooling to properly clean the holes out, etc.

- Difficulty in setting the concrete formwork in the correct position due to the lack of layout controls and difficulty working in water. The Contractor had constructed the formwork for the anchor blocks prior to installation; however, they had to attach additional triangular, wedge-shaped forms to the bottom of each block to account for the fact that the bedrock surface was not excavated/ripped to a level surface as had been specified by the Engineer. Additionally, since the Contractor repeatedly dragged and moved the formwork around during placement, the installation of the formwork likely resulted in the sloughing of materials surrounding the excavation migrating beneath the formwork, as discussed further below.

- The forms were not all set at the design top of the concrete blocks and all had slightly different finish elevations. However, the top elevation of each CAB was accepted by the Engineer.

- The concrete was not properly consolidated in the formwork at the time of the pour and the formwork appeared to have shifted during the pour. This resulted in large voids in the concrete that had to be patched as well as exposed reinforcing steel that had to be covered.

- The Contractor allowed material to slough in the CAB excavations and beneath the bottom of the formwork. This debris layer between the bottom of the anchor blocks and the bedrock

surface caused concern relative the structural capacity of the blocks and resulted in the need for this debris layer to be pressured grouted beneath each block prior to the installation of the anchor rods. Additionally, the Engineer determined that it was necessary to install the anchor rods to a depth of 10 feet below the bottom of the concrete anchor blocks rather than the initial design depth of 4 feet below the bottom of the concrete to ensure adequate embedment into bedrock.

- Rock anchor No. 4 on the anchor rod No. A6 deadman was only installed to a depth of 6.25 feet beneath the block due to drilling difficulties, as opposed to all other anchors which were drilled to a depth of 10 feet beneath the bottom of the blocks per the design modification noted previously.

All of these issues were eventually resolved and the CABs were eventually accepted by the Engineer (OCC).

4.10.2.9 Anchor Rod Spacing

The Contract Documents called for the anchor rods on the Zone 1 bulkhead to be spaced at an interval of approximately 12' 4-3/4" on-center. While accepted by the Engineer, the as-built survey revealed that the spacing on the tie rods ranged from 10'-11" to 12'-10" on the face sheets and 8'-2" to 8'-3" on the northern return wall. This modification to the design was also accepted by the Engineer.

4.10.2.10 Wale Assemblies

When attaching the steel wales to the sheet piles for the Zone 1 bulkhead, the Contractor had chosen to use threaded rod, field cut to length, in lieu of the specified fixing/anchor bolts. The use of the threaded rod was unacceptable to the Engineer due to the fact that the hex bolts had the ability to rotate off of the threaded bars unlike a fix head on a bolt and the field cutting of the rods resulted in damage to the galvanized coating on the rods. Additionally, the drilled holes were not coated or were coated at a temperature below the acceptable limits specified by the coating manufacturer and the amount of protrusion/stick-through of the threaded bars past the hex nuts was insufficient. Thus, the Contractor was given the option of removing and replacing the threaded rod, tack welding the nuts onto the rods, and repairing the coating, or removing the threaded rod and replacing them with the specified fix headed hex bolts.

After discussing alternative remedies and realizing that the threaded rods would need to be removed to properly coat the drilled holes, the Contractor elected to replace all of the threaded rods with the specified hex bolts in all locations, except for the northern return wall where replacement of the threaded rods was hindered by the already placed revetment stone. The specified procedure for treatment of the threaded rods that would remain in place included tack welding of the nut to the rod on the waterward end followed by the coating of the rod end and nut with high-build epoxy (Fox FX-764) and the touching up of the cut end of the rod on the landward side with Tnemec 90-97 Tneme-Zinc primer. It should be noted that the drilled holes in the sheet piles on the northern return wall were coated within an acceptable temperature range, and therefore, removal of the threaded rods to coat the drilled holes was not required in this location.

4.10.2.11 Anchor Wall Sheet Piles

The Zone 1 anchor wall sheet piles (deadman) were designed to be AZ12 sheet piles per the original design. However, on June 5, 2008, the first loads of anchor wall sheet piles arrived on Site and were found to actually be AZ13 sheet piles. The Contractor reported that the AZ13 sheet piles were more readily available than the AZ12 sheet piles and that they did not want to delay the project by waiting for AZ12 sheet piles to be fabricated. The AZ13 sheet piles were accepted by the Engineer as the AZ13 sheet piles were almost identical to the specified AZ12 sheet piles in dimension. The only difference is that the wall thickness of the AZ13 sheet piles is slightly thicker than that of the AZ12 sheet piles (weight increase to 51.14 pounds per lineal foot opposed to 48.78 pounds per foot, respectively).

4.10.2.12 Precast Concrete Caps

The Contractor experienced a significant number of problems during the installation of the precast concrete caps on top of each bulkhead. Such issues included, but are not limited to, the following:

- The threaded inserts in the cap sections did not align in the field with the pre-drilled holes in the steel angle that supports the caps. This resulted in significant re-drilling in the field and the use of an injectable anchoring epoxy (Pro-poxy 300) to secure anchor bolts to the cap. Additionally, the Contractor had cut new holes into the supporting steel angle with a torch, resulting in an irregular, rough edge as opposed to a smooth surface that would result from drilling. In locations where the new holes were cut rather than drilled, the Contractor was required to smooth the rough edges with an angle grinder prior to touching up the coating.

- Little effort was made by the Contractor to properly align the concrete caps. There were numerous vertical, horizontal, and rotational issues between adjacent sections of cap. Additionally, the Contractor did not maintain the specified ½- inch gaps between adjacent sections of caps and the actual gaps ranged from less than 1/16-inch to over 1-inch in size. These deficiencies presented potential trip hazards as well as aesthetic concerns. While these concerns were not a structural concern to the Engineer, the Contractor was required to seal all of the joints with the Sikaflex®-2c NS TG polyurethane sealant to reduce some of the aesthetic concerns and have the City accept the caps.

- A number of spalls and chips were observed in the caps following placement, mostly as a result of the Contractor's handling of the caps during placement. This type of damage presented only aesthetic concerns and repairs were completed by the Contractor using the Blendcrete™ product.

- A number of full depth cracks in the precast concrete were also observed after the Contractor's handling of the caps. The cracks posed aesthetic concerns as well as a concern relative to the potential for premature spalling of the areas around the cracks. However, since the cracks posed no structural concerns beyond spalling and the repair options posed more significant aesthetic concerns, the City made the decision to not have the cracks repaired by the Contractor.

- The Contractor field cut sections of the precast cap and did not properly protect the exposed cut ends of the reinforcing steel. Instead, the Contractor filled the joint with Sika ® Boom. While this procedure was accepted by the City, the reinforcement steel is not sealed from water and corrosion of the steel may result in premature spalling of the caps.

- In locations where the sheet piles were cut low and the concrete filler beams were utilized by the Contractor, there were additional alignment issues in some locations that resulted in poor bearing between the filler beams and the final precast concrete caps. To address this issue, the space between the two concrete surfaces was dry packed with Sikagrout 212 to provide full bearing and provide a seal.

The caps were originally designed to have an open half-inch shear key joint and while they are part of the bulkhead systems, were not designed to hold back soil or contaminants like the steel sheet piles. Thus, while the caps are not in accordance with the Contract documents, most of the remaining issues are related to aesthetics only and pose no impact on the remedy. The City did accept the precast caps prior to ending their contract with SWC. It should be noted that the Contractor was required to seal the joints around the concrete filler beams in locations where the steel sheet piles were too low to ensure that the structure was water tight to an elevation of 5.5 feet AMSL.

4.10.2.13 Coating Issues

One of the most significant issues associated with the bulkhead was the damage to the original epoxy coating which was shop applied to sheet piles prior to delivery to the Site. As first discussed at the August 13, 2009 progress meeting, the Engineer (OCC) identified long striations or "map cracking" in the coating while diving to review the post-driving condition of the welded interlocks. Since the cause of the cracking was unknown at the time and the Contractor was not taking any action to investigate the problem, a third party consultant was retained through the Engineer, specifically Corrosion Probe, Inc. (CPI), to complete an investigation of the coating. The primary cause of the map cracking damage was determined to be excessive film thickness, as discussed in CPI's "Coating Failure Analysis Report for Sheet Pilings at De Laval Project in Poughkeepsie, NY", dated December 2009. A color copy of this report has been included in Appendix AT.

In addition to the map cracking damage, significant "mechanical" damage (well beyond what is considered typical) was also observed on both bulkheads. While this problem was likely exacerbated by the excessive film thickness, much of the damage occurred from the Contractor's handling of the toe protection stone during placement and the lack of appropriate fendering on their boats.

After significant discussion with the Contractor over responsibility for the coating damage, a meeting was held at the Site on March 8, 2010 to address the dispute. At the conclusion of the meeting, representatives from Sherwin Williams (the coating manufacturer) and American Steel Coatings (the coating applicator) had conceded that excessive film thickness (measured to be in excess of 30 mils in most locations) was present in the areas of cracking. The Contractor and their subcontractors then made attempts to repair the coating.

In mid-April 2010, the Contractor commenced repairs to damage on the inside of the bulkhead only. Repairs above the splash zone (above elevation +2.0 feet NAVD88) on the waterward side of the bulkheads did not commence until mid-June 2010. Splash zone repairs (below elevation +2.0 feet NAVD88) on the waterward side of the bulkhead began in July 2010 and the underwater repairs (those repairs that could not be made at low tide and had to be completed by dive teams) on the

waterward side of the bulkhead did not commence until October 2010. The underwater repair effort was greatly hindered by the falling water temperatures by that time.

The following three types of coating repairs were required for the project. Copies of all accepted repair materials and procedures have been included in Appendix AU.

1. Map cracking & mechanical damage on landward side of the bulkhead above the fill zone and on the waterward side of the bulkhead above the splash zone (above elevation +2.0 feet NAVD88): These areas were repaired using the original Macropoxy 646 epoxy material and the submittal was accepted on April 9, 2010.

2. Map cracking damage in splash zone and underwater (below elevation +2.0 feet NAVD88): These waterward side areas were repaired using the Fox FX-764 material in accordance with the procedure accepted on April 21, 2010.

3. Mechanical damage in the splash zone and underwater (below elevation +2.0 feet NAVD88): These waterward side areas were repaired using the Fox FX-764 material in accordance with the procedure accepted on June 16, 2010.

Routine inspections by the Engineer during the completion of the repairs often revealed that the Contractor was not following the accepted repair procedures, progress with the repairs was slow, and that the Contractor was not coordinating the repair work with tides and weather (e.g. waiting to complete underwater work until the temperature of the river was almost below the minimum temperature required to complete the work). While the repairs to the landward side of the bulkhead (areas visible above grade and above water) were eventually accepted by the Engineer, the following areas of the coating repair were not accepted as complete by the Engineer:

- Landward side of the bulkheads below grade and below the water line (approximate elevation 0.0 feet NAVD88). It was determined that removing fill on the landward side of the bulkhead and dewatering the excavation to make these repairs was not practical, and thus, the City accepted the Contractor only making repairs above this elevation on the landward side of the bulkheads.

- On the waterward side of the bulkheads, a number of minor repairs above elevation +2.0 feet NAVD88 were not repaired, as indicated in OCC's December 8, 2010 partial review punch list, included in Appendix AV.

- Numerous areas on the waterward side of the bulkhead below elevation +2.0' NAVD88 were not accepted. Some of the types of remaining problems included delamination of the Fox FX-764 repair material, re-damaged areas due to the scaffolding systems and boats with improper fendering used by the Contractor, areas that were not repaired at all, areas where it was obvious that surface preparation was not completed prior to placement of material over the damaged area, the failure of the FX-764 material to fully cure/harden, areas which were partially prepared but never coated, etc. The exact cause of the failure of the FX-764 to cure was not determined by the Contractor, but was suspected by the Engineer to be the result of improper mixing of the two-part epoxy material.

Although numerous defects in the coating were still present at the time of the last review by the Engineer on December 8, 2010, the City ultimately terminated their Contract with SWC prior to completion of all of the repairs and decided not to retain another contractor to complete the repairs. While the bulkheads still serve as a barrier between the Hudson River and the remaining on-Site contamination and the goals of the remedy have been achieved, the remaining defects will potentially reduce the longevity of the bulkhead structures.

The Engineer (OCC) in conjunction with CPI estimated that a coating without defects should provide an additional service life of approximately 20 years in a memorandum submitted to the City on June 24, 2010. The overall service life of the bulkheads was estimated to be approximately 56 years and the bare steel sheet piles were estimated to corrode to the point of perforation (as opposed to structural failure) within 36 to 43 years. As a result remaining defects in the coating and associated shortened service life of the bulkheads, the frequency and level of detail for inspections of the bulkheads has been increased, as described in the SMP. Furthermore, it is anticipated that the level of maintenance will be increased and that significant repairs will be required sooner than if the coating was in accordance with the Contract Documents.

4.10.3 Utility Trench Backfill for the 54-Inch Outfall

The replacement of the 54-inch outfall was not part of the original Contract or the remedial action, but was added to the Contractor's Work via a change order. The City requested the Contractor replace the last 20-feet of pipe with new 54-inch diameter reinforced concrete pipe (RCP) and install a new precast concrete manhole so that they would have a termination point for an in-progress slip-

lining project. Additionally, a new precast concrete headwall was to be installed at the point of discharge into the Hudson River.

One of the requirements of the ROD was that all utility trenches be lined with a demarcation barrier (i.e. non-woven geotextile) and be backfilled with clean, imported fill. This was done with all utilities installed at the Site, except for the 54-inch outfall located near the north end of the Site. Due to the excessive size of the excavation associated with the outfall replacement construction and the Contractor's difficulty in maintaining appropriate overlaps with the demarcation barrier at the time of the installation, a field decisions was made to finish backfilling the excavation with on-Site fill material from the top of the pipe to the design subgrade. The NYSDEC accepted this design change since the non-replaced portion of the outfall would still be included under the SMP and the entire outfall would be located beneath the soil cover system. Other issues associated with the 54-inch outfall installation are not a deviation from the remedial design, but are discussed in Section 4.11.4.

4.10.4 Contractor Documentation

As indicated throughout the FER, the Contractor often struggled with providing the required documentation outlined in the Contract, making it difficult to comply with the requirements of the ROD. Numerous issues and/or errors were discovered with the documentation provided (or not provided) throughout the project including, but not limited to, the following examples:

- Failure to submit monthly project schedule updates or adhere to schedules provided.
- Submittal of incomplete submittal packages to the Engineer for review, often several times for one submittal.
- Failure to submit appropriate backup with payment applications to support work completed.
- Failure to submit required cost backup for requested change orders.
- Failure to provide survey data to support claims of bulkhead movement or other Site issues.
- Submittal of incomplete air monitoring data.
- Submittal of analytical data without an explanation of the purpose or location of samples.
- Submittal of inaccurate data (e.g. sheet pile driving logs, truck disposal logs, etc.).
- Submittal of duplicate weight tickets and/or manifests with payment applications.

- Submittal of poorly organized weight tickets and manifests (e.g. tickets not organized chronologically or by disposal facility.
- Submittal of incomplete compaction testing data and confirmatory sample information.
- Submittal of RFI's for inappropriate items (e.g. requesting a meeting).

This list is provided to document on-going issues during the course of the project with the Contractor's inability to submit the Contract required information and data to comply with the requirements of the ROD. This list is abbreviated and in no way should be considered a comprehensive list.

4.11 DEVIATIONS FROM NON-ROD DESIGN REQUIREMENTS

In addition to the deviations from the ROD-required elements of the remedial design, a number of additional deviations were made from the overall construction Contract. While some of these deviations were associated with Site-specific constraints/discoveries, most of the deviations were associated with the quality of work provided by the Contractor. The following sub-sections summarize the major deviations encountered during the project:

4.11.1 General Deviations & Site Issues

4.11.1.1 Site Security

During the course of construction, the Contractor had to be periodically reminded to replace/repair fencing and re-install warning signage. The primary security issue encountered during the construction was fisherman entering the north end of the Site to fish along shoreline. Upon discovery, any such persons were immediately requested to leave the Site. Additionally, the City of Poughkeepsie Police Department provided assistance in removing trespassers from the Site and provided routine patrols of the area, particularly on weekends, to attempt to reduce trespassers on the Site.

4.11.1.2 Clearing & Grubbing

Prior to commencing with off-site disposal of the timber waste, the Contractor used some of the wood chips as a means to stabilize the Site surface as well as a corridor along the shoreline in Zones 4 & 5 north of the Site. However, the Engineer and the NYSDEC insisted that the Contractor cease this activity upon discovery for two primary reasons: (1) it was unacceptable for the Contractor to place this material off-site at a non-permitted facility that is accessible to the public and has no environmental easement and (2), on-Site placement was not acceptable because all organic material would need to be removed from the Site surface prior to the Developer placing additional fill on the Site or the Contractor installing the soil cover system to minimize degradation and potential settlement associated with this material. The Contractor had to be reminded on a series of occasions that on-Site reuse of the chipped material was not acceptable and that offsite disposal was required.

4.11.1.3 Erosion & Sediment Controls

During the course of the remediation project, the Contractor experienced some problems with the erosion and sediment controls. The Contractor was periodically reminded to repair/replace the erosion and sediment controls throughout the duration of the project. Examples of some of the common problems encountered that required repeated direction to the Contractor, included:

- The silt fencing was not properly installed (e.g. stakes were not driven sufficiently deep to support the weight of silt fence itself or the bottom lap of geotextile fabric was not buried as required to properly function).

- The silt fencing was not properly maintained (e.g. torn sections or sections of fence knocked over were not repaired/replaced in a timely manner).

- While the tracking pad worked well when maintained, the tracking pad was not re-"dressed" with fresh stone on the surface often enough to sufficiently minimize tracking onto public roadways at times. Additionally, the Contractor had to be reminded repeatedly to sweep and/or wash the off-site roadways (primarily Rinaldi Boulevard).

- The turbidity curtain was not properly maintained. The Contractor had difficulties keeping the curtain pulled tightly to the shore at the ends, keeping low points from forming in the floating boom allowing the flow of water over the curtain, removal of debris from the curtain, etc. Additionally, after repeated warnings at the end of 2008 to remove the curtain from the River before ice began to form in the River, the Contractor left the curtain in the river into the winter months and ice caused significant damage to the curtains. Some curtain

was permanently lost in the river due to the Contractor's failure to maintain the curtain. A portion of the lost curtain was sunk intentionally by the Coast Guard after it moved into shipping lanes and repeated attempts to extract it from the ice in the river were unsuccessful. The Coast Guard crews were concerned that the floating curtain and associated ice dams could get caught in the propellers of boats and/or cargo ships and cause potential significant damage.

4.11.1.4 Stockpiling Methods

Throughout the project the Contractor was repeatedly reminded by the Engineer about the Contract requirements for constructing and maintaining the temporary containment pads. The primary issues included stockpiles overrunning the perimeter berms and the Contractor failing to keep stockpiles covered at all times. The Engineer also had to provide reminders to the Contractor throughout the construction phase relative to appropriate materials to be placed on the containment pad, the need to segregate materials properly, the need to remove and treat accumulated water on the pad, the need for maintenance (e.g. replacement of hay bales and patching holes), etc.

4.11.1.5 Dust Control

The Contractor's method of dust control was the use of potable water applied to the Site access roadways with a pickup truck carrying a small polyethylene tote and a small PVC header pipe for dispersion. Utilizing this method of applying water and the limited storage, the Contractor often struggled to keep up with the rate of evaporation, even after repeated complaints by the Engineer and the NYSDEC that the dust control was insufficient.

In response to concerns raised regarding dust control, the Contractor had initially proposed to use a semi-truck with a tanker trailer to apply higher volumes of water to the Site surface. However, the Engineer disapproved use of the tanker trailer because of the observation of what appeared to be asphalt emulsions on the outside of the tanker which indicated that the trailer had been previously used for storing asphaltic products. The Contractor claimed that the tank had been completely cleaned on the inside, but the Engineer's observation of the inside of the tank through a manway at the top of the tanker indicated that the tank did indeed still contain a tar-like residue in the bottom of the tank. The presence of a tar-like residue in the bottom of the tanker led to the Engineer's final rejection of the trailer for use at the Site.

After use of the tanker trailer was rejected by the Engineer and the NYSDEC, the Contractor made no further attempt to increase the level of dust suppression beyond the use of the pickup truck equipped with a tote tank for potable water. The ongoing elevated dust levels were evident in photographs taken by the Engineer and is demonstrated in the elevated dust monitoring results. The Contractor did attempt to implement a few other dust control measures periodically, including controlling the speed limit of vehicles and equipment on the Site, the covering of stockpiles, and re-establishing vegetation on disturbed portions of the Site; however, these measures were only marginally effective in further reducing dust levels.

4.11.1.6 Noise Levels

The working hours were restricted from 7:00 AM to 7:00 PM Monday through Friday and from 8:00 AM to 5:00 PM on Saturday per the Contract; however, the Contractor worked outside the permissible working hours identified in the Contract occasionally, sometimes without notification to the City. Upon request, the City initially granted the Contractor to work outside the weekday time restrictions identified in the Contract. Specifically an early start time of 5:00 AM time was approved by the City on a temporary basis. However, after the City received numerous complaints about construction equipment disturbing residents too early in the morning (before 5:00 AM in some cases) during the AOC excavations, the City enforced the working hours in the Contract and revoked any authorization for the Contractor to start operating equipment or driving trucks on the Site earlier in the morning than 7:00 AM.

4.11.1.7 CAMP Issues

The following list summarizes the primary issues encountered by the Contractor with the implementation of the CAMP:

- The Contractor setup the perimeter air monitoring stations with no real-time communications. Therefore, the Contractor seldom realized there was an exceedance until the end of the day when the data was downloaded. The Engineer required SWC to also utilize upwind stations for comparison purposes given that the Contractor was not aware of exceedances in real time.

- During the startup of the AOC excavations, the Contractor did not have the data loggers turned on, and therefore, some data was not recorded.

- The Contractor did not always position the monitoring in accordance with the wind direction. Additionally, the monitors were not moved during the course of the day when the prevailing wind direction changed.

- The Contractor did not always place an air monitoring station downwind of every operation; rather the Contractor only used one or two stations at a time to attempt to provide air monitoring coverage for the entire Site. However, since the Site is nearly 2,000 feet long, this often meant the instruments were placed a considerable distance apart (over 1,000 feet at times) from the intrusive activity being monitored.

- The data provided early on did not include instrument numbers and there were no sketches showing the location of air monitoring stations. Thus, it became difficult to discern what data was associated with which Site activity or the purpose of a particular data set.

- The Contractor did not provide calibration records for all instruments.

- The Contractor only occasionally identified the cause of exceedances and what the mitigation measure implemented was. Again, most of this was related to the issue that the Contractor did not know when the exceedances were occurring in real time. The Contractor also made little effort to diagnose reoccurring problems with instruments (e.g. the Contractor would contend that the elevated dust monitoring readings were due to rain entering the intake of the monitor, but yet would not install rain caps on the instruments after repeated requests to do so).

- Data was not collected during the full duration of the intrusive activities. The Contractor provided data for partial days in some instances, even though intrusive activities were documented as occurring throughout the entire work day.

- The Contractor seldom documented the reason for which no air monitoring was conducted on a particular day (e.g. heavy rains all day) or why data was only provided for partial days.

The Contractor took little initiative to address the "pump" alarms issues associated with the PIDs use for organic vapor monitoring. The air pump on the instrument is used to draw the air from the sampling area into the instrument where the airborne contaminants with ionization potentials similar or lower than the energy the PID lamp used in the detector. The Contractor had initially claimed that the rental company who supplied the PID instruments had stated that the PID was still collecting valid data even if it was operating in a "pump" alarm state. The Engineer contacted RAE Systems, Inc., the manufacturer of the PIDs used on-Site, and verified that the "pump" alarm comes on when

the pump air inlet is blocked or becomes wet and the pump is turned off to protect the instrument. Therefore, when the pump is turned off, the PID is not collecting representative air samples at the CAMP monitoring location(s). After several discussions with the Contractor regarding the proper operation of the instrument, the Contractor returned the instrument to the rental company and procured a replacement instrument for the Site.

4.11.2 Riprap Revetment

Riprap revetment was placed in along the river shoreline in all non-bulkhead areas to stabilize the shoreline and protect the soil cover system from potential erosion and/or scour. Again, the Contractor experienced several issues during the installation of the revetment. The primary issues encountered during the revetment installation included the following:

- Despite the Engineer's concerns and comments, the Contractor had a difficult time placing the woven geotextile beneath the bedding stone and maintaining appropriate overlaps.

- In some zones, particularly at the start of the revetment installation, the Contractor had a difficult time in achieving the correct 1.5 H:1 V slope. This resulted in some stone in Zone 2 being removed and having to be reinstalled after the correct subgrade slope was achieved. Some steeper than specified slopes of the finished surface of the revetment stone were also discovered beneath the water during an underwater investigation completed after the initial revetment installation. These areas were repaired by simply adding additional armor stone to the revetment to achieve the specified slope.

- In some areas, the armor stone was "dumped" as opposed to "placed" based upon visual observation, as the stones were not interlocked to provide the design intent for stability. In these areas, the Contractor was required to remove and replace the stone with appropriate placement techniques.

- During the post-installation underwater investigation, some voids were discovered in the armor stone. These were relatively easily repaired by the placement of additional stone in these areas.

- During the post-installation underwater investigation, it was discovered that some of the toe stone at the bottom of the revetment section were missing and some were simply placed on the bottom of the mud line rather than being keyed or toed into the river sediment. In these instances, the Contractor used a large excavator (Komatsu 1250) to push the stone into the soft sediments below to the correct elevation.

A limited number of the precast concrete jersey barriers installed at the top of the revetment section to separate the revetment from the Site soils were found to be cracked. It appeared that these cracks may have resulted in the early handling of the barriers prior to sufficient cure time. While some cracks still remain, the most heavily damaged barriers were replaced. Additionally, the top surface of the jersey barriers was damaged in some locations during the course of the construction, resulting in spalling of the concrete. As a result, the Contractor was required to patch the concrete surface in the most heavily damaged areas.

4.11.3 Live Stakes

Live stakes were to be installed in the Zone 5 section of riprap revetment to soften the appearance of the hard riprap shoreline. While the live stakes were installed north of the project Site and were not part of the remedial action, they were included in the Contract for the Remedial Action. The Contract specified the placement of approximately 50 live stakes with a maximum 20 percent mortality rate. During the Engineer's last review of the live stakes, the mortality rate was approximately 60 percent. While the exact cause of the mortality was not determined, the following issues were observed by the Engineer:

- The live stakes were not harvested during the dormant season and had leaves upon arrival at the Site.
- The live stakes were harvested well before 12 hours prior to installation and were not stored in a submerged vessel with clean water as specified.
- The outdoor temperatures exceeded 50 degrees Fahrenheit where the live stakes were being installed.
- Little soil was place around the base of the stakes and they were not watered regularly following installation.
- The specifications stated that 2 to 4 inches of the live stakes and two live buds shall be exposed above the riprap. The Contractor installed the stakes with 4 to 6 feet and hundreds of buds and even leaves were exposed above the riprap.

The Engineer expressed these concerns to the Contractor several times prior to, during, and following the installation of the live stakes. However, the recommendations by the Engineer were

not followed by the Contractor. Rather the Contractor attributed the mortality of the live stakes to the elevated salt levels in the Hudson River. To investigate this claim, the Engineer measured the salinity levels in the river immediately adjacent to Zone 5 on May 28, 2009 using an YSI Model 63 multi-parameter water quality meter. Over the 15-minute interval measured during an incoming tide, the maximum salinity level measured in the river was 0.1 parts per thousand (ppt), which is classified as fresh water and well below the threshold of 2 to 5 ppt of salinity required to be classified as slightly brackish water. Therefore, it is the opinion of the Engineer that the mortality of the live stakes was not related to the salinity levels in the Hudson River.

Based upon the high mortality rates observed in 2009, the Engineer required that SWC replace a number of the dead live stakes in 2010, but the Contractor again disregarded recommendations by the Engineer and essentially followed the same protocol as in 2009 to install the new live stakes. As expected after observing the Contractor's disregard of the project specifications, the mortality rates were similarly high at the end of 2010. After two failed attempts to achieve an 80 percent survival rate, the City did not require the Contractor to attempt to replace the dead stakes again in 2011.

4.11.4 Weep Hole Drainage System

Per the original Contract Drawings, the weep hole drainage system was to consist of 8-inch diameter PVC header pipe connected to the existing concrete retaining wall with 4-inch diameter PVC laterals and fabricated stainless steel plates. However, the Engineer accepted the Contractor's proposed change to switch to a 4-inch PVC flange bolted to the concrete wall.

Additionally, a Work Change Directive was issued to the Contractor during construction to revise the weep hole drainage system as a result of grading changes made by the Developer of the Site. The changes included the connection of additional weep holes to this closed drainage system, the lengthening of the main collection pipe due to the increased number of weep holes connected to the system, deepening of the pipe and manholes to maintain minimum slopes to the discharge point, and switching the 8-inch PVC collection pipe to 10-inch HDPE pipe to both handle the additional flow and tolerate the reduced soil cover over the top of the pipe as proposed by the Developer. The cost of these modifications was managed under Change Order No. 25.

During the installation of the weep hole drainage system, the Contractor experienced difficulty in laying out the system. As indicated by the as-built drawing provided by the Contractor, the location of the manholes was not as specified in the Contract and the elevation of most of the manhole frames and covers was incorrect. While the horizontal layout was accepted by the Engineer, a number of the manhole castings had to be reset. Additionally, one manhole had to be removed and completely reset as the structure was set over 8-inches too high in the middle of a future parking lot area. Finally, the Contractor had to be reminded to remove stones, brick and other debris from the clean backfill in the pipe trenches.

4.11.5 54-Inch Outfall Replacement

As, previously indicated, the replacement of the 54-inch outfall was not part of the original Contract or the remedial action, but was added to the Contractor's Work via a change order. In addition to the bottom of the trench not being lined with a demarcation barrier as required by the ROD, the Contractor experienced a number of other issues during the installation of this outfall. These issues included, but were not limited to the following:

- The Contractor could not place the bedding stone level when working beneath the water table and overlaps in the non-woven geotextile were not maintained.
- The Contractor could not set the precast structures in the correct positions horizontally or vertically after several attempts were made. The City eventually accepted the precast manhole structure being installed 4-inches out of plumb.
- The concrete pipe joints were not pulled tight, resulting in the need to pour concrete around the joints to seal them.
- The invert channel in the bottom of the manhole was not placed prior to installation of the manhole. Thus, the Contractor used a portion of the old corrugated metal pipe (CMP) to form the bottom channel in the structure and simply poured concrete beneath and along the sides of the CMP through the water in the manhole to create a final channel through the manhole.

The outfall construction was eventually accepted by the City engineers.

4.11.6 Outfall Backflow Preventers

A total of five (5) new outfalls were installed under the Contract for connection by the future Site Developer. The Contract Drawings required that a rubber, duckbill style check valve be installed on each outfall to reduce the potential of the future storm sewer systems being surcharged by the Hudson River during high tides and following storm events. However, given that outfall pipes consisted of corrugated HDPE pipe, the pipe material does not offer a tremendous bending or shear strength. Thus, since the outfalls at the bulkheads project out into the Hudson River, it was decided during the course of the construction that the installation of the backflow preventers on the bulkhead outfalls was not practical, as they would likely be torn off soon after installation by ice and/or debris floating in the River and could potentially damage the outfall pipe itself.

In addition to the bulkhead outfalls (one per bulkhead), there were two new outfalls installed in the Zone 2 revetment and one installed in the Zone 4 revetment. Since these outfalls were offered some protection from the revetment surrounding them, the backflow preventers were installed at these locations. However, as of the March 10, 2011, only the backflow preventers in Zone 2 were still attached. While the exact cause of the detached backflow preventer in Zone 4 is unknown, the end of the outfall pipe is relatively undamaged and the backflow preventer is still intact suggesting that it is possible that the bolts used to attach the backflow preventer were simply not tightened sufficiently during installation. This backflow preventer was not re-installed per a decision by the City of Poughkeepsie.

The backflow preventers were not part of the remedy for the Site and none of the other existing outfalls at the Site were equipped with backflow devices. Therefore, the fact that backflow preventers are not present at all new outfall locations was not considered to be a significant issue.

4.11.7 Silt Fence

Silt fence was required along the shoreline as a temporary erosion and sediment control (ESC) measure. The silt fence was initially installed along the shoreline as the Site was cleared. While no grading typically occurs at the property boundary because there is a need to blend the new grades into existing, this was not the case along the waterfront. Specifically, the proposed grades along the

shoreline resulted in the need for significant cuts to lower the shoreline to the correct elevation. Since complete replacement of the silt fence after the grades were modified was not part of normal maintenance activities included in the Contract, a change order was executed for the Contractor to install temporary silt fence (e.g. no wire backing) along the shoreline and then the final silt fence was installed after the grading work was completed per the original Contract.

4.11.8 Abandoned Drums

During the clearing and grubbing activities in Zone 1, the Contractor discovered four (4) abandoned drums. The drums were managed poorly by the Contractor and not in accordance with the direction provided by the Engineer and the NYSDEC. Issues included, but were not limited to the following:

- Upon discovery, the drums were not immediately overpacked.
- The Contractor moved one of the drums releasing some of the contents and no attempt was made to cleanup up the spill material until several days after the release.
- The Contractor spent considerable time putting a change order request together to manage the drums, thus delaying any corrective measures. The Engineer was advised of the drum discovery on the March 28, 2008 and a reasonable change order request that included the appropriate costs breakdown and unit pricing was not received until May 13, 2008.
- The sampling effort and receipt of analytical results for the waste characterization results were slow. The results were submitted to the Engineer in excess of 90 days following the overpacking of the drums. The results indicated that the contents were non-hazardous.
- Although the change order for the drum management and disposal was fully executed by May 30, 2008, the Contractor ultimately arranged for disposal of the drums on August 4, 2008.

While the Contractor's poor management of the four abandoned drums did result in additional on-Site soils requiring offsite disposal (to provide a cleanup of the material contaminated by the spill), it did not result in a significant impact to the environment and had no impact the Hudson River as the release was contained by temporary soil berms approximately 100 feet up-gradient of the bulkheads. As previously indicated, the manifest documenting the proper disposal of the drums has been included in Appendix AF. The analytical results for the characterization of the materials in the drums have been included in Appendix AE.

4.11.9 Contractor Spills

As previously indicated in the FER, the Contractor was held responsible to cleanup a number of petroleum-related spills/releases related to mismanagement and equipment failures and conduct post-cleanup confirmation sampling. While some equipment failures are typical on large construction projects, the frequency on this project was excessive and many were associated with poor housekeeping by the Contractor. As a result, a number of spills were reported to the NYSDEC's Spills Hotline, sometimes even when the spills were small and contained. The following list provides a summary of the spill reports that were prepared for the Site during the course of the construction. However, this list is not comprehensive of all spills/releases that were associated with the Contractor's actions. A number of other "non-reportable" spills also occurred that were small in quantity, contained, and cleaned up in a relatively timely manner by the Contractor.

- **June 26, 2008, NYSDEC Spill No. 0803608:** At approximately 11:50 AM, a hydraulic line failed on the vibratory hammer being utilized to drive the steel sheet piles for the Zone 1 bulkhead. As a result, an unknown amount of hydraulic oil sprayed into the Hudson River between the shoreline and the turbidity curtain. The prime Contractor rapidly mobilized to the release area with oil absorbents and spill booms in an attempt to recover/contain the hydraulic oil; however, upon reaching the scene with the appropriate cleanup supplies, their subcontractor (G. Donaldson), had already sprayed dish detergent, a dispersant, into the oil slick on the water surface. The use of dispersants reduced the amount of recoverable product with absorbents, but the Contractor did spend several hours that day attempting to recover any remaining oil on the water surface. G. Donaldson denied that dispersants were used; however, the Engineer documented the presence of bottles of dish detergent on-Site and informed the Contractor that the presence on-Site or future use of such dispersants was prohibited. This spill report was closed by the NYSDEC on June 27, 2008 following a DEC spill response inspection.

- **September 25, 2008, NYSDEC Spill No. 0807166:** During the installation of the Zone 3 bulkhead and associated demolition of former shoreline structures, product was observed rising to the surface of the water. While the Contractor had installed a turbidity curtain and some absorbents in the Hudson River to attempt to contain this product, a portion of the boom broke and released some of the product and debris into the river. Attempt was made by the Contractor to remove the product with absorbents, but inevitably some product was not recovered. This spill report was closed by the NYSDEC on September 25, 2008.

- **March 17, 2009, NYSDEC Spill No. 0813597:** During the course of the AOC-2/3 excavation, the completed Zone 3 bulkhead was intended to provide a barrier that would intercept any product in the AOC excavations from entering into the Hudson River. However, due to the issues with driving the sheet piles and sealing the interlocks properly

with a hydrophilic waterstop, some of the interlocks were discovered to be leaking and allowing a small amount of oil to enter into the river. The oil migration was eventually stopped by placing a spill boom and absorbents in the landward side of the bulkhead until the product could be properly controlled. Additionally, the leaking interlocks were later repaired. This spill report was closed by the NYSDEC on March 17, 2009.

- **August 18, 2009, NYSDEC Spill No. 0905797:** The NYSDEC project manager discovered waste motor oil and hydraulic oil that had leaked or been spilled by poor housekeeping around 7 drums behind the job trailers (associated with heavy equipment maintenance) near the entrance to the Site. Additionally, some garbage bags containing oil-soaked absorbents also appeared to be a potential source of the product observed on the ground surface. Upon request, the Contractor moved these materials to the Zone 2 containment pad until proper offsite disposal could be arranged. Additionally, the contractor was required to dispose the impacted Site soils and disposal the material off-site at their expense. This spill report was closed by the NYSDEC on August 18, 2009.

As indicated above, all of these spill reports have been closed by the NYSDEC.

4.11.10Project Schedule

As previously indicated, the unforeseen conditions and change orders executed for the project prolonged the project schedule. Specifically, the last executed change order extended the Substantial Completion date from November 28, 2008 to July 3, 2009 and the Final Completion date of the project from December 31, 2008 to July 30, 2009. As of the conclusion of 2010, the Contractor had yet to complete the repairs to the bulkhead coating system and install the soil cover system. Based upon financial considerations and delays by the Contractor (e.g. after routine requests by the Engineer to mobilize additional equipment and manpower), the City elected to remove the soil cover system installation from the Contract and have the Developer complete this task. Furthermore, the City determined that they would not have the Contractor return to the Site to complete the remaining coating repairs.

As of the Contractor's last day on-Site, November 12, 2010, they were over 470 days behind schedule for final completion, although it was the opinion of the Engineer that they were yet to be substantially complete since the bulkhead coatings repairs were not complete and they had yet to install the soil cover system. At the time the City terminated SWC's Contract on May 27, 2011, they were 666 days behind schedule and the work which had yet to be done still included completion of the bulkhead coating repairs, as well as the installation of the soil cover system.

While the deviation from the project schedule has resulted in undue hardship to the City, it is the opinion of the City and the Engineer, that the schedule delays have not impacted the overall effectiveness and eventual completion of the remedial action. The Developer's contractor ultimately completed the Site remedy with the installation of the soil cover system on January 17, 2012. This was approximately 900 days behind the final completion schedule. However, it should be noted that most of the delay was associated with SWC activities, which was one of the primary reasons for the ultimate termination of their Contract.

Since Notice to Proceed was issued to the Contractor on December 17, 2007 and the installation of the soil cover system was not complete until January 17, 2012, the overall construction duration was 1,492 days, or approximately 4.1 years. This excessive delay was unfortunate, and while a few unforeseen conditions were encountered during the construction, most of this extensive delay was attributed to the poor performance by the Contractor, as the formal final completion date due to the unforeseen conditions was extended only to July 30, 2009.

5.0 PROJECT FINANCIALS

As previously indicated, the City of Poughkeepsie entered into a SAC agreement with the NYSDEC in November 2005 (SAC No. C302762) to allow the City to seek reimbursement for a portion of the costs (up to 90 percent for eligible items) required to perform a supplemental investigation, complete a remedial alternative analysis and coordinate the remedy selection for the Site through the NYSDEC ERP program. The State added the City's eligibility for reimbursement for portion of incurred costs for remedial design and remedial action to the SAC through Amendment No. 1. SAC Amendments No. 2 & 3 extended the contract end dates to March 30, 2010 and March 30, 2011, respectively.

Some items included in the construction contract (e.g. riprap revetment, outfall installation for future stormwater system, etc.) were deemed ineligible for reimbursement because they were not considered to be a direct component of the remedy by NYSDEC and some items were deemed as only partially reimbursable, as described further in the following subsections.

The following subsections summarize the overall financials for the DeLaval project:

Section 5.1 – Payment Applications for Reimbursement
Section 5.2 – Construction Contract Financials
Section 5.3 – Developer Construction Financials
Section 5.4 – Other Construction Costs
Section 5.5 – Professional Services Financials
Section 5.6 – Claims Associated with Construction
Section 5.7 – Overall Project Costs Summary

5.1 PAYMENT APPLICATIONS FOR REIMBURSEMENT

The initial approved budgetary amendment to the SAC was approved in 2007 and increased the project budget to $10,361,550.00 with the maximum reimbursable funds of $9,325,400.00. In addition, two separate no-cost time extension amendments extended the SAC end date to March 30, 2010 and March 30, 2011, respectively. On February 19, 2010, the City submitted a request to

increase the project budget to $16,684,533 and the reimbursable funds to $15,016,085. However, since no new funding was available for the State's ERP program, there were no additional funds available for this project at the time of the request and the amendment was not approved. On July 7, 2011, the City submitted another amendment request to NYSDEC to revise the overall project budget to $16,032,004.49 with a reimbursable component of $12,136,400.95. Similarly, the Department did not review this request in detail at the time as there is no funding in the ERP program for the State to consider providing additional budget for the DeLaval project. As a result, the Department sent correspondence to the City on December 30, 2011 denying the request.

The last reimbursement application, Payment Application No. 10, was submitted to NYSDEC January 2010 and included claims for costs through October 25, 2009. However, the Department only reviewed the application thorough June 30, 2009, since, by the end of that month, reimbursable costs incurred had already exceed the maximum reimbursable funds available in the SAC by $168,136.65. The NYSDEC will only review the balance of Payment Application No. 10 or any future requests for reimbursement should the SAC for the DeLaval Site be further funded at some point in the future. The following table summarizes the payments made by the State to the City under the SAC agreement:

Table 5-1. Summary of Payments to the City Under SAC

Payment Application No.	Date	Amount Paid	Comment
1	10/24/2006	$138,645.59	
2	08/01/2007	$141,497.06	
3	01/30/2008	$129,306.52	DEC determined overpayment by $64,653.26
4	07/17/2008	$734,757.24	
5	09/03/2008	$380,769.08	
6	12/15/2008	$1,684,332.01	
7	05/22/2009	$845,779.09	
8	06/11/2009	$1,705,457.75	Reduced by $64,653.26 to correct No. 3 overpayment
9	08/21/2009	$1,876,033.13	
10	04/14/2010	$1,688,822.53	
Total		**$9,325,400.00**	Maximum Reimbursable SAC Funds

While the City continued to incur costs after the submittal of Payment Application No. 10, the NYSDEC has indicated that no further payment applications for reimbursement will be reviewed by the Department unless further funding becomes available for the DeLaval Site at some point in the future.

5.2 CONSTRUCTION CONTRACT FINANCIALS

Payment applications were typically submitted by the Contractor to the Engineer on a monthly basis for review and approval. A total of twenty-four (24) payment applications were reviewed and approved during the course of the construction work. A copy of the final approved payment application for January 2010 has been included in Appendix AW. The Contractor submitted additional draft payment applications in February, March and September of 2010; however, these payment applications were never approved by the Engineer, nor were they paid by the City. Therefore, all of the financial information discussed herein, is based upon the final approved payment application from January 2010.

As indicated by the summary table for the payment application (Appendix AW), the project was setup as a unit price Contract. Table 5-2 summarizes the financials for the construction Contract between the City and SWC. Additionally, the table summarizes the amount of the work classified as eligible for reimbursement by NYSDEC under the SAC.

Table 5-2. Summary of Construction Contract Financials

Original Contract Sum	$10,387,617.93
Approved Executed Change Order Total	$5,867,276.15
Contract Sum to Date (including executed change orders only)	$16,254,894.08
Total Completed & Stored to Date (by SWC)	$12,755,429.10
Retainage (5%)	$637,771.46
Total Earned Less Retainage (Amount Paid by City)	$12,117,657.65
Costs Paid by City Reimbursable by NYSDEC	$10,623,516.35
90% Reimbursement Amount Eligible	$9,561,164.71
90% Reimbursement Cap (SAC limit)	$9,325,400.00

Due to project changes and unforeseen conditions encountered during the construction process, a number of Contract items were closed out at a smaller or larger quantity then the bid quantity. Additionally, payment was withheld on a number of items by the City and/or the NYSDEC due to the Contractor's failure to complete items in accordance with the requirements of the Contract Documents. The table provided in Appendix AX provides a financial summary of the Contract between SWC and the City and any withholdings. The following list provides a detailed description of the information/column headings provided in the table:

- **Item No.:** This column provides the original item number or change order number included in the Contract.
- **Item Description:** This column provides a brief description of the line item or change order item in the Contract.
- **Contract Quantity:** This column provides the original Contract quantities from the bid summary form and the change orders.
- **Unit:** This column specifies the unit of measurement used for the item.
- **Unit Cost:** This column provides the cost paid to the Contractor per unit of the item installed.
- **Approved Contract Total:** This the originally approved contract sum, calculated as the Contract Quantity times the Unit Cost.
- **Total Quantity Approved for SWC:** This is the total quantity approved for payment to the Contractor through the final approved Payment Application No. 24 in January 2010. Any withholdings by the City are already reflected in these quantities.
- **Total $ Earned to Date:** This is the total payment approved to the Contractor through the final approved Payment Application No. 24 in January 2010.
- **5% Retainage:** This column shows the 5% of the Total $ Earned to Date kept by the City as retainage for each line item.
- **Actual Amount Paid By City:** This column shows how much money was actually paid to the Contractor at the time of the last approved payment application and is calculated as the Total $ Earned to Date minus the 5% retainage.
- **Quantity Variance from Contract:** This column shows the difference in quantity between the Contract Quantity and the Total Quantity Approved for SWC. Positive values indicate

that the full Contract Quantity was not utilized, where negative values in brackets indicate that that was an overrun from the Contract Quantity.

- **Reason for Variance in Quantity:** This column provides a written description as to why there was quantity overrun or under-run.

- **Quantity Withheld by the City & Reason for City Withholding:** These columns identify any quantities withheld by the City and the reasoning to support the withholding, respectively. The withholdings were typically associated with the Contractor's failure to comply with all Contract Requirements and do not include items that were simply not used. Any such withholdings were already accounted for/reflected in the Total Quantity Approved for SWC.

- **Additional Quantity Not Reimbursable by NYSDEC & Reason for NYSDEC Withholding:** These columns identify any additional quantities withheld by NYSDEC in addition to those already withheld by the City and the reasoning to support the withholding, respectively. Since these withholdings were determined after the Contractor's payment applications had been approved, these became costs that the City was ineligible to seek reimbursement for and became responsible for 100 percent of the cost.

- **$ Eligible for Reimbursement by NYSEC:** This is the amount of money paid to the Contractor by the City that the NYSDEC determined to be eligible for reimbursement (excludes withholdings).

- **90% Reimbursement Amount:** This column shows the amount of money that the NYSDEC approved reimbursement for to the City and was calculated at 90 percent of the $ Eligible for Reimbursement by NYSDEC. It should be noted that these values do not necessarily reflect the actual dollars reimbursed as this total amount exceeded the eligible reimbursement funds in the SAC.

As previously indicated in the FER, the primary elements of SWC's Contract not closed out included the bulkhead coating repairs and the installation of the soil cover system. However, the soil cover system was installed by the Developer through a separate agreement with the City and the City has elected not to have SWC make the final remaining bulkhead coating repairs. No additional payment has been made to SWC since the approval of the January 2010 payment application and no other settlements have been reached between the City and SWC at the time of this report relative to any items for which the City withheld payment.

5.3 DEVELOPER CONSTRUTION FINANCIALS

As previously indicated, the City terminated their Contract with SWC on May 27, 2011. In order to comply with the requirements of the ROD and implement the full remedy for the Site, the City worked with the Developer to complete the installation of the soil cover system. The Developer retained Village Construction Company, Inc. (VCCI) to complete the rough grading of the Site, install subsurface utilities required for future development of the Site, and install the soil cover system across the Site.

The table in Appendix AY provides a summary of the costs borne by the City for the work completed by the Developer on the City's behalf. This table does not reflect the costs paid for directly by the Developer. While most of these costs are associated with installation of the soil cover system, some of the items were associated with installing subsurface infrastructure in support of the future waterfront development by the City and other miscellaneous Site preparation tasks negotiated between the City and the Developer. The City elected to complete this work prior to the installation of the soil cover system to minimize future disturbances to the cover system and minimize the potential to have to complete work beneath the demarcation barrier. The following table summarizes the VCCI costs incurred by the City to date:

Table 5-3. Summary of Developer Construction Costs

Item(s)	Cost	Costs Eligible for Reimbursement	90% of Costs Eligible for Reimbursement
Soil Cover Layer Items	$767,550.99	$0.00	$0.00
Non-Soil Cover Layer Items	$399,671.05	$0.00	$0.00
Total	**$1,167,222.04**	**$0.00**	**$0.00**

Referring to SWC's original Contract for the installation of the soil cover system (including the demarcation barrier, soil cover & mulching), $551,499.48 had been allocated for the soil cover system. Since SWC had installed some soil cover in the SE corner of the Site, the remaining available balance in their Contract was $539,111.58. Thus, it is estimated that an additional $228,439.41 was spent to have the soil cover system installed by VCCI.

Per an October 19, 2010 letter from the NYSDEC to the City, costs for remediation borne by the City through its agreement with the Developer were not reimbursable pursuant to the SAC under the ERP. The NYSDEC based this decision on the fact that the agreement between the City and the Developer did not include the contract provisions which were required to be included by the City in order to implement the remedial activities pursuant to the requirements of the SAC.

5.4 OTHER CONSTRUCTION COSTS

In addition to the original construction Contract and Developer Costs, the City retained the services of a contractor to complete miscellaneous tasks:

- On October 28, 2011, the City retained a separate marine contractor, Seaway Diving and Salvage Co., to repair two leaking interlocks on the Zone 3 bulkhead, one of which was documented in OCC's December 8, 2010 site visit to prepare a partial punch list of the waterward side of the bulkhead coating touchups above elevation +2.0 feet AMSL (see Appendix AV). The second repair was discovered by the Contractor on the same date the repairs were made. The cost to the City to complete these repairs was $4,749.00.

- In February 2012, the City retained DeCar Fence Inc. to install a chain link fence around the bedrock outcropping near the northeast corner of the Site to separate the "Site" boundary from the overall "property" boundary. The cost of the fence installation was $11,952.00.

5.5 PROFESSIONAL SERVICES FINANCIALS

The table in Appendix AZ provides a summary of the Engineering fees for the DeLaval project by phase, including costs starting from the Engineer's involvement with the project in 2001. As indicated in the table, the total approved Engineering fees to date have been $1,900,017.24. While this is in excess of the originally budgeted fee for the project, the significant delays in project schedule and the issues encountered with administering the construction phase of the Contract (i.e. extended construction oversight timeframe, multiple reviews of submittals, preparation of extensive correspondence, etc.) resulted in the need for additional engineering fee.

Of this amount, approximately $780,000 has been for expenses, including subconsultant costs, subcontracted environmental & geotechnical laboratory costs, air monitoring subcontractors (project monitoring for ACM removals), equipment rental costs, shipping costs, reproduction/copies, and lodging/travel costs. Of the total expense costs, the primary expense (approximately $640,000) was

associated with CHA's subconsultant, OCC, who was responsible for the design, construction oversight, and construction administration tasks associated with the waterfront components of the project.

In addition to the Engineering costs, the City also incurred some additional professional fees during the course of the DeLaval project, specifically costs associated with the use of a professional land surveyor to monitor the bulkhead movement at the Site and legal services. The total cost of the surveying services was $31,062.50. To assist the City's Corporation Counsel on legal matters pertaining to this project, the City retained outside legal support from Jacobowitz and Gubits, LLP for the project beginning in August 2008.

Of the fees to date, $30,645.15 has been associated with conflict resolution discussion and management of Contractor claims, $5,193.25 has been associated with the development of the Environmental Easement for the Site, and $2,283.75 has been associated with the installation of the marina along the waterfront side of the DeLaval Site. Table 5-4 summarizes the overall professional costs to date as well as costs that are potentially eligible for 90 percent reimbursement to the City through the NYSDEC's ERP Program. It should be noted that some of the Engineer fees were deemed ineligible for reimbursement because they were associated with the design and coordination for elements of the project that were not required by the ROD.

Table 5-4. Summary of Professional Service Fees

Item(s)	Total Cost	Costs Eligible for Reimbursement	90% of Costs Eligible for Reimbursement
Engineering Consultant Fees	$2,045,617.24	$1,903,667.69	$1,713,300.92
Berger Engineering & Surveying: Professional Land Surveyor to Monitor Zone 1 Bulkhead Movement During Toe Stone Protection Placement	$31,062.50	$31,062.50	$27,956.25
Jacobowitz and Gubits, LLP: Legal Counseling Fees (through 01/2012)	$38,122.15	$35,838.40 (excludes marina)	$32,254.56
Total $ Professional Services	**$2,114,801.89**	**$1,970,568.59**	**$1,773,511.73**

5.6 CLAIMS ASSOCIATED WITH CONSTRUCTION

All claims referenced herein are discussed at the specific request of the NYSDEC. All claims were unresolved and/or pending at the time of completion of this FER, and therefore, the impact of such claims on the financial status of the project are unknown. Copies of the actual legal claims are maintained by the City's Corporation Counsel, but have not been included in the FER.

5.6.1 Informal Claims

During the first two of years of the construction project, SWC submitted a number of letters to the Engineer identifying potential claims for the project. The first such letter was dated July 8, 2008, in which SWC indicated that unforeseen subsurface obstructions encountered (e.g. timber pilings) and the need to contain "oil" product leaching from AOC-2/3 and resulted in project delays and additional costs incurred. In an August 15, 2008 letter to the Engineer, SWC claims that they wished to further articulate their claims. However, this letter provided no specific allocation of the time delay or a specific dollar amount of additional costs incurred by SWC. Rather, this letter noted a number of generalizations regarding Site issues and provided a list of types of items SWC would eventually seek compensation for.

As indicated, a number of these letters were addressed directly to the Engineer who was not party to the Contract and none of them included specific dollar values or specified delay timeframes, although one letter indicated that SWC had adjusted their project schedule by six months to account for unforeseen Site conditions. Since SWC never provided backup to these initial letters as required by the General Conditions of the Contract, they were not considered by CHA to be formal written claims against the City. However, the Engineer and/or the City did prepare formal written response to each of SWC's letters to clarify the Engineer's and/or the City's position on each point presented by SWC.

On January 27, 2010, Jacobowitz and Gubits, LLP, the City's consultant attorney for the DeLaval project, forwarded two claims to the attention of the Engineer. The claims were submitted to SWC from their subcontractor, G. Donaldson Construction, with the first claim dated January 12, 2009 and the second claim dated March 16, 2009. While the Engineer did not agree with a number of the

issues raised in the claims, a detailed response to these claims was not prepared by the Engineer, as the written claims were addressed to SWC and not the City. Per the General Conditions in the Contract, SWC was reminded by CHA that the Engineer would only review and render a decision/recommendation on claims submitted directly to the City, as the City had no contractual relationship with G. Donaldson Construction.

5.6.2 Formal Claims

On October 15, 2009, SWC met with the City and the Engineer to present their first formal claim on the project. Based upon the meeting, the City requested SWC to provide additional backup and clarification on the financial aspects of the claim. SWC's written "general conditions" claim was submitted to the City on October 23, 2009 as a new standalone claim. The City provided a copy of the claim to the Engineer on March 19, 2010. The claim stated that the costs presented were those previously disallowed in previously executed change orders, specifically field office overhead costs such as wages and benefits for SWC's Project Manager and Site Superintendent, job trailer rentals, and utility costs (e.g. electric, potable water, sanitary facilities, & telephone). SWC calculated that these costs were an average $1,048.46 per day. Since the project completion dates had been extended a total of 146 days through Change Order No. 30 (although SWC never executed Change Order No. 30), SWC calculated a total claim value of $153,075.16.

On March 19, 2010, the Engineer responded to SWC's claim and recommended no additional payment to SWC based upon the requirements outlined in the Contract. Specifically, it was the Engineer's opinion that the claimed costs were to be included in each change order and that the Contract between the City and SWC included a maximum allowable markup for overhead and profit (15 percent on Contractor's combined overhead and profit on labor costs and 10 percent on Contractor's combined overhead and profit on materials and equipment). Said percentages for overhead and profit had already been included in each of the change orders. To date, the City has not agreed to any settlement on this claim with SWC.

Finally, SWC filed a lawsuit against the City, Hayward Baker, Inc. D/B/A G. Donaldson Construction Co., A Division of Hayward Baker, Inc., and Fidelity & Deposit Company of Maryland

(G. Donaldson's bonding company) on July 22, 2011, following the City's termination of SWC's Contract. On October 12, 2011, the City filed a counterclaim against SWC. The Engineer was not made aware of any settlements between SWC and the City at the time of this FER, and therefore, any potential cost implications to the project associated with these claims is unknown.

5.7 OVERALL PROJECT COSTS SUMMARY

The following table summarizes all costs borne and actually paid by the City of Poughkeepsie on the DeLaval ERP project, excluding any internal City costs.

Table 5-5. Summary of Overall Project Costs

Item(s)	Total Cost	Costs Eligible for Reimbursement
Total Construction Costs (Original SWC Contract)	$12,755,429.10	$10,623,516.35
Developer Costs for Soil Cover System Installation & Shoreline Infrastructure	$1,167,222.04	$0.00
2011 Bulkhead Leaking Interlock Repairs	$4,749.00	$4,749.00
Fence Installation Around Northeast Bedrock Outcropping	$11,952.00	$11,952.00
Total Construction Costs Subtotal	***$13,939,352.14***	***$10,640,217.35***
Engineering Consultant Fees	$2,045,617.24	$1,903,667.69
Survey Services to Monitor Zone 1 Bulkhead Movement	$31,062.50	$31,062.50
Legal Counsel Fees	$38,122.15	$35,838.40
Total Professional Fees Subtotal	***$2,114,801.89***	***$1,970,568.59***
Total to Date	**$16,054,154.03**	**$12,610,785.94**
90% Reimbursement Amount for Eligible Items		$11,349,707.35
SAC Reimbursement Amount (at maximum)		$9,325,400.00
Additional Reimbursement if SAC was Fully Funded		$2,024,307.35
Total Cost to City Following Reimbursement		$6,728,754.03
Total Cost to City if SAC was Fully Funded		$4,704,446.68

Note: The total cost to the City does not include any potential settlements with SWC or future settlements that may be reached following the completion of this FER.

As indicated in the table above, the costs of the project to the City have been significant. However, future redevelopment of the Site is still anticipated and will help to offset the project costs over time.

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