**February 7, 2011**

# FINAL ENGINEERING REPORT
# MAIN SITE
# OPERABLE UNIT 1 (OU-1)

## 1 Nassau Place
**(Former Nassau Metals Corporation Facility)**
## Staten Island, New York
## Site Number V-00159-2

***Prepared for***

**NASSAU METALS CORPORATION**
**600 Mountain Avenue**
**New Providence, New Jersey 07974-2008**


**Remedial Engineering, P.C.**
***Environmental Engineers***

***and ROUX ASSOCIATES, INC.***

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# CERTIFICATION

I, Noelle M. Clarke, 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.

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 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, Noelle M. Clarke, of Remedial Engineering, P.C., am certifying as Owner's Designated Site Representative for the site.

072491 — NYS Professional Engineer #

02/07/2011 — Date


Signature

Note: include PE stamp

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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## LIST OF ACRONYMS

| Acronym | Definition |
|---|---|
| CAMP | Community Air Monitoring Plan |
| C&D | Construction and Demolition |
| CCP | Construction Contingency Plan |
| CQAP | Construction Quality Assurance Plan |
| CQCP | Construction Quality Control Plan |
| DGA | Dense Graded Aggregate |
| EC | Engineering Control |
| ECDI | East Coast Drilling, Inc. |
| ERH | Effective Range-High |
| ERL | Effective Range-Low |
| FER | Final Engineering Report |
| GCL | Geosynthetic Clay Liner |
| HASP | Health and Safety Plan |
| HDPE | High Density Polyethylene |
| IC | Institutional Control |
| MW | Monitoring Well |
| NYCDEP | New York City Department of Environmental Protection |
| NYCRR | New York City Rules and Regulations |
| NYS | New York State |
| NYSDEC | New York State Department of Environmental Conservation |

**LIST OF ACRONYMS**

| Acronym | Definition |
|---|---|
| NYSDOH | New York State Department of Health |
| NYSDOT | New York State Department of Transportation |
| OM&M | Operation, Maintenance and Monitoring |
| OU | Operable Unit |
| PCB | Polychlorinated Biphenyl |
| RA | Remedial Action |
| RAO | Remedial Action Objective |
| RAWP | Remedial Action Work Plan |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RSCO | Recommended Soil Cleanup Objective |
| RRAPDR | Revised Remedial Alternatives and Preliminary Design Report |
| SMP | Site Management Plan |
| SPDES | State Pollution Discharge Elimination System |
| SVOC | Semi-Volatile Organic Compound |
| TAGM | Technical Administrative Guidance Memorandum |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TCP | Traffic Control Plan |
| TSCA | Toxic Substances Control Act |
| TSDF | Treatment, Storage and Disposal Facility |

## LIST OF ACRONYMS

| Acronym | Definition |
|---|---|
| USACE | United States Army Corps of Engineers |
| USDOT | United States Department of Transportation |
| USEPA | United States Environmental Protection Agency |
| VCA | Voluntary Cleanup Agreement |
| VCP | Voluntary Cleanup Program |
| VOC | Volatile Organic Compound |
| WWHP | Work and Waste Handling Plan |

## 1.0 INTRODUCTION

On behalf of the Nassau Metals Corporation ("Nassau Metals"), Remedial Engineering, P.C ("Remedial Engineering") has prepared this Final Engineering Report ("FER") to describe the remedial activities performed at the Nassau Metals-owned portion of Site No. V-00159-2, located east of Arthur Kill Road, which is designated as Operable Unit 1 ("OU-1") as shown on Figures 1 and 2. Remedial Engineering is a New York State professional service corporation organized primarily for the purpose of providing engineering services for clients of Roux Associates, Inc. ("Roux Associates"). The Site No. V-00159-2 is defined in the Voluntary Cleanup Agreement ("VCA") between the New York State Department of Environmental Conservation ("NYSDEC") and Nassau Metals (W2-0801-01-04 dated January 4, 2002 and amended April 16, 2010) as the property formerly owned, in its entirety, by Nassau Metals that will be referred to, herein, as the "VCA Property". Under this agreement, Nassau Metals entered into New York State's Voluntary Cleanup Program ("VCP") to address the environmental conditions at the VCA Property. For the purposes of summarizing remediation activities at the VCA Property, now owned by multiple entities, Nassau Metals has subdivided the former facility into the following operable units, which are depicted on Figure 2:

- OU-1: the Nassau Metals-owned portion of the VCA Property located east of Arthur Kill Road;
- OU-2: the Best Equities LLC-owned portion of the VCA Property located east of Arthur Kill Road; and
- OU-3: the Nassau Metals-owned portion of the VCA Property located west of Arthur Kill Road.

Separate FERs and Site Management Plans ("SMPs") will be issued for each operable unit. OU-1 is the subject of this FER and will be referred to, herein, as "the Site."

Remedial activities for OU-1 were performed at various times between September 26, 2006 and August 29, 2008 in accordance with the applicable portions of the NYSDEC-approved Specifications, Project Plans, and Contract Documents ("Final Design Documents") dated February 14, 2006, with exceptions noted herein. The Final Design Documents and FER, which were prepared for Nassau Metals by Remedial Engineering, are considered a part of the VCA as an addendum to the Remedial Action Work Plan ("RAWP") for the VCA Property. The RAWP is presented as Exhibit "B" of the January 3, 2002 VCA and consists of the February 28, 2001 VCP Revised Remedial Alternatives and Preliminary Design Report ("RRAPDR") and five addenda. The addenda include two separate comment letters presented by the NYSDEC, the New York State Department of Health ("NYSDOH"), and the New York City Department of

Environmental Protection ("NYCDEP"), Nassau Metals' response to those comments, and a revised project schedule.

In addition, a set of "for construction" contract documents dated May 17, 2006 was issued to the bidders for the remedial construction. In addition, four addenda to the May 17, 2006 contract documents were issued to the bidders during the bid phase (Addendum No. 1 dated June 5, 2006; Addendum No. 2 dated June 20, 2006; Addendum No. 3 dated June 23, 2006 and Addendum No. 4 dated June 30, 2006). These documents did not change the essential elements of the remedy. They were issued to finalize contractual elements missing from the February 14, 2006 set; provide additional language regarding the dredge window imposed on work in Mill Creek and the embayment areas; and provide minor design modifications based on value engineering conducted during the bid phase and questions from the bidders. This FER summarizes the work performed in accordance with the Final Design Documents and any subsequent approved modifications.

This report is divided into the following five sections:

- Section 1.0: provides an introduction;
- Section 2.0: provides background information for the VCA Property and the Site;
- Section 3.0: presents the remedial goals and a summary of the Final Design remedy that are applicable to OU-1;
- Section 4.0: provides a summary of the remedial action performed for OU-1; and
- Section 5.0: provides a summary of the NYSDEC-approved deviations from the Final Design.

Supporting tables, figures and appendices are included at the end of this report. All appendices have been included electronically on a DVD that is located in a sleeve on the inside back cover of this report. In addition, hard copies of the following appendices have also been provided: Appendix I (As-Built Drawings) and Appendix U (Hazardous Waste Manifests).

## 2.0 VCA PROPERTY AND SITE BACKGROUND

This section provides a description of the location and history of the VCA Property, where applicable, and the Site, geologic conditions and nature and extent of contamination.

### 2.1 VCA Property and Site Description

The VCA Property is located in the Staten Island County of Richmond, New York. The VCA Property is immediately bordered on the north by Richmond Valley Road and on the south by the Staten Island Rapid Transit railroad tracks. The developed portions of the VCA Property are bordered on the east by Page Avenue and on the west by Arthur Kill Road (portion of OU-1). The undeveloped portions of the VCA Property extend approximately 500 feet east of Page Avenue (portion of OU-1) and 600 feet west of Arthur Kill Road (OU-3). Mill Creek bisects the VCA property, discharging to the Arthur Kill.

Operable Unit 1 is identified as Block 7971 and Lots 1, 66, 100, and 125 on the Richmond County Tax Map. Operable Unit 1 is an approximately 28-acre area bounded by a chain link fence separating lands now or formerly owned by Best Equities, LLC to the north, railroad tracks of Staten Island Rapid Transit to the south, undeveloped wetland areas now or formerly owned by CSX Transportation to the east, and Nassau Place and Arthur Kill Road to the west (see Figure 2). Mill Creek flows from east to west and bisects the property, discharging to the Arthur Kill. Page Avenue Bridge is an elevated roadway running north to south and bisects the property between Lots 100 and 125. The lands under the elevated roadway are located outside the limits of OU-1.

Wetlands along Mill Creek were delineated by Roux Associates in coordination with the NYSDEC as part of the remedial design phase of the project. Prior to remediation, wetlands were delineated as vegetated coastal shoals, bars and mudflats located within the 4-foot elevation contour. Salt meadow cordgrass (*Spartina patens*) and smooth cordgrass (*Spartina alterniflora*) were primarily observed in small patches along the one foot (above mean sea level) contour of the north and south banks of Mill Creek, consistent with the mean water level. Common reed (*Phragmites australis*) was the dominant vegetation in the wetland above the 2-foot contour. Marsh elder (*Iva frutescens*) was the most common shrub located intermittently along both banks of Mill Creek, between the Phragmites and the uplands. The south bank of Mill Creek between Arthur Kill Road and Page Avenue was characterized by relatively sparse vegetation interspersed with exposed fill, rocks, boulders, and debris. Areas that were temporarily or permanently disturbed during the work were restored or mitigated to a higher quality wetland than that which existed prior to remediation in accordance with the approved plans. The mitigation/ restoration of the wetlands are described in Section 4.

Prior to remediation, the wetlands areas located upstream and east of Page Avenue were primarily dominated by *Phragmites australis* and *Iva frutescens*. Due to the influx of stormwater runoff into Mill Creek and tidal restrictions along Mill Creek, these areas are classified as formerly connected ("FC") tidal marshes. These marshes contain minimal salinity, less than 0.5 parts per thousand ("ppt"), and consequently do not support intertidal vegetation (i.e., *Spartina spp.*). The lack of significant tidal flux and resulting salinity, in addition to the introduction of fresh stormwater runoff, has resulted in the establishment of a monoculture stand of *Phragmites australis*. Areas that were temporarily disturbed during the work were restored to a higher quality wetland than that which existed prior to remediation in accordance with the approved plans. The restoration of the wetlands is described in Section 4.

Mill Creek and the Arthur Kill are the surface water bodies located at the VCA Property. Mill Creek bisects the VCA Property, while the Arthur Kill lies to the west of Arthur Kill Road. Flow in Mill Creek is generally westward through the VCA Property where it discharges to the Arthur Kill waterway. Tidal influence extends through the VCA Property and into the wetland east of the Page Avenue Bridge. Tidal fluctuations are approximately five feet near Arthur Kill Road and 2 feet east of Page Avenue.

On March 13, 2002, Roux Associates collected *in situ* salinity measurements from numerous locations along Mill Creek, from Arthur Kill Road to the *Phragmites* wetland located east of Page Avenue. Salinity measurements were collected with a Horiba™ U-22 water quality meter during low and high tidal fluctuations. Salinities in Mill Creek range from moderately high 19.5 ppt near Arthur Kill Road to essentially fresh water (0.0 ppt) conditions east of Page Avenue.

The water table underlying the VCA Property occurs within portions of the base of the fill material and in the glacial moraine, which comprise the groundwater aquifer beneath the VCA Property. Groundwater is encountered at depths from 2 to 12 feet below land surface ("bls"). Groundwater at the VCA Property flows toward and discharges into Mill Creek. Tidal influences on Mill Creek generally do not affect the overall groundwater flow directions, except in the immediate vicinity of Mill Creek.

## 2.2 Operational History

Manufacturing at the former facility located within the limits of the VCA Property began around 1900. All manufacturing operations occurred east of Arthur Kill Road. The Tottenville Copper Company was the original operator at the VCA property, and used copper, lead, tin, and zinc as part of their manufacturing process. In 1923, a fire destroyed a portion of the facility, which was

subsequently rebuilt. In 1931, Nassau Metals became the operator of the facility. The facility became the centralized site for the reclamation of non-ferrous scrap metals from Western Electric plants as well as from other telephone companies. The scrap metals were refined and formed into metal products, including copper wire, solder, and lead sleeving. The facility contained two primary manufacturing operations: 1) copper was handled in Building 10/10X (formerly known as the "red metals" building), and 2) lead and tin were handled in Building 2 (formerly known as the "white metals" building). These buildings were located south of Mill Creek, within the limits of OU-1.

Small quantities of organic chemicals were used for equipment maintenance during the facility's history.

Much of the VCA Property east of Arthur Kill Road has been filled in over the years to support the expansion of the facility. Fill material consisted of soil, construction debris, telephone equipment, slag, and refractory bricks. The filled areas were then occupied by buildings, on-site roadways or pavement. The creation of land, using fill material, ceased by the 1970s.

In 1973, a wastewater treatment facility was built within the limits of the VCA Property to treat metals bearing wastewater. The wastewater treatment facility was located in the southeastern portion of the VCA Property within OU-1. During the initial operation of the wastewater treatment facility, approximately 6 to 7 cubic yards of dry, vacuum-filtered sludge were generated per week. Until 1979, the sludge was stockpiled on the ground underneath the Page Avenue overpass. From 1979 through 1981, the sludge was stored in the "red metals" building in containers, and processed for precious metals recovery. Starting in 1981, the sludge was sent off site for precious metals recovery.

In 1981, copper operations in the "red metals" building ceased. The building was decommissioned and demolished in 1984-1985. Lead and tin operations in Building 2 (the "white metals" building) continued until 1991. The "white metals" building was demolished in 1996-1997. Demolition activities are documented in the May 7, 1997 Building Demolition Completion Report prepared by Roux Associates. Additional building demolition on the south side of the VCA Property was performed by Roux Associates in 1998. Demolition activities are documented in the June 3, 1998 Phase I Building Demolition Completion Report. In 1999, all electroplating manufacturing operations moved from the south side of the VCA Property (OU-1) to 236 Richmond Valley Road, also known as Building 41 on the north side of the VCA Property in OU-2. Following the transfer of operations, all remaining buildings on the south side of Mill Creek, including the wastewater treatment facility, were demolished. Decommission and demolition activities for these buildings are documented in the August 2000 Completion Report

for Nassau Metals Corporation Phase II Building Closure and Demolition Project prepared by Environmental Engineering Services. All manufacturing operations were terminated at the VCA Property in 2001. Nassau Metals does not currently have any buildings or conduct any operations within the limits of OU-1.

### 2.3 Regulatory History

After all decommissioning and demolition activities were performed at the VCA Property and manufacturing operations were subsequently terminated in 2001, Nassau Metals entered into a VCA (W3-081-97-09) with the NYSDEC to evaluate environmental conditions at the VCA Property in preparation for anticipated redevelopment of the Nassau Metals-owned portion of the VCA Property. In accordance with the VCA, a Remedial Investigation ("RI") was performed to characterize the nature and extent of contamination at the VCA Property as discussed in Section 2.5 below. Based on the results of the RI, a RAWP and subsequent remedial design were developed to address sources of contamination identified at the VCA Property. A summary of the Remedial Action ("RA") is provided in Section 4.0. Following the performance of the RA, Nassau Metals initiated the process to amend the existing VCA, which subdivides the VCA Property into three operable units (OU-1, OU-2 and OU-3), as discussed previously. The VCA Amendment #1 was fully executed on April 16, 2010. Accordingly, separate FERs and SMPs have been prepared for each operable unit. OU-1 is the subject of this FER.

### 2.4 Geologic Conditions

The VCA Property is located in the southwestern portion of Staten Island, New York (Figure 1). Prior to the Remedial Action, the majority of the VCA Property east of Arthur Kill Road was underlain by fill material, which varied in thickness but averaged approximately 8 feet. Over 450,000 cubic yards of fill underlie the VCA Property, east of Arthur Kill Road. The fill material is comprised of fine to coarse sand with minor amounts of silt and clay, wire, slag, bricks, glass, plastic, wood, metal and parts of old telephones. The fill material is directly underlain by low permeability estuarine deposits in the vicinity of Mill Creek, and glacial moraine deposits in areas of the VCA Property furthest from Mill Creek. The estuarine deposits are comprised of peat, clay and silt, and range in thickness from 2 feet ("ft") to 9 ft. Previous geotechnical analyses indicate that the vertical permeability of the estuarine deposits is very low, measuring $3.96 \times 10^{-8}$ centimeters per second ("cm/sec"). Where present, the estuarine deposits will act as a low permeability barrier between the overlying fill and the underlying glacial moraine deposits.

The glacial moraine deposits are comprised of sand with minor amounts of gravel, silt, and clay. These deposits range in thickness from 32 ft to 58 ft. The glacial moraine deposits comprise the

ground-water aquifer beneath the VCA Property. However, the underlying groundwater is not used as a drinking water supply. Drinking water in Staten Island has been supplied by the upstate New York reservoirs since the early 1970s.

Underlying the glacial moraine deposits is the Raritan Clay, which was encountered during previous investigations ranging in depths from 52 ft to 72 ft. Previous geotechnical analyses indicate that the vertical permeability of the Raritan Clay is very low, ranging from 1.95 x 10 to 2.20 x $10^{-8}$ cm/sec. Bedrock reportedly lies approximately 300 ft bls beneath Staten Island.

The water table underlying the VCA Property occurs within portions of the base of the fill material and in the glacial moraine. Depth to water beneath the VCA Property ranged from 1 ft to 10 ft bls during April 2010. Three synoptic rounds of water-level measurements were made in selected wells at the VCA Property from May 20 through May 22, 1998. The ground-water flow direction was determined during the May 20, 1998 low tide water-level measurements to be towards Mill Creek from both the south and north portions of the VCA Property. The two remaining water-level measurement rounds were evaluated (low and high tides), and the resulting groundwater flow patterns are consistent with the May 20, 1998 water-level measurement round. These data indicate that tidal influences generally do not affect the overall ground-water flow directions. However, due to the 4-5 ft change in surface-water elevations observed during the tidal cycle, it is expected that during high tide, surface water will recharge groundwater within the immediate vicinity of Mill Creek. This phenomenon is commonly referred to as "bank storage."

## 2.5 Nature and Extent of Contamination

Prior to performing the RA, a RI was performed to characterize the nature and extent of contamination at the VCA Property. The results of the RI are described in detail in the following reports:

- December 1991 United States Environmental Protection Agency ("USEPA") Site Investigation Report prepared by Malcolm Pirnie, Inc.;
- May 1997 Initial Study Report prepared by Roy F. Weston, Inc.;
- September 1998 Site Investigation Report prepared by Roux Associates;
- November 1998 Voluntary Cleanup Program Remedial Alternatives Report prepared by Roux Associates;

- October 2000 Voluntary Cleanup Program Supplemental Site Investigation Report prepared by Roux Associates; and

- February 2001 Voluntary Cleanup Program Revised Remedial Alternatives and Preliminary Design Report prepared by Roux Associates.

Over 450,000 cubic yards of fill immediately underlie the VCA Property, east of Arthur Kill Road. Based upon the results of the various investigations performed, it was determined that the fill material contains wire, slag, bricks, metal, and other manmade materials. As part of this effort in OU-1, a total of fifty (50) samples of the fill material were submitted for metals analysis using the toxicity characteristic leaching procedure ("TCLP"). These analyses were performed to determine whether or not this material would be classified as a Resource Conservation and Recovery Act ("RCRA") characteristically hazardous waste if the fill material was removed from the ground since this classification does not apply if the fill materials remain in place. Thirty-five (35) of fifty (50) fill material TCLP analyses yielded metals concentrations exceeding USEPA regulatory levels for classifying the material as RCRA characteristically hazardous waste. Lead (in 35 of the 50 samples), silver (in 2 of 50 samples) and cadmium (in 2 of the 50 samples) were the only metals to be detected above the USEPA regulatory levels in the fill material at the Site. Please note that lead failed the TCLP test in the same samples that both the silver and cadmium failed the TCLP test.

Preconstruction tabular and graphical summaries of analytical data generated during the performance of the RI are presented in the RI reports cited above. Prior to the remedial action, most of the fill material at the property was capped with buildings, floor slabs, and pavement. Access to the localized areas where the fill material was not capped was limited to all of OU-3, vegetated fill areas located north of Mill Creek, the vegetated fill area located east of Page Avenue south of Mill Creek and the banks of Mill Creek.

During the performance of the RI and Supplemental RI, high concentrations of metals (i.e., copper, lead and zinc) were found in the sediment in Mill Creek onsite, east of Page Avenue, and in the embayment area at depths ranging from zero to greater than eight feet. As part of this effort, a total of twenty (20) samples from 10 locations throughout Mill Creek were submitted for metals analysis utilizing TCLP. Eleven (11) of twenty (20) sediment TCLP analyses yielded metals concentrations exceeding USEPA regulatory levels for classifying the material as RCRA characteristically hazardous waste. Lead (in 11 of the 20 samples) and cadmium (in 1 of 20 samples) were the only metals to be detected above the USEPA regulatory levels in the sediment across Mill Creek. Please note that lead failed the TCLP test in the same sample that cadmium failed the TCLP test. As noted above, the preconstruction tabular and graphical summaries of

analytical data generated during the performance of the RI are presented in the RI reports cited above. These sediments are potentially toxic to benthic organisms based upon the results of regional sediment toxicity studies and a constituent-by-constituent comparison against the New York State Sediment Screening Criteria and the Effective Range-Low ("ERL") and Effective Range-High ("ERH") guidelines. Similarly, these metals were also found at elevated concentrations in surface water in Mill Creek and the embayment area. The elevated surface water concentrations were generally caused by the presence of suspended sediment.

Prior to the remedial action, the source of metals, in particular lead, detected in Mill Creek included:

- the erosion of metals containing fill material at the property that was exposed along Mill Creek stream banks;

- the former discharge of suspended sediment from on-site storm sewer outfalls during significant storm events; and

- regional contributions from the Arthur Kill, which is known to be a severely impacted waterway and from Mill Creek, which drains an urban watershed.

The first two sources were addressed by the remedial action; however, addressing regional contributions from the Arthur Kill were beyond the scope of the remedial action.

## 3.0 REMEDIAL GOALS, PROPOSED REMEDY AND FINAL DESIGN APPROVAL

This section presents the objectives of the remedial action, generally summarizes the proposed remedy and describes the design approval process.

### 3.1 Remedial Action Objectives

The media of concern at the VCA Property include sediment and fill material. The remedial action objectives ("RAOs") developed for the VCA Property that are applicable to OU-1 are as follows:

- manage the metals-containing fill material underlying the VCA Property;
- prevent future metal loading into Mill Creek from the exposed fill material;
- address the metals-containing sediment in the defined portions of Mill Creek and the Embayment Area; and
- prevent the future discharge of metals-containing sediment from the stormwater sewers located within the limits of the VCA Property.

### 3.2 Summary of Proposed Remedy

The applicable elements of the proposed remedy for OU-1 are as follows:

- Sediment dredging/excavation, on-site stabilization, and on-site backfill beneath the proposed cap.
- Removal of eastern and western road crossings over Mill Creek, and removal of storm sewer outfalls.
- Wetland bank stabilization and mitigation at a 3:1 ratio for wetland areas that may be permanently disturbed during future redevelopment (south bank of Mill Creek Between Arthur Kill Road and Page Avenue) and restoration at a 1:1 ratio for temporarily disturbed wetland areas (north side of Mill Creek between Page Avenue and Arthur Kill Road, south side of Mill Creek east of Page Avenue and the fingers in Area C). NYSDEC approved a reduced planting frequency (3 feet on center) on the south bank of Mill Creek since this area will likely be disturbed as part of future site redevelopment and its potential loss was mitigated for in advance on the north bank at a 3:1 ratio.
- Import of soil/sand to be used for backfill in compliance with NYSDEC Technical and Administrative Guidance Memorandum ("TAGM") 4046 RSCOs.

- Installation of a Composite Cover System consisting of soil/ stone cap with geosynthetic clay liner ("GCL") or asphalt cap over various upland portions of the site.

- Cleaning and abandonment of the existing sewer systems south of Mill Creek.

- Installation/ rehabilitation of portions of the stormwater sewer system (piping and outfalls) north of Mill Creek.

- Implementation of SMP to verify the effectiveness of the remedy.

The limits of dredging consisted of the following areas:

- Area A – Embayment Area located west of Arthur Kill Road, which is located entirely within OU-3.

- Area B – Mill Creek bed between Arthur Kill Road and Page Avenue, which is located entirely within OU-1.

- Area C – Mill Creek bed and associated tributaries east of Page Avenue, which is located entirely within OU-1. For reference purposes, the set of tributaries located north of Mill Creek within the restored brackish marsh areas of Area C are referred to the "Finger Areas" herein.

Erosion and sediment control measures and appropriate engineering controls were employed throughout the construction period.

Implementation of remedial elements applicable to OU-1, as specified in the Final Design Documents, along with noted exceptions are discussed in the following section of this FER.

### 3.3 Final Design Approval

On October 18, 2006, the NYSDEC provided its formal approval of the Final Design Documents. The NYSDEC determined that the Final Design Documents substantially addressed the requirements of the VCA RAWP of January 2001 and the 100% Design Documents that were previously approved in July 2004. As noted previously, exceptions to the approved design, applicable to OU-3, are discussed herein. The October 18, 2006 approval letter is included in Appendix A.

## 4.0 SUMMARY OF REMEDIAL ACTION

Provided below is a summary of the remediation activities conducted within the limits of OU-1. Remedial activities for OU-1 were performed in multiple phases by Shaw Environmental and Infrastructure, Inc. (Shaw), Enviroscapes, Inc. (Enviroscapes), New York Construction, Inc. (NY Construction) (collectively referred to as "the Contractors" herein) and Roux Associates. Shaw and its designated subcontractors performed the bulk of the remedial action under the direct supervision of Remedial Engineering at various times, from September 26, 2006 to November 28, 2007 and from May 10 to 20, 2008. Under the direction supervision of Remedial Engineering, Enviroscapes performed significant portions of wetland restoration work and related erosion repairs north and south of Mill Creek from June 25, 2008 through August 1, 2008, and NY Construction performed asphalt installation and related activities from August 15, 2008 to September 3, 2008. Roux Associates performed the following on behalf of Nassau Metals, at various times, between September 26, 2006 and August 29, 2008:

- supported Nassau Metals in coordinating all required permitting;
- handled all regulatory agency coordination and reporting;
- attended weekly project meetings and prepared/ issued related agendas and minutes;
- provided ongoing contract document clarification to Shaw and NY Construction, as required;
- organized and maintained the information needed to document the construction;
- provided field oversight and support, as necessary, of the specified remedial activities;
- installed and developed monitoring wells MW-103, MW-105 and MW-106; and
- implemented the required Community Air Monitoring Plan ("CAMP") during all intrusive activities.

Copies of daily construction reports and monthly construction progress reports prepared and submitted to the NYSDEC during the performance of the work are provided in Appendices B and C, respectively. The major components of the remedial action are identified below, and are detailed in the following sections of this FER. Except where noted, the details provided below primarily reflect work performed by Shaw. These tasks include:

- permitting;
- contractor submittals (the Contractors);

- implementation and management of a site-specific Health and Safety Plan (the Contractors);
- preconstruction meeting, mobilization and site preparation (i.e., construction of temporary access roads, clearing and grubbing, soil erosion and sedimentation control, etc…);
- water management;
- removal of eastern and western road crossings over Mill Creek;
- sediment dredging/ excavation, stabilization and on-site placement;
- backfilling of Mill Creek;
- wetland bank regrading, mitigation, stabilization, and restoration (Shaw and Enviroscapes);
- management of petroleum-impacted soils encountered during the regrading of the southern banks along Mill Creek;
- construction of soil cap with GCL;
- mechanical processing of concrete and asphalt for on-site re-use;
- construction of asphalt cap (Shaw and NY Construction);
- cleaning and abandonment of the existing site sewer systems;
- rehabilitation of site Stormwater System;
- installation of off-site fill materials;
- waste transportation and disposal;
- monitoring well abandonment and construction (Shaw and Roux Associates);
- construction of a new drainage swale from the 42-inch NYCDEP sewer to Mill Creek;
- surveying and As-Built Drawings (certified by Remedial Engineering);
- equipment Decontamination; and

- demobilization.

Following the performance of the remedial action, a Site Management Plan will be prepared and submitted under separate cover, as discussed in Section 4.23 of this FER, to verify the effectiveness of the remedy.

## 4.1 Permitting

The following key permits were obtained prior to commencement of the related remedial activities at the site and are included in Appendix D.

- United States Army Corps of Engineers ("USACE") Permit No. 2002-01563 – Executed on November 9, 2006.

- Extension to USACE Permit – On March 16, 2007, the USACE approved an extension of the dredging window from March 16, 2007 to June 1, 2007 for the 2007/ 2008 dredging season.

- NYSDEC Water Quality Permit No. 2-6405-00001/02004 – Executed on July 19, 2006. The respective notification to commence work was issued on November 17, 2006.

- Modification of Topography Authorization for Application No. 060355 RAR – Formally approved on October 11, 2006.

- State Pollution Discharge Elimination System ("SPDES") Permit Equivalent for Site No. W2-0801-01-04 – Executed on November 14, 2006.

- Addendum to SPDES Permit Equivalent for Site No. W2-0801-01-04 – Executed on February 12, 2007.

- Building Permit No. 500856291-01-EW-OT – Issued on February 16, 2007 and renewed on September 11, 2007.

## 4.2 Contract Submittals

Prior to commencement of remedial activities at the site, Shaw provided the following documents, where applicable, for review and approval by Remedial Engineering and the NYSDEC when requested:

- materials and equipment suppliers and manufacturers;

- list and qualifications of subcontractors;

- construction schedule;
- quality control procedures;
- work Sequence;
- contractor Work Plans (Work and Waste Handling Plan {"WWHP"}, Health and Safety Plan {"HASP"}, Construction Quality Assurance Plan {"CQAP"}, Construction Quality Control Plan {"CQCP"}, Construction Contingency Plan {"CCP"} and Traffic Control Plan {"TCP"}); and
- preconstruction survey.

The Contractors provided numerous other submittals and shop drawings as required in the Specifications. Work did not commence in a particular area (i.e., water management, import of off-site fill materials, geosynthetic clay liner installation, etc.) until the required submittals were received and approved by Nassau Metals, Remedial Engineering and the NYSDEC, where applicable.

Although formal approvals were not provided, NYSDEC comments, where applicable, were provided on Shaw's HASP, CQCP, CCP and TCP on October 27, 2006 and the CQAP on November 11, 2006. Approval of Shaw's WWHP was provided by the NYSDEC on November 11, 2006 (Appendix A). Additional information requested by the NYSDEC in their approval letter was specific to the remedial action in OU-3 and, as such, will be discussed in the FER for OU-3.

The preconstruction survey was provided to the NYSDEC on December 15, 2006 (Appendix E).

### 4.3 Implementation and Management of a Site-Specific Health and Safety Plan

Remediation activities were performed in a manner consistent with 29 CFR 1910 and 1926 and in accordance with the Contractors' HASPs, where applicable. The Contractors performed work in Level D protection, which included work boots, rubber over-boots (as required), hard hats, and safety glasses.

Roux Associates and Shaw conducted particulate and Volatile Organic Compound ("VOC") monitoring during the performance of intrusive remedial activities as discussed below.

### 4.3.1 Air Particulate Monitoring

Particulate air monitoring was performed consistent with NYSDEC TAGM 4031 and the NYSDOH Community Air Monitoring Protocol provided in Appendix J of the Final Design Documents during intrusive remedial activities. Particulate dust monitoring was performed upwind and downwind of the Work areas. Exceedances of the action level of 150 $\mu g/m^3$ were recorded on the following occasions during the work:

| Date | Time | Concentration* ($\mu g/m^3$) |
|---|---|---|
| 1/24/07 | 13:10 | 980.4 |
| 1/26/07 | 10:26 | 183.8 |
| 1/26/07 | 10:41 | 401.4 |
| 1/26/07 | 10:56 | 436.4 |
| 1/26/07 | 11:26 | 276.1 |
| 1/26/07 | 11:41 | 175.7 |
| 1/26/07 | 11:56 | 234.3 |
| 1/26/07 | 13:41 | 198.0 |

* 15 Minute Background Corrected Average.

The exceedance on January 24, 2007 occurred as a result of an application of portland cement-based sediment stabilization product (Max-Chem) to the excavated sediment. Shaw stopped the stabilization work for approximately one hour and misted the area before resuming work in the sediment stabilization area. No further exceedances were experienced that day.

The exceedances observed on January 26, 2007 were caused by wind blowing the clean fill materials that were stockpiled and spread throughout this area of the site. Shaw had a water truck on site, but the valves were frozen on January 26, 2007, which prevented Shaw from being able to adequately suppress dust in the open portions of the site. As noted, Shaw brought a new, fully functioning, water truck to the site on January 27, 2007 to address dust control at the site, as needed. Consistent with the approved remedial design, Shaw continued to properly control dust throughout the site utilizing the water truck and other means as necessary. As a result, no additional exceedances for particulates were experienced for the duration of the Work.

The NYSDEC was immediately notified when an action level for dust was exceeded.

Dust monitoring data and the respective action level exceedance reports noted above are provided in Appendix F. Data reports were not provided for days when data could not be collected due to problematic weather events (i.e., rain or snow) or equipment malfunction.

#### 4.3.1.1 Dust Control

During the course of the work, all construction activities performed by Shaw were conducted to minimize dust that would cause a hazard or nuisance to others. Roux Associates was responsible for monitoring dust in accordance with the specifications and Shaw implemented all necessary measures to control dust to within acceptable levels. As noted above, Shaw had a water truck equipped with a water cannon dedicated to dust suppression available on site at all times. The measures that were taken included:

- applying water on the haul roads;
- misting equipment and excavation faces;
- hauling materials in tarped or water tight containers;
- reducing speed of vehicles moving through areas of the site;
- covering excavated areas and material after excavation activity ceases; and
- stopping work.
- Dirt Glue$^{TM}$ applied to exposed surfaces.

The primary sources of water for dust control were 39,000 gallons of treated wastewater as discussed in Section 4.5; a portion of the 120,000 gallons of off-site non-potable water delivered to the site by Dana Transport, Inc. (Appendix G); and additional water, as needed, from a nearby, off-site fire hydrant permitted by the City of New York.

### 4.3.2 Volatile Organic Compound Air Monitoring

Air monitoring for VOCs was performed consistent with the NYSDOH Community Air Monitoring Protocol provided in Appendix J of the Final Design Documents during intrusive remedial activities. No VOC action levels were exceeded during the performance of the work.

VOC air monitoring data is provided in Appendix F. Data reports were not provided for days when data could not be collected due to problematic weather events (i.e., rain or snow) or equipment malfunction.

## 4.4 Pre-Construction Meeting, Mobilization and Site Preparation

Prior to mobilizing to the site, a Pre-Construction Meeting was conducted on September 20, 2006 to identify the roles and responsibilities of key project personnel, review procedures for contractor submittals, health and safety, schedule, payment requisitions, change order requests and other general administrative issues. The selected Contractor for the remediation of OU-1, Shaw, mobilized to the site on September 26, 2006. Following mobilization to the site, a preconstruction meeting was held on-site between key project personnel from Nassau Metals, Shaw and the NYSDEC. Shaw served as the general Contractor who performed the entire remedial action except for asphalt paving installation (performed by NY Construction), portions of wetland restoration north and south of Mill Creek (performed by Enviroscapes, In.) and installation of Monitoring Wells MW-103, MW-105 and MW-106 (performed by Roux Associates).

Remedial Engineering's field representative provided construction oversight for the duration of the Remedial Action. Construction oversight included shop drawing review, daily inspection to verify conformance with the Contract Documents, health and safety monitoring, material tracking, preparation of daily field reports, preparation of monthly construction progress reports, photo documentation, and holding weekly progress meetings.

Prior to the initiation of the major remedial construction activities, several site preparation tasks were performed by Shaw as listed below:

- verification of on-site utilities within the work zone prior to initiating any intrusive activities;
- coordination of access agreements with adjacent property owners;
- performance of an initial site Survey;
- set up and operation of temporary construction utilities and facilities such as trailers, telephone and electrical service, sanitary facilities and emergency response materials;
- installation of NYSDEC-required project sign and general warning signs;
- installation of soil erosion and sedimentation control measures;
- construction of stockpiles and sediment staging areas;
- construction of sediment containment/stabilization area;
- construction of temporary access roads;

- set up and operation of systems for management of site construction wastewater;
- installation of a decontamination area;
- clearing and grubbing in the work areas; and
- repair of fencing along the site perimeter.

During the performance of site preparation activities, the following exceptions to the Final Design Documents were approved by the NYSDEC:

- Hay bales were installed on paved areas and fastened to adjacent fencing, where applicable, based on the verbal approval provided during the October 4, 2006 Kickoff Meeting at the site and subsequently memorialized in Progress Report No. 1 (Appendix C).
- Existing asphalt was utilized as the primary stabilized entrance to OU-1 based on the verbal approval provided during the October 4, 2006 Kickoff Meeting at the site and subsequently memorialized in Progress Report No. 1 (Appendix C).
- Modifications to the proposed access road layout and construction requirements were issued and approved in the field on October 4, 2006 during the Kickoff Meeting at the site. Follow-up questions on the proposed layout were addressed in the subsequent Minutes issued on October 9, 2006 and related email dated October 10, 2006 (Appendix A).
- Use of a protective, interim dust and erosion control coating of Dirt Glue$^{TM}$ Light for on-site stockpiles to be consolidated under the Soil-GCL Cap was verbally authorized on June 8, 2007 by the NYSDEC.

### 4.5 Water Management

Shaw was responsible for water management at the site during the performance of the remedial action. Water management was required for Mill Creek Water and construction wastewater. Construction wastewater (including Mill Creek maintenance dewatering water) was generated from the following sources:

- construction and development of monitoring wells;
- runoff from disturbed areas;
- runoff from stockpiles;

- construction wastewater from sanitary/ sewer cleaning activities;
- maintenance dewatering (Mill Creek water); and
- decontamination activities.

All construction wastewater was treated by the temporary construction wastewater treatment facility constructed by Shaw, except a portion of oily contaminated water generated during the cleaning of the on-site sanitary sewers, which was collected, transported, and disposed of off-site as non-hazardous waste as discussed in Section 4.17.4. Management of Mill Creek Water and eventual treatment of construction wastewater streams are discussed in the following subsections.

### 4.5.1 Management of Mill Creek Water

Management of Mill Creek Water during the performance of the remedial action involved dewatering portions of Areas B or C within Mill Creek after the area to be remediated was appropriately dammed and the upgradient stream flow was adequately bypassed around the work area. There were two classifications of dewatering (initial and maintenance dewatering) that occurred during the ongoing remediation of Mill Creek as noted in the NYSDEC-approved WWHP. Initial dewatering involved the pumping of standing water after implementation of appropriate dams (i.e., inflatable aqua dams, earthen dams, etc.) and related bypass piping were installed to facilitate remediation of segmented portions of Mill Creek. Inflatable pipe plugs were used to isolate the portion of Area B between the two preconstruction culvert crossings. The water removed from the isolated portions of Mill Creek, prior to initiating remediation (initial dewatering), was removed using dry prime pumps and was discharged downgradient of the work area through siltation bags. Once the standing water was removed from the work area, maintenance dewatering was initiated during the intrusive excavation and backfilling operations. Maintenance dewatering involved pumping of residual water, as necessary, within the isolated portion of Mill Creek, to facilitate ongoing dredging and backfilling of Areas B and C of Mill Creek. The maintenance dewatering water was considered a construction wastewater and was collected, containerized and transported to the on-site wastewater treatment facility described in Section 4.5.2 below.

During major storm events, upgradient and downgradient dams were removed, where applicable, as a protective measure to minimize adjacent flooding in and around Mill Creek. This situation occurred when the bypass pumping system could not maintain an acceptable water level upgradient of the isolated portion of Mill Creek.

### 4.5.2 On-Site Treatment of Construction Wastewater

A wastewater treatment facility was constructed in accordance with the NYSDEC-approved WWHP in the south central portion of the site to treat all construction wastewater generated during the performance of the Work. The treatment system contained the following components:

- two primary 20,000 gallon influent tanks;
- two secondary 20,000 gallon influent tanks;
- bag filtration at 10 microns;
- two 2,000 pound carbon absorption units;
- bag filtration at 1 micron;
- one 2,000 pound organo clay filter unit; and
- two 20,000 gallon effluent tanks.

All construction wastewater, except a portion of oily-impacted wastewater encountered during the cleaning of the on-site sewer system as discussed in Section 4.14, was pumped to the influent tanks and subsequently pumped for treatment through a series of 10 micron filter bags, carbon treatment vessels, organo clay filter units, when applicable, 5 micron filter bags and eventually discharged temporarily discharged into the two effluent holding tanks. Once treated, the construction wastewater was managed as discussed below.

Treated construction wastewater was re-used to support sanitary/ sewer cleaning operations, discharged to the Arthur Kill Waterway pursuant to the NYSDEC SPDES Permit Equivalent issued for the project on November 14, 2006 and subsequent addendum issued on February 12, 2007 (Appendix D) or utilized for dust control in accordance with the NYSDEC email approval to use treated construction wastewater for dust control which was requested and verbally provided on January 31, 2007 and memorialized in Progress Report No. 4 (Appendix C).

In accordance with the requirements of the permit, two treated effluent samples were collected and analyzed. For comparison purposes, two respective untreated effluent samples were collected and analyzed. The results of the samples collected for maintenance dewatering and sewer cleaning operations are provided in Appendix H and were below all specified treatment levels. A brief description of the four samples collected is provided below:

- analytical results from untreated maintenance dewatering wastewater (MI-1) and untreated sewer cleaning wastewater (SC-1) samples were collected on December 20, 2006; and

- analytical result from treated maintenance dewatering wastewater (ME-1) and treated sewer cleaning wastewater (SE-1) samples were collected on December 27, 2006.

Approximately 73,000 gallons of wastewater was treated and managed during the performance of the work as follows:

- 24,000 gallons of treated wastewater that were re-used to support sanitary/ sewer cleaning operations as discussed in Section 4.14;

- 10,000 gallons were discharged in accordance with the requirements of the site-specific SPDES Permit Equivalent; and

- 39,000 gallons of treated wastewater were used for on-site dust control.

A portion of oily-impacted wastewater encountered during the cleaning of the on-site sewer system was not treated by the temporary on-site treatment facility, but was disposed of off-site as non-hazardous construction wastewater as discussed in Section 4.17.4.

Prior to demobilization of the influent frac tanks, the solids remaining in the tank were removed, dewatered and containerized for sampling and analysis. Based on the analysis results, the solids were disposed as discussed in Section 4.17.2.

All impacted wastewater treatment system media was disposed of off-site as discussed in Section 4.17.

### 4.6 Removal of Eastern and Western Road Crossing Over Mill Creek

The two former road crossings over Mill Creek, between Arthur Kill Road and Page Avenue, were demolished and removed during the performance of the remedial action. The western crossing had three 48-inch culverts and the eastern crossing had four 36-inch culverts to convey

water through the crossings. Concrete debris was mechanically processed and installed below the on-site asphalt cap as discussed in Section 4.12. Miscellaneous rebar and concrete was transported and disposed of off-site as discussed in Section 4.17.1. All other fill material encountered was consolidated beneath the Soil-GCL cap as discussed in Section 4.11.

### 4.7 Sediment Dredging, Stabilization and On-Site Placement

Dredging, stabilization and on-site placement of excavated sediments are discussed in the following subsections of this FER.

#### 4.7.1 Sediment Dredging

Dredging of Areas B and C within OU-1 was performed utilizing traditional long reach excavators from the shoreline after the segmented portions to be remediated were isolated, bypassed and maintenance dewatering initiated. A total of 3,917.1 cubic yards of sediment, including allowable overdredge, were removed to a minimum depth of 1 foot from Mill Creek within OU-1. This included 2,857.2 cubic yards from Area B and 1,059.9 cubic yards from Area C. The horizontal and vertical limits of dredging within Mill Creek are shown on As-Built Drawings AB-1 and AB-4 (Appendix I). Removed sediments were loaded into off-road dump trucks, temporarily staged, and stabilized in the sediment containment/stabilization area prior to on-site consolidation within the designated area below the Soil-GCL Cap.

Dredging of sediment west of Arthur Kill Road within the limits of the Embayment Area ("Area C") is addressed in the FER for OU-3.

#### 4.7.2 Stabilization, Placement and Compaction of Dredged Sediments

All sediment excavated during the remediation of Areas B and C was placed in upland areas south of Mill Creek above existing contaminated soil, asphalt or concrete and capped with a Soil-GCL Cap as discussed in Section 4.11. A small portion of the stabilized sediment was consolidated near the former truck loading docks beneath the area capped with asphalt. In this area, a minimum separation of 2 feet was maintained between the top of the asphalt surface and the top of stabilized sediment. Prior to placement under the Soil-GCL Cap or the Asphalt Cap, the excavated sediment was dewatered and then stabilized, at various proportions, consistent with the requirements of the NYSDEC-approved WWHP with the specified stabilizing agent, Max Chem as manufactured by La Farge of North America. Although Shaw made every effort to meet the strength requirements of the remedial design, Shaw could not consistently achieve 50 pounds per square inch ("psi") after 7 days of curing time and 100 psi after 28 days of curing time (Appendix J). The reason why the process was ineffective was not confirmed. As an

alternative method for confirming the acceptability of stabilized sediments, Shaw graded out the stabilized material in 1 to 2 foot lifts and performed compaction testing across the approved area for placement of stabilized sediments. Compaction results consistently exceeded the design requirement of 95% of the maximum dry density as determined by the Modified Proctor, which were comparable to compaction testing collected across the site (Appendix K).

### 4.8 Backfilling of Mill Creek

Following sediment removal and grading, a minimum of one foot of sand backfill was installed in the dredged areas within Mill Creek. The work was performed utilizing traditional long reach excavators from the shoreline after the segmented portions to be remediated within Areas B and C were isolated, bypassed, dewatered and excavated. The vertical and horizontal limits of backfilled areas within Mill Creek are provided on As-Built Drawings AB-3 and AB-4 (Appendix I).

The sand utilized for backfilling Mill Creek was also utilized for constructing the Soil-GCL Cap and for capping areas within the limits of OU-2 as discussed in Section 4.16.3. A total of 60,916 tons of sand was imported to the site. All soil/sand imported to the site was compared with the chemical criteria presented in Table 1. Chemical and physical testing and related certifications are also discussed in Section 4.16.3.

Prior to placing the sand backfill for Areas B and C, excluding the "Finger Area", a 10 oz. geosynthetic filter fabric (SKAPS GT-110) as manufactured by SKAPS Industries, Athena, Georgia was installed to act as a visual barrier above non-remediated sediments. Between Arthur Kill Road and Page Avenue, a geogrid, (Fornit 30) as manufactured by Huesker, Inc., Charlotte, North Carolina, was installed beneath the filter fabric to provide additional strength. Product specifications for the geosynthetic materials installed are provided in Appendix L.

### 4.9 Wetland Bank Regrading, Stabilization, Mitigation and Restoration

Due to the close proximity of remediation activities to jurisdictional wetland areas, disturbances were unavoidable in certain areas of the site during the performance of the remedial action. In accordance with the NYSDEC-approved Wetland Mitigation Plan and the subsequent Addendum dated November 16, 2006, wetland bank stabilization and mitigation was performed at a 3.56:1 ratio (exceeding the minimum specified ratio of 3:1) for wetland areas that may be permanently disturbed during future redevelopment (south bank of Mill Creek between Arthur Kill Road and Page Avenue) and restoration was performed at a 1:1 ratio for temporarily disturbed wetland areas (north side of Mill Creek between Page Avenue and Arthur Kill Road, south side of Mill Creek east of Page Avenue and the "Finger Area" in Area C). The Addendum

was issued to memorialize discussions and agreements regarding modifications to the wetland mitigation plan to address NYSDEC comments from a letter dated June 23, 2006, additional issues discussed during the October 4, 2006 project kickoff meeting and telephone and email correspondence in October and November 2006. On June 10, 2008, the NYSDEC later approved a reduced planting frequency (3 feet on center) on the south bank of Mill Creek since this area will likely be disturbed as part of future site redevelopment and its potential loss was mitigated for in advance on the north bank at a minimum 3:1 ratio (Appendix A).

The actual wetland areas that were disturbed and subsequently restored are shown on As-Built Drawings AB-6 and AB-7 (Appendix I). In addition, Tables 2 and 3 provide complete details on the vegetation species (common name and scientific name), planting/ seeding density (for each of the selected species), and plant/ seeding quantity for the low marsh, high marsh and brackish areas, respectively.

A typical cross-section of the bank restoration for Mill Creek is depicted on Detail 14 of As-Built Drawing AB-10 (Appendix I). In addition, the key construction elements for restoring the wetland banks along Mill Creek (excluding the fingers in Area C) are listed below and discussed in greater detail in the following subsections of this FER:

- regrading the banks for proper drainage and vegetation establishment;
- herbicide application in certain portions of regraded areas;
- installation of geogrid for bank stabilization;
- installation of a geosynthetic filter fabric above the geogrid to act as a visual barrier above non-remediated sediments and to filter suspended sediments from the groundwater prior to discharge to Mill Creek;
- installation of 6 to 18 inches of a sand drainage layer; and
- installation of a 6 inch vegetated topsoil layer.

For the "Finger Area" within Area C, shown on As-Built Drawing AB-7 (Appendix I), the elements of restoration, other than 1-foot of sand placement, discussed below do not apply since these areas only required seeding and planting as noted in Table 2.

### 4.9.1 Regrading

The slopes along the north and south banks of Mill Creek were modified in accordance with the requirements of the remedial design. Material removed as the slopes were reshaped was managed and shipped off-site in accordance with Section 4.10 or managed and consolidated below the limits of the Soil-GCL Cap as discussed in Section 4.11. The slopes along the north side of Mill Creek varied while the slopes along the south side were generally graded on a 4:1 slope. Preliminary grade (grades prior to placement of off-site fill materials) along the north and south banks of Mill Creek are shown on As-Built Drawings AB-1 and AB-4 (Appendix I).

### 4.9.2 Herbicide Application

On May 14, 2007 Roux Associates submitted a Herbicide Application Plan (Appendix E) to the NYSDEC for invasive species control of *Phragmites australis* (common reed) within a portion of the proposed wetland footprint slightly east of Arthur Kill Road, which was conditionally approved on May 17, 2007 via email (Appendix A). Based on follow-up conversations with the NYSDEC, Rodeo* Herbicide, as manufactured by Dow AgroSciences LLC, was used instead of the chemical product (Habitat® as manufactured by BASF Corporation) identified in the May 17, 2007 letter. The total application area was approximately 6,500 square feet and was located adjacent to Arthur Kill Road. Follow-up, verbal approval was provided by the NYSDEC to apply the herbicide in a secondary location north of Mill Creek, slightly west of Page Avenue Bridge. The primary areas of concern for the potential reestablishment of common reed were areas where on-site sediments and soils have recently been excavated and the root system of the previously existing monoculture stand of common reed was still intact.

A New York State licensed aquatic pest control applicator applied the herbicide with a backpack sprayer in accordance with manufacturer's requirements. In order to limit any overspray effects on non-target species, the application of the herbicide was only performed on sunny days where there was low wind and no precipitation predicted to occur within 12 hours of application. In addition, the herbicide was applied at low tide as requested by the NYSDEC.

### 4.9.3 Installation of Geogrid

A biaxial geogrid product (Fornit 30) as manufactured by Huesker, Inc., Charlotte, North Carolina was installed to add strength and stabilize the northern and southern banks of Mill Creek. The geogrid was installed and anchored within the limits of Mill Creek up to the 4-foot contour elevation as shown in Detail 14 on As-Built AB-10 (Appendix I). Product specifications for the Fornit 30 geogrid are provided in Appendix L.

### 4.9.4 Installation of Geosynthetic Filter Fabric Layer

A 10 oz. geosynthetic filter fabric (SKAPS GT-110) as manufactured by SKAPS Industries, Athena, Georgia was installed to act as a visual barrier above non-remediated sediments and to filter suspended sediments from the groundwater prior to discharge to Mill Creek. The filter fabric was installed and anchored within the limits of Mill Creek up to the 4-foot contour elevation as shown in Detail 14 on As-Built AB-10 (Appendix I). Product specifications for the SKAPS GT-110 filter fabric are provided in Appendix L.

### 4.9.5 Installation of Sand Cover Layer

A 12 to 18-inch sand layer was installed on top of the geosynthetic filter layer between the 1-foot and 4-foot elevations to provide cover and drainage as shown in Detail 14 on As-Built AB-10 (Appendix I). The sand was installed with a minimum permeability of 0.01 cm/sec as discussed in Section 14.16.3. The sand layer was also installed and compacted by traversing the banks with track mounted excavation equipment to 95% or greater of the maximum dry density as determined by the Standard Proctor. Nuclear field density tests were performed at a minimum frequency of one per half-acre. Compaction test results for the site are included in Appendix K.

All soil/sand imported to the site was compared with the chemical criteria presented in Table 1. Chemical and physical testing for imported sand utilized for the sand cover layer is discussed in Section 4.16.3.

### 4.9.6 Installation of Vegetated Topsoil Layer

An uncompacted, 6-inch topsoil layer was installed over the sand cover layer between the 1-foot and 4-foot elevations. The actual limits of restored wetland areas are shown on As-Built Drawings AB-6 and AB-7 (Appendix I). In addition, Tables 2 and 3 provide complete details on the vegetation species (common name and scientific name), planting/ seeding density (for each of the selected species), and plant/ seeding quantity for the low marsh, high marsh and brackish areas, respectively. The percentage of actual species planted within each respective low marsh, high marsh and brackish area deviated from the NYSDEC-approved Wetland Mitigation Plan and subsequent Addendum due to lack of availability for certain types of plants. Specifically, *Juncus gerardii* and *distichlis spicata* were replaced with additional quantities of *spartina patens*. Erosion control matting (S150BN) as manufactured by North American Green, Evansville, Indiana was utilized to protect installed seed and plants. Product specifications for the erosion control matting are provided in Appendix L. The vegetated topsoil cover layer was installed as shown in Detail 14 on As-Built AB-10 (Appendix I).

All soil/sand imported to the site was compared with the chemical criteria presented in Table 1. Chemical and physical testing for imported topsoil utilized for the topsoil layer is discussed in Section 4.16.2.

During the performance of the remedial action, it was observed that the wetland along the south bank of Mill Creek was not able to hold a 4:1 slope through "soft" vegetative measures as requested by the NYSDEC. Therefore, modifications to restoring the southern bank of Mill Creek were proposed to the NYSDEC and conditionally approved, as discussed below.

#### 4.9.6.1 Restoration Modifications for Southern Bank of Mill Creek

Once the initial efforts for restoring the southern bank of Mill Creek were completed, it was observed that the wetland along the south bank of Mill Creek was not able to hold a 4:1 slope. The initial plan called for installation of 6 inches of wetland substrate, seeding of the low marsh areas with *Spartina alterniflora*, planting the high marsh areas with *Spartina patens*/ *Distichlis spicata*/ *Juncus gerardii* (as none of these species are commercially available as seed), and installation of a bio-net erosion control mat. In 2007, the planting substrate was installed, the low marsh was seeded, and erosion control mat was installed. However, the high marsh area of the south bank was not planted as planned as it was not possible to start planting until November 2007, and by that time, it was too late in the season to perform the planting.

Based on follow-up inspections of the Work area, it appeared that the Mill Creek tidal action resulted in the natural sloughing of the planting substrate from the high marsh areas (between the 3 and 4-foot contours) to the low marsh areas (between the 1 and 3-foot contours). Therefore, the majority of the high marsh areas settled into the low marsh. It was also believed that the majority of *Spartina* seed planted in the low marsh has washed away and is thus not expected to germinate this spring.

As the planting substrate found a stable elevation within the low marsh, Nassau Metal's proposed to maintain the existing elevations (closer to a 6:1 slope) in place of the previous plans. In order to stabilize the south bank, Nassau Metals also proposed to reseed the south bank as low marsh (i.e., *Spartina alterniflora*) followed by the installation of a reinforced erosion control mat for better slope stability and planting on a reduced frequency of 3 feet on center. Specifically, Enviroscapes smoothed out these areas and seeded the entire south bank with *Spartina alterniflora* and planted the south bank with *Spartina alterniflora* (for low marsh areas) and *Spartina patens* (for high marsh areas) plugs on 3 foot centers. The combination of reinforced erosion control mat, seeding, and plugs is expected to provide superior slope stabilization than

planting plugs alone. In selected areas where additional protection was warranted, the toe of the erosion control mat was anchored with coir logs, as trench anchoring into the planting substrate does not work well. During the post-remediation monitoring phase, Nassau Metals will closely monitor the south bank to ensure slope stabilization. If the slopes are not stable, alternative stabilization practices will be evaluated. It is important to note that the wetlands on the south bank are likely to be removed during future development; however, in the interim, they have been mitigated for in advance on the north bank.

The modifications highlighted above were approved in the NYSDEC letter dated June 10, 2008 (Appendix A). In addition, Tables 2 and 3 provide complete details on the modified vegetation species (common name and scientific name), planting/ seeding density (for each of the selected species), and plant/ seeding quantity for the low marsh, high marsh and brackish areas, respectively, along the southern bank of Mill Creek. As a note regarding performance of the south bank of Mill Creek, the south bank (between Arthur Kill Road and Page Avenue) will be included in the wetland monitoring program to confirm that adequate vegetation has been established to stabilize the banks. However, these areas will not be subject to the minimum survival rate required of the restored and created wetlands elsewhere on site since these areas will likely be disturbed in the next few years for future development. Maintenance will be performed on these areas as necessary to maintain bank stabilization

#### 4.9.6.2 Seepage of Water Through Banks North of Mill Creek

During the performance of the remedial action, seepage of water through the banks north of Mill Creek, adjacent to Arthur Kill Road, was observed. Several minor lateral seeps were observed as the slopes north of Mill Creek were excavated to preliminary grade. A more significant seep was observed north of Mill Creek, approximately 20 to 30 feet east of Arthur Kill Road (Refer to As-Built Drawing AB-3). Since the seep could not be eliminated, 1.5-inch to 3-inch stone was placed in the immediate vicinity of the seep to limit erosion. No geotextile was installed in the immediate vicinity of the seep; however, the geogrid was installed.

### 4.10 Management of Petroleum-Impacted Soils

During the regrading work south of Mill Creek, petroleum-impacted soil was encountered, excavated and staged for off-site disposal. After a follow-up discussion with the NYSDEC case manager, a spill number was not obtained because the impacted soils were addressed consistent with the Remedial Design Documents. The approximate location was from the former 48-inch culverts (former western Mill Creek Road crossing) to a location approximately 350 feet east of the former 48-inch culverts (approximately midway between the former 36-inch [eastern Mill Creek Crossing] and 48-inch culverts). To prevent the potential migration of sheen beyond

the isolated work area located between the former culvert locations, three sets of spill containment hard booms were ordered and installed at the following locations: (1) east of Arthur Kill Road; (2) east of the former 36-inch culverts; and (3) east of the former 48-inch culverts. A total of 326.27 tons of lead hazardous petroleum-impacted soil was removed, staged, and shipped off site as discussed in Section 4.17.2.

## 4.11 Construction of Soil-GCL Cap

A soil cap with Geosynthetic Clay Liner (Soil-GCL Cap) was installed in upland areas (above the 4-foot elevation) as shown on As-Built Drawing AB-3 (Appendix I). The design limits of the Soil-GCL cap were reduced in two areas as noted below:

- A 0.6-acre area (Mature Tree Area) north of Mill Creek and southwest of the brick office building located in OU-2 was removed from the proposed footprint of the Soil Cap based on the rationale presented in Roux Associates November 16, 2006 letter to the NYSDEC (Appendix E). The change to the proposed remedy preserved approximately 70 mature trees with a diameter greater than six inches, maintained a visual block of the site from Arthur Kill Road and provided some cost savings related to the area that would no longer be required to be capped. Infiltration to the subsurface in this area should be minor due to the significant amount of uptake from the trees and underbrush. In support of this request for a modification to the scope of work, two soil samples (SB-301 and SB-302) were collected from the area as noted in the November 16, 2006 letter and analyzed for the Target Analyte List ("TAL") of metals and metals using the TCLP. In addition, the lithology of each soil sample was logged, reviewed and evaluated. Each sample was collected from 0 to 2 feet below land surface. The soil collected at locations SB-301 and SB-302 was comprised of brown sand with minor amounts of gravel and silt. There was no slag, metal, or plastic debris observed. One metal in SB-301 (antimony) and two metals in SB-302 (copper and zinc) only slightly exceed NYSDEC RSCOs or the site background concentrations established in Roux Associates' Site Investigation Report. Concentrations of these metals are below the unrestricted cleanup standards cited Title 6, Subpart 375.6 ("Remedial Program Cleanup Objectives") of the New York City Rules and Regulations ("NYCRR") (referred as "Part 375 unrestricted standards" herein). There were no TCLP metals that exceeded hazardous waste regulatory levels.

- A 0.02 acre area (Bus Stop Area) located on the northeast corner of Nassau Place and Arthur Kill Road that is outside of the fenced boundary of the site was removed from the proposed footprint of the Soil Cap based on the rationale presented in Roux Associates July 20, 2007 letter to the NYSDEC (Appendix E). The Bus Stop Area has always been outside the limit of site operations.

Installation of the NYSDEC-approved Soil-GCL Cap included the following key components:

- consolidation and regrading;
- installation of GCL;
- installation of sand drainage layer; and
- installation of vegetated topsoil layer/ stone layer.

A typical cross-section of the Soil-GCL Cap (with vegetated topsoil layer) is depicted on Detail 14 of As-Built Drawing AB-10 (Appendix I). The methods for anchoring the GCL at the OU-1 and OU-2 interface and at the 4-foot elevations north and south of Mill Creek are shown on Details 1 and 2, respectively, of As-Built Drawing AB-8 (Appendix I). Greater detail on each element listed above is provided in the following subsections of this FER. As a note, portions of the GCL within the stormwater drainage swales were covered with 2 feet of stone, as discussed in section 4.15.

### 4.11.1 Consolidation and Regrading

All on-site fill materials generated as part of site regrading efforts were consolidated within the footprint of the Soil-GCL Cap or in limited areas beneath the Asphalt Cap up to 2 feet below the final design grade. These materials included the following:

- Material generated from the general regrading of the banks north and south of Mill Creek.
- Material generated from the general regrading of the site to meet proposed final grades.
- Sediment removed from the limits of Mill Creek.
- Soil Cuttings from geotechnical borings performed by Langan Engineering and Environmental Services (Langan), approved by the NYSDEC in its December 28, 2006 Letter (Appendix A).
- Material generated during the construction of the connection between the pre-existing 42-inch outfall to the recently constructed NYCDEP Drainage Swale.
- Approximately 60 yards of sediment removed from the discharge side of the 42-inch outfall to the recently constructed NYCDEP Drainage Swale after construction was complete.

After consolidation and regrading efforts were completed, the areas were surveyed prior to installation of the sand and vegetated topsoil/ stone layers (designated "preliminary graded"). Preliminary grade is shown on As-Builts Drawing AB-1 and AB-4.

### 4.11.2 Installation of Geosynthetic Clay Liner

The GCL was installed on top of the preliminary grade to provide an impermeable barrier and a visual barrier above the non-remediated subgrade. The reinforced GCL (Bentonite DN as manufactured by CETCO) consists of a layer of sodium bentonite between two non-woven geotextiles, which are needle-punched together. Product specifications for the GCL are provided in Appendix L. The GCL was installed by CETCO (a subcontractor to Shaw), a Bentonite DN-approved installer. The subgrade was inspected for items such as large sharp objects and sudden changes in grade and approved by CETCO prior to installation of the GCL. The subgrade approval forms are included in Appendix M. The GCL was installed, overlapped, and seamed in accordance with the specifications and the manufacturer instructions. The panel and seam layout are also included in Appendix M. Approximately 619,491 square feet of GCL was installed on-site across OU-1 and OU-2 as shown in As-Built Drawing AB-3 (Appendix I). The GCL was utilized for the construction of the Soil-GCL Cap during the performance of the remedial actions for both OU-1 and OU-2.; therefore, an allocation between the actual quantity of GCL used for individual elements of the remedial action within OU-1, cannot be made in this FER.

### 4.11.3 Installation of Sand Cover Layer

An 18-inch sand layer was installed on top of the GCL to provide cover and drainage. The sand was installed with a minimum permeability of 0.01 cm/sec as discussed in Section 14.16.3. The sand layer was installed and compacted with a vibratory roller to 95% or greater of the maximum dry density as determined by the Modified Proctor. Nuclear field density tests were performed at a minimum frequency of one per half-acre. Compaction test results for the site are included in Appendix K.

Chemical and physical testing for imported sand utilized for the sand cover layer is discussed in Section 4.16.3.

### 4.11.4 Installation of Vegetated Topsoil Layer/ Gravel Layer

Once the sand layer component of the Soil-GCL Cap was installed, either a vegetated topsoil layer or stone layer was installed as shown on As-Built Drawing AB-3 (Appendix I).

#### 4.11.4.1 Installation of Vegetated Topsoil Layer

An uncompacted, 6-inch topsoil layer was installed over the sand cover layer. The actual limits of the vegetated topsoil layer is shown on As-Built Drawings AB-4 and AB-5 (Appendix I) and Tables 2 and 3 provide complete details on the vegetation species (common name and scientific name), seeding density for the upland and adjacent areas of the site. The topsoil cover layer was installed as shown in Detail 14 on As-Built Drawing AB-10 (Appendix I).

Chemical and physical testing for imported topsoil utilized for the topsoil layer is discussed in Section 4.16.2.

The Soil-GCL Cap was hydroseeded with mulch at a rate of 20 pounds per acre above the 6-foot elevation in accordance with the following mix rate: 25% switchgrass, 25% annual ryegrass and 50% northeast wildflower mix.

The Soil-GCL Cap was seeded at a higher rate of 45 pounds per acre between the 4-foot and 6-foot elevations in accordance with the following mix rate: 25% switch grass, 35% annual ryegrass, 10% little bluestem, 10% alkali grass and 20% coastal panic grass. This was done to prevent the seed from washing away during higher than average tide periods. Once the seed was installed, a protective bionet erosion control blanket, Model No. SC-2 as manufactured by EastCoast Erosion Control Blankets, erosion mat was installed over the seeded area that consists of 70% straw and 30% coir blanket. The erosion mat was anchored using 6-inch, 11-gauge wire staple installed at a frequency of 1 staple per 9 square feet. Product specifications for the erosion mat are provided in Appendix L.

#### 4.11.4.2 Installation of Stone Layer

To facilitate access to DOT-owned property below Page Avenue Bridge, a 6-inch stone cover layer was installed within a portion of the property in and around Page Avenue. In addition, an approximate 2-foot wide, 6-inch stone cover layer was installed along the northern limits of OU-1 where the fencing separating OU-1 and OU-2 was installed. Both stone layers are shown on As-Built Drawing AB-3 (Appendix I).

Physical testing for imported 2.5-inch stone utilized for the stone cover layer is discussed in Section 4.16.8.

## 4.12 Mechanical Processing of Concrete and Asphalt for On-Site Re-Use

Approximately 3,500 cubic yards of excavated concrete and asphalt were mechanically processed using an Extec C-12 rock crusher and placed below the asphalt cap shown on As-Built Drawing AB-3 (Appendix I). During processing, a dedicated water truck was utilized to minimize dust generation during the performance of the work.

## 4.13 Construction of the Asphalt Cap

An area of approximately 362,817 square feet on the south side of the site was capped with two inches of asphalt on September 2 and 3, 2008 after an initial stone subbase was installed at varying thicknesses. Most of these areas included former parking areas, building slabs, and building foundations. A portion of the asphalt cap extended past these areas, as part of efforts to have a uniform perimeter for the asphalt cap. As-built construction details for both components of the asphalt cap are depicted on Detail 8 on As-Built Drawing AB-9. The limits and the final grading of the asphalt cap are shown on As-Built Drawing AB-3 (Appendix I).

Prior to installing the asphalt cap, approximately 3,500 cubic yards of mechanically processed concrete and asphalt, as discussed in Section 4.12, was initially used to perform rough grading of the area to be capped. This was followed by the installation of 10,750.85 tons of ¾-inch stone by Shaw and 897.71 tons of ¾-inch stone by NY Construction that was used to complete final grading. The facility scale tickets for all imported stone for this task is provided in Appendix N. The respective clean fill certifications are provided in Appendix O. A front end loader and vibratory roller were used to place, grade and compact the underlying stone subbase prior to installation of the asphalt cap.

Once final grading of the stone subbase was completed, a 2 -inch asphalt cap was installed. The bituminous wearing course was a Type 6 mixture as per Section 401, "Plant Mix Pavements," of the New York State Department of Transportation ("NYSDOT") Standard Specifications with an asphalt content ranging from 5.8 percent to 7.0 percent and a fine/course aggregate content conforming to the following gradation:

| Sieve Size | Percent Passing |
|---|---|
| 1" | 100 |
| ½" | 95 – 100 |
| # 4 | 65 – 85 |
| # 10 | 36 – 65 |

| Sieve Size | Percent Passing |
|---|---|
| # 20 | 15 – 39 |
| # 40 | 8 – 27 |
| # 100 | 4 – 16 |
| # 200 | 2 – 6 |

The respective load tickets for the asphalt delivered and placed are provided in Appendix P.

### 4.14 Cleaning and Abandonment of the Existing Site Storm Sewer Systems

Existing sanitary, stormwater, and industrial process sewers located south of Mill Creek were cleaned and abandoned, to the extent practical, as shown on As-Built Drawing AB-2 (Appendix I). However, as shown on the as-built drawing, several process lines were not cleaned or abandoned as noted below:

- Several process lines could not be located during the performance of the work.

- The inactive process line associated with manholes MH-1, MH-33, MH-34, MH-35, MH-36, MH-44 and MH-51 was not cleaned or abandoned in accordance with the remedial design because there was no sludge in the sewer and to keep this line "available for future redevelopment activities. However, the height of the manholes were adjusted, where applicable, to meet the revised grading south of Mill Creek. It should be noted that the line is no longer active; therefore, nothing drains into it. In addition, the connection to the existing sanitary sewer running off-site, parallel to Arthur Kill Road, was removed during the preconstruction demolition phase.

- Two unidentified manholes, connected by reinforced concrete pipe ("RCP") (approximately 30 inches in diameter), along the east side of Arthur Kill Road (approximately 5 feet from the existing fence line) were encountered during the performance of the work. The bottom of each manhole was estimated to be approximately ten feet below grade. Flow was observed at each manhole. The source of the flowing water was not determined. However, it is suspected that the RCP is the municipal sewer that is shown on record drawings to actually be within the limits of Arthur Kill Road. It was determined that the flow was coming from the north. These manholes and the associated line were not cleaned or abandoned.

Cleaning was accomplished using high pressure jetting. The primary sources of water for cleaning were 24,000 gallons of re-used treated wastewater as discussed in Section 4.5; a portion of the 115,000 gallons of off-site non-potable water delivered to the site by Dana Transport, Inc. (Appendix F); and additional water, as needed, from a nearby, off-site fire hydrant permitted by the City of New York.

Abandonment was accomplished using a controlled density fill product (General Utility Trench Mix with a design strength of 60-90 psi) provided by Scara-Mix, Inc. located in Staten Island, New York,. Approximately 192 cubic yards of controlled density fill was used. The facility scale tickets for all imported controlled density fill for this task is provided in Appendix N and the respective clean fill certification is provided in Appendix O. All sediment generated during these activities was stabilized and disposed off site as discussed in Section 4.17.2.

In addition, site storm water outfalls that formerly discharged to Mill Creek were removed, at a minimum, to approximately 10 feet from each respective outfall location as noted in the As-Built Drawing AB-5 (Appendix I). The specific site storm sewer outfalls that were removed were: xx2, xx4, 001, 005, xx1, xx1a, xx3, xx5, 003, 004, 006, 007, 008, 009, 010, 011, 016, 017, and 018.

### 4.14.1 Management of Spill No. 0609869

On November 29, 2006, the investigation of CB-13 by Shaw identified a ½-inch layer of an oily material on the surface of the water in the manhole. As a result, Roux Associates, on behalf of Nassau Metals, obtained a Spill No. from NYSDEC (No. 0609869) for the product that was observed in this catch basin. Product and oily water from CB-13 was removed along with impacted sediments as part of cleaning operations and disposed of off-site. Specifically, 10,400 gallons of non-hazardous construction wastewater was ultimately disposed as a result of cleaning the entire existing sewer system along with 13.29 tons of lead hazardous and petroleum-contaminated sediments is discussed in Section 4.17.

The spill was subsequently closed on June 26, 2007. Documentation is provided in Appendix Q.

### 4.14.2 Management of Breach at Sediment Containment/ Stabilization Area

On July 2, 2007, Shaw and Roux Associates observed sewer cleaning sediments migrating away from the southeast corner of the sediment containment/stabilization area located along the southern limits of the site as a result of a breach at this location. Several hundred gallons of sediment migrated south of the containment area towards the on-site railroad tracks. As of July 5, 2007, the containment area was repaired and the bulk of the sediment that left the

sediment containment area was recovered. The remaining sediments adjacent to the on-site railroad tracks were recovered and restaged in the sediment containment/ stabilization area. With the addition of stabilization media (i.e., speedy dry) to expedite the removal of the sediment and the excavation of surrounding and underlying soils, approximately 1 to 2 cubic yards of sediment was ultimately recovered. The recovered sediment was shipped off-site as hazardous waste as discussed in Section 4.17.2. Notification of the incident was provide in the Minutes for Construction Meetings 38 and 39 and memorialized in Monthly Construction Progress Report No. 9. With NYSDEC concurrence, a spill number was not obtained.

## 4.15 Rehabilitation of Site Stormwater System

The following subsections discusses rehabilitation of existing stormwater outfalls north of Mill Creek and installation of new drainage swales and associated drainage features north and south of Mill Creek.

### 4.15.1 Rehabilitation of Existing Stormwater Outfalls North of Mill Creek

Pipe outfalls No. 013, 014 and 015 north of Mill Creek were replaced/ modified as noted in Detail 15 of As-built Drawing AB-10 (Appendix I). These outfalls connect to existing manholes MH-65, MH-63 and MH-67, respectively, located on OU-2 as shown on As-Built Drawing AB-5 (Appendix I). Outfall No. 012 was not located during the performance of the Work. A new headwall structure was installed for a previously unidentified 36-inch RCP of unknown origin between Outfalls No. 14 and 15.

### 4.15.2 Installation of New Stormwater Drainage Swales and Associated Features

As shown on Drawing AB-3 (Appendix I), approximately 4,000 linear feet of drainage swales/ outfalls were installed north and south of Mill Creek, west of Page Avenue Bridge. Although not a formal part of the approved Final Design Documents, a new, vegetated drainage swale, as discussed in Section 4.19, connecting the existing NYCDEP 42-inch storm sewer that discharges onto Nassau Metals-owned property just east of Page Avenue to Mill Creek was constructed by Shaw during the performance of the remedial action. Construction requirements for various types of swales discussed herein are shown on Details 6 and 9 on As-built Drawing AB-9 (Appendix I). The design originally specified vegetated drainage swales; however, a field modification was implemented that resulted in the use of stone and riprap to construct the remaining drainage swales. NYSDEC verbally approved the change to the use of stone and riprap in the swales in non-wetland areas on September 5, 2007 and provided email concurrence for the change to stone in wetland areas on September 11, 2007 as described further below. Prior to this change, the drainage swale north of Mill Creek and a portion of the drainage swale east of the asphalt cap were seeded at a rate of one pound per square foot using the following mix: 20%

each of redtop, creeping bengrass, Virginia wild rye, fox sedge and alkali grass. A turn reinforcement mat (SC250) as manufactured by North American Green, Evansville, Indiana was initially utilized to protect the installed seed mixture. Product specifications for the turf reinforcement matting are provided in Appendix L. Stone was later placed at the base of this vegetated swale as noted on Detail 9 on As-Built Drawing AB-9 (Appendix I).

All site drainage swales ultimately discharge to Mill Creek through five outfall swales. Outfalls Swales No. 1, 2 and 3 convey stormwater south of Mill Creek and Outfall Swales No. 4 and 5 convey stormwater north of Mill Creek. Construction details for these swales are presented on Detail 15 on As-Built drawing AB-10 (Appendix I). Outfall swale No. 005 was added during the implementation of the remedy to facilitate stormwater drainage in this area of the site. It should be noted that NYSDEC approval was obtained on September 11, 2007 before Outfall Swales No. 1 and 2 were changed to stone over GCL through the wetland areas and Swale No. 3 added (Appendix A). The outfall swales to the South were already approved to be constructed of stone and riprap.

In addition, as shown on Drawing AB-5, 7 new headwalls and associated HDPE piping were installed north of Mill Creek to convey stormwater from OU-2 catch basins CB-B, CB-C, CB-D, CB-E, CB-F, CB-G, and CB-H), respectively, to Mill Creek. The 7 new outfalls discharge into the drainage swale north of Mill Creek, which ultimately discharges to the creek through the outfall swales No. 004 and 005. An additional headwall and associated HDPE piping was installed to convey infiltrated stormwater that will collect from the eastern portion of OU-2 to Mill Creek through the drainage swale north of the creek. To confirm connection of existing catch basins located on OU-2 with Mill Creek, a limited dye study was performed on June 5, 2007. Notification for the performance of this dye study was provided on June 4, 2007.

A 7.5-foot strip of stone was installed along the western portion of OU-1, south of Mill Creek, as shown on As-Built Drawing AB-3 (Appendix I) to facilitate site drainage along the perimeter of the site. Similarly, a stone riprap swale was installed along the western portion of OU-1, north of Mill Creek, as shown on As-built Drawing AB-3 (Appendix I) to facilitate site drainage along the perimeter of the site. Specific construction details for the perimeter swale north of Mill Creek are provided on Detail 2 on As-Built Drawing AB-8 (Appendix I).

### 4.16 Off-Site Fill Materials

During the performance of the remedial action for OU-1, several types of fill materials were imported and placed on-site as discussed in this FER. This section of the FER discusses the

chemical and physical quality, where applicable, of the following fill materials utilized during the performance of the remedial action.

- 16,650 cubic yards of low organic topsoil from the Wyckoff Mills site located in Monroe Township, New Jersey;
- 2,866 total cubic yards of topsoil (355 cubic yards of low organic topsoil and 2,511 cubic yards of high organic topsoil) from Nature's Choice Belvidere, New Jersey site;
- 60,916.58 tons of sand from Amboy Aggregates Facility located in South Amboy, New Jersey;
- 192 cubic yards of controlled density fill from Scara-Mix, Inc. located in Staten Island, New York;
- 12,520.20 tons of dense grade aggregate ("DGA") from Stavola Company, Inc.'s (Stavola's) quarry located in Bridgewater Township in New Jersey;
- 3,806.25 tons of ¾-inch crushed stone from Stavola Company, Inc.'s (Stavola's) quarry located in Bridgewater Township in New Jersey;
- 897.71 tons of ¾-inch stone Tilcon's New York, Inc. (Tilcon's) quarry located in West Nyack, New York;
- 5,043.90 tons of 2.5-inch stone from Stavola's quarry located in Bridgewater Township in New Jersey;
- 605.72 tons of small core stone ($D_{50}$ = 6 inches) from Trap Rock Industries, Inc.'s quarry located in Kingston, New Jersey; and
- 339.28 tons of large core stone ($D_{50}$ = 12 inches) from Trap Rock Industries, Inc.'s quarry located in Kingston, New Jersey.

Clean fill certifications for all imported topsoil, sand, common fill, controlled density fill, DGA, stone and riprap are provided in Appendix O. Chemical and physical data for each type of material, where applicable, is discussed in the following subsections of this FER.

### 4.16.1 Imported "Low Organic" Topsoil from Wyckoff Mills Site

Sixteen thousand, six hundred fifty cubic yards of "low organic" topsoil was imported from a clean, virgin source, whereby the topsoil was generated as part of coastal wetland enhancement activities. The imported "low organic" topsoil originated from Shaw's Wyckoff Mills Wetland

Bank (Wyckoff) site located in Monroe, New Jersey within the Raritan Drainage Basin. The site is a NJDEP-approved freshwater wetland mitigation bank that was created in 2000. Under the guidance and approval of the NJDEP, a grading operation was conducted in the southern half of the bank during the fall/winter 2006/ 2007 with the goal of capturing more storm water and holding it on-site for a longer period of time, thus making the site wetter for a longer duration. The grading was conducted by LARK Excavating and overseen by Shaw. In doing so, approximately 35,000 cubic yards of material was graded and stock piled in four distinct piles along Wyckoff Applegarth Road. Two of the piles were common fill while the other two were topsoil. The two Wyckoff Mills site topsoil piles were mixed, at the Wyckoff Mills site, with approximately 3%, by weight, of fresh mushroom compost as manufactured by USA Gypsum AgriMarketing, Inc. to generate a "low organic" topsoil product that was used for upland areas of the site after approval to use this product as a source of topsoil was provided by the NYSDEC. The physical data report for the mushroom compost is provided in Appendix S.

The topsoil piles were randomly sampled, composited, and analyzed prior to mixing the mushroom compost and importing this "low organic" topsoil to the site. A total of two pre-qualification and six post-qualification samples from the proposed "low organic" topsoil source were collected and sampled for VOCs, semi-volatile organic compounds ("SVOCs"), metals, po polychlorinated biphenyls ("PCBs") and pesticides/ herbicides with the respective analytical results being summarized in Tables 4 through 8. The respective analytical data reports are included in Appendix R for this proposed fill material source. The respective clean fill certification is provided in Appendix O.

All chemicals of concern were below NYSDEC TAGM Recommended Soil Cleanup Objectives ("RSCOs") cited in the remedial design or below the Part 375 unrestricted standards. For reference purposes, detections for chemical parameters (chromium) that exceeded TAGM RSCOs; but are below Part 375 unrestricted standards, are highlighted in bold, where applicable, in Tables 4 through 8.

The representative physical data reports (Appendix Q) for the "low organic" topsoil from the Wyckoff Mills site indicate that the off-site fill material achieved the minimum requirements of the technical specifications. These reports specifically indicate that the total organic content is approximately 3.73% (between the acceptable range of 1% and 10%); sand content is approximately 52% (slightly less than 55% maximum requirement); and clay content is approximately 28% (between the acceptable range of 12% and 50%).

Formal approval to import and use topsoil from the Wyckoff Mill site was requested on April 20, 2007 from the NYSDEC. The NYSDEC reviewed this request and subsequently provided their formal approval on May 31, 2007 (Appendix A).

All of the imported low organic topsoil was utilized within the limits of OU-1 during the construction of the Soil-GCL Cap as discussed in Section 4.11.4.1. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.2 Imported Topsoil from Nature's Choice

2,866 cubic yards of topsoil was imported from a clean, virgin source, which was provided by Nature's Choice Facility located in Belvidere, New Jersey. Of this material, 355 cubic yards of "low organic" topsoil was imported and placed in OU-2 and 2,511 cubic yards of "high organic" topsoil was placed in OU-1. The facility was formerly a farm and has since been operated as a supplier of organic landscaping products facility for 15 years. All of the sand used at the Nature's Choice site comes from Siberini & Sons in Middle Smithfield, Pennsylvania. All of the compost used is produced at the Natures Choice site from leaves, grass and yard waste brought to the site.

A total of one pre-qualification and two post-qualification samples from the proposed topsoil source, which is representative of both "low and high organic" topsoil imported to the VCA Property during the remediation of OU-1 and OU-2, were collected and analyzed for VOCs, SVOCs, metals, PCBs and pesticides/ herbicides with the respective analytical results being summarized in Tables 4 through 8. The analytical data reports are included in Appendix R for this fill material source. The clean fill certification is provided in Appendix O.

All chemicals of concern were below NYSDEC TAGM RSCOs cited in the remedial design or below the Part 375 unrestricted standards except an acetone detection of 400 mg/kg for the July 20, 2007 sample collected from the 2$^{nd}$ post-qualification set of samples from the Nature's Choice topsoil site. For reference purposes, detections for chemical parameters (benzo(b)fluoranthene, benzo(a)pyrene, calcium, magnesium and acetone) that exceeded TAGM RSCOs; but are below Part 375 unrestricted standards, are highlighted in bold, where applicable, in Tables 4 through 8.

The representative physical data reports (Appendix Q) for the "low organic" and "high organic" topsoil from the Nature's Choice site indicate that the off-site fill material achieved some, but not all, of the minimum requirements of the technical specifications as noted below:

- For the "low organic" topsoil, these reports specifically indicate that the **total organic content** is approximately 10.87% (is slightly above the specified range of 1% and 10%); sand content is approximately 64.2% (greater than 55% maximum requirement); and silt/ clay content is approximately 35.8% (within the acceptable range of 12% and 50%).

- For the "high organic" topsoil, these reports specifically indicate that the **total organic carbon** is approximately 8.8% (is between the specified range of 6% and 12%); sand content is approximately 77% (greater than 55% maximum requirement); and clay content is approximately 10% (slightly below the acceptable range of 12% and 50%). It should be noted that for the high organic sample, total organic content was not measured; instead, total organic carbon, also an acceptable measure for organic content, was measured. Organic matter is different to total carbon in that it includes all organic compounds (i.e., hydrogen, oxygen, nitrogen, etc…), not just carbon. A conversion of 1.72 is commonly used to convert organic carbon to organic matter.

Formal approval to import and use topsoil from the Nature's Choice site was requested on May 17, 2007 (based on pre-qualification results) and July 26, 2007 (based on first post-qualification results) from the NYSDEC. The NYSDEC reviewed these requests and subsequently provided their formal approval on May 31, 2007 for the first request (Appendix A) and informal approval on the second request by meeting the conditions for approval in our July 27, 2007 email to the NYSDEC.

All of the imported "low organic" topsoil was utilized within the limits of OU-2. The "high organic" topsoil was utilized for several purposes (i.e., construction of the Soil-GCL Cap and restoration of the wetland banks) during the performance of the remedial action for OU-1. Therefore, an allocation between the quantity and quality of high organic topsoil used for individual elements of the remedial action within OU-1 cannot be made in this FER. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.3 Imported Sand

60,916.58 tons of sand was imported from a clean, virgin source, which was provided by Amboy Aggregates' Facility located at Block 161, Lot 25, 175 Main Street, City of South Amboy, County of Middlesex, New Jersey. The imported sand originated from the Ambrose Channel in Lower New York Bay under Federal Permit No. 2001-00492 and NJDEP Permit No. 84-0745.

A total of one pre-qualification and eight post-qualification samples from the proposed sand source were collected and analyzed for VOCs, SVOCs, metals, PCBs and pesticides/ herbicides

with the respective analytical results being summarized in Tables 4 through 8. The respective analytical data reports are included in Appendix R for this fill material source. The respective clean fill certification is provided in Appendix O.

All chemicals of concern were below NYSDEC TAGM RSCOs cited in the remedial design or below the Part 375 unrestricted standards. For reference purposes, detections for chemical parameters (antimony) that exceeded TAGM RSCOs; but are below Part 375 unrestricted standards, are highlighted in bold, where applicable, in Tables 4 through 8.

The representative physical data reports (Appendix Q) for the sand from the Amboy Aggregates' Facility indicated the following:

- The sieve analyses for all pre- and post-qualification tests indicated that 85% passing of the No. 10 sieve, which was slightly below the specified rate of 90%.

- The permeability analyses for all pre- and post-qualification tests were indicated, on average, that the $10^{-2}$ cm/sec permeability requirement, as specified in the remedial design, was achieved.

All of the imported sand was utilized within the limits of OU-1 and OU-2. The sand was utilized for several purposes (i.e., construction of the Soil-GCL Cap and restoration of the wetland banks for OU-1 and remediation of several areas within OU-2) during the performance of the remedial actions for OU-1 and OU-2; therefore, an allocation between the quantity and quality of sand used for individual elements of the remedial action within OU-1, cannot be made in this FER. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.4 Imported Controlled Density Fill

192 cubic yards of a controlled density fill product (General Utility Trench Mix with a design strength of 60-90 psi) was imported to the site. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported controlled density fill product. The representative physical data report for this fill material is provided in Appendix Q.

All of the imported controlled density fill product was utilized within the limits of OU-1 during the abandonment of the former sanitary, stormwater and industrial process sewers. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.5 Imported Dense Graded Aggregate

12,520.20 tons of DGA was imported from a clean, virgin source, which was provided by Stavola's Facility located at Block 6.01, Lot 711 in Bridgewater Township, New Jersey. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported DGA. The representative physical data report for this fill material is provided in Appendix Q.

Imported DGA from Stavola was utilized for several purposes (construction of asphalt subbase for OU-1 and OU-2 and construction of temporary access roads) during the performance of the remedial action for Operable Units 1 and 2; therefore, an allocation between the quantity of DGA used within each operable unit, as well as the individual elements of the remedial action within each operable unit, cannot be made in this FER. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.6 Imported ¾-Inch Crushed Stone From Stavola

3,806.25 tons of ¾-inch crushed stone was imported from a clean, virgin source, provided by Stavola's Facility located at Block 6.01, Lot 711 in Bridgewater Township, New Jersey. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported ¾-inch stone. The representative physical data report for this fill material is provided in Appendix Q.

Imported ¾-inch crushed stone was utilized for several purposes (subbase for OU-2 asphalt cap and construction of new storm water facilities for OU-2, which were connected to outfalls located within the limits of OU-1) during the performance of the remedial action for Operable Units 1 and 2; therefore, an allocation between the quantity of ¾-inch crushed stone used within each operable unit, as well as the individual elements of the remedial action within each operable unit, cannot be made in this FER. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.7 Imported ¾-Inch Stone from Tilcon

A shipment of 897.71 tons of ¾-inch stone was imported from a clean, virgin source, provided by Tilcon's Facility located at West Nyack, New York. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported ¾-inch stone. The representative physical data report for this fill material is provided in Appendix Q.

All of the imported ¾-inch stone was utilized within the limits of OU-1 during the construction of the subbase for the asphalt cap. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.8 Imported 2.5-Inch Stone

A shipment of 5,043.90 tons of 2.5-inch stone was imported from a clean, virgin source, provided by Stavola's Facility located in Bridgewater Township, New Jersey. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported 2.5-inch stone. The representative physical data report for this fill material is provided in Appendix Q.

Imported 2.5-inch stone was utilized for several purposes (construction of portions of stone/ riprap swales north and south of Mill Creek and construction of the stone layer for selected portions of the Soil-GCL Cap in and around Page Avenue Bridge) during the performance of the remedial action for Operable Unit 1; therefore, an allocation between the quantity 2.5-inch stone used within OU-1 cannot be made in this FER. The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.9 Small Core Stone

A shipment of 605.72 tons of small core stone ($D_{50}$ = 6 inches) was imported from a clean, virgin source, provided by Trap Rock Industries, Inc. Facility located in Kingston, New Jersey. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported small core stone. The representative physical data report for this fill material is provided in Appendix Q.

The small core stone was utilized as part of several key components of the remedy including the construction of the riprap armament along Arthur Kill Road, north of Mill Creek (Detail 4 on Drawing AB-8 {Appendix I}); construction of portions of stone/ riprap swales south of Mill Creek (Detail 6 on Drawing AB-9 {Appendix I}); and construction of outfall riprap aprons (Detail 15 on Drawing AB-10 {Appendix I}). The locations of each of these components are shown on As-Built Drawings AB-3 and AB-4 (Appendix I). The delivery tickets for all imported fill materials are provided in Appendix N.

### 4.16.10 Large Core Stone

A shipment of 339.28 tons of large core stone ($D_{50}$ = 12 inches) was imported from a clean, virgin source, provided by Trap Rock Industries, Inc. Facility located in Kingston, New Jersey. The respective clean fill certification is provided in Appendix O.

Consistent with the requirements of the Final Design Documents, no chemical analysis was required or performed for any imported large core stone. The representative physical data report for this fill material is provided in Appendix Q.

The large core stone was utilized as part of several key components of the remedy including the construction of portions of the stone/ riprap swales south of Mill Creek (Detail 6 on Drawing AB-9 {Appendix I}) and construction of the NYCDEP Drainage Swale (Detail 11 on Drawing AB-9 {Appendix I}). The locations of each of these components are shown on As-Built Drawings AB-3 and AB-4. The delivery tickets for all imported fill materials are provided in Appendix N.

## 4.17 Waste Transportation and Disposal

All C&D debris, bulky waste and spent filter bags generated during the performance of the remedial action by Shaw was transported and disposed at an appropriate recycling facility/ transfer station. In addition, the following contaminated wastes were generated, transported, and disposed at appropriate treatment, storage and disposal facilities ("TSDFs") during the performance of the remedial action:

- hazardous sediments generated from cleaning the former on-site sanitary/ sewer system;
- hazardous petroleum-impacted soil excavated along the south bank of Mill Creek;

- non-hazardous spent wastewater treatment facility media; and
- non-hazardous construction wastewater generated from cleaning a portion of the former sanitary/ sewer system.

All TSDFs were permitted under the RCRA, Toxic Substances Control Act ("TSCA"), and/or by the State in which the TSDF is located, where applicable. The haulers of all wastes were permitted and licensed to transport wastes in New York and all localities and states through which they transported the wastes. All transporters, where applicable, were permitted in accordance with RCRA, United States Department of Transportation ("USDOT"), state and local requirements, and possessed an EPA identification number. All vehicles used for the transportation of wastes, where applicable, were also in conformance with USDOT and USEPA requirements and the requirements of all states through which the wastes were transported. All applicable manifesting and placarding transportation requirements were implemented. In accordance with the Final Design Documents, all trucks were visually inspected by Shaw and Roux Associates on-site personnel and properly decontaminated prior to leaving the VCA Property.

Shaw coordinated the transportation and disposal of all C&D debris and bulky waste, hazardous solid waste, non-hazardous spent wastewater media and non-hazardous construction wastewater generated during the performance of their component of the RA performed at the VCA Property, as discussed below. For reference purposes, a summary of all waste shipped off-site by Shaw is presented in Table 9 through 12, respectively.

### 4.17.1 Construction and Demolition Debris and Bulky Waste

A summary of the construction and demolition ("C&D") debris and bulky waste generated, transported and disposed of off-site during the course of the remediation project for all Operable Units is provided below, within this FER for OU-1, since there was no allocation for C&D debris and bulky waste generated during the performance of the remedial action by Shaw for the Nassau Metals Site:

- 50 pieces of railroad steel (1 load);
- 240 cubic yards of aquadam (6 loads);
- 180 cubic yards of concrete and rebar (6 loads);
- 540 cubic yards of general debris (18 loads);

- 120 cubic yards of railroad ties (6 loads);
- 120 cubic yards of scrap metal (4 loads);
- 90 cubic yards of site debris/ trash (3 loads); and
- 210 cubic yards of vegetative debris (7 loads).

All C&D debris and bulky waste was transported by Flag Container Services, Inc. with its headquarters located in Staten Island, New York or Nacirema Industries, Inc. with its headquarters located in Bayonne, New Jersey to the following facilities:

- all vegetative debris (7 loads) – Reliable Wood Recycling located in Jersey City, New Jersey;
- all railroad ties (6 loads) – Eagle Recycling located in North Bergen, New Jersey; and
- all scrap metal, steel and site debris (38 loads) – Nacirema Industries, Inc. located in Bayonne, New Jersey.

The six loads of aquadam were generated as part of efforts to isolate the Embayment Area for OU-3, but were disposed of as part of the OU-1 remediation effort. The demolition and removal of the former remnants of the railroad line located east of Page Avenue, north of Mill Creek were not included as an element of the remedial design, but was included as a field modification during the performance of the work. The respective load of railroad steel and 4 loads of railroad ties generated during the performance of the Work were disposed of as part of the OU-1 remediation effort.

The disposal tickets for each shipment of C&D debris and bulky waste are provided in Appendix T.

### 4.17.2 Hazardous Solid Waste

A summary of the hazardous waste generated, transported and disposed of off-site during the course of the remediation project for OU-1 is provided below:

- 13.29 tons of lead hazardous sediments (one load) generated from the cleaning of CB-13, as discussed in Section 4.14, was transported and disposed of at Michigan EQ's TSDF located in Belleville, Michigan;

- 326.27 tons of lead hazardous petroleum-impacted soil (13 loads) generated during the bank excavation along the south side of Mill Creek, as discussed in Section 4.10 of this FER, was transported and disposed of at Michigan EQ's TSDF located in Belleville, Michigan;

- 177.55 tons of lead hazardous sediments (7 loads) generated from the cleaning of certain portions of the on-site sanitary/ sewer system, as discussed in Section 4.14 of this FER, was transported and disposed of at Michigan EQ's TSDF located in Belleville, Michigan; and

- 21.81 tons of lead hazardous, TSCA sediments (one load) generated from the cleaning of certain portions of the on-site sanitary/ sewer system, as discussed in Section 4.14 of this FER, was transported and disposed of at Veiola's TSDF located in Port Arthur, Texas.

All hazardous waste was transported by Horwith Trucks, Inc. with headquarters in North Hampton, Pennsylvania. The hazardous waste manifests and certified weight scale tickets are provided in Appendices U and V, respectively. For reference purposes, the respective waste characterization data is provided in Appendix W.

### 4.17.3 Non-Hazardous Wastewater Treatment System Spent Media

A summary of the non-hazardous wastewater treatment system spent media generated, transported and disposed of off-site during the course of the remediation project for OU-1 is provided below:

- 6,000 pounds of non-hazardous spent organo-clay media (one load) was transported by CleanVentures and disposed of at Cycle Chem's disposal facility located in Elizabeth, New Jersey; and

- 5,000 pounds of non-hazardous spent carbon media (one load) was transported by CleanVentures and disposed of at Cycle Chem's disposal facility located in Elizabeth, New Jersey.

The respective non-hazardous bills of lading are provided in Appendix X. For reference purposes, the respective waste characterization data is provided in Appendix W.

### 4.17.4 Non-Hazardous Construction Wastewater

A summary of the non-hazardous construction wastewater generated, transported and disposed of off-site during the cleaning of the former on-site sanitary/ sewer system within OU-1 is provided below:

- 10,399 gallons of non-hazardous construction wastewater (3 loads) was transported by Cycle Chem, Inc. and disposed of at Clean Waters of New York disposal facility located in Staten Island, New York.

The non-hazardous bills of lading are provided in Appendix Y. For reference purposes, the respective waste characterization data is provided in Appendix W.

## 4.18 Monitoring Well Abandonment and Construction

During the performance of the remedial action, twenty-six (26) monitoring wells were abandoned in accordance with NYSDEC requirements by Shaw's Subcontractor, East Coast Drilling, Inc. ("ECDI") located in Moorestown, New Jersey between. The abandoned monitoring wells were constructed of either 2-inch or 4-inch PVC and installed to depths ranging from 7-feet to 4l-feet deep. ECDI removed the wells by over drilling them with hollow stem augers. The augers created a l0-inch diameter borehole. The borehole was backfilled with cement-bentonite grout via the tremie method. Any drill cuttings generated were consolidated below the on-site Soil-GCL Cap. The augers, drilling rig and tools were decontaminated between locations. The decontamination procedure was performed at the decontamination pad located on site. The well abandonment logs are provided in Appendix Z. Notification for abandonment was provided to the NYSDEC on March 26, 2007 (Appendix E).

New monitoring wells MW-101, MW-102, MW-104 and MW-107 were installed and developed by Shaw's subcontractor ECDI, as shown on As-Built Drawing AB-3 (Appendix I). MW-103, MW-105, and MW-106 were subsequently installed and developed by Roux Associates as shown As-Built Drawing AB-3 (Appendix I). NYSDEC Notification for well installation was provided on June 15, 2007. The respective monitoring well construction logs are provided in Appendix AA. All development water generated by Shaw was treated by the temporary, on-site construction wastewater treatment system. All development water generated by Roux Associates was containerized on-site, but treated as part of the wastewater treatment system constructed, operated and maintained during the remediation of OU-3. All soil cuttings generated from the construction of monitoring wells installed by Shaw were consolidated below the Soil-GCL Cap. However, the soil cuttings generated from the construction of monitoring wells installed by Roux Associates were disposed with waste materials generated, transported and disposed of off-site as part of the remediation of OU-3.

### 4.19 Construction of New Vegetated Drainage Swale

Although not a formal part of the approved Final Design Documents, a new, vegetated drainage swale connecting the existing NYCDEP 42-inch storm sewer that discharges onto the Nassau Metals-owned property just east of Page Avenue to Mill Creek was constructed by Shaw during the performance of the remedial action. The new, vegetated drainage swale was designed using information provided by NYCDEP's consultant Hazen and Sawyer. Roux Associates submitted the design of the new vegetated drainage swale, along with several other related design elements, to the NYSDEC and NYCDEP on March 6, 2007, which was subsequently approved by the NYSDEC on April 12, 2007 (Appendix A).

Not all elements of the design were constructed, including: removal of the existing headwall from the existing 42-inch pipe; installation of a new precast concrete manhole at the discharge point of the existing pipe in order to change the direction of the pipe toward the east; installation of approximately 25 linear feet of 42-inch diameter corrugated high density polyethylene ("HDPE") pipe; construction of a new stilling basin with concrete embedded rip rap bottom and side walls; and installation of a new precast concrete headwall at the pipe outlet to the stilling basin. The as-built conditions of the vegetated drainage swale, as currently constructed, are shown on As-Built Drawing AB-3 and Detail 11 on Drawing AB-9 (Appendix I). All soil/ sediment excavated as part of the work was backfilled beneath the Soil-GCL Cap installed as part of the overall NYSDEC-approved Site Remediation. Once completed, the vegetated drainage swale immediately alleviated the flooding condition adjacent to the Staten Island Railway railroad tracks, which was the goal of the drainage feature.

### 4.20 Surveying and As-Built Drawings

Surveying was performed throughout the work to document as-built conditions for all elements of the work performed for the Site. The bulk of surveying was performed by Layout, Inc., a New York State-certified surveyor, under the direction of Shaw. The as-built drawings for OU-1 and OU-2 are provided in Appendix I since an allocation between the surveying performed for both operable units during the performance of the work was not made.

### 4.21 Equipment Decontamination

All equipment that came into contact with impacted areas of OU-1 was decontaminated prior to removal from the site. Disposal vehicles were loaded in non-impacted areas of OU-1 and therefore did not require decontamination. Equipment decontamination certificates are provided in Appendix AB.

## 4.22 Demobilization

Once the bulk of remedial activities were completed, Shaw proceeded to demobilize from the site on November 28, 2007. As part of these efforts, the following major tasks were performed:

- All temporary utilities (electric, water and telephone) were disconnected.

- All major temporary facilities (engineering trailer, construction trailer, union trailer, water treatment system, sanitary units, trash units, equipment decontamination pad, etc…), except one storage container (with unused geotextiles, unused media, etc…), unused jersey barriers and unused erosion controls were temporarily located below Page Avenue Bridge, were dismantled and removed from the site. The materials temporarily staged below Page Avenue Bridge were subsequently removed as part of the remedial action for OU-3.

- All health and safety monitoring and sampling supplies and equipment, temporary work zone barriers, temporary construction fencing and soil erosion and sedimentation control measures were removed from the site.

- The fencing for the site was secured on the north and west and parallel to Page Avenue Bridge and the keys for each locked access gate were furnished to Nassau Metals.

Subsequent to this demobilization effort, other direct contractors of Nassau Metals demobilized from the site after their work activities were completed. Enviroscapes demobilized on August 1, 2008, while NY Construction demobilized on September 3, 2008

## 4.23 Implementation of Site Management Plan

The Site contains residual contamination in soil and groundwater left after completion of the remedial action performed under the VCP. Engineering Controls have been incorporated into the remedy to provide proper management of residual contamination in the future to ensure protection of public health and the environment. A Site-specific Declaration of Covenants and Restrictions ("deed restriction" or the Declaration) will be recorded with the Richmond County Clerk that provides an enforceable means to ensure the continued and proper management of residual contamination and protection of public health and the environment. It requires strict adherence to all Engineering Controls ("ECs") and all Institutional Controls ("ICs") placed on the Site by the grantor of the deed restriction and any and all successors and assigns of the grantor. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs.

Site management is the last phase of the remedial process and is triggered by the approval of the Final Engineering Report and issuance of the VCA Release and Covenant Not to Sue (VCA Release) by NYSDEC. The SMP continues in perpetuity or until extinguished in accordance with 6NYCRR Part 375. It is the responsibility of the deed restriction grantor, and its successors and assigns to ensure that all Site Management responsibilities under the SMP are performed.

The SMP provides a detailed description of all procedures required to manage residual contamination at the Site following the completion of the Remedial Action. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain all treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC; and (5) defining criteria for termination of treatment system operation.

The ICs on the Site ("Controlled Property") include:

- Compliance with the Declaration of Covenants and Restrictions and this SMP by the Grantor and the Grantor's successors and assigns.
- All Engineering Controls must be operated and maintained as specified in this SMP.
- All Engineering Controls on the Controlled Property must be inspected at a frequency and in a manner defined in the SMP.
- Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP.
- Unless prior written approval by the NYSDEC or if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens (hereinafter referred to as "the Relevant Agency") is first obtained, there shall be no construction, use, or occupancy of the Site that results in the disturbance or excavation of the Site which threatens the integrity of the composite cover system, or which results in unacceptable human exposure to contaminated soils.
- The Controlled Property may be used for restricted industrial/restricted commercial use only (not including day care, child care, and medical care) provided the long-term

Engineering and Institutional Controls included in the SMP remain in use without the express written waiver of such prohibition by the NYSDEC or other Relevant Agency.

- The owner of the Site shall maintain the composite cover system, where appropriate, or after obtaining the written approval from the Relevant Agency, by modifying with alternative materials.

- Vegetable gardens and farming on the Controlled Property are prohibited.

- The site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from previous certification or that any changes to the controls were approved by the NYSDEC; and (2) nothing has occurred that impairs the ability of the controls to protect public health and the environment or that constitute a violation or failure to comply with the SMP.

- NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually or at an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

- The owner of the Site shall prohibit the use of the groundwater underlying the Site without treatment rendering it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Relevant Agency.

- The Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Site and shall provide that the owner, and its successors and assigns, consent to the enforcement by the Relevant Agency, of the prohibitions and restrictions that Paragraph X of the VCA requires to be recorded and hereby covenants not to contest the authority of the Department to seek enforcement.

- Any deed of conveyance including the portion of the Site referred to as the Site shall recite that the said conveyance is subject to the Declaration of Covenants and Restrictions.

A description of the engineering controls, institutional controls, and post-remediation Operation, Maintenance and Monitoring ("OM&M") associated with the site are presented in the site-specific SMP for OU-1 provided in Appendix AC. The executed copy of the Declaration of Covenants and Restrictions is provided in Appendix AD.

## 5.0 DEVIATIONS FROM THE APPROVED REMEDIAL DESIGN

Nassau Metals has completed the implementation of the Remedial Action for the Nassau Metals-owned portion of Site No. V-00159-2, which is designated as OU-1, located in Staten Island, New York. In accordance with the requirements of the VCA (No. W2-0801-01-04, dated January 4, 2002) between the NYSDEC and Nassau Metals, Remedial Engineering, P.C. certifies that the remedial action was implemented in accordance with the NYSDEC-approved Specifications, Project Plans and Contract Documents dated February 14, 2006, with the exceptions noted in this FER. The exceptions noted in this FER are listed below and discussed in Section 4. Minor modifications to the remedy that did not change the essential elements of the remedy are also discussed throughout Section 4.

It is worth noting that a set of "for construction" contract documents dated May 2006 was issued to the bidders for the remedial construction. In addition, four addenda to the May 17, 2006 contract documents were issued to the bidders during the bid phase (Addendum No. 1 dated June 5, 2006; Addendum No. 2 dated June 20, 2006; Addendum No. 3 dated June 23, 2006 and Addendum No. 4 dated June 30, 2006). These documents did not change the essential elements of the remedy. They were issued to finalize contractual elements missing from the February 14, 2006 set; provide additional language regarding the dredge window imposed on work in Mill Creek and the embayment areas; and provide minor design modifications based on value engineering conducted during the bid phase and questions from the bidders.

### 5.1 Exceptions to Design Documents

The following list includes exceptions to the Final Design Documents applicable to OU-1 and identifies sections within this FER where these exceptions are discussed. The NYSDEC has been notified and has approved these exceptions, as appropriate.

- An extension of the dredging window to June 1, 2007 (For the 2006/ 2007 dredging season) was issued (Section 4.1).
- Isolated dust monitoring exceedances were observed and managed during the performance of the Work on January 24 and 26, 2007 (Section 4.3.1).
- Hay bales were installed on paved areas and fastened to adjacent fencing, where applicable (Section 4.4).
- Existing asphalt was utilized as the primary stabilized entrance to OU-1 (Section 4.4).
- Modifications to the proposed access road layout and construction requirements were issued, approved and implemented (Section 4.4).

- Use of a protective, dust and erosion control coating of Dirt Glue$^{TM}$ Light for on-site stockpiles to be consolidated beneath the Soil-GCL Cap was permitted (Section 4.4).

- Discharge of treated water to the Arthur Kill Waterway was permitted during the performance of the Work (Section 4.5.2).

- Use of treated water from the Arthur Kill Waterway to "wet down" dry areas within OU-1 to minimize dust generation (Section 4.5.2.1).

- Modifications to the strength requirements of the remedial design, from 50 pounds psi after 7 days of curing time and 100 psi after 28 days of curing time. As an alternative, Shaw graded out the stabilized material in 1 to 2 foot lifts and performed compaction testing across the approved area for placement of stabilized sediments. Compaction results consistently exceeded the design requirement of 95% of the maximum dry density as determined by the Modified Proctor, which were comparable to compaction testing collected across the site. (Section 4.7.2)

- Modifications to the NYSDEC-approved Wetland Mitigation Plan were issued in the form of an Addendum issued November 16, 2007 to the NYSDEC. The Addendum was issued to memorialize discussions and agreements regarding modifications to the wetland mitigation plan to address NYSDEC comments from a letter dated June 23, 2006, additional issues discussed during the October 4, 2006 project kickoff meeting and telephone and email correspondence in October and November 2006. On June 10, 2008, the NYSDEC later approved a reduced planting frequency (3 feet on center) on the south bank of Mill Creek since this area will likely be disturbed as part of future site redevelopment and its potential loss was mitigated for in advance on the north bank at a minimum 3:1 ratio. (Section 4.9).Use of an herbicide for invasive species control of *Phragmites australis* (common reed) was permitted (Section 4.9.2).

- Grossly impacted soils were encountered and managed during the excavation of the southern banks along Mill Creek (Section 4.10).

- An area of mature trees located north of Mill Creek and southwest of the brick office building was not required to be capped (Section 4.11).

- A 0.02 acre portion area within the limits of the proposed remedy that is currently located outside the fenced boundary of the VCA Property at the northwest corner of Nassau Place and Arthur Kill Road was not required to be capped (Section 4.11).

- Fifteen (15) cubic yards of soil cuttings that were previously generated during a geotechnical investigation performed by Langan in 2004 was placed beneath the Soil-GCL Cap (Section 4.11.1).

- Several process sewer lines were not cleaned or abandoned (Section 4.14).

- Management and closure of Spill No. 0609869, which was opened as a result of product encountered in an on-site catch basin during the cleaning and abandonment of the on-site sewer system (Section 4.14.1).

- A limited dye study for selected catch basins connected to Mill Creek was performed (Section 4.15.2).

- Use of riprap swales instead of vegetated swales within two small areas within the limits of jurisdictional wetlands north of Mill Creek was permitted (Section 4.15.2).

- Use of riprap swales instead of vegetated swales in upland areas north and south of Mill Creek was permitted (Section 4.15.2).

- Use of topsoil from the Wyckoff Mills site. For reference purposes, detections for chemical parameters (chromium) that exceeded NYSDEC TAGM 4046 RSCOs; but are below Part 375 unrestricted standards, are highlighted in bold, where applicable, in Tables 4 through 8 (Section 4.16.1).

- Use of topsoil from the Nature's Choice site. For reference purposes, detections for chemical parameters (benzo(b)fluoranthene, benzo(a)pyrene, calcium, magnesium and acetone) that exceeded NYSDEC TAGM 4046 RSCOs; but are below Part 375 unrestricted standards, are highlighted in bold, where applicable, in Tables 4 through 8 (Section 4.16.2).

- A new drainage swale from the 42-inch NYCDEP sewer to Mill Creek was designed and constructed (Section 4.19).