Final Remedial Investigation Report
Engineer School, Fort Totten

Fort Totten Coast Guard Station
Formerly Used Defense Site, Queens, New York
Contract No.: W912DR-10-D-0003, Task Order No.: 003
FUDS Property No.: C02NY0057
Watermark Project No.: 10404-03

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Formerly Used Defense Site
Queens, New York

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ACRONYMS

ADR	Automated Data Review
ALM	Adult Lead Model
AMEC	AMEC Environment & Infrastructure
APP	Accident Prevention Plan
ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
CALEPA	California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGS	Coast Guard Station
cm^2	Square Centimeter
cm^3	Cubic Centimeter
COC	Chain-of-Custody
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
DoD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objectives
Eco-SSL	Ecological Soil Screening Levels
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FS	Feasibility Study
ft	Feet
FUDS	Formerly Used Defense Site
g/m^2	Grams per Square Meter
GPR	Ground Penetrating Radar
GSD	Geometric Standard Deviation
GPS	Global Positioning System
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
kg/m^3	Kilogram per Cubic Meter
km	Kilometer
Koc	Organic Carbon Partition Coefficient
Kow	Octanol-water Partition Coefficient
IDW	Investigation-Derived Waste
IEUBK	Integrated Exposure Uptake Biokinetic Model
IRIS	Integrated Risk Information System
LCS	Laboratory Control Samples
LNAPL/DNAPL	Light Non-Aqueous Phase Liquids/Dense Non-Aqueous Phase Liquids
LOAEL	Lowest Observed Adverse Effect Level
µg/dL	Micrograms per Deciliter
µg/L	Micrograms per Liter
mg/kg	Milligram Per Kilogram
mg/L	Milligram Per Liter

mg/m3	Milligrams per Cubic Meter
MOA	Mode of Action
MRL	Minimal Risk Levels
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NAE	New England District
NCEA	National Center for Environmental Assessment
NOAEL	No-Observable-Adverse-Effects-Level
NPL	National Priority List
NYPD	New York Police Department
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORNL	Oak Ridge National Laboratory
PAHs	Polycyclic aromatic hydrocarbons
PbB	Blood Lead Level
PCB	Polychlorinated Biphenyls
PEF	Particle Emission Factor
PID	Photoionization Detector
PPRTV	Provisional Peer Reviewed Toxicity Values
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentrations
RfD	Reference Dose Values
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RSL	Regional Screening Levels
SCOs	Soil Cleanup Objectives
SEDD	Staged Electronic Data Deliverable
Site	Fort Totten CGS FUDs
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SQL	Sample Quantitation Limit
SRI	Supplemental Remedial Investigation
SRI2	Supplemental Remedial Investigation #2
STSC	Superfund Technical Support Center
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TRPH	Total Recoverable Petroleum Hydrocarbons
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
UR	Unit Risk
USACE	United States Army Corps of Engineers

USCG	United States Coast Guard
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
Watermark	Watermark Environmental, Inc.

EXECUTIVE SUMMARY

This Final Remedial Investigation Report, Engineer School, Fort Totten presents the results of the Supplemental Remedial Investigation #2 (SRI2) completed by Watermark Environmental, Inc. (Watermark) and summarizes the results of previous investigations completed by others in the upland portion of the Fort Totten Coast Guard Station (CGS) Formerly Used Defense Site (FUDS) in Queens, New York (the Site). The Site is located on the current United States Coast Guard (USCG) property in northeast Queens County, Long Island, New York, which is situated on a peninsula extending out into Little Neck Bay and the East River portion of Long Island Sound (Figure 1-1).

Previous environmental investigations detected semi-volatile aromatic hydrocarbons (particularly polycyclic aromatic hydrocarbons (PAHs) and metals in surface soils at concentrations greater than the New York State Department of Environmental Conservation (NYSDEC) Soil Cleanup Objectives (SCOs). PAHs, metals, and chloroform were also detected in site groundwater at concentrations that resulted in unacceptable risk. Previous remedial actions consisted of removal of soil near the exterior of the south side of Building 615 that was contaminated with mercury that had been discharged to a floor drain within the building.

The purpose of the SRI2 was to collect additional soil and groundwater data to further delineate and characterize environmental conditions in the upland portion of the Site and to support an updated Human Health Risk Assessment and Screening Level Ecological Risk Assessment (HHRA and SLERA). The results will be used to support the development and evaluation of appropriate remedial alternatives, if required.

For the purposes of the SRI2, the Site was divided into five investigation areas (Areas 1 through 5) based on current and former building locations and Site uses (Figure 1-2). Area 1 had previously been adequately characterized; however, the HHRA needed to be updated and was done so as part of this SRI2. Areas 2 through 5 were previously investigated, but underwent further characterization as part of this SRI2, including the analysis of surface and subsurface samples for metals, mercury species, and/or PAHs. The five monitoring wells were redeveloped and a site-wide groundwater sampling round was conducted on May 9, 2011. The groundwater samples were submitted for laboratory analysis of volatile organic compounds (VOCs), PAHs, and metals. Additional field work was conducted in November 2012, consisting of shallow soil sampling for mercury in Area 3, hand-digging of observation holes in Area 4 to look for potential sources of PAHs detected in previous soil samples, and groundwater sampling of monitoring wells MW-4R and MW-5 for PAHs.

The Engineer School/Fort Totten property is a FUDS, and U.S. Army Corp of Engineers (USACE) is the lead agency for addressing FUDS in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). However, the Site is not a National Priority List (NPL) site and NYSDEC is also involved in the site investigation oversight. As such, chemical concentrations in soil samples from the Site are compared, in this SRI2 report, to the “Residential” and the “Industrial” USEPA Regional Screening Levels (RSLs) and the NYSDEC SCOs. Chemical concentrations in soil samples are also compared to background concentrations which were calculated as described in Appendix B.

Results of the 2011 soil sampling and analysis were generally consistent with previous investigations, confirming that metals and PAHs are present in soil and fill material. The 2011 data were evaluated along with historical data to characterize the nature and extent of contamination within each area at the Site. Semi-volatile organic compounds (SVOCs) were detected at concentrations greater than background in one or more samples in Areas 1 through 4. Using benzo(a)pyrene as an indicator of PAH concentrations, Areas 1 through 3 have slightly elevated concentrations with respect to background, and Area 4 has significantly higher concentrations with respect to background. Based on visual observations from soil borings and hand-dug holes, the elevated PAH concentrations in Area 4 are attributable to urban fill (coal, coal ash, and asphalt were observed at sample locations where elevated PAH concentrations were detected). Metals were also detected in one or more samples in Areas 1 through 5 at concentrations greater than background.

With respect to the site-wide groundwater, PAHs were detected in the 2011 samples from MW-4R and MW-5, and metals were detected in all five monitoring wells that were sampled. Benzo(a)anthracene, benzo(b)fluoroanthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in MW-5 in 2011 at concentrations above the NYS Class A groundwater guidance criteria. High molecular weight PAHs are not very soluble in water, therefore it is likely that these PAH detections were related to suspended solids in groundwater rather than dissolved PAHs. To test this assumption, additional groundwater samples were collected from MW-4R and MW-5 in November 2012. These samples were collected in both field-filtered and unfiltered form and were analyzed for PAHs only. The results did not confirm the previously detected compounds. The only PAHs detected above the reporting limit were fluoranthene and pyrene, and both were an order of magnitude below their New York State Class A groundwater criteria. Sodium was the only metal and chloroform was the only VOC detected above their New York State Class A groundwater criteria in the May 2011 samples.

An HHRA was performed in a manner consistent with USEPA CERCLA guidance. The HHRA evaluated potential exposures to soil for Current Outdoor Workers (landscapers), Current Trespasser, Future Outdoor Workers, Future Indoor Workers, Future Construction Workers, Future Recreational Receptors, and Future Residents in five exposure areas at the Site (Area 1, Area 2, Area 3, Area 4, and Area 5) and the Background Area. In addition, potential dermal exposures to groundwater for the Future Construction Worker and potential potable use of groundwater for the Future Resident were evaluated for the Site.

The HHRA resulted in a finding of unacceptable cancer risk in Area 4 for the Future Resident due to PAHs, principally benzo(a)pyrene. The HHRA also resulted in a non-cancer screening Hazard Index (HI) greater than 1 associated with a single elevated arsenic concentration in Area 3. This sample was collected adjacent to a deck believed to be constructed of pressure treated lumber. When the data from this sample point were excluded from the HHRA, the target organ-based segregated HI for all COPCs, including arsenic, is below 1.

Risks associated with exposure to lead were not evaluated using a Hazard Index approach. Rather, consistent with standard practice, risks associated with exposure to lead were evaluated using USEPA blood lead models for both adults and children. The results indicate that the allowable blood lead concentration of 10 µg/dL was exceeded for the Future Child Resident in Area 1.

The calculated HIs for the background soil data (ranging from 2 to 3) for hypothetical future residents were also greater than 1 (HIs for the age groups ranged from 2 to 3). Because the calculated HIs are similar for the five areas of the site and for the background soil data set, the incremental non-cancer risk associated with soil in the five areas is considered to be negligible.

Cancer risks and non-cancer hazard indices (HIs) for the hypothetical Future Construction Worker dermal contact exposure with site-wide shallow groundwater were calculated based on the May 2011 groundwater data. The results are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer HI value of 1. Currently the Site is supplied by municipal water. No current or foreseeable use of groundwater has been identified, and potential salt water intrusion and low well yield would preclude future use of the groundwater for potable or non-potable purposes. However, a hypothetical future scenario of potable use of groundwater was evaluated. The cancer risk estimate for the Future Resident (potable groundwater use (4 x 10^{-3}) evaluated at the Site is above the CERCLA acceptable risk range. The driver for cancer risk from exposure to groundwater is dibenz(a,h)anthracene (based on the May 2011 results). The non-cancer HI estimates for the Future Resident (potable groundwater use) evaluated at the Site are below a value of 1.

A qualitative risk evaluation was performed based on the 2012 soil and groundwater sample results in order to provide a qualitative update to the HHRA. The maximum and mean mercury concentration of soils samples collected in Area 3 in 2012 were lower than exposure point concentration, suggesting that addition of the newly collected mercury data would lower the exposure point concentration for mercury in surface and subsurface soil in Area 3. Lowering of the exposure point concentration would result in lower estimated exposures and associated risks. The 2012 mercury data support the conclusion of the HHRA that mercury in surface and subsurface soil within Area 3 is not a human health concern for all receptors evaluated.

The 2012 groundwater samples contained far fewer PAHs and at much lower concentrations than were detected previously. Only two PAHs (fluoranthene and pyrene) were detected and these occurred in only one sample (MW-5 unfiltered). The concentrations of these PAHs were well below the corresponding USEPA Tapwater RSLs. The RSLs for these compounds are set at a hazard quotient of 1. This means that for even sensitive individuals, long-term consumption of drinking water containing concentrations equal to the RSL would be without appreciable risk of any adverse effects. The two compounds detected in the November 2012 sampling are associated with much lower risk (e.g., not of concern) than those associated with the previously detected compounds.

A SLERA was performed in a manner consistent with USEPA, CERCLA, and NYSDEC guidance for the Site to evaluate the potential for chemical constituents of concern detected in surface soil in upland exposure areas to adversely affect ecological receptors. The SLERA indicated that:

- Concentrations of SVOCs in Area 1, 2, 3, and 4 are not likely to result in actionable population level effects to ecological receptors. Risk from three SVOCs (1-methylnapthalene, carbazole, and dibenzofuran) could not be evaluated because screening benchmarks were not available.
- Concentrations of metals in Area 1, 2, 3, 4, and 5 are not likely to result in actionable population level effects to ecological receptors.
- While hazard quotients (HQs) for pesticides in Area 2 surface soil are greater than 1, concentrations of all pesticides retained as chemicals of potential ecological concern (COPECs) are below screening levels and therefore are not actionable (USACE, 2005). No further evaluation of potential adverse effects from chemical constituents of concern detected in surface soil in upland exposure areas to ecological receptors is necessary.

The human health surface and subsurface exposure point concentrations (EPCs) for each area and the background dataset were compared to the NYSDEC SCOs. A discussion of the comparison is presented below.

- In Area 1 surface soil, the copper EPC is greater than the Unrestricted Use SCO, the chromium and lead EPCs are greater than the Residential Use SCOs, and the mercury EPC is greater than the Restricted Residential Use SCO. In subsurface soil, the chromium and cobalt EPCs are greater than the Residential Use SCOs, the lead and mercury EPCs are greater than the Restricted Residential Use SCOs, and the copper EPC is greater than the Commercial Use SCO.
- In Area 2 surface soil, the chromium and lead EPCs are greater than the Unrestricted Use SCOs, the indeno(1,2,3-cd)pyrene and mercury EPCs are greater than the Restricted Residential Use SCOs, and the copper EPC is greater than the Industrial Use SCO. In subsurface soil, the chromium, lead, and mercury EPCs are greater than the Unrestricted Use SCOs.
- In Area 3 surface soil, the copper and lead EPCs are greater than the Unrestricted Use SCOs, the chromium EPC is greater than the Residential Use SCO, and the arsenic EPC exceeds the Industrial Use SCO. In subsurface soil, the chromium and lead EPCs are greater than the Unrestricted Use SCOs, the mercury EPC is greater than the Restricted Residential Use SCO, and the copper EPC exceeds the Commercial Use SCO.
- In Area 4 surface soil, the lead EPC is greater than the Unrestricted Use SCO, the chrysene, chromium, and mercury EPCs are greater than the Residential Use SCOs, the benzo(a)anthracene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene EPCs are greater than the Restricted Residential Use SCOs, and the benzo(a)pyrene EPC is greater than the Industrial Use SCO. In subsurface soil, the lead and mercury EPCs are greater than the Unrestricted Use SCOs, the chrysene and chromium EPCs are greater than the Residential Use SCOs, the benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene EPCs are greater than the Restricted Residential SCOs, and the benzo(a)pyrene EPC is greater than the Industrial Use SCO.
- In Area 5 surface soil, the copper and lead EPCs are greater than the Unrestricted Use SCOs, the chromium EPC is greater than the Residential Use SCO, and the mercury EPC is greater than the Commercial Use SCO. In subsurface soil, the chromium EPC is greater than Unrestricted Use SCO and the mercury EPC is greater than the Commercial Use SCO.
- In background surface soil, the lead and mercury EPCs are greater than the Unrestricted Use SCOs and the chromium EPC is greater than the Residential Use SCO. In subsurface soil, the lead and mercury EPCs are greater than the Unrestricted Use SCOs and the chromium EPC is greater than the Residential Use SCO.

Recommendations for next steps are to proceed with a Feasibility Study to identify and evaluate appropriate remedial alternatives for addressing lead in Area 1 soils. A FS is recommended for lead in Area 1 soils because the blood lead levels for future child exposure to soil are above the allowable blood lead concentration. No-action is recommended for Area 2 based on a finding of acceptable risk. No-action is recommended for Area 3, because the only risk greater than risk limits (arsenic-specific hazard quotient greater than one for a future residential land use scenario) is driven by a single elevated detection of arsenic associated with a deck constructed of pressure treated wood. In the absence of that detection, the cancer risks and non-cancer HIs for future land use receptors at Area 3 would be within or below the acceptable risk range and below the threshold non-cancer HI value of 1. Additional investigation (November 2012) and qualitative risk evaluation of mercury in Area 3 confirmed the conclusion of the HHRA; mercury in surface soil within Area 3 is not a human health concern for all receptors evaluated. No-action is recommended for Area 4 because the risk from PAHs is attributable to urban fill. No action is recommended for Area 5 based on a finding of acceptable risk. Because Area 5 contains low-levels of residual mercury in the subsurface, a letter from the U. S. Coast Guard has been requested by USACE to describe the site management controls that are currently in-place to address these low levels of mercury. Upon receipt, this letter will be forwarded to NYSDEC, and added to this report. No-action is recommended for area groundwater because there is no current exposure and no potential for future exposure and a qualitative risk evaluation of 2012 groundwater sampling results indicates risk from exposure to groundwater is not of concern.

Based on the results of the RI, HHRA, and SLERA, a preliminary Remedial Action Objective (RAO) was developed for Area 1.

- Area 1: Prevent or reduce potential future residential human exposure to soil with lead concentrations such that the probability of an individual child (aged 0 to 84 months) exceeding a blood lead level of 10 μg/dL is 5 percent or less.

The Feasibility Study will include a no action alternative to serve as a baseline against which all other alternatives will be compared. Various combinations of land-use controls, engineering controls, and active remedial measures will also be evaluated. The Army's preferred remedy will be presented in the Proposed Plan which will be made available for public comment. The final remedy, when selected, will be documented in the Decision Document, which will be signed by the USACE.

1.0 INTRODUCTION

This Final Remedial Investigation Report, Engineer School, Fort Totten presents the results of the Supplemental Remedial Investigation #2 (SRI2) completed by Watermark Environmental, Inc. (Watermark) and summarizes the results of previous investigations completed by others in the upland portion of the Fort Totten Coast Guard Station (CGS) Formerly Used Defense Site (FUDS) in Queens, New York (the Site). This report was prepared by Watermark Environmental, Inc. (Watermark) for the U.S. Army Corps of Engineers (USACE), New England District (NAE) under Contract No. W912DR-10-D-0003, Task Order No. 003. This report was prepared in a manner consistent with United States Environmental Protection Agency (USEPA's) 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*.

The Site is located in the northwest portion of Long Island in the Queens Borough of New York City, New York (Figure 1-1). The Site covers 7.8 acres and is located on Little Bay in Long Island Sound. The Site is currently owned and operated by the United States Coast Guard (USCG), although a large portion of the Site is currently not in use. The Site was formerly owned and operated by the Department of Defense (DoD). Investigations at the Site have been ongoing since the 1980s.

A brief description of the Site setting and background is provided in this section. A more detailed description of the Site and site history can be found in the Final Remedial Investigation (RI) report (USACE, 2005), the Final Supplemental Remedial Investigation (SRI) report (USACE, 2006), and the Draft Feasibility Study (FS) (USACE, 2009).

1.1 Report Organization

The remainder of this report is organized as follows:

Section 2 Project Purpose and Objectives

This section identifies the purpose and objectives of the SRI2 and this report.

Section 3 Conceptual Site Model

This section provides discussion of the Conceptual Site Model (CSM), based on the updated information that has been collected during the SRI2.

Section 4 Completion of Field Investigations

Section 4 documents the implementation of 2011-2012 field programs that included soil and groundwater investigation activities.

Section 5 Field Investigation Results

Section 5 describes and summarizes the results of the 2011 SRI2.

Section 6 Nature and Extent of Contaminants

Section 6 presents a summary of the nature and distribution of contamination in soil and groundwater at the Site. Tables and figures comparing reported concentrations (historical and recently collected data) of detected parameters in soil to screening criteria and background concentrations are presented for each of five areas of the Site addressed in this report. The nature and extent of detected analytes is summarized by chemical class and distribution of analytes. The objective of this section is to present the analytical data that are representative of current conditions (conditions after the previously conducted response actions).

Section 7 Contaminant Fate and Transport

Section 7 presents discussion of contaminant fate and transport for the most frequently detected parameters in soil and groundwater. This discussion relates potential sources of contamination with the hydrologic setting in discussion of potential routes of contaminant migration and exposure including soil and groundwater. The chemical and physical properties of contaminants and their setting are discussed in the context of contaminant transport.

Section 8 Human Health Risk Assessment

Section 8 documents the HHRA activities and summarizes the results of the HHRA.

Section 9 Screening Level Ecological Risk Assessment

Section 9 documents the Screening Level Ecological Risk Assessment (SLERA) activities and summarizes the results of the SLERA.

Section 10 Summary and Conclusions

This section presents the summary and conclusions for the Fort Totten CGS FUDS related to nature and extent, fate and transport of contamination, and risk to human and environmental receptors for current and reasonably foreseeable land uses and conditions.

Section 11 References

This section identifies references cited throughout the document.

1.2 Site Description

The Site is located on a portion of the former Fort Totten installation in northeast Queens County, Long Island, New York, which is situated on a peninsula extending out into Little Neck Bay and the East River portion of Long Island Sound. A general site location is shown in Figure 1-1, and a map of the Site containing current and former buildings is presented in Figure 1-2. The SRI2 focused on the groundwater and soil within five specific areas of the Fort Totten CGS FUDS (Figure 1-2). The five areas were delineated based on previous investigation results and reflect areas where either additional characterization and human health risk assessment were necessary (e.g., Areas 2, 3, 4, and 5) or where existing data were adequate, but an updated risk assessment was necessary (Area 1). The five areas are used as exposure areas for the purpose of the HHRA. Figure 1-2 depicts the five areas in relationship to the total FUDS area of 7.8 acres. The ball fields east of Area 4 were included in the original FUDS boundary, but were excluded from the SRI2 investigation based on previous sampling results and a determination from the NY Department of Health that no contaminants were detected in the soil at levels that would pose a health concern for users of the ball field (NYDOH, 1996) (Appendix N). At USACE's request, New York State Department of Environmental Conservation (NYSDEC) provided a letter dated March 18, 2014 (NYSDEC 2014) confirming that the 1.8 acre ball field area is are no longer considered a part of the Fort Totten Coast Guard Site and that the remaining portion of the site is now listed as approximately 7.8 acres in size. The letter notes that the reduction was handled internally as a "boundary modification" as opposed to a "delisting", but that the net outcome was the same. A copy of the letter is provided in Appendix Q.

The area around Buildings 620 and 621 was also excluded from further characterization during SRI2 based on the results of previous investigations that did not indicate a need for further characterization. Buildings 620 and 621 were constructed in the late 1800's, were formerly used respectively as a torpedo laboratory and shop building, and were later converted to housing and a garage, respectively (USACE, 1985) (Appendix N). The previous investigations included an electro-magnetic survey conducted in December 1986 using a Geonics EM-31, the purpose of which was to detect potential buried ordnance and drums. No buried ordnance or drums were found (Metcalf & Eddy, 1988).

The Fort Totten FUDS lies within an area designated by the City of New York as Special Fort Totten Natural Area District – 4 (City of New York, 2011). Appendix A of the zoning resolution includes a plan map of the Special Fort Totten Natural Area District – 4 that indicates that the RI Area 1 and adjacent ball field are designated as open space, RI Areas 2 and 4 lie within the Development Area (Area E) zoned for residential use, and RI areas 3 and 5 lie within the Bay Area (Area D) where the zoning includes commercial use, with residential use above the ground floor of buildings existing prior to April 28, 1993.

1.3 Operational History

DoD acquired Fort Totten, a 146.75-acre property, between 1857 and 1943, for the coastal defense of Long Island Sound and the eastern entrance to the East River. Fort Totten also served as a post-Civil War hospital, an engineering school, and a training site for West Point Cadets. It is currently the Headquarters for the 77th Army Reserve Command. The Department of the Army conveyed 9.6 acres of the property to the USCG, while still retaining ownership of the remaining 137.15 acres. This FUDS project is limited to the excess portion (7.8 acres) of Fort Totten presently owned by the USCG and excludes the 1.8 acre ball field area as described above). The FUDS occupies the north-west portion of the peninsula and is bounded by U.S. Army property on the north, east, and west. Access to this property is gained via Willets Street which branches off of Totten Avenue.

1.4 Previous Environmental Investigations

Little Bay and the upland (on land) portion of the Site has been the subject of previous investigations, dating back to 1988 (USACE, 2005). The previous investigations at the Site are summarized below.

The first investigation, a Site Investigation, was commissioned by the USACE in 1988. It was conducted by Metcalf & Eddy (Metcalf & Eddy, 1988). Shallow soil and sediment samples were collected from various locations on the property and five groundwater monitoring wells were installed. An electro-magnetic survey (EM-31) was also conducted that did not detect any buried ordnance or drums.

In the summer of 1992, the USACE ordered the collection of four surface soil samples around the Fill Area (referred to in this report as Area 1 and depicted on Figure 1-2) for the analysis of Total Recoverable Petroleum Hydrocarbons (TRPH) and mercury (USACE, 1992). The Fill Area was created when the Army placed soil excavated from the vicinity of Buildings 118, 119, and 121 (former vehicle maintenance shops) in a low spot in a recreational field to eliminate periods of standing water. The excavated material included portions of the building's parking lots. No mercury was detected, and the petroleum hydrocarbon concentration ranged from 193 - 695 milligram per kilogram (mg/kg).

In June 1996, NYSDEC completed a Registry Site Classification Decision form that identified the 9.6 acre parcel as a "…Class 2 category, meaning that the hazardous waste disposed there represents a significant threat to public health and/or the environment and action is required". The justification for classification stated: "The mercury contamination is (sic) the Bay is most likely the result of improper disposal of mercury contaminated wastes used in the manufacture, repair, or disposal of various weapons systems during the Army's use of the site. The mercury contamination in the Bay is extensive; Marine Resources has stated that these sediments would be considered impaired for benthic and fish life. Elevated levels of mercury contamination on site, and elevated levels of mercury and other heavy metals in sediments off-site represent a significant threat to public health and the environment. A determination of significant threat is warranted" (NYSDEC, 1996).

USACE initiated a comprehensive RI in 1997 to determine the nature and extent of the contamination reported in the earlier two studies. The RI was conducted in two phases. Phase I was conducted from July of 1997 through August of 1998 and included the collection and analysis of soil, sediment, and groundwater samples. Thirteen soil borings were advanced and samples collected at various depths. Phase II was conducted between November 1999 and August 2000 to obtain more detailed information about the Site. The Phase II investigation involved the collection of sediment, groundwater, surface water, and surface soil samples from the same or similar locations as Phase I. Fifty-two surface soil samples were collected from the Site and analyzed for metals and/or semi-volatile organic compounds (SVOCs). These investigations addressed both the upland area and Little Bay.

During Phases I and II of the RI, USACE collected and analyzed 92 soil samples from 70 different locations in the upland areas of the Site. Although no pesticides or polychlorinated biphenyls (PCBs) were detected, the analysis showed that concentrations of polycyclic aromatic hydrocarbons (PAHs) and metals in some surface soil samples were greater than the NYSDEC Soil Cleanup Objectives (SCOs) (USACE, 2005).

In July 2002 USACE prepared the Draft RI Report (USACE, 2002) which summarized investigations for the uplands area and Little Bay. Review of historical documents indicated the Fill Area was created when the Army placed soil in a low spot of the recreation field to eliminate periods of standing water. The soil came from Buildings 118, 119, and 121, former vehicle maintenance shops. Historical records review also indicated Building 615 was used as a torpedo and mine repair facility, where mercury was removed from guidance systems and disposed of through floor drains. The report included human health and ecological risk assessments. The USACE issued a No Further Action Record of Decision (ROD) for Little Bay (USACE, 2003) based on the results of the 2002 risk assessments. This ROD called for follow-up sampling in three years to confirm the previous results. This was upheld by confirmatory sampling that was completed in 2006 (USACE, 2006). More detailed information regarding the ROD can be found in the ROD for Little Bay, FUDS Fort Totten CGS, Queens, New York (USACE, 2003). Further RI investigations focused on the upland portion of the Site, as no further action was required for Little Bay.

The USACE conducted an SRI in the summer of 2004 focused on the upland area and Building 615 to address data gaps identified by the NYSDEC and New York State Department of Health (NYSDOH) regarding the Fill Area, upland areas, and Building 615. Building 615 was originally used as a torpedo and mine repair facility. The armaments contained mercury in their guidance systems, and when repair required removal of the mercury, it was disposed of through the floor drains. During previous investigations, the sump sediments were removed. The drain pipes of Building 615 were also sampled and removed (USACE, 2005).

Twelve soil borings were advanced and 24 additional soil samples (and nine duplicates) were collected from the Site. The sampling locations for the 2004 samples were selected based on the presence of high concentrations of SVOCs and lead during the previous sampling round (USACE, 2006). Real-time air monitoring for mercury was conducted inside of Building 615, as well as the collection of air samples for off-site analysis for mercury. A total of 26 air samples, including quality assurance and background samples, were analyzed by the off-site laboratory (USACE, 2006). The results indicated that there were no detectable concentrations of mercury greater than the state screening level. Two sediment/sludge samples were collected from the drain pipe connected to a floor drain located outside of the photography laboratory (just inside the front door of Building 615). Mercury was detected in both sediment/sludge samples. Dye tests indicated that the floor drain in the hallway of Building 615 was not connected to the discharge conduits protruding from the seawall. Subsequent investigation (Appendix N – Field Report May 2006) revealed that the floor drain pipe probably was never connected to a septic tank or sewer, but instead discharged into the subsurface soil just beyond the Building 615 footing wall.

The SRI Final Report (USACE, 2006) included a HHRA for the upland portion of the Site. Hazards and risks from exposure to surface and subsurface soil were conducted for two areas, the Fill Area (referred to as Area 1 in this report) and the Other Area (which represented the remainder of the upland portion of the Site). The groundwater at the FUDS was evaluated as one exposure unit. The HHRA indicated that soil in the Fill Area of the Site presented an unacceptable hazard under a residential reuse scenario due to lead. Therefore, it was recommended that any future residential reuse be restricted. The HHRA indicated that soil in the Other Area of the Site did not present an unacceptable risk under the multiple scenarios evaluated and can be considered for unrestricted residential reuse. The results of the groundwater future residential adult and child risk assessment indicated that groundwater may not be appropriate for use as a potable water source. Risks from inhalation of mercury in Building 615 were not quantified, because mercury was not detected at concentrations greater than the detection limit.

In May of 2006, EA Engineering Science and Technology and the USACE were at the Site to oversee an exploratory excavation to determine the discharge point of a floor drain where mercury had been disposed of in Building 615. The exploratory excavation was conducted within the parking area south of Building 615. A septic tank was encountered during the excavation activities; however, the discharge point of the floor drain could not be located. A total of three samples were collected during these field activities. SB-1 was collected from the base of the septic tank for volatile organic compounds (VOCs), SVOCs, pesticides, PCBs, target analyte list (TAL) metals, and cyanide. SB-2 was collected from an area of dark colored soil for toxicity characteristic leaching procedure (TCLP) analysis. SB-3, a composite sample, was collected from an excavated trench and analyzed for mercury. It was determined that further investigation was required to determine the discharge location of the floor drain pipe. On October 30 and 31, 2006, a second exploratory investigation was conducted to determine the discharge point of the floor drain and to conduct additional soil sampling activities. During this exploratory excavation, a total of nine samples (SB-04 through SB-12) were collected and analyzed for mercury. Two of these samples were also analyzed for one or more of the following: target compound list (TCL) VOCs, SVOCS, pesticides, PCBs, TAL metals, TCLP, and Resource Conservation and Recovery Act (RCRA) characteristics. Samples could not be collected between the first cess pool and the footing because there was less than 6 inches between the walls. Soil was also not collected to the west of the cess pools since the bricks walls of the cess pools abut the sea wall.

The results of these sampling activities identified a hot spot of mercury centered around SB-08 [6.5 mg/kg at 4.3 feet below ground surface (ft bgs)] and SB-09 (25 mg/kg at 4.4 ft bgs). On March 22, 2007, excavation activities were conducted to remove these two hot spots of mercury. The excavation extended laterally west to the three dry wells, east to the buried power line, and north to SB-07, and south to SB-02. Vertically, the excavation extended down to approximately 7 ft bgs. A figure depicting all three excavation activities in included in Appendix A, which contains the 2006 and 2007 Field Reports describing the excavation activities. During these excavation activities, sample locations SB-07, SB-08, and SB-09 were removed. These three samples are no longer considered representative of Site conditions and were not included in the nature and extent discussion, the HHRA, or the SLERA. Confirmatory composite soil samples were collected from the side walls and bottom of the excavation. One composite soil sample was collected from each sidewall of the excavation where soil was exposed. Samples were collected from the north (SB 18), east (SB 17), and south (SB 16) sidewalls of the excavation. The east wall sample (SB 17) was collected from soil beneath the approximately two-ft depth concrete electrical conduit that extends along the entire length of the east wall. No sample was collected from the west wall since this was the exposed surface of the three brick cesspools. Also, one composite soil sample was collected from the bottom of the excavation (SB 15). Four grab samples were collected from each sidewall/bottom to form each composite sample. Confirmatory soil samples were analyzed for mercury by USEPA Method 7471. The results of the post-excavation confirmatory samples detected mercury at concentrations ranging from 2 mg/kg on the north wall to 12.2 mg/kg along the east wall. Details of the Area 5 previous excavations are presented in Section 6.3.6.

In 2008, in support of the Draft FS (USACE, 2009) and the Building 615 Soils Investigation, USACE conducted a study to determine whether the PAHs and metals in the soil at the Site differ from selected background locations, and to establish baseline concentrations of metals and PAHs in the soil in the area surrounding the Site (Appendix B). The Site has a long history within a major metropolitan area, resulting in soils that contain old fill materials. The land underlying the Site was filled over the course of many years prior to military occupation to create land. Of primary interest for the background study are patterns of contamination that may be attributed to military disposal or releases and thus may be eligible for restoration, versus the presence of urban fill used over hundreds of years that may not be eligible or appropriate for restoration. PAHs and metals are released to the environment during incomplete combustion of organic material including wood, coal, petroleum, garbage, and also are associated with human activities such as cooking and heating. Industrial and vehicle fuel products containing crude oil, coal tar, creosote, and asphalt often contain PAHs, even prior to combustion. Materials containing PAHs and metals were used over time to fill the land surface in the course of developing the Site. In urban settings such as Fort Totten, deposition of airborne particulates from historic and current urban activity continues to this day, resulting in ubiquitous, consistent, and elevated levels of PAHs and metals.

The background study included soil samples collected from fifteen hand auger holes with soil samples taken at two depths (0 to 3 inches bgs and 18 to 24 inches bgs). All background samples were obtained from within a half mile radius, with all sampling points spaced at least 50 ft apart. The 15 sample locations yielded 15 shallow samples and 15 deep samples, plus 3 quality control (QC) and 3 quality assurance (QA) samples. Results from this sampling effort, and discussion of the investigation were presented in Appendix B. Figure 1-3 identifies the soil background sampling locations.

The background study derived threshold concentrations of PAH and metal in the soils near the Site to compare with soil samples from the Site. Table 1-1 presents the site-specific background values (95% Upper Threshold Limits or 95%UTLs) used as comparison criteria throughout this report. The 95% Upper Prediction Limits (UPL) were also calculated for each of the analytes detected in the background samples and compared to the 95% UTL. The 95% UPL did not alter the findings based on the 95% UTL.

Hypothesis tests of the Site and background samples were also conducted to help distinguish whether the central tendencies of concentrations in Site soils differ from the background. Results of hypothesis tests suggest that for most of the metals and PAHs there are different populations of target analyte concentrations in the shallow and deep soil on-site compared to those of the background locations, with higher concentrations typical on-site. Taken together, threshold values, hypothesis tests, and site observations were used to help determine if the Site has been contaminated by military disposal activities as opposed to regional conditions and generalized historic filling practices that employed contaminated materials.

In 2009 the USACE conducted an FS to evaluate remedial alternatives for the risk posed by impacts to soil in the upland portion of the Site. Previous investigations had shown that some metals and SVOCs were present in the soil at concentrations that exceed state screening criteria. The Draft FS report presented remedial alternatives to address the areas at the Site with metals and SVOCs concentrations above NYSDEC SCOs and background concentrations developed in the background study described above (USACE, 2009). The alternatives presented in the draft document were inconsistent with the results of the RI and the report has not been finalized. For example, the RI indicated the Site was acceptable for unrestricted use with the exception of the Fill Area which presented an unacceptable risk for a future resident, but the FS evaluated remedial alternatives that addressed the entire Site. USACE and NYSDEC agreed to re-evaluate the Site, address data gaps and update the HHRA for all areas in order to complete the RI Phase. A new FS will also be developed to address any areas that may warrant remedial action and/or land use restriction. The collection of the additional data that was completed in 2011-2012 is the subject of this report.

The *Contamination Evaluation Report at the U. S. Coast Guard Station (Former Engineering School), Fort Totten, Final Engineering Report*, dated March 28, 1988, identified subsurface anomalies at the ball field east of Area 4 (Figure 1-2). Based on the historic use of Fort Totten as a coastal defense battery, there was concern that the anomalies may be associated with ordnance. On December 12, 2012, an ordnance and explosives investigation team from the USACE (Baltimore District) excavated the areas where the anomalies were identified and discovered cultural debris that was not ordnance related (pipes, nails, wire, an antique roller skate, and reinforced concrete). The findings of the December 12, 2012 follow-up anomaly investigation (including photographs) are provided in the USACE Daily Quality Assurance Oversight Report dated 12 December 2012 (Appendix N). Based on these findings, no further actions are recommended for the ball field.

Separate from the environmental investigations conducted by USACE, soil samples were collected by the USCG from the ball fields in 1996. Fifteen samples were collected and analyzed for the USEPA Priority Pollutant List compounds (126 compounds). The samples were collected from five separate areas at three different depths within the ball fields. The NY Department of Health reviewed the data and determined no contaminants were detected in the soil at levels that would pose a health concern for users of the ball field (NYDOH, 1996) (Appendix N). Based on this information and findings from the SI, the ball field area of the Fort Totten USCG FUDS was not included in later investigations.

1.5 Cleanup Criteria

Although the Site is not a Federal National Priority List (NPL) site, the USACE must comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) when managing FUDS (USACE, 2009). Throughout this report, concentrations of parameters reported in soil samples are compared to the USEPA June 2011 Regional Screening Levels (RSLs) obtained at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm (USEPA, 2011a), as these values are risk-based concentrations used as screening tools in CERCLA HHRAs. Both “Residential” and “Industrial” RSLs have been used as points of reference in reviewing and evaluating the nature and extent of contamination in this report.

In addition to the RSLs, NYSDEC Subpart 375-6 Remedial Program SCOs (http://www.dec.ny.gov/regs/15507.html) (NYSDEC, 2011b), are used as preliminary screening levels for comparison against soil concentrations. Five categories of NYSDEC SCOs have been considered in the nature and extent evaluations: Unrestricted Use; Residential Use; Restricted Residential Use; Commercial Use; and Industrial Use. The Unrestricted Use SCOs are the most conservative of the SCOs. In additional to the SCOs and the RSLs, calculated site-specific background criteria are also utilized in evaluating nature and extent of contamination.

Table 1-1 presents a summary of the calculated site-specific background concentrations. Table 1-2 presents a summary of the SCOs and RSLs used as screening levels throughout this report.

In order to "initiate the identification of potential federal and state ARARs and, as appropriate, other criteria, advisories, or guidance to be considered" during the RI/FS, NYSDEC referred USACE to the Standards, Criteria and Guidance (SCG) documents available on the NYSDEC webpage at the following: http://www.dec.ny.gov/regulations/61794.html. A formal evaluation of applicable or relevant and appropriate requirements (ARARs) will be coordinated and developed with NYSDEC as part of the feasibility study.

2.0 PROJECT PURPOSE AND OBJECTIVES

The objectives of the SRI2 are to address the data gaps as discussed in the Final RI Work Plan (Watermark, 2011) and Work Plan Addendum (Watermark, 2012), and to collect additional data in support of an updated HHRA/SLERA. The SRI2 work was conducted to further delineate and characterize environmental conditions at the Site in order to evaluate the need for remediation and to support evaluation of any remedial alternatives that may be required.

2.1 Project Approach and Rationale

In the SRI2, the Site was divided into five investigation areas based on current and former building locations and Site uses. Of the five investigation areas, four of the areas were further investigated in the SRI2. Those areas are defined below.

- Area 1 Fill Area;
- Area 2 Former Building 624;
- Area 3 Buildings 610 to 612;
- Area 4 Building 625 and former Building 609; and
- Area 5 Building 615.

The project sampling and analysis approach for each of these four areas is discussed below. A detailed summary of the work performed as part of the SRI2 is presented in Section 4.0. A figure depicting the entire Site, including all five investigation areas with the soil and monitoring well sampling locations, is presented in Figure 2-1.

2.2 Area 1 Fill Area

Area 1 is located in the northeast corner of the Site. Area 1 was created when the Army placed soil excavated from elsewhere at Fort Totten in a low spot of a recreation field to eliminate periods of standing water. The soil came from Buildings 118, 119, and 121, which were former and existing vehicle maintenance shops on the Army-owned portion of Fort Totten. The excavated soil included a portion of those buildings' parking lots (USACE, 2005). Additionally, upon site visits in 2010 and 2011 it is apparent that the site has been used as a dumping area for yard waste and debris from the facility.

A total of 24 soil samples have been collected from Area 1 during past site investigations (Phase I, Phase II, and SRI) and submitted for laboratory analysis of metals, SVOCs, and VOCs. This area was not investigated further as part of the SRI2, as the USACE and NYSDEC agreed that it had already been sufficiently characterized. The data collected during previous investigations were used during the SRI2 to conduct a HHRA and a SLERA specific to Area 1.

2.3 Area 2 Former Building 624

Previous investigation at Area 2 resulted in two areas of mercury detections in soil samples above NYSDEC Restricted Residential SCOs, and two areas of elevated PAHs concentrations above NYSDEC's Industrial SCOs. During the 2011 SRI2, soil samples were collected in Area 2 to confirm the previous detections of PAHs, delineate the vertical and horizontal extent of the PAH impacts, and delineate the horizontal extent of the mercury impacts. Additionally, soil samples were collected to evaluate background concentrations of metals and PAHs in soils in Area 2 to evaluate if the metals and PAHs are consistent with atmospheric deposition background in this area.

2.4 Area 3 Buildings 610 to 612

Previous investigation at Area 3 resulted in one isolated copper concentration above the NYSDEC Commercial SCO at 1-2 ft bgs in boring B-1. The vertical and horizontal extent of the copper impact at this location had not previously been delineated. During the 2011 SRI2, soil borings were advanced in this area to delineate the extent of copper impacts. Additionally, mercury at concentrations above NYSDEC's Restricted Residential

SCO was reported in this area. Samples were collected in 2011 and 2012 to delineate the extent of the mercury impacts.

One historical surface soil sample, SS-39, had PAH concentrations above NYSDEC's Restricted Residential SCO; therefore, additional soil sampling was conducted to delineate PAHs in the surrounding area.

2.5 Area 4 Building 625 and Former Building 609

Area 4 had historically produced consistent PAH soil concentrations above NYSDEC Industrial SCOs. Since PAHs can be both naturally occurring and anthropogenic in nature, additional sampling was conducted in Area 4 during the 2011 SRI2 to determine if the concentrations of PAHs were related to a release or historic non-point sources. While no specific source was identified, there are concentrations of several PAHs that are higher than concentrations in the background areas and Areas 1, 2, 3, and 5. Observation holes were hand-dug in November 2012 to determine the presence and nature of fill materials. The holes were dug at locations where soil samples with elevated PAH concentrations were previously collected. Each hole measured approximately 10-12 inches wide and approximately 12 inches deep.

2.6 Area 5 Building 615

Investigation of Area 5 was focused on the area of mercury impacted soil south of Building 615. During the 2011 SRI2, soil borings were extended to a depth of 4 ft bgs in and around the previously investigated area to evaluate the horizontal and vertical extent of the mercury impacts. Soil borings were also advanced in the roadway east of Building 615, and east of Building 614 (which lies south of Building 615) to determine if there were any additional areas of mercury release.

2.7 Site-Wide Groundwater Sampling

Two previous rounds of groundwater sampling from the five existing monitoring wells at the Site were conducted in July 2000 and April 2002 prior to the SRI2. As part of the 2011 SRI2, another site-wide groundwater monitoring round was conducted to determine current groundwater conditions and to support the HHRA. Two monitoring wells (MW-4R and MW-5) were sampled in November 2012 to verify the May 2011 results. The 2012 samples were collected as both field-filtered and unfiltered, to determine if the elevated PAHs previously detected were associated with suspended sediment in the samples.

3.0 CONCEPTUAL SITE MODEL (CSM)

This section discusses the CSM that is based on an evaluation of the environmental and physical setting of the Site, institutional knowledge of the Site contamination sources, fate and transport processes, and an assessment of potential contaminant exposure pathways and human and ecological receptors.

The Site consists of 7.8 acres located on the Fort Totten Coast Guard Station, which occupies the Willets Point peninsula in the major urban area of Queens Borough, New York City (Figure 1-1). Fort Totten was used for the coastal defense of Long Island Sound and the eastern entrance to the East River. Fort Totten also served as a post-Civil War Hospital, an engineering school, and a training site for West Point Cadets. Currently, a portion of the Site is used as the Headquarters for the 77th Army Reserve Command. The Coast Guard also retains jurisdiction over the 7.8 acres being investigated in this report. There are seven existing and two former buildings at the Site, as well as maintained fields, parking areas, and some undeveloped areas. The Site topography in the east is large flat open areas, with wooded areas to the north. The western portion of the Site has steep wooded slopes, with open areas for buildings. The Site is bordered by Fort Totten property to the north, east, and west (Figure 1-2) and is adjacent to Little Bay located to the west (Figure 1-2).

Overburden conditions at the Site consist of man-made fill underlain by silt, silty sand, and interbedded clay layers. Soil borings from the 2011 sampling activities noted the presence of foreign materials (i.e., other than soil) in surface soil samples including wood, coal, slag, metal, ceramic, glass, brick, and possibly ash. The unconsolidated deposits range in thickness from 12 to 33 ft and consist of fine-grained brown sand and silt with occasional pebbles and cobbles. Soils consist predominately of silty sand interlayered with minor amounts of poorly graded sand, fine-grained well-sorted sand, and organic silt (USACE, 2005). Bedrock beneath the project site is described as a complexly folded and faulted unit of gneiss and schist lying approximately 250 ft below sea level (USACE, 2009).

Depth to groundwater ranges from approximately 6 to 17 ft bgs as measured in five monitoring wells (MW-1 to MW-5) at the Site. These monitoring wells were installed by Metcalf & Eddy in 1988 as part of the first Site Investigation and their locations are presented on Figure 2-1. At some point in time, the MW-4 well was abandoned and replaced by MW-4R, located adjacent to the MW-4 boring (the exact date of, and reason for abandonment, is unknown). MW-4R was gauged and sampled as part of the SRI2. Groundwater flow at the Site is generally to the west towards Little Bay and groundwater discharge occurs along the shoreline of the peninsula into Long Island Sound (USACE, 2005).

Contaminants consist of PAHs and metals found in surface and subsurface soils, with the highest concentrations in the 0 to 2-inch depth interval. Elevated PAHs (with respect to background) have been detected in Areas 1 through 4 at the Site. The highest concentrations were detected in Area 4 just west of Former Building 609. Metals (including mercury) have been detected in all five Areas. Elevated lead concentrations were consistently detected in the southern portion of Area 1. Elevated mercury concentrations were consistently detected in Area 5 south of Building 615. Elevated concentrations of other metals are sporadically distributed across the Areas.

The source of elevated metals and PAHs at Area 1 is fill. Area 1 was previously known as the Fill Area and was created when the Army placed soil excavated from elsewhere at Fort Totten in a low spot of a recreation field to eliminate periods of standing water. The soil came from Buildings 118, 119, and 121, which were former and existing vehicle maintenance shops, on the Army-owned portion of Fort Totten. The excavated soil included a portion of those buildings' parking lots (USACE, 2005).

The source of mercury in soil at Area 5 is subsurface disposal (through a floor drain) of waste containing mercury. This mercury-containing-waste was disposed in association with armaments repair which was one of the historical DoD operations at Building 615.

Other than the fill in Area 1 and mercury in Area 5, there are no known specific sources for the PAH and metals concentrations at the Site. Due to the long history of development and use at the Site, and its proximity to highly developed urban areas and major transportation hubs, it is very likely that the PAHs and metals concentrations can be attributed to urban fill (i.e., coal residue, cinder ash, brick fragments, and pavement materials). Historically, urban fill was often placed along shorelines to create more land suitable for development and many of the samples collected at the Site contained man-made materials and coal fragments. It is also likely that atmospheric deposition of PAHs and metals has occurred as a result of the proximity of the Site to heavily urbanized and industrialized areas. Elevated concentrations of metals at specific sample locations are likely due to the heterogeneity of the urban fill material rather than a specific release.

There were low concentrations of PAHs and metals detected in the May 2011 groundwater samples collected at the Site. The November 2012 samples from MW-4R and MW-5 did not confirm the previous detections (only two PAHs were detected and these only occurred at low concentrations in the unfiltered sample from MW-5).

Current receptors to exposure to soil include trespassers/recreational receptors and outdoor commercial or industrial workers (adults). Hypothetical future receptors include outdoor commercial or industrial workers, indoor commercial or industrial workers, construction workers, recreational receptors, and residents. These receptors have the potential to be exposed to surface soil via incidental ingestion and dermal contact. Outdoor workers and construction workers have the potential to be exposed via inhalation of soil-derived dust as well.

Groundwater is not used for any potable or non-potable purposes and is not anticipated to be in the future, due to the potential for saltwater intrusion from Little Bay. Excessive drawdown during monitoring well sampling in 2011 and 2012 also indicates that groundwater would not likely be used as a potable or irrigation source due to low yield. Therefore ingestion and dermal contact associated with use of groundwater are not potential exposure routes at the Site. The depth to groundwater on Site ranges from 6 to 17 ft bgs and there is the potential for a construction worker to come in contact with groundwater during excavation activities. Therefore, dermal contact with Site groundwater is the only potential groundwater exposure pathway.

Existing wildlife habitat is minimal. Wildlife use of the Site is likely transitory and limited to species commonly associated with developed areas moving between nearby wetlands and urban residential areas. Wildlife likely to inhabit the site include raccoons (Procylon lotor), opossum (Didelphis virginiana), mice and eastern cottontail (Sylvilagus floridanus), american robin (Turdus *migratorius*), common grackle (*Quisculus quiscula*), black-capped chickadee (*Parus atricapillus*), and tree swallow (*Ifidoprocne bicolor*). No reptiles have been observed at the Site during the various historical field activities, though they also may potentially use the Site for foraging, cover, and breeding purposes. Reptile species that may be present include the eastern garter snake (*Thamnophis s. sirtalis*), eastern milk snake (*Lampropeltist triangulum*), and eastern smooth green snake (*Opheodrys v. vernalis*) (USACE, 2009).

4.0 COMPLETION OF FIELD INVESTIGATIONS

This section presents a summary of activities completed as part of the planning and implementation of the SRI2 program at the Site.

4.1 Site Investigation Project Planning

Planning efforts associated with the SRI2 program were initiated shortly after contract award and included a number of conferences and teleconferences to discuss the program objectives and the preparation of the project work documents including the Accident Prevention Plan (APP), RI Work Plan, Quality Assurance Project Plan (QAPP), and Work Plan Addendum.

The APP summarized the safety considerations necessary to complete the SRI2 activities in a safe and efficient manner and was provided as an appendix to the RI Work Plan. The QAPP, prepared in accordance with the guidelines established in the Uniform Federal Policy-Quality Assurance Project Plans (UFP-QAPP), was provided as an appendix to the RI Work Plan and outlined the Data Quality Objectives (DQO's) for the SRI2 program at the Site.

Comments on the Draft RI Work Plan were received from NYSDEC on April 21, 2011. These comments were incorporated into the Final RI Work Plan (Watermark, 2011). A copy of the Final RI Work Plan (in hard and electronic copy formats) was submitted to the reference librarian at the Bay Terrace Library in Queens, NY on October 30, 2011. This effort was completed as part of establishment of the administrative record repository for this project in accordance with the CERCLA guidance provisions for administrative records. The administrative record repository will be updated accordingly with project related information as work progresses.

An initial site reconnaissance was conducted during the project planning phase to identify any site-specific conditions and other factors to be taken into account when planning the field activities. No site work associated with field investigations was initiated until safety briefings were held and documented as facilitated by Watermark field personnel.

Based on results of the 2011 field work and analytical data, additional soil sampling, groundwater sampling,, and hand-digging of observation holes was detailed in the Work Plan Addendum (Watermark, 2012) and executed in November 2012.

4.2 Groundwater Monitoring Well Redevelopment

Prior to collecting any groundwater samples, the five existing on-site monitoring wells (Figure 4-1) were redeveloped to remove any accumulated sediments and remove any impurities from the sand pack surrounding the well screen. Monitoring well redevelopment efforts were completed on May 4, 2011 and were conducted as listed below.

- Wells were gauged for depth to water, depth to bottom, and depth to any possible non-aqueous phase liquid (NAPL) present prior to redevelopment of the well. The May 4, 2011 well gauging form is presented in Appendix C;
- Wells were redeveloped using a submersible (whale) pump;
- Wells were redeveloped using the purge and surge method to optimize the amount of silt removed from each well;
- A minimum of three well volumes was removed from each of the wells or until the purge water was visually clear;
- Development water was contained in 55-gallon department of transportation (DOT) drums for subsequent characterization, removal, and off-site disposal as investigation-derived waste (IDW); and,
- A minimum of 72 hours was allowed to pass between redevelopment of the well and collection of groundwater samples.

No NAPL was encountered during groundwater monitoring well redevelopment activities. MW-1, MW-3, and MW-4R went dry before three well volumes were purged. These wells were allowed to recharge before purging activities resumed. Well development logs from field efforts are presented in Appendix C.

4.3 Groundwater Sampling

A groundwater sampling round was conducted on May 9, 2011 using the five existing on-site monitoring wells. Additional groundwater samples were collected from monitoring wells MW-4R and MW-5 on November 28, 2012. The sampling activities are summarized below.

- A synchronous round of groundwater gauging was conducted in all five monitoring wells on May 9, 2011. Wells were gauged for the presence of light non-aqueous phase liquids/dense non-aqueous phase liquids (LNAPL/DNAPL) and to measure water elevation using an oil-water interface probe (a copy of the May 9, 2011groundwater gauging form is presented in Appendix C);
- Groundwater purging and sampling was conducted using a peristaltic pump with disposable polyethylene tubing which was replaced between each well;
- Each groundwater monitoring well was purged in accordance with USEPA Low-Flow groundwater sampling protocol;
- The following parameters were monitored while the well was being purged using a multi-meter water quality meter equipped with a flow through cell: temperature, pH, oxidation reduction potential, conductivity, dissolved oxygen, and flow rate;
- A turbidity sample was collected via a wye bypass valve prior to inflow into the flow-thru cell; and
- Draw-down within the well was monitored continuously while pumping and kept to a minimum. Due to the need for a minimum pumping speed to maintain suction, and slow recharge in some of the wells, drawdown exceeded the target of 0.3 ft in MW-1, MW-3, and MW-4R on May 9, 2011. Overall, draw-down ranged from 0.12 ft at MW-5 to 6.49 ft at MW-1 throughout the purging and sampling process on May 9, 2011. During sampling of MW-4R on November 28, 2012, roots were retrieved from the well on the water level meter. During pumping at MW-4R, despite minimum pumping speed, the drawdown exceeded the target of 0.3 ft and the water level fell below the pump intake. The well was purged to the pump intake three times and allowed to partially recover between each pumping event. Three well volumes were removed from the well before the groundwater sample was recovered. During sampling of MW-5 on November 28, 2012, the draw-down was 0.18 ft throughout the purging and sampling.

Once the groundwater quality parameters stabilized, the tubing was disconnected from the flow-through cell, and the groundwater sample was collected by Watermark field personnel directly from the disposable tubing to prevent cross-contamination between wells. Groundwater samples were placed directly into laboratory provided containers, logged into the chain-of-custody (COC), placed on ice for preservation, and picked up by a courier for delivery to the laboratory for analysis and reporting.

The groundwater samples collected in May 2011 were analyzed for VOCs by Methods 5030B/8260B, PAHs by Methods 3510C/8270D, metals by Methods 3010A/6010C, and mercury by Methods 7470A. One laboratory trip blank accompanied the groundwater samples and was analyzed for VOCs and PAHs. In addition, one duplicate sample was collected to evaluate laboratory and sampling precision.

The groundwater samples collected in November 2012 were analyzed for PAHs by Methods 3510C/8270D. Two samples were collected from each well sampled in November 2012 (MW-4R and MW-5). One sample from each well was field filtered with a 0.45 micron filter. In addition, one duplicate sample was collected from MW-5 to evaluate laboratory and sampling precision and one matrix spike/matrix spike duplicate sample was collected.

In May 2011, purge water was returned to the subsurface via the well it was extracted from after sampling at the well was completed. No sheen was noted on the purge water; therefore it was not necessary for it to be drummed for off-site disposal. Purge water collected in November 2012 was drummed and transported off-site for appropriate disposal. The 2012 purge water was handled in a different manner than the 2011 purge water to avoid any public perception concerns with discharging the water to the ground surface. The 2012 purge water did not have any off-odors or sheen that would have triggered a requirement to containerize.

Groundwater gauging and low-flow sampling sheets generated during groundwater sampling efforts are provided in Appendix C. Laboratory results from the groundwater sampling program at the Site are discussed in Section 5.6.

4.4 Monitoring Well Survey

On May 9, 2011, NY Land Surveyor, PLLC of Fresh Meadows, NY performed a survey of the five existing on-site monitoring wells (MW-1, MW-2, MW-3, MW-4R, and MW-5). The survey included vertical measurements of the ground surface and the top of the well casing relative to the US National Spatial Reference System of 2007, as well as horizontal coordinates for each well's location using the New York State Plane Coordinate System. The survey included the horizontal locations of buildings in proximity of the monitoring wells. The survey was conducted in accordance with the USACE Engineering Manual 1110-1-1005. A figure depicting the monitoring well locations is included as Figure 4-1.

4.5 Underground Utility Identification and Locating

On May 3, 2011, Watermark marked out each of the proposed soil sampling and drilling locations using spray paint and pin flags. DigNet of New York and Long Island was notified of proposed soil sampling and drilling activities on May 3, 2011 and DigNet Ticket Number 111231436 was assigned.

On May 4, 2011, Underground Surveying, LLC of Danbury, CT performed a non-destructive, non-invasive utility locating survey of the areas of proposed drilling (Area 3 and Area 5). The survey was performed by two geophysical survey technicians using cable and pipe locating equipment and ground penetrating radar (GPR). Electric, sewer, and drainage were located and marked with spray paint. The absence of gas and communication lines within the drilling area was verified.

On November 20, 2012, DigNet of New York and Long Island was notified of proposed digging activities planned for Areas 3 and 4 and DigNet Ticket Numbers 123251140 and 123251219 were assigned.

4.6 Soil Sampling

The first soil sampling program at the Site commenced on May 9, 2011 and was completed on May 13, 2011 by a two person field team from Watermark. A total of 123 (111 primary and 12 duplicate) soil samples were collected from the four Areas of Interest: Area 2, Area 3, Area 4, and Area 5. Details of the soil sampling conducted in each area are explained below. All soil sampling was conducted in accordance with the Site-Specific QAPP and the Final RI Work Plan (Watermark, 2011).

Many of the soil samples were to be collected at locations in close proximity to soil sample locations from previous investigations. Survey data of the horizontal locations for these past samples were unavailable; therefore, the new soil borings were located as accurately as possible using Site landmarks and figures from past reports. Locations of previous borings, as reported in previous reports, are repeated on the figures in this report.

The second soil sampling program at the Site occurred on November 28, 2012 by a two person field team from Watermark. A grid with nodes at 10 ft intervals was centered around previous sampling location SS-38. Samples were collected at depths ranging from two inches below ground surface (bgs) to a maximum of 14 inches bgs. Sample depth and number of samples at each location varied depending on the thickness of the root zone. Mercury, like many metals, is known to accumulate within root zones as a result of bio uptake; therefore an objective of the sampling was to collect one sample directly below the root zone, one deeper sample from approximately 6-12 inches bgs (or slightly deeper if the sample below the root zone was collected deeper than 6 inches bgs), and depending on the thickness of the root zone, a sample from within the root zone to ensure that the near-surface soil interval was also represented. A total of 54 (51 primary and 3 duplicate) soil samples were collected from Area 3.

Field screening data generated from soil sampling efforts are provided on the boring logs provided in Appendix C. Laboratory results from the soil sampling program at the Site are discussed in Sections 5.2 through 5.5.

4.6.1 Soil Sampling Objectives

Each soil sample from the first sampling program (May 2011) was intended to fulfill one or more of the objectives listed below.

- Generally characterize the extent of contamination, as is customary for remedial investigations;
- Determine general concentrations of contaminants in each area in order to support risk assessment exposure scenarios for the human health and ecological risk assessment;
- Determine the concentration of contaminants at locations where elevated concentrations were detected in past investigations, but at depth intervals that are appropriate for risk assessment, i.e., 0 to 2 inches for surface soils and 6 to 24 inches for subsurface soils; and
- Determine the approximate extent of elevated contaminant concentrations at previously identified locations.

The specific objectives for each sample location were presented in the Final RI Work Plan (Watermark, 2011).

The objective of the second soil sampling program (November 2012) in Area 3 was to confirm the presence and determine the extent of historic elevated detections of mercury around SS-38 (Watermark, 2012).

4.6.1.1 Laboratory Analyses and Mercury Speciation Sampling and Analysis

As discussed in the Final RI Work Plan (Watermark, 2011), mercury speciation soil sampling was conducted in May 2011 in order to better evaluate the nature of mercury at the Site and to support a more precise Risk Characterization of Site-related mercury. For the mercury speciation effort, a total of 30 soil samples were collected from two depth intervals at various locations throughout the four Areas of Interest, and submitted to Frontier Global Sciences, Inc. (Frontier) laboratory for the elemental, total, and methyl mercury analysis. These 30 (28 primary and 2 duplicates) samples were analyzed to represent locations previously identified with elevated concentrations of mercury.

During the second soil sampling program (November 2012), a total of 54 (51 primary and 3 duplicate) soil samples were collected from Area 3 and analyzed for mercury via USEPA Method 7471A by Test America. Based on the results of the 2011 mercury speciation (summarized in Section 10.1), additional mercury speciation was not required for the 2012 samples.

Previous Site investigations have determined that current contaminants of potential concern at the Site are primarily PAHs and metals. The Sampling and Analysis Plan included in the Final RI Work Plan (Watermark, 2011) was developed to fill specific data gaps identified as necessary to delineate the vertical and horizontal extent of PAH and metal impacts within the specified Areas of Concern. During the first soil sampling program (May 2011), and in accordance with the Final RI Work Plan (Watermark, 2011), a total of 91 (81 primary and 10 duplicate) soil samples were collected for TAL metals analyzed via Method 3050B/6010C by Test America Laboratories Inc., of Pittsburg, PA (Test America) from various locations throughout Area 2, Area 3, and Area 5. A total of 84 (78 primary and 6 duplicate) soil samples were collected for PAHs analyzed via USEPA Method 3540C/8270D by Test America from various locations throughout Area 2, Area 3, and Area 4.

4.6.2 Soil Sampling Procedure

Soil sampling for the first soil sampling program (May 2011) was conducted in accordance with the Soil Sampling and Analysis Plan of the Final RI Work Plan (Watermark, 2011). Sampling activities are summarized below.

- Two soil samples were collected at each of the sample locations; one from 0 to 2-inches bgs, and one from 6 to 24 inches bgs. A third, deeper, sample was collected from select locations;
- Soil samples were screened with a photoionization detector (PID) using the jar headspace method according to the standard operating procedure (SOP) for the jar headspace screening method included in the SS-QAPP (Watermark, 2011);
- Soil samples were visually characterized and boring logs for the direct-push borings were completed;

- Soil from each sample interval was placed in a stainless-steel bowl and blended prior to collecting a sub-sample for the laboratory. All non-disposable sampling equipment was decontaminated prior to initial use, and in between each sample location in accordance with the SOP included in the SS-QAPP (Watermark, 2011);
- Each sample was immediately placed into a laboratory-supplied container for analysis, logged into the COC, placed on ice for preservation, and picked up by a courier for delivery to the laboratory for analysis and reporting;
- Excess soil was placed back in the auger hole in the interval from which it was generated;
- The ground surface was restored to a manner in which the borehole does not pose a trip hazard; and
- The coordinates of each sample location were recorded using a handheld global position system (GPS) device, with accuracy requirements of 1 foot or less. The coordinates were recorded in the New York State Plane Coordinate System.

A total of 72 of the soil samples were collected with a hand auger. At each of these soil sampling locations, the Watermark Field Scientist advanced a pre-cleaned stainless steel hand auger to the terminal depth of 24 inches bgs.

A track-mounted direct push Geoprobe drill rig operated by Tri-State Drilling Technologies, Inc. of Garden City, NY was used to collect the remaining 39 samples from 13 locations (the locations requiring samples from below 24 inches). Samples were collected from the sampling locations using four-foot polyvinyl chloride (PVC) liners in discrete intervals. Boring logs for the Geoprobe borings completed during the 2011 SRI2 field activities are presented in Appendix C.

Soil sampling for the second soil sampling program (November 2012) was conducted in a similar manner as the first sampling program with the following exceptions.

- The depth of the soil samples was modified based on observations of the depth of the root zone at each sample location. The number of samples collected at each location also varied dependent on the thickness of the root zone. Sample rationale is described above under Section 4.0.
- Because the soil samples were not collected for VOC analysis, they were not screened with a PID using the jar headspace method.
- The samples were collected and blended in disposable sampling equipment; therefore decontamination of equipment was not necessary.

4.6.3 Quality Control/Quality Assurance Sampling

The QA samples listed below were collected to evaluate laboratory accuracy, as well as to evaluate field techniques.

- One duplicate sample was collected for each 20 samples collected in any given media (soil or groundwater);
- One matrix spike/matrix spike duplicate (MS/MSD) sample was collected for each 20 soil samples collected for metals analysis; and
- One equipment rinsate sample was collected in each area from a non-disposable piece of sampling equipment after it had been properly decontaminated.

The duplicate samples and MS/MSD samples were collected by placing the samples into additional laboratory-supplied containers for analysis, logging them into the COC, and keeping them on ice for preservation until they were picked up by a courier for delivery to the laboratory for analysis and reporting.

Equipment rinsate samples were collected by rinsing properly decontaminated non-disposable sampling equipment with laboratory-grade deionized water and collecting the rinse water in laboratory-supplied containers for analysis, logging them into the COC, and keeping them on ice for preservation until they were picked up by a courier for delivery to the laboratory for analysis and reporting.

4.6.4 Work Plan Deviations

- In a deviation from the Final RI Work Plan (Watermark, 2011), a track-mounted direct push Geoprobe drill rig was utilized instead of a hollow-stem auger to collect the remaining 39 samples from 13 locations. This occurred as a result of an unanticipated change in the field schedule and the unavailability of the auger rig to support the revised schedule. The Geoprobe also allowed for greater on-site mobility and minimized disruption to current New York Police Department (NYPD) activities at the Site. Samples were collected from the 13 sampling locations using four-foot PVC liners in discrete intervals. The quality of the Geoprobe samples was equal to or better than samples typically collected from a hollow-stem auger drill rig because of the precision sampling capability and good sample recovery.
- In a second deviation from the Final RI Work Plan (Watermark, 2011), for two samples, AI5-106 and AI5-101, a 0 to 6-inch interval was sampled instead of the Work Plan directed 0 to 2-inch interval. This deviation was necessary when enough sample volume could not be collected or accessed due to a void of soil immediately beneath the concrete at these sample locations.
- The work plan specified that one equipment rinsate blank would be collected per sampling day. Instead, one equipment rinsate blank was collected per sampling area. This deviation was primarily the result of human error, but it did ensure that total field sources of potential contamination were evaluated on an Area by Area basis.
- The work plan specified that samples from eight locations in Area 4 would be held for PAH analysis pending the results from other Area 4 samples analyzed for PAHs. As a result of human error, all of the Area 4 samples were analyzed for PAHs, except for the two depth intervals at location AI4-101that were inadvertently analyzed for metals. This deviation resulted in a significantly higher number of analyses than were planned.
- In a deviation from the Work Plan Addendum (Watermark, 2012), the soil sampling plan was modified in the field based on input received from the USACE on November 28, 2012. The sampling plan was modified to distinguish between mercury concentrations resulting from previous site activities versus mercury present through atmospheric deposition and the attraction and retention of mercury within the root zone of plants. Rather than collect samples at 0 to 6 inches and 6 to 12 inches at every location, sample depths were based on the thickness of the root zone, which varied significantly from one location to the next. The rationale for sample depths and number of sample at each location is described under Section 4.0. In general, samples were collected immediately below the root zone, in the 6 to 12 inch interval, and depending on the thickness of the root zone, from somewhere within the root zone.

Soil samples were collected using disposable sampling equipment; therefore an equipment rinsate blank was not collected. The above deviations did not result in data gaps. The data obtained during this RI, when combined with historical sample results, is considered adequate to characterize the nature and extent of site contamination and to calculate risk to human health and ecological receptors.

4.6.5 Area 2 Soil Sampling

A total of 27 (24 primary and 3 duplicate) soil samples were collected from a total of 12 locations in Area 2 (AI2-101 through AI2-112) as shown on Figure 4-2. Two soil samples were collected at each of the sample locations; one from 0 to 2 inches bgs, and one from 6 to 24 inches bgs. Each sample was analyzed for metals and PAHs. Soil samples were also collected at four locations (AI2-107, AI2-109, AI2-111, and AI2-112) for mercury speciation analysis. Area 2 soil sampling was conducted on May 12 and 13, 2011.

Several quality assurance/quality control (QA/QC) samples, listed below, were collected from this area.

- Two duplicate samples (Dup-AI2-1 and Dup-AI2-2) collected in order to evaluate analytical precision;
- One sample (MS/MSD-AI2) collected to evaluate the accuracy of the soil matrix; and
- One equipment rinsate blank (ER-AI2).

Dup-AI2-1 and Dup-AI2-2 are duplicates of AI2-108 (0-2 inches) and AI2-108 (6-24 inches) respectively. MS/MSD-AI2 represents AI2-110 (0-2 inches).

The location of previous sample SS-29 was resampled (AI2-106) to confirm the previous detection of PAHs and to delineate the vertical extent of the impact. The samples were collected in depth increments that are more compatible for risk assessment. The field staff closely examined the intended sample location to avoid sampling in a localized depression that may have been a past borehole. The field staff also examined the material in the sample that may be indicative of sampling in a previous boring. It is believed that efforts to avoid the previous location were successful. Figure 4-2 presents the 2011 soil sampling locations in Area 2.

4.6.6 Area 3 Soil Sampling

As part of the first sampling program (May 2011), a total of 30 (27 primary and 3 duplicate) soil samples were collected from a total of 12 locations in Area 3 as shown on Figure 4-3. Shallow soil samples were collected with a hand auger from nine of the sample locations (AI3-101 through AI3-105, AI3-108, AI3-109, AI3-11, and AI3-112), while deeper samples were collected with a Geoprobe at three of locations (AI3-106, AI3-107, and AI3-110). At each of the 12 locations, soil samples were collected from the 0 to 2-inch bgs interval and the 6 to 24-inch bgs interval for analysis of TAL Metals and PAHs by USEPA Method 3540C/8270D. Soil samples were also collected at four locations (AI3-104, AI3-105, AI3-111, and AI3-112) for mercury speciation analysis. At the deep locations, AI3-106, AI3-107, and AI3-110, an additional sample was collected from a 2 to 4-ft bgs interval for analysis of TAL Metals only. Area 3 soil sampling was conducted on May 10 and 11, 2011.

Several QA/QC samples were collected from this area. They included:

- Two duplicate samples collected in order to evaluate analytical precision;
- One MS/MSD sample collected to evaluate the accuracy of the soil matrix; and
- One equipment rinsate blank.

Dup-AI3-1 and Dup-AI3-2 are duplicates of AI3-108 (0-2 inches) and AI3-108 (6-24 inches) respectively. MS/MSD-AI3 represents AI3-111 (6-24 inches). Figure 4-3 presents the 2011 soil sampling locations in Area 3.

As part of the second sampling program (November 2012), a total of 54 (51 primary and 3 duplicate) soil samples were collected from a total of 19 locations as shown on Figure 4-4. The holes were created with a shovel and disposable sampling equipment was used to collect each sample. All of the samples were analyzed for mercury via USEPA Method 7471A. The depth of each sample was based on observations at each location.

Several QA/QC samples were collected from this area. They included:

- Three duplicate samples collected in order to evaluate analytical precision; and
- Three MS/MSD sample collected to evaluate the accuracy of the soil matrix.

AI3-FD-01, AI3-FD-02, and AI3-FD-03 are duplicates of AI3-213(2-3”), AI3-208(2-4”), and AI3-207(6-4”) respectively. MS/MSD was performed on samples AI3-213(2-3”), AI3-208(6-11”), and AI3-207(6-12”). Figure 4-4 presents the 2012 soil sampling locations in Area 3.

4.6.7 Area 4 Soil Sampling

A total of 32 (30 primary and 2 duplicate) soil samples were collected from a total of 15 locations in Area 4 as shown on Figure 4-5. Two soil samples were collected at each of the sample locations; one from 0 to 2 inches bgs, and one from 6 to 24 inches bgs. All of the samples in Area 4 were collected using a hand auger and were collected for analysis of PAHs. Soil samples were also collected at four locations (AI4-105, AI4-106, AI4-112, and AI4-115) for mercury speciation analysis. Area 4 soil sampling was conducted on May 9, 11, and 12, 2011.

Several QA/QC samples were collected from this area. They included:

- One duplicate sample collected in order to evaluate analytical precision; and
- One equipment rinsate blank.

Dup-AI4-1 is a duplicate of AI4-115 (0-2 inches). Figure 4-5 presents the 2011 soil sampling locations in Area 4.

4.6.8 Area 5 Soil Sampling

A total of 34 (30 primary and 4 duplicate) soil samples were collected from a total of 10 locations in Area 5 as shown on Figure 4-6. At each of the 10 locations, soil samples were collected from three depth intervals: 0 to 2-inches bgs, 6 to 24-inches bgs, and 2 to 6-ft bgs. Samples were collected with a Geoprobe for analysis of metals. Four samples from two depth intervals (0 to 2-inches bgs and 6 to 24-inches bgs) at two locations (AI5-105 and AI5-106) were also collected for mercury speciation analysis. Area 5 soil sampling was conducted on May 10 and 11, 2011.

Several QA/QC samples were collected from this area. They included:

- Two duplicate samples collected in order to evaluate analytical precision;
- Two MS/MSD samples collected to evaluate the accuracy of the soil matrix; and
- One equipment rinsate blank.

Dup-AI5-1 and Dup-AI5-2 are duplicates of AI5-105 (0-2 inches) and AI5-105 (6-24 inches) respectively. MS/MSD-AI5-1 and MS/MSD-AI5-3 represent AI5-108 (0-2 inches) and AI5-108 (6-24 inches) respectively. Figure 4-6 presents the 2011 soil sampling locations in Area 5.

4.7 Observation Holes

On November 29, 2012, nine observation holes were dug in Area 4, in accordance with the Work Plan Addendum (Watermark, 2012), to determine if previous detections of PAHs in soil samples may be attributable to coal, coal ash, asphalt, fill material, parking, or other sources unrelated to a release. The observation holes were located at previous sampling locations identified as having elevated concentrations of PAHs or evidence of fill material. Each former sample location was reacquired using a hand-held GPS device. In three areas where previous sampling locations were in close proximity to each other, one observation hole was dug amongst the previous sampling locations. A shovel was used to excavate the shallow holes to allow for visual inspection and characterization. Each hole was dug to approximately 12 inches bgs. Photographs were taken of material from each hole (Appendix O). The ground surface was restored in a manner that the holes did not pose a trip hazard.

4.8 Site-wide Survey

On May 13, 2011, after the soil sampling activities were completed, Watermark recorded the coordinates of each sample location using a handheld GPS, with accuracy requirements of 1 foot or less. The coordinates were recorded in the New York State Plane Coordinate System. These coordinates were used to produce a geo-referenced photographic image of the site.

On November 29, 2012, after the second soil sampling program was completed in Area 3, Watermark recorded the coordinates of each sample location using a handheld GPS, with accuracy requirements of 1 foot or less. The coordinates were recorded in the New York State Plane Coordinate System.

4.9 Data Validation

An independent validation of the analytical data was completed for the 2011 and 2012 analytical data discussed in this RI. Worksheet #36 of the SS-QAPP summarized validation criteria and data validation goals for each matrix, analytical parameter, and concentration level. The data validation consisted of results qualification, electronic data verification, and the preparation of a Data Validation Report as outlined in the RI Work Plan (Watermark, 2011). The validation reports include the following information:

- identity of the laboratory used for analysis;
- a summary of analytical methods;
- a summary of samples that are included in the sample set;
- a listing of sample collection and analysis parameters that were evaluated;
- a discussion of data validation actions, qualifications, and observations; and
- a tabulation of validated samples results.

Under direction of the USACE, an initial data validation step was completed using the Staged Electronic Data Deliverable (SEDD) and Automated Data Review (ADR) software. The ADR system has a computerized data validation module that performs a subset of data validation checks specified in the USEPA and NYSDEC guidelines. Sample results and associated QC data were compared to project specific QC limits that are set up by the project chemist prior to running the validation module. The ADR assigned validation action codes to all results that are associated with QC measurements outside project QC goals, and the validation module applied data validation qualifiers to the final results. The data qualification actions were reviewed by the project chemist prior to accepting the final data.

Overall the QC parameters and measurements checked during validation met requirements in the analytical method, validation guidelines, and QA plan goals. No data were rejected as a result of the data validation. Some results were qualified as estimated (J or UJ) due to QC parameters that were outside of acceptable criteria. A list of qualified data is presented in the Data Validation Reports.

Qualifiers applied to the data during validation were entered into the electronic data deliverables in the database. Validated data were used to generate tables and figures. Copies of the Data Validation Reports are included in Appendix D.

5.0 FIELD INVESTIGATION RESULTS

The following sections describe the result of the 2011 and 2012 sampling activities:

5.1 Area 1 Soil Sampling

No additional soil samples were collected at Area 1, as the USACE and NYSDEC agreed that Area 1 had been fully characterized prior to the 2011 sampling (Watermark, 2011).

5.2 Area 2 Soil Sampling

Area 2 soil sampling was conducted on May 12 and 13, 2011.

As indicated in Section 4.6.6, samples AI2-101 through AI2-112 were analyzed for PAHs and metals in surface (0-2 inches) and subsurface (6-24 inches) samples. Table 5-1 presents the soil analytical results for any analytes detected in 2011 soil samples collected from within Area 2.

All eighteen PAHs [1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene] were detected in at least one of the 12 sample locations at both sampling depths (many were detected in all samples). All reported concentrations were below 1 mg/kg for both surface and subsurface soils.

A total of eight PAHs were detected at concentrations above background (Table 1-1, Section 1.4, and Appendix B) in one or more surface soil samples [acenaphthylene, benzo(a)pyrene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene] and four were detected at concentrations above background in one or more of the subsurface soil samples [2-methylnaphthalene, acenaphthylene, benzo(ghi)perylene, dibenz(a,h)anthracene]. One or more PAHs were detected at a concentration above background in all of the surface soil samples with the exception of AI2-109 and AI2-111. In the subsurface samples, only locations AI2-103 and AI2-107 had detected concentrations above background.

Benzo(a)anthracene, benzo(b)fluroanthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations that exceed the Residential RSLs (but not the Industrial RSLs) in one or more of both the surface and subsurface samples. Benzo(a)pyrene was detected at concentrations that exceed both the Residential and Industrial RSLs in one or more surface and subsurface samples. One or more of these analytes was detected at concentrations above the Residential RSLs in all 12 surface soil samples. The same is true for the subsurface soil samples with the exception of AI2-109, and AI2-112. None of the PAHs detected in either the surface or subsurface samples had concentrations greater than any of the SCOs.

Twenty one out of twenty two metals (all but thallium) were detected at one or more of the 12 sampling locations (most were detected in all sampling locations). A total of 11 metals (antimony, arsenic, barium, beryllium, calcium, cobalt, copper, magnesium, sodium, vanadium, and zinc) were detected in surface soil samples at concentrations above background. Five metals (antimony, beryllium, copper, magnesium, and selenium) were detected in subsurface soil samples at concentrations above background.

One or more metals were detected at concentrations above background in 7 out of 13 surface soil samples (a duplicate was collected at AI2-108). One or more metals were detected at concentrations above background in all of the subsurface soil samples.

Two metals, copper, and lead, were detected at concentrations exceeding the Residential RSLs but below the Industrial RSLs. Arsenic was detected at concentrations exceeding both RSLs; most of these concentrations were below background.

Copper was detected in 25 of 26 soil samples at concentrations below 100 mg/kg and below the Residential RSL (3,100 mg/kg). Copper was detected in the shallow soil sample AI2-108(0-2 inches) and its duplicate, at 11,500 mg/kg and 958 mg/kg, respectively. This maximum detected copper concentration was below the Industrial RSL, but above the Residential RSL.

Lead was detected at concentrations ranging from 27.4 mg/kg [AI2-109 (6-24 inches)] to 418 mg/kg [AI2-108 (0-2 inches)]. The detection of lead in AI2-108 (0-2 inches) was the only concentration greater than the Residential RSL. None of the lead detections exceeded background.

Arsenic was detected at concentrations above both the Residential and Industrial RSLs with concentrations ranging from 2.3 mg/kg to 11.7 mg/kg. These concentrations are mostly consistent with background. Only two arsenic concentrations, 11.7 and 11.3 mg/kg in A12-108 (0-2 inches) and its duplicate were detected above background.

Total mercury was analyzed for in all sampling locations with the exception of AI2-108 (surface and subsurface), it's duplicate, and AI2-110 (surface and subsurface). Total mercury was detected in all samples where it was analyzed. Mercury was detected at concentrations exceeding background in two surface samples (AI2-109 and AI2-111). None of the subsurface soil samples had total mercury concentrations greater than background. Samples collected from four locations (AI2-107, AI2-109, AI2-111, and AI2-112) were also analyzed for mercury speciation analysis. Elemental mercury was not detected in any of the four sampling locations (both in the shallow and deep intervals). Methyl mercury was detected at concentrations ranging from 0.0007 mg/kg to 0.011 mg/kg in the surface samples and 0.00008 mg/kg to 0.001 mg/kg in the subsurface samples. Methyl mercury was not detected in A12-112 (6-24 inches). All total mercury and methyl mercury concentrations were below both the Residential and Industrial RSLs.

Total mercury was detected in all of the surface sampling locations above the Unrestricted Use SCO, and in AI2-106, AI2-109, and AI2-111 above the Restricted Residential Use SCO. Total mercury was detected in the subsurface soil samples in AI2-103, AI2-105, AI2-106, AI2-109, and AI2-111 at concentrations exceeding the Unrestricted Use SCO. In the deeper interval, only AI2-111 exceeded the Restricted Residential Use SCO.

5.3 Area 3 Soil Sampling

Area 3 soil sampling was conducted on May 10 and 11, 2011 and on November 28 and 29, 2012

5.3.1 2011 Results of Area 3 Soil Sampling

As indicated in Section 4.6.7, samples AI3-101 through AI3-112 were analyzed for PAHs and metals in surface (0-2 inches) and subsurface (6-24 inches) samples. At three locations, AI3-106, AI3-107, and AI3-110, an additional sample was collected from a 2 to 4 ft bgs interval for analysis of TAL Metals only. Table 5-2 presents the soil analytical results for any analytes detected in soil samples collected from within Area 3 in 2011.

Seventeen of eighteen PAHs [all but benzo(k)fluoranthene] were detected in at least one of the 12 sample locations in both the surface and subsurface samples (most were detected in all samples). Fifteen out of seventeen detected PAHs had concentrations in the surface and subsurface soil samples greater than background. One or more PAHs were detected at concentrations above background in all of the surface soil samples except for AI3-104, AI3-106, and AI2-112. PAHs were detected at concentrations above background in six out of the thirteen subsurface soil samples.

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations greater than the Residential RSLs. Both surface and subsurface samples had detected concentrations of PAHs that were greater than the Residential RSLs. Benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected at concentrations that were higher than their respective Industrial RSLs as well.

Twenty one out of twenty two metals were detected in one or more surface and subsurface soils in Area 3. Most metals on the analyte list had a high frequency of detection. Nineteen of twenty two metals had maximum concentrations in surface soil samples greater than background. Only five out of twenty two metals were detected in subsurface soil samples at concentrations greater than background (arsenic, beryllium, magnesium, selenium, and sodium). One or more metals were detected at concentrations greater than background in nine of thirteen surface soil samples and in ten of the twelve subsurface soil samples.

Arsenic, cobalt, iron, and lead were detected at concentrations above the corresponding Residential RSLs. Arsenic and lead were detected at concentrations above the Industrial RSLs as well. Arsenic was detected at concentrations greater than the Residential and Industrial RSLs in all of the surface and subsurface samples. Concentrations ranged from 2.3 mg/kg to 132 mg/kg. Eight of the arsenic concentrations (ranging from 7.7 mg/kg to 132 mg/kg) were detected at concentrations greater than background. Concentrations of cobalt and iron were above the Residential RSL in only one sample, AI3-103 (0-2 inches). Lead was detected at concentrations below the Residential RSLs in all samples except for AI-103 (0-2 inches) and AI3-107 (0-2 inches).

Three samples were collected from a depth of 2 to 4 ft bgs [AI3-106 (2-4 ft), AI3-107(2-4 ft), and AI3-110(2-4 ft)] and analyzed for metals. Only arsenic was detected at a concentration greater than an RSL (it exceeded both the Residential and Industrial RSLs); however, arsenic concentrations are significantly lower than those detected in the shallower samples. Arsenic ranged from 3.4 to 5.3 mg/kg in these three samples which are below background.

Both surface and subsurface samples were collected from four locations (AI3-104, AI3-105, AI3-111, and AI3-112) for mercury speciation analysis. Total mercury was detected in all 8 samples, however all mercury detections were below background. Elemental mercury was not detected in any of the four sampling locations (both in the shallow and deep intervals). Methyl mercury was detected at concentrations ranging from 0.00079 mg/kg to 0.00226 mg/kg in the surface samples and 0.000179 mg/kg to 0.00078 mg/kg in the subsurface samples. None of the mercury concentrations in the shallow sampling intervals exceeded either of the RSLs.

Total mercury was detected at concentrations above the Unrestricted Use SCOs but below the Residential Use SCOs in AI3-104, AI3-105, and AI3-111 in the surface and subsurface sampling interval. Total mercury was detected at concentrations above the Restricted Residential Use SCOs in AI3-112 (0-2 inches) and below all SCOs in (6-12 inches).

5.3.2 2012 Results of Area 3 Soil Sampling

A total of 51 surface soil samples plus three field duplicates were collected from within Area 3 and analyzed for mercury via method 7471A. Mercury was detected in all 51 field samples and the three field duplicates at concentrations ranging from 0.15J mg/kg to 1.1J mg/kg. Table 5-3 presents the soil analytical results for all the soil samples collected from within Area 3 in 2012.

None of the total mercury results exceeded background and none exceeded the Residential RSL or the NYSDEC SCO for Commercial use. 51 of the 53 field samples had total mercury concentrations above the Unrestricted Use SCOs, but below the Residential Use SCOs. Concentrations slightly exceeded the Residential Use SCOs at two locations: AI3-214 (5-6 inches) and AI3-202 (5-6 inches). At both of these locations, the soil sampled above and below these intervals was below the Residential Use SCOs.

5.4 Area 4 Soil Investigation

Area 4 soil sampling was conducted on May 9 and 12, 2011. The follow-on investigation, consisting of hand-digging observation holes, was conducted on November 29, 2012.

5.4.1 2011 Soil Sampling Results

As indicated in Section 4.6.8, samples AI4-101 through AI4-115 were analyzed for PAHs in surface (0-2 inches) and subsurface (6-24 inches) soil samples. Table 5-4 presents the soil analytical results for any analytes detected in soil samples collected from within Area 4.

A total of 18 PAHs [1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene] were detected in Area 4. All PAHs were detected at a frequency of detection of 90 percent (26/29 samples) or higher, with the exception of benzo(k)fluoranthene.

Fifteen of eighteen PAHs were detected at concentrations greater than background in both surface and subsurface soil samples [all but 1-methylnapthalene, 2-methylnaphthalene, and naphthalene in surface soil samples and all but 1-methylnapthalene, benzo(k)fluoranthene, and phenanthrene in subsurface soil samples]. One or more PAHs were detected at concentrations above background in all surface samples with the exception of A14-115. One or more PAHs were detected at concentrations above background in seven out of the 14 subsurface soil samples.

A total of five PAHs were detected at concentrations greater than both the Residential and Industrial RSLs. These PAHs included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. PAHs were detected at concentrations significantly higher than the other samples in AI4-106(0-2 inches) and AI4-111(0-2 inches) and deep sample AI4-106(6-24 inches).

Metals were analyzed for at one sampling location, AI4-101, in both the shallow and deep sample. Metals were detected in these samples, but at low concentrations. Magnesium was the only metal detected at a concentration above background in the surface sample and selenium and sodium were the only metals detected at concentrations above background in the subsurface sample. Arsenic was detected at concentrations below the SCOs, but above both the Residential and Industrial RSLs.

Both surface and subsurface samples were collected from four locations (AI4-105, AI4-106, AI4-112, and AI4-115) for mercury speciation analysis. Total mercury was detected at low concentrations in all eight samples and below background. Elemental mercury was not detected in any of the four sampling locations (either in the shallow or deeper samples). Methyl mercury was detected at concentrations ranging from 0.000293 mg/kg to 0.000708 mg/kg in the in the surface soil samples and at concentrations ranging from 0.00031 mg/kg to 0.000639 in the in the subsurface soil sample. None of the mercury concentrations in the surface or subsurface sampling intervals exceeded the RSLs.

Total mercury was detected at a concentration above the Unrestricted Use SCOs but below the Residential Use SCOs in AI4-105 (0-2 inches) and AI4-106 (0-2 inches). Total mercury was detected at concentrations below all SCOs in all four subsurface samples.

5.4.2 2012 Observation Holes

All nine observation holes dug in Area 4 on November 29, 2012 contained evidence of fill materials that likely contributed to previous detections of PAHs. Pieces of coal were observed in all nine holes, asphalt was observed in four holes, and coal ash was observed in one hole. Evidence of other fill materials was also present in many of the holes; brick was observed in three holes, a layer of large diameter (1 to 2 inches) crushed stone was observed in two holes, glass was observed in two holes, a rusty nail was observed in one hole, a wire was observed in one hole, and a piece of concrete was observed in one hole. Details of observations at each location are presented in Table 5-5 and pictures of the fill materials are contained in Appendix O.

5.5 Area 5 Sampling

Area 5 soil sampling was conducted on May 10 and 11, 2011.

As indicated in Section 4.6.9, samples AI5-101 through AI5-110 were analyzed for metals in surface (0-2 inches), subsurface (6-24 inches), and deep (2-6 ft) samples. Table 5-6 presents the soil analytical results for any analytes detected in soil samples collected from within Area 5.

A total of 21 metals (all metals with the exception of thallium) were detected in one or more samples in Area 5. Most metals were detected at a high frequency of detection except for silver and selenium, which was only detected in six and five surface samples, respectively. A total of eight metals (arsenic, calcium, cobalt, copper, lead, magnesium, sodium, and zinc) were detected at concentrations above background in surface soil samples. Ten metals (antimony, chromium, cobalt, iron, magnesium, potassium, selenium, sodium, vanadium, and zinc) were detected at concentrations in subsurface soil at concentrations greater than background. Twenty metals (all metals except for silver and thallium were detected in the deep samples).

Only two metals, arsenic and lead, were detected in Area 5 soil samples at concentrations greater than exceeding one or more RSLs. Arsenic was detected in all samples at concentrations greater than both the Residential and

Industrial RSLs, but at concentrations generally consistent with background. There was only one concentration detected slightly above background; 13.3 mg/kg in A15-101 (0-6 inches). Lead was detected in one sample, AI5-107 (0-2 inches), at 587 mg/kg which exceeds the Residential RSL of 400 mg/kg.

Samples from two locations (AI5-105 and AI5-106) at the surface and subsurface depth intervals were also submitted to the laboratory for mercury speciation. Total mercury was detected in all four locations; however, all of the total mercury concentrations were less than background and the Residential and Industrial RSLs. Elemental mercury was not detected in any of the samples. Methyl mercury was detected between 0.00015 and 0.00017 in surface samples and 0.00021 in the subsurface samples, which are all below the Residential and Industrial RSLs. Methyl mercury was not detected in samples A15 (0-2 inches) and (6-24 inches).

5.6 Groundwater Analytical Results

Groundwater samples were collected in 2011 and 2012. The 2011 sampling round included all five monitoring wells at the site (MW-1, MW-2, MW-3, MW-4R, and MW-5). Each well was sampled for VOCs, PAHs, and metals, including mercury. The 2012 sampling event was limited to PAHS in MW-4R and MW-5.

5.6.1 2011 Groundwater Analytical Results

As indicated in Section 4.3, a groundwater sampling round was conducted on May 9, 2011 using the five existing on-site monitoring wells. The following is a summary of the groundwater sampling results.

The May 9, 2011 groundwater gauging data was used to create a groundwater contour map. Groundwater flows west towards Little Bay. The map is presented as Figure 5-1.

No LNAPL or DNAPL was detected in any of the five monitoring wells. Draw-down within the well was monitored continuously while pumping and kept to a minimum. Due to the need for a minimum pumping speed to maintain suction, and the wells production rate, the draw-down within the wells ranged from 0.12 ft at MW-5 to 6.49 ft at MW-1 throughout the purging and sampling process.

Table 5-7 presents the groundwater analytical results for any analytes detected in groundwater samples collected in 2011. One VOC, chloroform, was detected in two monitoring wells (MW-2 and MW-4R) both at a concentration of 0.014 milligram per liter (mg/L).

A total of 10 PAHs were detected at least once in on-site groundwater samples. PAHs were not detected in MW-1, MW-2, and MW-3. Benzo(b)fluoranthene, fluoranthene, and pyrene were detected at 0.000033, 0.000044, and 0.000037 mg/L, respectively, in MW-4R. All 10 detected PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene) were detected in MW-5. Benzo(a)anthracene, benzo(b)fluoroanthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations above the New York State (NYS) Class A groundwater guidance criteria (NYSDEC, 2011a). Because high molecular weight PAHs are not very soluble in water, it appears that these PAH detections are related to suspended solids in groundwater rather than dissolved PAHs.

Aluminum, barium, calcium, magnesium, potassium, and sodium were detected in all five monitoring wells. Chromium was detected in all wells except MW-1. Manganese was detected in all monitoring wells except MW-1 and MW-4R. Nickel was detected in all but MW-2 and MW-3. Cobalt, copper, iron, lead, mercury, and zinc were detected in MW-4R only. Sodium was the only metal detected above its NYS Class A groundwater criteria.

5.6.2 2012 Groundwater Analytical Results

As indicated in Section 4.3, groundwater sampling of monitoring wells MW-4R and MW-5 was conducted on November 28, 2012.

Table 5-8 presents the groundwater analytical results. No PAH compounds were reported in the filtered and unfiltered samples from MW-4R or in the filtered sample from MW-5. Only two PAH compounds, fluoranthene and pyrene, were reported at low concentrations in the unfiltered sample from MW-5. The reported concentrations of fluoranthene and pyrene were 0.039J μg/L and 0.032J μg/L, respectively.

6.0 NATURE AND EXTENT OF CONTAMINATION

6.1 Introduction

This report documents Site conditions for the Fort Totten CGS FUDS. Additional soil and groundwater sampling was conducted by Watermark in 2011 to address data gaps that existed in the analytical results obtained for the Site. The Site consists of a total of five areas as follows:

- Area 1 Fill Area;
- Area 2 Building 624;
- Area 3 Buildings 609 to 612;
- Area 4 Building 625; and
- Area 5 Building 615.

Area 1 was fully characterized in the previous RI and as such was not investigated as part of the SRI2. However, a discussion of the nature and extent of contamination at Area 1 is included herein. Refer to the Final RI Report (USACE, 2005) for additional information regarding Area 1.

6.2 Sources

The potential sources of contamination at the Site include fill used in Area 1 and subsurface disposal (through a floor drain) of waste containing mercury from Area 5. Area 1 was created when the Army placed soil excavated from elsewhere at Fort Totten in a low spot of a recreation field to eliminate periods of standing water. The soil came from Buildings 118, 119, and 121, which were former and existing vehicle maintenance shops, on the Army-owned portion of Fort Totten. The excavated soil included a portion of those buildings' parking lots, which contained asphalt, a source of PAHs (USACE, 2005). The source of metals and PAHs in Area 1 is attributable to the fill from the former and existing vehicle maintenance shops (USACE, 2005). The mercury containing waste in Area 5 was disposed of in association with armaments repair which was part of historical DoD operations at Building 615.

No specific point source of PAH and metals contamination had been identified in previous investigations and reports for Areas 2 through 4. No visual staining or odors consistent with petroleum sources from past operations were observed during the 2011 or 2012 activities. Fill materials, specifically materials that likely contributed to detection of PAHs in the soil (i.e., coal, coal ash, asphalt), were observed in soil borings and observation holes in Area 4 that were co-located with elevated PAH concentrations.

PAHs are almost ubiquitous in soil, especially in industrial and urbanized areas. They can be introduced into the environment via natural and anthropogenic combustion processes; however, PAH concentrations in soil have increased over the last 100 to 150 years, especially in urban areas (USACE, 2005) due to anthropogenic activities. The majority of PAHs are emitted from fossil fuel combustion sources such as automobiles, coking plants, asphalt production, and manufacturing facilities that use fossil fuel (USACE, 2005). PAHs are also present in industrial chemical wastes, such as coal tar, petroleum refinery sludge, waste oils and fuels, and wood-treating residues (USACE, 2005). As a result of these anthropogenic sources, PAHs can be detected at significantly higher concentrations in urban areas, despite the fact that a point source does not necessarily exist. Concentrations of benzo(a)pyrene in urban soils appear to be about two orders of magnitude higher than concentrations in rural soil (USACE, 2005).

The 2009 Draft FS stated that "Based on the concentrations of SVOCs found in the upland soils, there is no indication of a specific release in soils at the Site because the concentrations are consistent with those expected in an urban environment. Metals concentrations are not above geographic norms." (USACE, 2009). The 2011 soil investigation did not identify any specific sources of PAHs or metals that had not previously been identified. The 2011 soil data and the historical soil data have been compared, in the current document, to background that are presented in Appendix B. The comparison of SVOC concentrations and metals concentrations to background indicates that some of these analytes have been detected in soil samples at concentrations that are greater than background. Based on the presence of man-made materials and coal, coal ash, and asphalt observed in the soil borings and observation holes co-located with elevated PAH concentrations in Area 4, it is likely that the elevated concentrations of PAHs are associated with urban fill at the Site and/or deposition due to being located in an urban environment. Individual high concentrations of metals including arsenic, lead, and copper may be due to the heterogeneity of the fill material and not representative of a specific release.

The soil concentration distributions of sixteen PAHs have been evaluated to determine if the PAHs in soil throughout the Site are likely to be from a single population – suggesting that the source of PAHs is urban fill rather than a specific point source (Appendix M). For each compound, all of the soil concentrations were used to construct a Quantile (Q-Q) plot for, first, the raw data, and second, for log-transformed data (natural log). Simultaneously, the Wilks-Shapiro normality test was applied to the raw data and also the log-transformed data.

For each compound, the entire Site dataset (the background data plus the data from Areas 1 through 5) has been shown graphically in an outlier notched box plot. The notched box plot shows the interquartile range (25 percentile to 75 percentile and the data points above and below that range. On those plots, outliers (1.5 times the interquartile range above the 75 percentile or below the 25 percentile, and separately, 3 times the interquartile range above the 75 percentile or below the 25 percentile). For each compound, a figure has also been prepared that shows outlier notched box plots side-by-side for the background dataset, Area 1, Area 2, Area 3, and Area 4. Area 5 data are not plotted because there are two or fewer PAH results for each compound and therefore the results cannot be plotted in a meaningful way.

In the Quantile plots, the actual data are plotted on a graph that shows a theoretical normal distribution (a straight line). If the Site data plot on or very near the theoretical normal, with no sharp breaks or deviations from the theoretical line, that indicates the data follow a normal distribution (or if the log-transformed data follow a normal distribution, the data follow a log-normal distribution) and the data are likely from a single population (consistent with the absence of one or more specific point sources). The Quantile plots indicate heterogeneity of the soils and fill materials. The plots show multiple inflection points indicative of heterogeneous populations, and generally poor fit of data with respect to normal or lognormal distributions of the sample concentrations. These results indicate that the Site is largely built upon contaminated fill materials of a diverse and widespread nature, and generally does not indicate releases or disposal areas.

Appendix M also presents a table comparing site and expected concentrations in urban fill materials in Massachusetts (MassDEP, 2002) and Maine (MEDEP, 2012) (Table M-1). Comparison of the concentrations indicates that while PAHs at the site are elevated, they are not inconsistent with conditions seen at other old yet smaller urban areas in other states (Table M-1).

Hypothesis tests of site and background samples conducted to help distinguish whether the central tendencies of concentrations in Site soils differ from background was also conducted (Appendix M). Tables M-2 and M-3 show the results of hypothesis tests of metal and PAH samples in Site and background soils, for surface and subsurface soils. Although there were exceptions, the hypothesis tests of the samples indicate predominantly heterogeneous metals and PAH populations in the shallow and the subsurface soil intervals. Further, most of the UTLs for background PAHs differ for shallow and deep soil. In some cases, sample detections were too few to conduct a hypothesis test or compute a statistically reliable UTL. For most of the metals and PAHs, hypothesis tests of samples suggested different populations of target analyte concentrations in the shallow and deep soil on-site compared to those of the background locations, with higher concentrations typically on-site.

The statistical analysis discussed above and the comparison to published urban soil background values indicates that the Site is largely built upon contaminated fill materials of a diverse and widespread nature, and generally does not indicate releases or disposal areas. The analysis confirms that the PAHs and metals at the site are of generally poor quality, consisting of very old fill with heterogeneous fill materials and contaminants accumulated over a very long time. The fill at the site appears to be older and of lower quality than the nearby fill materials from the background near roadways. The urban soil and fill material at the site indicate a local baseline condition rather than a disposal area to be restored. It appears several soil samples from Area 4 contain elevated concentrations of several PAH compounds that are somewhat higher than published values and higher than in Areas 1, 2, 3, and 5. The elevated concentrations in Area 4 are likely attributable to coal, coal ash, and asphalt, which was observed in all nine observation holes that were co-located with elevated PAH concentrations.

6.3 Nature and Extent of Releases

For purposes of site investigation and possible future clean-up efforts the Site has been divided into five investigation areas as illustrated on Figure 1-2. Impacts to surface and subsurface soil in each of the five areas are discussed below.

6.3.1 Soil Characterization

The nature and extent of the chemicals detected in soil at the Site, based on 2011 sampling results, is discussed here in the context of the USEPA RSLs. For comparison purposes, detected concentrations of chemicals in soil are compared both to the "Residential" and the "Industrial" RSLs. These values are risk-based concentrations typically used to screen chemicals for the selection of contaminants of potential concern (COPCs) in the CERCLA HHRA and are used here to frame the discussion of nature and extent of contamination.

To provide additional context, the NYSDEC, Subpart 375-6 Remedial Program SCOs have also been utilized as points of comparison in the nature and extent section as well. The SCOs for the following five land use categories have been considered: Unrestricted Use; Residential Use; Restricted Residential Use; Commercial Use; and Industrial Use. The Unrestricted Use SCOs are the most conservative of the SCOs. Tables and figures supporting the following sections have been formatted to reflect the comparison of soil analytical data to all seven of the RSLs and SCOs. A color coding system indicates whether a concentration is above specific SCOs. A separate notation is used to indicate whether or not a detected concentration is above either a Residential RSL (underlined) or an Industrial RSL (black border around the cell). Additionally, in the tables and figures, a comparison of reported soil concentrations to background is presented. Any analyte concentration above background is bolded in the tables and figures.

It should be noted that at times the SCOs and RSLs differ by orders of magnitude. SCOs are contaminant-specific remedial action objectives for soil based on a site's current, intended or reasonably anticipated future use. SCOs consider protection of public health, protection of groundwater, protection of the environment, background values, and maximum allowable concentrations. The RSLs are contaminant-specific values calculated for the protection of human health; they do not take into consideration protection of groundwater, protection of the environment, background values, or maximum allowable concentrations. As such, some RSLs and SCOs differ substantially, as the protection of groundwater, the environment, and the maximum allowable concentration cap can lead to lower SCOs in relation to the RSLs and the incorporation of background values can lead to SCOs much higher than the RSLs.

The most recent soil investigation included the collection of soil samples for mercury speciation. Samples were submitted for laboratory analysis of mercury, methyl mercury, and elemental mercury. From a risk assessment standpoint, it is important to understand the amount of elemental mercury, verses methyl mercury, and inorganic mercury present since each form has its own physical and toxicological properties. If present, elemental mercury may be of special concern because it is found in liquid form in its natural state, is easily vaporized at room temperature, and is well absorbed through inhalation. By subtracting the concentrations of elemental mercury and methyl mercury from the total mercury, the concentrations for inorganic mercury can be calculated. Inorganic mercury is not very mobile and does not bioaccumulate as readily as other forms of mercury.

Elemental mercury was not detected in any of the soil samples analyzed for that parameter. Methyl mercury was detected at low concentrations, indicating that the predominant species of mercury in soil samples analyzed is inorganic mercury. As indicated in Table 1-2, USEPA RSLs and NYSDEC SCOs for inorganic mercury are generally higher than those for other forms of mercury, reflecting its lower exposure-related risk when compared against elemental and methyl mercury.

6.3.2 Area 1 – Fill Area

Area 1 is located in the northeast corner of the Site and is an area of historic filling. A total of 24 soil samples have been collected from this area during past site investigations (Phase I, Phase II, and SRI) and submitted for laboratory analysis of metals, SVOCs, and VOCs. This area was not investigated further as part of the SRI2, as the USACE and NYSDEC agreed that the Fill Area has been sufficiently characterized previously.

Table 6-1 presents analytical data for all parameters detected in one or more soil samples collected from Area 1 and compares the data to the SCOs, RSLs, and background. Figures 6-1 and 6-2 depict sampling locations and Area 1 soil concentrations that are greater than one or more SCOs or RSLs for metals and PAHs, respectively. These figures are formatted using the same system as the tables (described in Section 6.3.1) to indicate how concentrations compare to the RSLs, SCOs, and/or background.

A total of seven VOCs were detected in Area 1. All VOC concentrations were below corresponding Residential or Industrial RSLs. One VOC, acetone (a common laboratory contaminant) was detected at concentrations above the Unrestricted Use SCO in Area 1.

Five SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations above the Residential RSLs; three of these PAHs, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene, were detected at concentrations above the Industrial RSLs. The highest concentrations of PAHs were detected in B-11 (0-1 ft), FLA-11 (16-18 ft) and FLA-48 (0-2 inches). The remaining concentrations are substantially lower. Elevated SVOC detections appear to be located primarily in the central and eastern portion of Area 1 in borings FLA-11, FLA-48, and B-11 both at shallow and deep depths.

Five SVOCs were detected in soil samples at concentrations above one or more SCOs in Area 1. The five SVOCs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected at concentrations above one or more SCOs in 5 of the 25 samples. Four of the five samples are shallow soil samples (between 0 to 1 foot bgs) and one sample was collected from 16 to 18 ft bgs. Of the five samples with SVOC concentrations greater than SCOs, three are duplicate samples, and one or more of the SVOCs were not detected in the corresponding field sample(s). The benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene detections in the five samples are greater than the Restricted Residential Use SCO, but below the Commercial Use SCO. The chrysene concentrations were greater than the Residential Use SCO, and the benzo(a)pyrene concentration was greater than the Industrial Use SCO.

Twenty two metals were detected in Area 1. Concentrations of three metals (arsenic, lead, and thallium) in one or more soil samples were above the Residential RSLs. Arsenic and lead were also detected in one or more samples at concentrations greater than the Industrial RSLs.

Arsenic was frequently detected at concentrations above the Residential and Industrial RSLs (26/27 samples with concentrations above the Residential RSLs and 25/27 samples with concentrations above the Industrial RSLs). Arsenic concentrations ranged from 0.21 mg/kg to 10.1 mg/kg and concentrations above 4 mg/kg were detected throughout the Area. Background concentrations for arsenic are 10.73 mg/kg and 7.599 mg/kg in surface and subsurface soil. Although arsenic is present in soil samples collected throughout Area 1, concentrations are generally consistent with background (three arsenic concentrations slightly exceed background).

Lead was detected at concentrations greater than both the Residential and Industrial RSLs within Area 1. There is a greater predominance of elevated lead concentrations in Area 1 compared to Areas 2 through 5. Nine locations within Area 1 had lead concentrations greater than the Residential RSL, compared to zero to four locations with elevated lead concentrations in Areas 2 through 5. The highest concentrations were detected in B-11 and B-10 in the 0-1 ft bgs depth interval. The concentrations at those locations are greater than background. Lead concentrations are elevated throughout Area 1, but the higher concentrations tend to be located in the southeast and southwestern portion of Area 1.

Thallium was detected at concentrations above the Residential RSL in only two soil samples, both of which were collected from the same borehole (B-11 0-1 ft bgs and B-11 1-2 ft bgs). However, these samples were collected in triplicate and the concentrations of thallium in the other two samples were below the Residential RSL. Additionally, thallium concentrations in samples from all other Area 1 locations were substantially lower and thallium was detected at a low frequency of detection.

Mercury was detected in all samples within Area 1 at concentrations ranging from 0.01 mg/kg to 2.5 mg/kg. The maximum concentration of mercury was detected in B-10 from 0-1 ft bgs. Mercury concentrations tended to be slightly lower in deeper samples. Concentrations of mercury were primarily below background; however, four mercury concentrations slightly exceeded background.

Eight metals were detected in soil samples at concentrations above one or more SCO in Area 1. Of those eight metals, only three (barium, copper, and lead) were detected at concentrations above Commercial Use SCOs, but below Industrial Use SCOs. The concentrations above Commercial Use SCOs were reported in borings B-10 and B-11 from 0 to 2 ft bgs.

6.3.3 Area 2 – Building 624

Area 2 is located west of Area 1 in the vicinity of former Building 624 (Figure 1-2). Previous investigations have found elevated concentrations of metals and SVOCs (specifically PAHs) in soil samples from Area 2. Metals, primarily mercury, have been detected in the vicinity of SB-04 and SB-05. Elevated PAHs have been detected in the vicinity of SB-05 and SS-29. Table 6-2 presents analytical data for all parameters detected in one of more soil samples collected from Area 2 and compares the data to the SCOs, RSLs, and background.

Figures 6-3 and 6-4 depict sampling locations and Area 2 soil concentrations that are greater than one or more SCOs or RSLs for metals and PAHs, respectively. These figures are formatted using the same system as the tables (described in Section 6.3.1) to compare concentrations to RSLs, SCOs, and/or background.

Only three VOCs have been detected in any soil samples from Area 2 and all concentrations were less than the respective SCOs and RSLs. Due to the infrequent detections of VOCs and the low detected concentrations in historical investigations, VOCs were not further evaluated in Area 2 during the SRI2.

A total of eight pesticides have been detected in soil samples within Area 2. Only one pesticide, heptachlor epoxide, was detected at a concentration greater than the Residential RSL (0.12 mg/kg). This detection was at sample location 624-SS-05 from 0-0.5 ft bgs. Three of the detected pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) have associated SCOs. 4,4'-DDT was detected at concentrations greater than the Unrestricted Use SCO in samples 624-SS-01 through 624-SS-06. Only one other pesticide was detected in those samples (heptachlor epoxide) at a concentration of 0.12 mg/kg in 624-SS-05. Eight pesticides were detected in sample 624-SS-53 with 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT concentrations greater than the Unrestricted Use SCO. Pesticides were also detected in 624-SS-54. Due to the infrequent detections of pesticides and the low detected concentrations in historical investigations, pesticides were not further evaluated in Area 2 during the SRI2.

Twenty-five SVOCs have been detected in one or more soil samples in Area 2. Five PAHs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations above the Residential RSLs and three, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene, were detected at concentrations above the Industrial RSLs. All five of these PAHs, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected above the background. Concentrations are higher in the surficial samples (i.e., 0-2 inches bgs), but concentrations above RSLs have also been encountered at all depth intervals. The five aforementioned PAHs are consistently detected at concentrations above the Residential RSLs in the 2011 surficial samples throughout Area 2, with occasional detections above the Industrial RSLs.

There are two areas where the highest concentrations of SVOCs have been detected. The first is in the vicinity of location SB-05. The maximum concentration of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene were detected in this sample location at a depth of 0-0.5 ft bgs. Samples SS-24 through 28 were collected from 0 to 2 inches bgs surrounding SB-05 and while there are detected concentrations above the Residential and Industrial RSLs, the concentrations are significantly lower than in sample SB-05. This indicates the elevated concentration appears to be limited to the immediate area of that sample. During the SRI2, sample AI2-107 was collected near SB-05 at two depth intervals (0-2 inches bgs and 6-24 inches bgs). SVOC concentrations from this sample were substantially lower than those detected in SB-05.

The second area with elevated concentrations of PAHs was at SS-29 at 0 to 2 inches bgs, just west of Bayside Street. The maximum concentrations within Area 2 for benzo(a)anthracene, benzo(b)fluoranthene, and phenol were detected at this location. The concentrations of, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were very close to the maximum detected concentrations as well. Sample location AI2-106 was selected to confirm impacts near SS-29, and sample AI2-108 was collected to evaluate the eastern extent of the PAH contamination. The results from both AI2-106 and AI2-108 in both the surface and subsurface intervals detected much lower concentrations of PAHs than had been originally detected in SS-29.

Six SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene] were detected in soil samples at concentrations above one or more SCOs in Area 2. Of the six detected SVOCs, only benzo(a)pyrene was detected at concentrations above the Industrial Use SCO. Both detections of benzo(a)pyrene (1.6 mg/kg and 1.5 mg/kg) above Industrial Use SCOs were from shallow soil samples (less than 0.5 ft bgs) in sample locations SB-05 and SS-29, respectively (Figure 6-4). The remaining PAHs were detected at concentrations above the Unrestricted Use SCOs, the Residential Use SCOs and/or the Restricted Residential Use SCOs. All concentrations above the SCOs were in these two samples, which both lie along the northern end of the paved road, Bayside Street, which provides access to Area 2. The 2011 sampling activities were designed to further delineate the extent of PAH impacts in both of these sampling locations. As discussed above, sample locations AI2-105 and AI2-106 were selected to confirm and delineate the previously detected concentrations of PAHs in the area of SS-29. The PAH results from these samples were substantially lower than the concentrations of PAHs in SS-29; neither the shallow interval (0-2 inches) or the deeper interval (6-24 inches) samples had detected PAHs at concentrations above any of the SCOs. Sample location AI2-107 was selected to confirm and vertically delineate the detected PAHs in the area of SB-05. All of the concentrations of PAHs detected in AI2-107 in either the shallow or deep interval were less than the SCOs.

The maximum concentration of each PAH in Area 2 soil samples was compared to background. Maximum concentrations of all of the aforementioned PAHs were greater than background.

Three metals (arsenic, copper, and lead) were detected at concentrations greater than the Residential RSLs. Arsenic is the only metal that detected at a concentration above the Industrial RSLs. Arsenic was detected at concentrations above the Residential RSLs in all but one sample within Area 2. The two highest concentrations of arsenic were detected at 11.7 mg/kg and 11.3 mg/kg in AI2-108 (0-2 inches and its duplicate, respectively). Lead was detected at concentrations greater than the Residential RSLs in four locations – SB-04, SS-23, SB-05, and SS-28. Concentrations tend to decrease as you move away from these two locations. Copper was detected in one location [AI2-108 (0 to 2 inches) at 11,500 mg/kg] above the Residential RSLs. A duplicate sample was collected from this location with a result of 958 mg/kg, which is below the Residential RSL at 3,100 mg/kg. This is the only location within Area 2 where a copper concentration is greater than an RSL. The surrounding samples, AI2-106, AI2-109, and AI2-107 have substantially lower concentrations of copper, the highest of which is 75.9 mg/kg in the surface soil sample collected from AI2-109. The locations of these elevated metals concentrations coincide with the locations where mercury was further evaluated in 2011, which is discussed below.

Although mercury was detected at concentrations below the RSLs, it was identified as a concern in previous phases of the RI investigation due to concentrations above the SCOs. Based on previous investigations, two areas were identified that were of primary concern regarding mercury. These two areas were around SB-04 and SB-05. At SB-04 and nearby sample location SS-23, mercury was detected at 2.3 mg/kg and 2.7 mg/kg respectively. The 2011 SRI2 sample locations AI2-109, AI2-111, and AI2-112 were selected to help bound the mercury contamination identified in SB-04 and SS-23. Concentrations of mercury were low in AI2-112 (e.g., below 0.5 mg/kg); however, elevated concentrations were reported in sample AI2-109 (2.08 mg/kg in the 0-2 inch bgs sample) and AI2-111 (1.63 mg/kg and 1.76 mg/kg in the 0-2 and 6-24-inch samples respectively). The second area with elevated concentrations of mercury was around SB-05 at SS-28 (mercury at 1.8 mg/kg). 2011 SRI2 samples AI2-107, AI2-108, and AI2-106 were collected around SS-28. Mercury was detected at AI2-106 (0-2 inches bgs) at a concentration of 1.1 mg/kg and at AI2-107 (0-2 inches bgs) at an estimated concentration of 0.323 mg/kg.

Six metals (chromium, copper, lead, nickel, zinc, and mercury) were detected in soil samples at concentrations above one or more of the SCOs in Area 2. Of these six metals, only copper, lead, and total mercury were detected at concentrations above the Restricted Residential Use SCO. Lead was detected at concentrations greater than the Residential Use SCOs in four locations – SB-04, SS-23, SB-05, and SS-28. Copper was detected in one location (AI2-108 at 11,500 mg/kg) above the Industrial Use SCO. A duplicate sample was collected from this location with a result of 958 mg/kg. This is the only location where the copper concentration is greater than the Residential Use SCO. The surrounding samples, AI2-106, AI2-109, and AI2-107 have significantly lower concentrations of copper, the highest of which is 75.9 mg/kg in the surface soil sample collected from AI2-109.

The maximum detected concentrations of these metals were compared to background. Of those discussed above, maximum arsenic and lead concentrations were just above background, and copper was detected at concentrations consistent with background with the exception of the one elevated detection of copper at AI2-108, which appears to be an anomaly. Mercury concentrations were also consistent background. This suggests that metals in Area 2 may be elevated due to regional influences, and not Site activities.

6.3.4 Area 3 – Buildings 610, 611, and 612

Area 3 is located in the southwest portion of the Site (Figure 1-2) and encompasses Buildings 610, 611, and 612, which are currently in use by the USCG. Previous soil investigations have shown one isolated concentration of copper greater than its respective Commercial Use SCO at 1-2 ft bgs in boring B-1, widespread detections of mercury above the Restricted Residential Use SCO, and SS-39, reported PAHs above the Restricted Residential Use SCO.

Tables 5-3 and 6-3 present analytical data for all parameters detected in one of more soil samples collected from Area 3 and compares the data to the SCOs, RSLs, and background. Figures 6-5, 6-6, and 6-7 depict sampling locations and Area 3 soil concentrations that are greater than one or more SCOs or RSLs for metals Figure 6-5 and 6-7) and PAHs (Figure 6-6). These figures are formatted using the same system as the tables (described in Section 6.3.1) to compare concentrations to RSLs, SCOs, and/or background.

Only four VOCs have been detected in any soil samples from Area 3 and concentrations were less than all five SCOs and the RSLs (except for acetone which exceeded the Unrestricted Use SCO). Due to the infrequent detections of VOCs and the low detected concentrations in historical investigations, VOCs were not further evaluated in Area 3 during the SRI2.

A total of five PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected in soil at concentrations above the Residential RSLs and three [benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene] were detected at concentrations in soil above the Industrial RSL. All five of these PAHs were also detected at concentrations greater than background. Concentrations are higher in the surficial soil samples (i.e., 0-2 inches), but concentrations of PAHs detected above the RSLs have been encountered at all depth intervals. The five aforementioned PAHs are consistently detected in the 2011 surficial samples at concentrations above the Residential RSLs, with occasional detections above the Industrial RSLs. As indicated above, elevated concentrations of PAHs [benzo(b)fluoranthene at 1.4 mg/kg, chrysene at 1.1 mg/kg and indeno(1,2,3-cd)pyrene at 0.68 mg/kg] were detected in SS-39 from 0-2 inches bgs. Sample locations AI3-101 and AI3-102 were selected to evaluate the northern and southern impacts of PAHs around SS-39. Concentrations in AI3-101 (0-2 inches) were similar in concentration to SS-39. Concentrations in AI3-102 (0-2 inches) were lower than those in AI3-101 (0-2 inches) or SS-39.

Additional sampling was conducted throughout Area 3 to further characterize the concentrations of PAHs present in soil. PAHs were detected at elevated concentrations in the shallow depth interval (0-2 inches) at AI3-103 and AI3-111. The maximum PAH concentrations within Area 3 were detected at AI3-103 with benzo(a)anthracene at 1.5 mg/kg, benzo(a)pyrene at 1.8 mg/kg, benzo(b)fluoranthene at 2.9 mg/kg, and indeno(1,2,3-cd)pyrene at 1.2 mg/kg. Additionally, concentrations in AI3-111 (0-2 inches bgs) were similar. Surrounding samples are significantly lower which indicates these are two isolated pockets of elevated PAHs.

Five SVOCs, [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene], were detected above both the Unrestricted and the Residential Use SCOs in Area 3. All but chrysene were also detected at concentrations greater than the Restricted Residential Use SCO. SVOCs were originally detected at concentrations above the SCOs in two sample locations, SS-37and SS-39, at a depth of 0-2 inches below the ground surface. After additional sampling, SVOCs above the SCOs were also detected in AI3-101 (0-2 inches), AI3-103(0-2 inches), and AI3-111(6-24 inches). The maximum concentrations of benzo(a)anthracene and benzo(b)fluoranthene are greater than the Unrestricted Use SCO; the maximum concentration of benzo(a)pyrene is greater than the Industrial Use SCO.

All of the aforementioned PAHs were detected at concentrations above background.

All twenty two metals were detected in Area 3 soil. Four metals (arsenic, cobalt, iron, and lead) were detected at concentrations greater than their respective Residential RSLs and two (arsenic and lead) were detected at concentrations greater than their respective Industrial RSLs. All four of these metals were detected at concentrations greater than background.

Arsenic was detected consistently throughout the area at concentrations ranging from 1.2 mg/kg to 132 mg/kg (above both the Residential and Industrial RSLs). Arsenic concentrations were consistent with background at most locations with the exception of AI2-103 (0-2 inches and 6-24 inches) and AI2-105 (0-2 inches and 6-24 inches) where surface arsenic concentrations were 53.7 mg/kg and 132 mg/kg and subsurface concentrations were 17.4 mg/kg and 18.9 mg/kg, respectively. AI3-105 was collected immediately adjacent to a deck (6 feet west, downslope, of the deck platform, and 5.5 feet north of the deck stairs) (Appendix O) believed to be constructed of pressure treated lumber, and therefore accounting for the elevated arsenic at this location. Concentrations in surrounding samples, including AI3-108, AI3-109, and AI3-104 were significantly lower.

As indicated above, an elevated concentration of copper (2,470 mg/kg) was detected at B-1, south of Little Bay Road. Borings AI3-106, AI3-107, and AI3-110 were advanced to delineate the copper concentrations around B-1. Concentrations in these borings at all three depth intervals were substantially lower than the detected concentration in B-1. All detected concentrations in these three borings were below background with the exception of the maximum concentration [166 mg/kg in AI3-106 (2-4 ft bgs)]. This indicates that this elevated concentration of copper is isolated to that one location.

Lead was detected in SB-06 (0-0.5 ft), AI3-103 (0-2 inches), and AI3-107 (0-2 inches) at concentrations greater than the Residential RSL. Lead was detected at a concentration greater than both the Residential and Industrial RSL in AI3-103 (0-2 inches) (2,140 mg/kg). With the exception of this elevated lead concentration, the other lead concentrations were below or consistent with background.

Mercury has been detected throughout Area 3 at elevated concentrations. The areas with the highest mercury concentrations have been encountered around SB-07/SS-38/SS-37 and at B-2. These concentrations are less than the Residential or Industrial RSLs; however, they are greater than background and twelve samples have mercury concentrations above the Residential Restricted Use SCO. The mercury concentration in one location (SS-38) exceeded the Commercial Use SCO. Sample results at AI3-112 and AI3-111 both in the surface and subsurface intervals have lower mercury concentrations, indicating that there is a pocket of mercury at B-2 from 0 to 2 ft bgs.

Results of the November 2012 soil sampling for total mercury indicate that the elevated mercury concentrations previously detected at SB-07, SS-38, and SS-37 are not reproducible. The maximum mercury concentration from the November 2012 sampling results is 1.1J mg/kg [AI3-202 (5-6 inches)], which is below background.

In addition to these previously identified locations, two new locations of elevated concentrations were identified during the 2011 sampling. One is AI3-103. The maximum detected concentration of barium, cadmium, chromium, lead, nickel, and zinc were detected in AI3-103 (0-2 inches). All of these metals were detected at concentrations greater than background in this sample. Concentrations were lower in the 6-24 inch sample; however, arsenic was still detected above background in this deeper sample. This sample also coincides with elevated concentrations of PAHs, most of which were detected above background as well. Samples AI3-106 and AI3-107 had lower metals concentrations, so these impacts appear to be localized to AI3-103. Also, as indicated above, AI3-103 and AI3-105 had elevated concentrations of arsenic at concentrations substantially higher than those previously detected at the Site.

Nine metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc) were detected at concentrations above one or more SCOs in Area 3. However, five metals, chromium, copper, lead, zinc, and mercury, were the most frequently detected. Chromium was detected in all samples above the Unrestricted Use SCOs, in 12 samples above the Residential Use SCOs, and in one sample above the Restricted Residential Use SCO. All but two chromium concentrations were below background, and no concentrations exceeded the RSLs. Copper was detected at concentrations that greater than the Unrestricted Use SCOs and had previously been detected at a concentration greater than the Commercial Use SCO in B-01 from 1-2 ft bgs. This elevated concentration of copper, in sample location B-1, was further delineated as part of this RI with the collection of samples located at AI3-106, AI3-107, and AI3-110. All copper concentrations in these sampling locations were below the SCOs with the exception of AI3-106 (2-4ft), which had a detection greater than the Unrestricted Use SCO. Lead was detected consistently throughout the area at concentrations above the Unrestricted SCOs. Three locations, SB-06, AI3-103, and AI3-107, had concentrations detected above either the Commercial Use or Restricted Residential Use SCOs. Zinc had occasional detections above the Unrestricted SCOs throughout the Area. Mercury was detected at concentrations greater than the Unrestricted Use SCO throughout the area. Mercury was detected at concentrations greater than its Restricted Residential Use SCO in nine samples, and it's Commercial Use SCO in one sample, SS-38, at a depth of 0-2 inches.

One sample, AI3-103 had concentrations of eight of the nine aforementioned metals above one or more of the SCOs, with the maximum detected concentrations of arsenic, cadmium, lead, nickel, and zinc detected in that location from 0-2 inches. Lower concentrations were found in the deeper interval with only arsenic, lead, and zinc detected at concentrations above one or more SCOs. Arsenic was detected at concentrations in this location above the Industrial Use SCO in both the shallow and deep sample. Additionally, arsenic was detected at concentrations above the Industrial Use SCO in AI3-105 at both surface and subsurface depth intervals and in A13-111 in the surface depth interval.

All of the lead detections, with the exception of 2140 mg/kg in AI3-103 were detected at concentrations below background. Other detected metals, specifically arsenic, copper, and iron, had some concentrations that were above background.

6.3.5 Area 4 – Building 625

Area 4 is located in the central portion of the Site and is bordered by North Loop Road to the east, Abbott Road to the south, and Bayside Street to the west (Figure 1-2). Area 4 includes Building 625 in the north and former Building 609 in the southeast corner. Previous investigations have found elevated concentrations of SVOCs, specifically PAHs, in soil samples from Area 4.

Table 6-4 presents analytical data for all parameters detected in one of more soil samples collected from Area 4 and compares the data to the SCOs, RSLs, and background. Figures 6-8 and 6-9 depict sampling locations and Area 4 soil concentrations that are greater than one or more SCOs or RSLs for metals and PAHs, respectively. These figures are formatted using the same system as the tables (described in Section 6.3.1) to compare concentrations to RSLs, SCOs, and/or background.

Only four VOCs (2-butanone, acetone, trichloroethene, and vinyl chloride) have been detected in Area 4. All VOCs were detected at concentrations less than the Residential and Industrial RSLs. Acetone, a common lab contaminant, was the only VOC detected at concentrations above an SCO in Area 4. Due to the infrequent detections of VOCs and the low detected concentrations in historical investigations, VOCs were not further evaluated in Area 4 during the SRI2.

Six SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations greater than their respective Residential RSLs. Five of these SVOCs [all but benzo(k)fluoranthene] were detected at concentrations greater than their Industrial RSLs as well. Concentrations of these six SVOCs were consistently detected above the RSLs throughout Area 4, however elevated concentrations of some PAHs [i.e., benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene] were detected in samples collected around SB-1, B-5, SB-3, and

AI4-106. These concentrations were detected at a maximum of 7.3 mg/kg of benzo(a)anthracene, 9.8 mg/kg of benzo(a)pyrene, and 16 mg/kg of benzo(b)fluoranthene. Although some detections were greater than their respective RSLs, concentrations along the western and northern boundary of the site are significantly lower. All of these PAHs have been detected in one or more soil samples at concentrations greater than background.

A total of seven SVOCs (all of the above-listed SVOCs plus chrysene) were detected at concentrations greater than one or more of the SCOs. Benzo(a)pyrene benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected at maximum concentrations greater than the Industrial Use SCOs. Benzo(a)anthracene and indeno(1,2,3-cd)pyrene were detected at a maximum concentration greater than the Commercial Use SCOs. Benzo(k)fluoranthene was detected above the Residential Use SCO and chrysene was detected above the Restricted Residential Use SCO.

Elevated concentrations of PAHs were detected southeast of Building 625 in the areas surrounding SB-3 (SS-12, SS-13, SS-14, and SS-15). For the May 2011 sampling, samples AI4-103, AI4-104, AI4-105, and AI4-106 were collected to confirm and delineate the elevated PAH concentrations. Concentrations of PAHs in samples AI4-103 and AI4-104 were significantly lower than those immediately surrounding SB-3. Sample AI4-105 confirmed the presence of elevated concentrations within the vicinity of SB-3. Sample AI4-106 had elevated concentrations of PAHs in both the 0-2-inch and 6-24-inch intervals. Observations during drilling (AI4-102) and during digging of observation holes (AI4-102, AI4-106), indicate the presence of coal, coal ash, and asphalt (Table 5-5), which are likely the sources of the elevated PAH concentrations. The presence of fill materials that can contain PAHs (i.e., coal, asphalt) and the sporadic distribution of the elevated concentrations indicates the elevated PAH concentrations are attributable to fill materials.

Elevated concentrations of SVOCs were detected in the area surrounding samples SS-5, B-5, and AI4-113. Fill materials (coal, concrete, and brick) were observed in observation holes at B-5 and AI4-113 (Table 5-5), indicating the fill material is the likely source of the elevated PAHs.

Elevated concentrations of SVOCs were detected at AI4-111 and AI4-108. Observations during drilling and digging of observation holes indicates the presence of fill materials (coal, coal ash, brick, and metal) (Table 5-5), which are likely the sources of the elevated PAH concentrations. Elevated concentrations of SVOCs were detected in the area around SS-3/B-6 as well (along the southeastern corner of Former Building 609). Samples AI4-112 and AI4-115 were collected to delineate these PAH impacts. Concentrations were lower in these two samples in both the shallow and deep intervals. As such, it appears that the PAH impacts are limited to the area immediately surrounding SS-3. Coal and asphalt were observed in the observation hole dug at adjacent location B-6 (Table 5-5), indicating the elevated PAH concentrations are likely attributed to fill materials.

As indicated above, elevated PAHs are located in a few areas within Area 4. Concentrations of several PAHs are higher than corresponding concentrations in the background locations and Areas 1, 2, 3, and 5. A statistical analysis of the Area 4 PAH concentrations compared against PAH concentrations in background and Areas 1, 2, 3, and 5 (Appendix M) indicate that the Area 4 concentrations are somewhat inconsistent with PAH concentrations elsewhere at Fort Totten. Observations of fill materials, specifically coal, coal ash, and asphalt, during drilling and digging of observation holes in all the areas of elevated PAH concentrations, indicate the elevated concentrations are likely attributable to urban fill materials. The PAHs concentrations in Area 4 may be slightly higher than detected elsewhere due to heterogeneity.

One metal, arsenic, was detected at a concentration greater than both the Residential and Industrial RSLs. Arsenic concentrations ranged from 0.53 to 19.2 mg/kg. However, all but three of the detected arsenic concentrations were below background (10.73 mg/kg and 7.599 mg/kg, respectively). All other metals were detected at concentrations below their respective RSLs.

Six metals (arsenic, chromium, copper, lead, mercury, and zinc) were detected at concentrations above one or more of their respective SCOs in Area 4. Of the six metals, only arsenic and chromium were reported above background. The detections of chromium were above the Unrestricted Use SCO and some were above the Residential Use SCO. Although arsenic was detected above its Industrial Use SCO at one location, all other arsenic concentrations were below all five SCOs.

6.3.6 Area 5 – Building 615

Area 5 is located on the western portion of the Site southeast of Building 615 (Figure 1-2). Previous investigations have shown elevated concentrations of metals, specifically mercury, in Area 5.

Table 6-5 presents analytical data for all parameters detected in one of more soil samples collected from Area 5 and compares the data to the SCOs, RSLs, and background. Figures 6-10 and 6-11 depict sampling locations and Area 5 soil concentrations that are greater than one or more SCOs or RSLs for metals and PAHs, respectively. These figures are formatted using the same system as the tables (described in Section 6.3.1) to compare concentrations to RSLs, SCOs, and/or background.

A total of three VOCs (acetone, methylene chloride, and vinyl chloride) were detected in Area 5. All of these were detected at concentrations less than the Residential and Industrial RSLs and the SCOs. Due to the infrequent detections of VOCs and the low detected concentrations in historical investigations, VOCs were not further evaluated in Area 5 during the SRI2.

A total of three PAHs, [benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene], were detected at concentrations greater than the Residential RSLs. Of those three analytes only benzo(a)pyrene was detected at a concentration greater than the Industrial RSL. These detections were in 615-SB01. All of these concentrations were below background. No other samples were analyzed for SVOCs. One SVOC, phenol, was detected at a concentration above the Unrestricted SCO. Due to the low frequency of detection (one in 4 samples) and low concentrations reported in the historical samples, SVOCs were not evaluated further as part of the SRI2.

Three metals (arsenic, cobalt, and lead) were detected at concentrations greater than the RSLs. Of these three metals only arsenic was also detected at a concentration greater than the Industrial RSL. Arsenic was detected at concentrations greater than the Residential RSLs in all 39 samples, and the Industrial RSLs in 37 samples. However, all detections of arsenic were below background with the exception of one detection (13.3 mg/kg in sample AI5-101 from 0 to 2 inches bgs). Cobalt was detected at a concentration above the Residential RSL in one location (SS-42); the remaining concentrations were below the Residential RSLs, however some were detected above background. Lead has been detected at concentrations above the Residential RSLs in SS-41, SS-42, and SS-43. Additionally, lead was detected in AI5-107 at a concentration greater than the Residential RSL. With the exception of three locations, lead concentrations were detected below background.

Eight metals (arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected at concentrations greater than their respective SCOs in Area 5. Of the eight metals, mercury was detected above the Industrial Use SCO, copper was detected above the Commercial Use SCO, lead was detected above the Restricted Residential Use SCO, chromium was detected above the Residential Use SCO, and arsenic, nickel, and silver were detected above the Unrestricted Use SCO.

Mercury was detected in all 23 samples at Area 5. The mercury detections are associated with former subsurface piping and three subsurface cesspool dry wells located south of Building 615. Between May 2006 and March 2007, three separate excavation events were conducted in an attempt to remove the impacted soil which had concentrations above the SCOs (Figure 6-12 and Appendix N Field Reports). The May 2006 excavation activities resulted in two excavations. The area around the southern cess pool was excavated east to the underground power line and south past the edge of the cesspool, to an approximate depth of four feet. An excavation east of the underground power line and adjacent to the building was also conducted to search for additional routes of transmission of mercury from the building. This excavation was also completed to an approximate depth of four feet bgs. No evidence of drain pipes or septic tanks were observed in the eastern excavation. The October 2006 excavation was focused on determining the discharge point for the Building 615 floor drain and determining the presence/absence of mercury-impacted soils at potential discharge points. This excavation was completed to an approximate depth of five feet bgs and uncovered. The two northern cesspools and the point where the drain line exited the building were uncovered. A live sewer line running across the top of the cess pools was also revealed. The March 2007 excavation focused on the area between the cesspools and the underground power line based on results of the sampling conducted in October 2006. All of the soil between the cesspools and the underground power lines was removed. The excavation extended north to sampling location SB-07 and south to SB-02, and was completed to an approximate depth of seven feet bgs. During these excavation activities, October 2006 sample locations SB-07, SB-08, and SB-09 were removed; these samples are therefore no longer considered representative of Area 5 soils. However, 2007 excavation confirmation soil samples collected after detected mercury concentrations at 9.8 mg/kg (615-SB-15) and 12.2 mg/kg (615-SB-17), which were greater than background and one concentration 12.2 mg/kg that was greater than the Residential RSLs. 615-SB-15 was collected from the bottom of the excavation and 615-SB-17 was collected from the eastern wall of the excavation, beneath the underground power line. Just east of 615-SB-17, on the east side of the underground power line, just south of Building 615, the soil was excavated and sampled for mercury (615-SB-03, 1.6 mg/kg) as part of the May 2006 excavation. South of this component of the May 2006 excavation activities, surface and subsurface soil samples were collected with a maximum mercury detection of 4.8 mg/kg (SS-44, 0-2 inches). Samples A15-106 and A15-105 were collected south and east of the known mercury-contaminated areas. Concentrations in these samples were significantly lower and below background.

Based on all of the sample results, the highest concentrations of mercury were detected between the cesspools and the underground power line. All of this soil was removed by 2006 and 2007 excavation activities. Soil east of the maximum mercury detections and east of the underground power line was also removed. Bounding samples to the southeast and south of the maximum mercury detections have much lower mercury detections, indicating the area of highest mercury detections was defined and removed. Sample results indicate there is some inaccessible soil beneath the underground power lines with mercury concentrations up to 12.2 mg/kg.

7.0 CONTAMINANT FATE AND TRANSPORT

Neither chemical concentrations nor chemical structures remain constant in the environment. When a chemical is released into the environment, it may be transported, transformed, and/or accumulated in one or more media. This section discusses the processes and various chemical and physical properties that affect the fate and transport of the metals and PAHs detected at the Site.

Contaminant Sources

Contaminants at the Site consist of metals (including mercury) and PAHs. The following potential sources of contamination have been identified at the Site.

- Area 1, previously known as the Fill Area was created when the Army placed soil excavated from elsewhere at Fort Totten in a low spot of a recreation field to eliminate periods of standing water. The soil came from Buildings 118, 119, and 121, which were former and existing vehicle maintenance shops, on the Army-owned portion of Fort Totten. The excavated soil included a portion of those buildings' parking lots. The source of metals and PAHs in Area 1 is fill impacted from the former and existing vehicle maintenance shops (USACE, 2005).
- Building 615 was originally used as a torpedo and mine repair facility. The armaments contained mercury in their guidance systems, and when repair required removal of the mercury, it was disposed of through the floor drain (USACE, 2005). The source of mercury contamination in Area 5 was the discharge of mercury through these floor drains.
- No source of PAH and metals contamination has been identified for Areas 2 through 5. Based on the concentrations of SVOCs found in the upland soils, there is no indication of a specific release in soils at the Site; however, elevated concentrations of SVOCs and metals are most likely attributed to fill materials at the Site and/or variation in surface soil concentrations in urban environments.

Migration Pathways

The potential migration pathways include the following:

- Migration of contaminants in surface soil via overland flow due to precipitation to Little Bay;
- Leaching of soluble constituents present in Site soils to groundwater;
- Migration of dissolved phase constituents in overburden groundwater to Little Bay; and
- Volatilization of mercury to Building 615.

Environmental Fate and Transport

The environmental fate and transport characteristics of the contaminants at the Site are described herein.

Metals detected above either of the RSLs and/or the SCOs in soil include arsenic, barium, cobalt, copper, chromium, iron, lead, nickel, mercury, thallium, and zinc. The mobility of metals in soil depends on many factors including soil type, oxidizing/reducing conditions, pH, and organic content. Aluminum, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, and zinc were detected in groundwater. Of the metals detected, both in soil and groundwater, the maximum concentrations in groundwater are 0.2% of the maximum concentrations detected in soil.

Higher molecular weight compounds, such as PAHs are relatively insoluble and are not expected to dissolve in or be transported by groundwater. Transport and partitioning of PAHs in the environment are determined to a large extent by physicochemical properties such as water solubility, vapor pressure, Henry's law constant, octanol-water partition coefficient (Kow), and organic carbon partition coefficient (Koc). The maximum concentration of PAHs that were detected, both in soil and groundwater were compared and groundwater concentrations are 0.013% of soil concentrations or less.

The fate and transport of principal site contaminants is described below.

- Surface soil contaminants are not migrating in significant quantities to surface water bodies. Surface water and sediment sampling of Little Bay did not detect concentrations of metals or SVOCs at concentrations higher than those found in surface water in Little Neck Bay and the concentrations and patterns of PAHs in both locations indicate that Little Bay is no more impacted than Little Neck Bay (USACE, 2005). As such, while this is a potential pathway, it does not appear to be an active pathway at this time.
- Concentrations of PAHs and metals are present in overburden groundwater. Low concentrations of both metals and PAHs are present in groundwater, with the highest concentrations in MW-4R and MW-5, the two downgradient wells.
- Based on the presence of PAHs and metals in the two downgradient wells, contaminants may be traveling through groundwater towards Little Bay. However, surface water sampling did not detect significant concentrations of metals and/or PAHs (USACE, 2005). As such, this is not a complete pathway.
- The SRI2 evaluated the potential for mercury impacts in ambient air in Building 615 due to volatilization. The sample results for the indoor air sampling in Building 615 indicated that there were no detectable concentrations of mercury greater than the state screening level (USACE, 2006).

8.0 HUMAN HEALTH RISK ASSESSMENT

8.1 Introduction

This section presents the Baseline HHRA for the Site. The HHRA is based on data collected up through the May 2011 sampling events. The results of the November 2012 sampling are discussed in Section 8.7, Qualitative Update of Baseline Human Health Risk Assessment. The objective of the HHRA is to quantify the human health risks associated with potential exposures to site-related constituents under current and reasonably foreseeable future land use conditions, in the absence of any remedial actions. Following this HHRA, the next section (Section 9) characterizes the risks to environmental receptors for the Site. The HHRA will organize and present risk information, along with an analysis of uncertainty, as an aid in the decision making process. Characterizing risks at the Site will provide stakeholders with information that will be helpful to make remedial decisions that are protective of human health and the environment.

8.1.1 Regulatory Context of Human Health Risk Assessment

A complete list of regulation, guidance, and policy documents that have been relied upon to complete the HHRA is included in the References List in Section 10. Specifically, the HHRA is performed using USEPA CERCLA guidance for risk assessment, including, but not limited to the USEPA risk assessment guidance and directives listed below.

- USEPA, 1989a. "Risk Assessment Guidance for Superfund: Volume 1, Part A Human Health Evaluation Manual”.
- USEPA, 1989b. "Part B Development of Risk-based Preliminary Remediation Goals".
- USEPA, 1991. “Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors (OSWER Directive 9285.6-03)”.
- USEPA, 1992a. “Guidance for Data Usability in Risk Assessments”.
- USEPA, 1997a. “Exposure Factors Handbook”. August.
- USEPA, 2001a. “Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, Review Draft-For Public Comment”, EPA/540/R/99/005, OSWER 9285.7-02EP. September.
- USEPA, 2001a. “Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments) Final”. December.
- USEPA, 2002a. “Calculating Upper Confidence Limits for Exposure Point Concentrations (EPCs) at Hazardous Waste Sites: Office of Solid Waste and Emergency Response/Office of Solid Waste and Remedial Response; OSWER 9285.6-10. December.
- USEPA, 2002b. “User’s Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children” (EPA 9285.7-42, May).
- USEPA, 2002c. “Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils”, EPA530-F-02-052.
- USEPA, 2003a. “Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risk Associated with Adult Exposures to Lead in Soil” (January).
- USEPA, 2003b. “Human Health Toxicity Values in Superfund Risk Assessments” (OSWER No. 9285.7-53, December).
- USEPA, 2005a. “Guidelines for Carcinogen Risk Assessment”; Risk Assessment Forum. EPA/630/P-03/001F. March.
- USEPA, 2005b. “Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens”, Risk Assessment Forum, EPA/630/R-03/003F. March.
- USEPA, 2008. “Child-Specific Exposure Factors Handbook”.

- USEPA, 2009. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part F, Supplemental Guidance for Inhalation Risk Assessment), Final EPA-540-R-070-002, OSWER 9285.7-82", January.
- USEPA, 2010. "ProUCL Version 4.00.05, User Guide, (Draft)" EPA/600/R-07/038. May. www.epa.gov.
- USEPA, 2011a. *Regional Screening Levels*. June.
- USEPA, 2011b. *Integrated Risk Information System (IRIS)*. October. http://www.epa.gov/iris

8.1.2 Content of the Human Health Risk Assessment

The HHRA is completed using a four-step process, consistent with the framework for risk assessment described in Risk Assessment Guidance for Superfund *(RAGS)* (USEPA, 1989a). The four steps include Data Evaluation (sometimes also referred to as Hazard Identification), Exposure Assessment, Toxicity Assessment, and Risk Characterization. Supporting documentation of the risk assessment methods, inputs, and results are provided in tables, figures, and appendices to the document. The organization of the HHRA and content of each of the report sections is described below.

The remainder of Section 8.1 provides the Site background and description and the CSM. Figure 1-2 provides Site location and layout. Table 8-1 provides 'RAGS Part D, Table 1', which provides the 'road map' for the risk assessment and the basis for the grouping of analytical data described in Section 8.2 and the exposure assessment described in Section 8.3. The term "RAGS" is an acronym for the USEPA RAGS.

Section 8.2, Data Evaluation and Identification of Chemicals of Potential Concern, (and Appendix E) summarize and document the evaluation of existing data and the development of the data sets used in the HHRA and documents the selection of the chemical parameters that are evaluated in the HHRA (COPCs). Appendix E includes a list of samples [organized by medium (and by exposure area within each medium)] used in the HHRA and it includes the analytical data for each data set. The culmination of the data evaluation is the Selection of COPCs for each of the Site media. The selection of COPCs is documented in tables and text.

Section 8.3, Exposure Assessment, provides information documenting the human populations that could access or use the Site under current and possible future land use conditions, discusses how those populations could potentially be exposed to the COPCs in Site media, and quantifies how much exposure could occur. Specific components of the Exposure Assessment include descriptions of current and future land uses, exposure areas, exposure pathways, and exposure scenarios, and documentation of EPC and exposure intake calculations. Appendix F provides supporting documentation for calculation of EPCs using USEPA software.

Section 8.4, Toxicity Assessment, provides information concerning the toxicological attributes of COPCs and the dose-response relationships of the COPCs that are used to quantify health risks. Appendix G provides toxicity profiles which summarize the health effects that could be associated with exposures to the COPCs.

Section 8.5, Risk Characterization, presents the methodology that is used to calculate and summarize health risks, as well as the results and interpretation of the calculated risks. Included in this section is an uncertainty analysis, which provides an evaluation of the variables and assumptions in the HHRA that could or may have affected the results of the risk assessment. Appendices H and I present the RAGS Part D tables that collectively provide the documentation of risk calculations. Appendix J presents the calculations associated with risks to lead.

Section 8.6 provides the summary and conclusions of the HHRA. The results are presented in the context of CERCLA risk management criteria.

8.1.3 Site Description

Section 2.1 of this RI contains a comprehensive and detailed description of the Site located on Willets Point in Queens, New York. The reader is referred to Section 2.1, and the comprehensive Site description is not repeated here.

Site attributes that are relevant to the HHRA are described further in Section 8.3.

8.1.4 Site Investigations

The Site investigation history is presented in Section 2.3 and the results of the RI Field Work are presented in Sections 4.0 and 5.0.

The Site investigations have identified PAH and metal constituents in soil at concentrations greater than screening levels. As documented in Section 6.0, the SRI2 has successfully characterized the nature, extent, and fate and transport associated with the detected constituents in the various media at the Site. The CSM, which integrates the nature and extent of contamination, hydrogeology, and fate and transport, is presented in Section 3.0, and is very briefly summarized, in the context of the HHRA, in the following subsection.

8.1.5 Conceptual Site Model (CSM)

An exposure CSM is used to describe the potential migration pathways through which Site-related contaminants may have been transported and/or trans-located from source or release areas at the Site to other environmental media where possible human and environmental exposure may occur. The physical CSM for the Site (sources, migration pathways, receiving media) is described in detail in Section 3.0 and potential human receptors have also been identified. The potential human receptors and exposure pathways are discussed below in the context of the physical CSM.

For the purposes of this HHRA, the current and foreseeable future uses of the Site were considered. Currently a portion of the Site is used as the Headquarters for the 77th Army Reserve Command, and the remaining portion of the Site consists of maintained fields, parking areas, and some undeveloped areas. The Coast Guard retains jurisdiction over the 7.8 acres being investigated in this report. The future use of the Site is undetermined, therefore foreseeable future uses will be evaluated in this HHRA. Given that information and working assumptions, the following human receptors are considered for this HHRA.

Current Land Use

- Outdoor Commercial/Industrial Workers (adults)
- Trespasser/Recreational Receptors (adolescents and adults)

Future Land Use

- Outdoor Commercial/Industrial Workers (adults)
- Indoor Commercial/Industrial Workers (adults)
- Construction Workers (adults)
- Recreational Receptors (children and adults)
- Residents (children and adults)

An exposure pathway is the course a chemical takes from its source to the person being contacted. Exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure. Exposure pathways generally consist of four elements: 1) a source and mechanism of chemical release, 2) a retention or transport medium, 3) a point of potential human contact with the contaminated medium (known as the exposure point), and 4) an exposure route at the contact point (e.g., ingestion of soil, inhalation of vapors) (USEPA, 1989a). For the exposure pathway to be considered potentially complete, all four elements must be present.

An exposure point (also called an exposure area or exposure unit) is a location within which an exposed receptor may reasonably be assumed to move at random and where contact with an environmental medium (e.g., soil) is equally likely at all sub-locations. In addition to the behavior of receptors, the existing pattern of chemical constituents in environmental media is also considered in identifying exposure areas. The identified current and future receptors, the assumption of random exposure within an exposure area, and the nature and extent of contamination have been considered in identifying exposure areas for the HHRA. Important factors in identifying the exposure areas at the Site include the current and anticipated future uses of the various areas of the Site. Therefore, the HHRA exposure areas at the Site reflect current and future receptors and the current and future uses of the various areas within the Site.

Environmental media evaluated quantitatively in this HHRA (exposure media) include surface soil (and airborne dust), subsurface soil (and airborne dust) and groundwater (potable use for future resident and dermal contact for a construction worker involved in excavation activities).

Exposure routes are the mechanisms by which people are exposed to environmental media. Exposure routes that are typically evaluated in environmental risk assessments include ingestion of the environmental medium, skin (dermal) contact with the environmental medium, and inhalation of outdoor or indoor air. In this HHRA, incidental ingestion and dermal contact with soil are evaluated for all receptors. Potential inhalation of soil-derived dust is evaluated for future outdoor workers and future construction workers only.

The Site is currently serviced by municipal water. Currently groundwater at the Site is not used for any potable uses. Since the Site is located on the shores of Little Bay there is the potential for intrusion of Little Bay surface water into the groundwater. The salinity of water in Little Bay is approximately 20 parts per thousand. The intrusion of Little Bay water could yield groundwater undrinkable due to the high salinity. As a conservative measure; however, potable use of groundwater (ingestion and dermal contact) was evaluated for a future residential scenario. The depth to groundwater on Site ranges from 6 to 17 ft bgs. There is the potential for a construction worker to come in contact with groundwater during an excavation. Therefore dermal contact to Site groundwater was evaluated for future construction workers. Table 8-1 provides a summary of the receptors and exposure scenarios evaluated in the HHRA.

8.2 Data Evaluation and Identification of Chemicals of Potential Concern

The data evaluation and selection of COPCs described in this section includes the components listed below.

- Summary of media and areas of the Site that have been investigated and that are evaluated in the HHRA;
- Identification of available analytical data relevant to the HHRA for the Site;
- Identification of data representative and not representative of current and future conditions at the Site;
- Summary of data quality, with an emphasis on potential limitations that could introduce uncertainty into the risk assessment;
- Summarization of analytical data for each medium evaluated in the HHRA;
- Methods used to group and summarize data for use in the risk assessment; and
- Selection of COPCs for each medium.

Section 8.2.1 is a summary of data collected during previous investigations and response actions, identification of sampling locations for the Site and the background area, and preliminary identification of potential human exposures. Section 8.2.2 is a general discussion of data evaluation methods. Section 8.2.3 documents the Site data evaluation and selection of COPCs. Appendix E identifies and documents the analytical data selected for use in the HHRA.

8.2.1 Data Collection Summary

The entire body of available medium-specific analytical laboratory data for surface soil, subsurface soil and groundwater at the Site has been evaluated to determine the subsets of data that are appropriate to characterize human health risks for current and foreseeable future land uses and site conditions. Data collected from the Site has previously been described in Sections 2.3 and 5.0 and the nature and extent of contamination has been discussed in Section 6.0.

The laboratory analyses associated with historical and SRI2 investigation activities, have been conducted using USEPA published and approved laboratory analytical methods. The data collected as part of the SRI2 have undergone data validation in accordance with the QAPP and the data validation report in contained in Appendix D of this report.

The analytical data collected for Site environmental media and that were considered for use in the HHRA are associated with the analytical data listed below.

- Surface soil (historical soil samples with a top depth of zero ft bgs and a bottom depth less than 2 ft bgs and SRI2 soil samples collected from 0–0.5 ft bgs) samples collected from on Site locations.
- Subsurface soil samples (collected from within the 0.5–10 ft bgs interval) collected from on Site locations.
- Deep subsurface soil samples (from greater than 10 ft bgs) collected from on Site locations. The deep subsurface soil samples are considered to be representative of isolated or inaccessible soils. Data from inaccessible soils are not considered in this HHRA.
- Background surface soil samples (from the 0–0.25 ft bgs interval) collected from off Site locations.
- Background subsurface soil samples (from the 1.5–2 ft bgs interval) collected from off Site locations; and
- Groundwater samples collected from on Site locations during the SRI2.

All of the available analytical data that have been collected through May 2011 have been considered for use in the HHRA. The results of the November 2012 sampling are considered in the Qualitative Update of Baseline Human Health Risk Assessment discussed in Section 8.7.

Based on the preliminary evaluation of potential human exposure, Table 8-1 (summary of receptors and exposure pathways) and Figure 8-1 (human health CSM) provide the framework for evaluating data to be used in the HHRA and for making decisions about grouping of the analytical data.

The Site has previously been divided into five areas for the purpose of investigation and possible future clean-up effort. The five investigations areas were determined based on historic site use. These previously identified areas will be used as exposure areas for the purpose of the HHRA. The exposure areas have been identified as Area 1, Area 2, Area 3, Area 4 and Area 5. These exposure areas are show on Figure 1-2.

The exposure areas are described below.

- Area 1 (Fill Area) – Located in the northeast corner of the Site, this area is approximately 44,100 square feet. This is an area of historic filling. The fill soil came from the excavation of parking lots for the construction of vehicle maintenance shops at Buildings 118, 119, and 121. The soil was used to fill low spots which commonly had standing water in them.
- Area 2 (Building 624) – Located west of Area 1, this area is approximately 43,100 square feet. Building 624 was located in this area and has since been demolished. Building 624 was historically used to store pesticides.
- Area 3 (Buildings 610, 611, and 612) – Located in the southwest portion of the Site, this area is approximately 121,200 square feet. This area contains buildings 610, 611, and 612 which are currently in use by the USCG.
- Area 4 (Building 625) – Located in the central portion of the Site, this area is approximately 64,800 square feet. This area includes Building 625 in the north and the former Building 609 in the southeast corner.
- Area 5 (Building 615) – Located on the western portion of the Site, this area is approximately 14,300 square feet. This area contains Building 615 which was originally used as a submarine maintenance shop as well as a torpedo and mine repair facility.

Background Area – Background samples were collected in the vicinity of the Site. A Background Study was prepared by the USACE, and presents the locations of background samples (USACE, 2009, Watermark, 2011, Appendix B).

8.2.2 General Data Evaluation Considerations

Overall, the data evaluation and selection of data for use in the HHRA have been conducted to identify data that are: (1) representative of existing soil conditions; and (2) "usable" (that is, of sufficient quality) for HHRA purposes.

8.2.2.1 Representative Data

Data that are no longer representative of current Site conditions have been excluded from the HHRA. In addition, data associated with soil samples inaccessible to human receptors (such as deep subsurface soils greater than 10 ft bgs) have also been excluded from the HHRA. The analytical data for soil and groundwater were evaluated to identify the data that are representative of current and foreseeable conditions at the Site.

Data that are considered "representative of current conditions" are those associated with samples that were collected from media that remain at the Site and there is no reason to believe that detected compounds and associated concentrations have changed substantially since the time of sample collection. Conversely, some historical data are no longer representative of current site conditions because they are associated with media that have been removed from the Site during past removal actions.

8.2.2.2 Usable Data for Human Health Risk Assessment Purposes

USEPA risk assessment guidance (USEPA, 1989a) discusses usability of data for risk assessment purposes and identifies several factors to be evaluated when determining data usability, including:

- Accepted or approved analytical methods;
- Reporting limits sufficient to identify concentrations of potential concern; and
- Data validation that addresses precision, accuracy, repeatability, completeness, and comparability of the laboratory analytical data.

The data sets to be used in the HHRA have been identified based on their representative nature and usability as outlined above. The data have been summarized by media, and COPCs selected, as described in the following subsections.

8.2.3 Data Evaluation and Selection of COPCs

The available analytical data for Site soil and groundwater have been compiled and have been evaluated in a manner consistent with sections 8.2.2.1 and 8.2.2.2 to select the data to be used in the HHRA. Subsequently, COPCs have been selected for each of the environmental media. The following subsections document the data evaluation and selection of COPCs for the Site.

8.2.3.1 Data Evaluation

The data evaluation for the Site identified the data representative of current conditions at the Site and also evaluated the usability of the data. The data evaluation is summarized below.

8.2.3.1.1 Representative Data

All of the data collected for the Site as identified in the Sections 2.3 and 5.0have been compiled into a project-specific database. The Site analytical data have been grouped by environmental medium. Representative data have been identified by eliminating data associated with samples collected from media (soil) that were subsequently excavated and removed.

- Analytical data from samples that were associated with soil that was subsequently excavated during response actions at the Site do not represent current conditions at the Site and therefore have not been utilized in the HHRA. An excavation took place near Building 615 in March 2007. The following locations were excavated and are not used in the HHRA: 615-SB-07, 615-SB-08, and 615-SB09.

- Analytical data associated with deep subsurface soil samples (top depth greater than 10 ft bgs) have not been included in the dataset used for the HHRA because those deep soils are not accessible for current or foreseeable receptors.
- QA/QC samples, including field duplicates, have not been included in the HHRA dataset. The corresponding field samples are considered representative of site conditions. The QA/QC samples are used exclusively in the data validation activities.

8.2.3.1.2 Usable Data for Human Health Risk Assessment Purposes

Analytical Methods

The investigations conducted prior to 2011 have been summarized in Section 2.3. The SRI2 investigation activities have been summarized in Section 5.0. Analytical methods used to analyze soil and groundwater samples collected as part of the SRI2 field work include:

- VOCs by USEPA Method SW846 8260B;
- SVOCs by USEPA Method SW846 8270D;
- Total metals by USEPA Method 6010C/7470A/7471B;
- Total and elemental mercury by USEPA Method 1631E; and
- Methyl mercury by USEPA Method 1630.

Details regarding the use of these methods are presented in the Data Validation Report included as Appendix D.

Evaluation of Reporting Limits

The analytical reporting limits included in the representative Site dataset have been evaluated to determine the usability of the data. The maximum reporting limit in soil for several compounds is greater than the associated screening value [benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and thallium]. In all cases where the maximum reporting limit is greater than the associated screening value, the compound has been identified as a COPC.

Data Validation Findings

SRI2 Analytical Data

Data validation was completed by the AMEC Environment & Infrastructure (AMEC) project chemist in accordance with the Site Specific QAPP (Appendix A of the Final RI Work Plan) (Watermark, 2011). Validation for VOCs, SVOCs, and total metals was completed using USEPA Region II guidelines (USEPA, 2005c; USEPA, 2006a; USEPA, 2006b) and NYSDEC Division of Environmental Remediation guidance for Data Usability Summary Reports (NYSDEC, 2010). Project specific QC limits from the QAPP were used.

Under direction of the USACE, an initial data validation step was completed using the SEDD and ADR software. The ADR system has a computerized data validation module that performs a subset of data validation checks specified in the USEPA and NYSDEC guidelines. Sample results and associated QC data are compared to project specific QC limits that are set up by the project chemist prior to running the validation module. The ADR assigns validation action codes to all results that are associated with QC measurements outside project QC goals, and the validation module applies data validation qualifiers to the final results. The data qualification actions are reviewed by the project chemist prior to accepting the final data.

During the ADR review and/or Region II guideline validation the following data quality indicators were reviewed:

- Case Narrative;
- Sample Collection and Holding Times;
- QC Blanks;
- Laboratory Control Samples (LCS);

- MS/MSD;
- Laboratory and Field Duplicates;
- Surrogate Spikes;
- Reporting Limits;
- Data Completeness;
- Electronic Data Verification;
- Instrument Performance Checks (Tune);
- Initial Calibrations;
- Continuing Calibrations;
- Internal Standards;
- Calculation checks; and
- Raw data verification.

Data qualifications were completed if necessary in accordance with the validation guidelines and professional judgment using the following qualifiers:

U = The target compound was not detected at concentrations greater than the associated quantitation limit

J = The reported concentration is considered an estimated value

The Data Validation Report is included in this report as Appendix D.

The result of the data evaluation process is a dataset to be used to assess human health risks for Site soil, and groundwater. Appendix E identifies all of the environmental samples that have been selected for use in this HHRA.

8.2.3.2 Selection of Chemicals of Potential Concern

The HHRA dataset derived through the data evaluation process described above was utilized to produce subsets of data to be used for selecting COPCs for surface soil (Site-wide, excluding the background data), subsurface soil (Site-wide), and groundwater (Site-wide). Tables 8-2 through 8-4 are 'RAGS Part D Table 2's' that provide summaries of the risk assessment data for the Site media and that also document the selection of COPCs. Figures 4-1 through 4-5 show the locations of samples used in the HHRA within each exposure area for surface soil, subsurface soil, and groundwater. Table 8-5 and Table 8-6 provide data summaries for detected parameters in background surface soil and background subsurface soil, respectively. The background soil sample locations are shown in Figure 1-3.

Tables 8-2 through 8-4 utilize the descriptors listed below to summarize the data sets:

- Frequency of detection (number of positively detected results/total number of results);
- Range of reporting sample quantitation limits (SQLs) for non-detects;
- Range of detected concentrations;
- Data qualifier associated with each maximum detected concentration;
- Sample location associated with each maximum detected concentration; and
- Maximum concentration detected in the corresponding background data set.

The chemicals considered to be likely to pose more than a *de minimis* level of risk are identified, and subsequently included in the quantitative HHRA. The COPCs are selected by reducing the number of chemicals to be considered by applying a concentration/toxicity screen and by eliminating essential nutrients. The procedure used to select COPCs for the HHRA is summarized below.

A. Concentration-Toxicity Screening

- Selected as a COPC in soil if the maximum detected concentration is greater than either the USEPA RSL (adjusted) for residential soils (USEPA, 2011a) or NYS Restricted Use Soil Cleanup Objective for residential land use.
- Selected as a COPC in groundwater if the maximum detected concentration is greater than either the USEPA RSL (adjusted) for tap water or Federal MCLs.
- Chemicals for which no screening value is available are retained as COPCs unless they are essential nutrients. Essential nutrients include: calcium, magnesium, iron, potassium and sodium.

The RSLs for soil address direct contact (ingestion and dermal contact) exposures, as well as inhalation of constituents that may be released to air. The published RSLs have been derived as the lower of the concentration associated with a cancer risk of 1 in 1 million ($1x10^{-6}$) and the concentration associated with a non-cancer hazard quotient (HQ) of 1. The published RSLs have been adjusted for use in the risk-based screening step. The adjusted RSL used for that purpose is the lower of the concentration associated with a cancer risk $1x10^{-6}$ and the concentration associated with a non-cancer HQ of 0.1. The NYS Residential SCOs address direct contact (ingestion and dermal contact) exposures, inhalation of constituents that may be released to air, and consumption of home grown produce. The SCOs have been derived as the lower of the concentration associated with a cancer risk of 1 in 1 million ($1x10^{-6}$) and the concentration associated with a non-caner HQ of 0.2.

The use of the tap water RSLs and Federal MCLs to identify COPCs in groundwater ensures that analytes present at concentrations that could exceed an Applicable or Relevant and Appropriate Requirement (ARAR) or potentially pose more than a *de minimis* risk for residential potable use are identified, regardless of whether the groundwater is presently or may be in the future used as a potable water source.

B. Additional Considerations:

The following additional guidelines are used for COPC selection:

- A parameter is not selected as a COPC if it is considered an essential human nutrient. The following inorganic analytes are considered essential human nutrients: calcium, magnesium, potassium, and sodium. Several other constituents are also considered to be essential human nutrients (e.g., selenium), but could also pose toxicity at elevated concentrations and were therefore were not eliminated from the list of COPCs based on essential nutrient status alone.
- A parameter is not selected as a COPC if it is detected at a low concentration and a low frequency. Low frequency is defined as detected less than five percent of samples.

The results of the COPC selection for each data set are provided in Tables 8-2 through 8-4. The following notes are used in those tables to denote the reasons for selection or exclusion of analytes as COPCs:

ASL: Concentration used for COPC screening (maximum detected concentration) is greater than the risk-based screening value; the analyte is selected as a COPC.

BSL: The concentration used for COPC screening (the maximum detected concentration) is less than the risk-based screening value; the analyte is therefore not selected as a COPC.

NSL: There is no risk-based screening value available; the analyte is selected as a COPC.

E: The analyte is an essential nutrient, and is therefore not selected as a COPC.

FOD: The analyte is detected at a low frequency and low concentration and therefore is not selected as a COPC.

The results of the COPC selection are identified below, by medium.

- Surface Soil: COPCs in surface soil (0-0.5 ft) include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, heptachlor epoxide, aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, thallium, and vanadium (Table 8-2).
- Subsurface Soil: COPCs in subsurface soil (0.5-10 ft) include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, aluminum, antimony, arsenic, barium, chromium, cobalt, copper, lead, manganese, mercury, thallium, and vanadium (Table 8-3).
- Groundwater: COPCs in groundwater include chloroform, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and chromium (Table 8-4).

All chemicals that were retained as COPCs were detected at maximum concentrations in excess of the appropriate screening values if screening values were available. However, no screening value was available for carbazole. Consequently, carbazole was selected as COPCs in surface soil and subsurface soil (carbazole was not detected in groundwater).

8.3 Exposure Assessment

The condition of a chemical contacting the outer boundary of a human is exposure. Most of the time, the chemical is contained in air, water, soil, a product, or a transport or carrier medium; the chemical concentration at the point of contact is the exposure concentration. An exposure assessment is the quantitative or qualitative evaluation of that contact; it describes the intensity, frequency, and duration of contact, and often evaluates the rates at which the chemical crosses the boundary (chemical intake or uptake rates), the route by which it crosses the boundary (exposure route; e.g., dermal, oral, or respiratory), and the resulting amount of the chemical that actually crosses the boundary (a dose) and the amount absorbed (internal dose).

The objective of the exposure assessment is to estimate the type and magnitude of exposures to COPCs at or migrating from the Site. The exposure assessment includes the following components:

- Characterization of the exposure setting (including current and future land uses);
- Identification of exposure pathways (including receptor identification and exposure scenarios, and exposure points);
- Identification of EPCs;
- Quantification of exposures; and
- A summary of exposures by receptor and exposure point.

For the Site, the exposure media evaluated quantitatively in the HHRA include surface soil, subsurface soil, and groundwater.

Based on the current and assumed future land uses for the Site, receptors evaluated in one or more exposure area include an outdoor worker, an indoor worker, a construction worker, a resident, a recreational receptor, and a trespasser.

8.3.1 Exposure Setting and Exposure Pathways

The exposure setting and identification of complete and incomplete exposure pathways are discussed in the following subsections.

8.3.1.1 <u>Exposure Setting and Potentially Complete Exposure Pathways</u>

The current land use at the property has been described in detail in Section 8.1.3. The exposure setting and exposure pathways (including exposure media, receptors, exposure areas, and exposure routes) have previously been identified and discussed in the CSM (Section 8.1.5), in Table 8-1.

The Site has previously been used as a post-Civil War hospital, an engineering school, and a training site for West Point Cadets. Currently a portion of the Site is used by the USCG (Area 3) the remaining portions of the Site are maintained grass areas or undeveloped wooded areas. As discussed previously, the exposure areas (Area 1, Area 2, Area 3, Area 4, and Area 5) identified for the Site are identified in Figure 1-2. Under the current Site use, there is the potential for commercial/industrial workers to be present frequently in all exposure areas for landscaping activities. Also there is the potential under current land use for trespassers to be present in all of the exposure areas. It is also assumed that the outdoor worker could potentially be exposed to subsurface soil by direct exposures (ingestion and dermal contact).

The most likely future use of the Site will be for commercial/industrial purposes, although the future use of the Site has not been determined. If the Site use were to remain as commercial/industrial then potential receptors would include both outdoor and indoor workers. In that scenario, outdoor workers might have the potential for direct contact (ingestion and dermal contact) with surface and subsurface soil. In addition the outdoor worker could be exposed to soil-derived airborne dust (inhalation) from both surface and subsurface soil. Other potential future uses for the Site would include residential use or recreational use. Potential receptors would then include residents and recreational receptors. In a residential scenario, child and adult residents could potentially be exposed to surface and subsurface soil via incidental ingestion and dermal contact. In addition, future residents could potentially use Site groundwater for potable uses and be exposed to groundwater via ingestion and dermal contact. Potential recreational receptors could be exposed to surface and subsurface soil via incidental ingestion and dermal contact. If the Site is redeveloped in the future another potential receptor would be a construction worker. A future construction worker could potentially be exposed to surface and subsurface soil by direct exposure (ingestion and dermal contact) as well as soil-derived airborne dust (inhalation) from both surface and subsurface.

Table 8-1 provides a summary of the receptors and exposure scenarios evaluated in the HHRA for the Site. Figure 8-1 also presents the HHRA CSM, which identifies receptors, exposure pathways, and exposure routes evaluated in the HHRA.

8.3.1.2 Incomplete Exposure Pathways

The data collected to date suggest that the exposure pathways listed below are not complete at the Site and, therefore, are not evaluated in a quantitative manner in the HHRA.

- Home-grown vegetables for human consumption, and direct soil exposures associated with growing of fruits and vegetables, as the Site has a heavily industrial anthropogenic environment, and soil consists of fill material.
- Exposure related to release of VOCs in soil to ambient air. VOCs have not been detected in surface soil.
- Potential vapor intrusion risks from groundwater or soil, as the COCs detected at the Site do not easily volatilize.

8.3.2 Exposure Point Concentrations (EPCs)

The USEPA defines the EPC as the representative medium-specific chemical concentration a receptor may contact at an exposure point over the exposure period (USEPA, 1989a). Separate EPCs are calculated for each exposure medium at each exposure point. The typical concept of human exposure within a defined exposure area is that an individual contacts the contaminated medium on a periodic and random basis. Because of the repeated nature of such contact, the human exposure does not really occur at a fixed point but rather at a variety of points with equal likelihood that any given point within the exposure area will be the contact location on any given day. Thus, exposure areas were identified considering the likelihood of a receptor contacting all areas within the exposure area with equal probability, as reflected in EPCs based on arithmetic averages of the chemical concentrations within the exposure area. However, to account for uncertainty in estimating the arithmetic mean concentration, the USEPA recommends that an UCL on the mean be used to represent the EPC.

In accordance with USEPA guidance, Reasonable Maximum Exposure (RME) EPCs for surface soil and subsurface soil are based on the lesser of the 95 percent UCL on the arithmetic mean concentration (95% UCL value) or the maximum detected concentration in the data set (USEPA, 2002a).

The 95% UCL values are calculated using the ProUCL software (Version 4.1.00, USEPA, 2010b). The ProUCL software performs a goodness-of-fit test for data sets with or without non-detects to identify the distribution type for the data set (e.g., normal, lognormal, gamma, or non-discernible), and then calculates a conservative and stable 95 percent UCL value in accordance with the framework described in "Calculating Upper Confidence Limits for EPCs at Hazardous Waste Sites" (USEPA, 2002a). The software includes numerous algorithms for calculating 95% UCL values, and provides a recommended UCL value based on the algorithm that is most applicable to the statistical nature of the data set.

EPCs are identified in 'RAGS Part D Table 3s', which are presented in Table 8-7 (surface soil by exposure area), Table 8-8 (shallow subsurface soil by exposure area), and Table 8-9 (groundwater). ProUCL output sheets are provided in Appendix F.

EPCs may be based on COPC concentrations that are directly measured, or on COPC concentrations that are estimated via modeling. EPCs for evaluating potable use of groundwater are the maximum detected groundwater concentrations for each COPC. EPCs that are used to quantify ingestion and dermal contact exposures are based on measured concentration data. Since the true exposure medium for evaluation of inhalation exposures is air, and no analytical data for air were collected, EPCs that are used to evaluate inhalation exposures were modeled from source media concentrations. Inhalation exposure to soil-derived dust was evaluated for outdoor workers and construction workers. The source media for dust is soil, and the soil EPCs are used as the 'source' concentrations for estimating dust-associated COPC concentrations in air.

8.3.3 Exposure Quantification

The calculation of cancer risk and non-cancer HQs require the quantification of exposure (as a dose or intake) or as a representative concentration) and the evaluation of the exposure using dose-response values or exposure-response values. Exposures to COPCs are quantified by calculating COPC-specific doses (or intakes) (ingestion and dermal contact) or representative concentrations (air/inhalation exposures) for the receptors at the various exposure points or exposure areas for current and possible future land uses. This section describes the process that is used to quantify COPC exposure for ingestion and dermal contact with soil, inhalation exposure for soil-related dust, and dermal exposure to groundwater. The quantification of exposures is based on the specifics of the exposure scenarios for the receptors evaluated.

8.3.3.1 Exposure Scenarios

Exposure scenarios are used to quantitatively describe the COPC exposures that could theoretically occur for each land use and exposure pathway evaluated. The exposure scenarios are used in conjunction with EPCs to derive quantitative estimates of COPC intake or exposure. The ultimate goal of developing exposure scenarios, as defined in USEPA guidance, is to identify the combination of exposure parameters that results in the most intense level of exposure that may "reasonably" be expected to occur under the current and future site conditions (USEPA, 1989a). As such, a single exposure scenario is often selected to provide a conservative evaluation for the range of possible receptors and populations that could be exposed at the Site for a given land use. For example, when evaluating a theoretical residential land use, a residential scenario that is modeled to be protective for the children and adults who live at the residence (i.e., people who are there all the time) is assumed to be protective for all other receptor populations (such as friends or neighbors) and, therefore, it unnecessary to also evaluate those other, less-exposed, receptor populations. The exposure scenarios that are used to evaluate health risks associated with the potentially complete exposure pathways under current and possible future land use conditions are listed below.

Current Land Use:

- Outdoor worker: This is a long-term receptor exposed during the work day that is expected to be at the Site frequently for landscaping activities. The outdoor worker scenario (e.g., landscaping or construction material supply) considers a long-term employee who spends the majority of each work-day outdoors (8 hours per day, 36 days per year, for 25 years) where incidental ingestion of surface soil and dermal contact with surface soil occur. The exposure frequency of 36 days per year assumes landscaping occurs 4 days per month between March and November. The incidental ingestion rate and dermal contact parameters used are USEPA recommended default parameters for the outdoor worker receptor (USEPA, 2002c). The current outdoor worker has been evaluated in all five exposure areas and background.

- Trespasser: Older children/adolescents and adults who may infrequently enter the Site for walking or some type of teenage activity. This scenario evaluates potential ingestion and dermal exposures to surface soil in all five areas and background. The assumed exposure frequency for the trespasser scenario is 40 days per year (2 days per week from April to August).

Future Land Use:

- Outdoor worker: The future outdoor worker scenario (e.g., outdoor warehousing, bulk material storage or construction material supply) is a long-term receptor who spends the majority of each work day outdoors (8 hours per day, 225 days per year, for 25 years per USEPA, 2002) where incidental ingestion of soil, dermal contact with soil and inhalation of wind-borne dust occur. The incidental ingestion rate and dermal contact parameters used are the USEPA recommended default parameters for the outdoor worker receptor (USEPA, 2002c). The future outdoor worker has been evaluated in all five exposure areas and background.
- Indoor worker: The indoor worker scenario (e.g., office work, indoor manufacturing, and indoor warehousing) considers a long-term employee who spends the majority of each work day indoors (8 hours per day, 250 days per year, for 25 years per USEPA, 2002c) where incidental ingestion of soil that may be tracked or transported indoors as dust and dermal contact to soil occur. The incidental ingestion rate and dermal contact parameters used are the USEPA recommended default parameters for the indoor worker receptor (USEPA, 2002c). The indoor worker has been evaluated in all five exposure areas and background.
- Construction worker: The construction worker scenario provides an estimate of potential risks associated with a short-term, high-intensity contact with surface soil and subsurface. The construction worker scenario assumes that a worker spends each work-day over a one year period at the Site (resulting in a frequency of 8 hours per day, 5 days per week, or 250 days per year). Incidental soil ingestion and dermal contact exposures have been evaluated using UESPA recommended default parameters for this scenario assuming dermal exposure is limited to the head, hands, and forearms of the construction worker (USEPA, 2002c). Also inhalation of fugitive dusts generated by construction vehicle traffic on unpaved roads using USEPA recommended default parameters (USEPA, 2002c). In addition to exposure to soil, potential dermal contact to groundwater during an excavation has been evaluated. It is assumed that a construction worker's hands and forearms are potentially exposed to groundwater. It is further assumed that a construction worker would not be exposed to groundwater every day during construction activities. An exposure frequency of 30 days per year and an exposure time of one hour per day are used to evaluate dermal contact risks from groundwater.
- Recreational receptor: The recreational receptor includes both young children and adults. It is assumed that the recreational receptor spends 52 days per year at the Site. The remaining exposure parameters are based on USEPA default assumption for the residential exposure to soil, which amounts to a conservative exposure scenario.
- Resident: The HHRA assumes that residents include both young children and adults. Consistent with USEPA guidance (USEPA, 1989a) the residential receptor has been evaluated as a child (ages 1 through 6) and an adult, who are assumed to live at their place of residence and potentially exposed to Site media over a 30 year period. Exposure parameters used are based on USEPA default assumptions for residential exposure to soil (incidental ingestion and dermal contact) and potable use (ingestion and dermal contact) of groundwater.

Exposures to COPCs are quantified by using numerical parameters that include ingestion rates, dermal contact areas, body weights, exposure times, exposure frequencies, and exposure durations, which are defined below. These parameters and the sources of their values are documented in Tables 8-10 through 8-14. The specific numerical values for each of these parameters are selected in consideration of the receptor activities and ages that the exposure scenarios are modeling, and are generally selected as the upper-end (generally 95th percentile) values for each quantitative parameter. Using receptor scenarios that are protective for all potentially exposed populations associated with a given land use, with numerical parameters that are generally based on the upper-end distributions, results in exposure scenarios are referred to as the RME. Exposure parameters are developed from USEPA national guidance (USEPA, 1997a; 2002c; 2004; 2011c). The exposure parameters used to quantify exposures for each of the scenarios described in this section are provided in RAGS Part D ‘Tables 4’s, which are presented as Tables 8-10 through 8-14.

8.3.3.2 *Quantification of Exposure – Doses and Representative Exposures*

Exposures are quantified in two major ways – via the calculation of a daily intake (oral and dermal exposures) or by calculating a representative exposure concentration (inhalation).

By combining the EPC and the receptor exposure parameters, the daily dose (soil and groundwater) or representative exposure concentration (air) is calculated. Those measures of exposure are subsequently used with toxicity values to characterize health risks.

Fundamentally, the calculated dose/intake is a function of EPC and exposure parameters:

Dose/Intake = (EPC) x (Exposure Parameters)

Average daily chemical intake for the incidental ingestion of soil is calculated by use of the following formula (USEPA, 1989a):

$$DI_{Soil\text{-}Ing} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

- $DI_{Soil\text{-}Ing}$ = average daily chemical intake via soil ingestion (mg/kg-day)
- CS = chemical concentration in soil (mg/kg)
- IR = ingestion rate (mg soil/day)
- CF = conversion factor (10^{-6} kg/mg)
- FI = fraction ingested from contaminated source (unit less)
- EF = exposure frequency (days/year)
- ED = exposure duration (years)
- BW = body weight (kg)
- AT = averaging time (period over which exposure is averaged, days)

Dermal exposure to soil is assumed to occur simultaneously with incidental ingestion exposure. Exposure to soil through dermal contact has been evaluated for all receptors under current and future land-use scenarios. Chemical intakes for the soil pathway via dermal exposure are calculated using the following equation:

$$AD_{Derm} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

- AD_{Derm} = average daily absorbed chemical dose (mg/kg-day)
- CS = chemical concentration in soil (mg/kg)

CF = conversion factor (10^{-6} kg/mg)
SA = skin surface area available for contact (square centimeter [cm^2])
AF = soil to skin adherence factor (mg/cm^2)
ABS = absorption factor (unit less)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

Average daily chemical intake by inhalation of soil particles for the construction worker scenario will be calculated by using the following formula (USEPA, 2009):

$$DI_{Inh} = \frac{CA \times ET \times EF \times ED \times CF}{AT}$$

where:

DI_{Inh} = average daily chemical intake via inhalation (milligrams per cubic meter [mg/m^3])
CA = chemical concentration in air (mg/m^3)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF = conversion factor (1 day/24 hrs)
AT = averaging time (period over which exposure is averaged, days)

The chemical concentration in air (CA) term will be calculated as follows:

$$CA = CS \times (1/PEF)$$

where:

PEF = Particle emission factor (m^3/kg)

For the purposes of calculating chemical intake via inhalation, USEPA's default PEF value of 1.36×10^9 m^3/kg will be used (USEPA, 2002c). The construction worker PEF is a subchronic PEF and will be calculated using the following equation (USEPA, 2002c):

$$PEF = {}^{Q}/_{C_{SR}} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left({}^{W}/_{3}\right)^{0.4} \times \left(\frac{365-p}{365}\right) \times \Sigma VKT}\right]$$

where:

Q/C_{sr} = inverse ratio of 1-h geometric mean air concentration to the emission flux along a straight road segment bisecting a square site (22.5 grams per square meter [g/m^2]-s per kilogram per cubic meter [kg/m^3])
F_D = dispersion correction factor (unit less, 0.19)
T = total time over which construction occurs (s)
A_R = surface area of contaminated road segment (293 m^2)
W = mean vehicle weight (tons)
p = number of days with at least 0.01 inches of precipitation (days/year)
$\sum VKT$ = sum of fleet vehicle kilometers (km) traveled during the exposure duration

Average daily chemical intake for the ingestion of groundwater is calculated by use of the following formula (USEPA, 1989a):

$$DI_{GW\text{-}Ing} = \frac{CS \times IR \times FI \times EF \times ED}{BW \times AT}$$

where:

$DI_{GW\text{-}Ing}$	=	average daily chemical intake via groundwater (mg/kg-day)
CS	=	chemical concentration in groundwater (mg/l)
IR	=	ingestion rate (l/day)
FI	=	fraction ingested from contaminated source (unit less)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged, days)

Average daily chemical intake for dermal absorption of chemicals in groundwater will be calculated using the following formula (USEPA, 2004):

$$DI_{GW\text{-}Derm} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

where:

$DI_{GW\text{-}Derm}$	= average daily absorbed chemical dose (mg/kg-day)
CW	= chemical concentration in groundwater (mg/L), as represented by the EPC
SA	= skin surface area available for contact (cm^2)
PC	= chemical-specific dermal permeability constant (cm/hour)
ET	= exposure time (hours/day)
EF	= exposure frequency (days/year)
ED	= exposure duration (year)
CF	= conversion factor for water (1 L/1000 cubic centimeter [cm^3])
BW	= body weight (kg)
AT	= averaging time (period over which exposure is averaged, days)

The specific equations used to calculate doses/intakes for soil and exposures for inhalation of soil-derived dust are those presented in USEPA guidance (USEPA, 1989a; 2004; 2009), and are provided in the exposure parameter Tables 8-10 through 8-14, as discussed in subsection 8.3.3.1.

8.4 Toxicity Assessment

The objective of the toxicity assessment is to quantify the relationship between the intake, or dose, of COPCs and the likelihood that adverse health effects may result from exposure to the COPCs.

There are two major types of adverse health effects evaluated in the HHRA: non-carcinogenic, and carcinogenic. Non-carcinogenic health effects refer to toxicological effects other than cancer which may result from exposure to a substance, such as toxicity to the liver, skin, or central nervous system. Carcinogenic health effects refer to the development of cancer which may result from exposure to a substance. Following USEPA guidance (USEPA, 1989a), these two types of effects (non-carcinogenic and carcinogenic) are evaluated separately.

There are two types of toxicity values, or dose-response values, for evaluating health risks: Cancer slope factors (CSF) and unit risk (UR) values for carcinogens; and reference dose values (RfD) and reference concentrations (RfC) for non-carcinogens. For potentially carcinogenic COPCs, both types of values have been developed by USEPA because these COPCs may elicit both carcinogenic and non-carcinogenic (systemic) effects. In addition, because toxicity and/or carcinogenicity can depend on the route of exposure (i.e., oral or inhalation), unique dose-response values have been developed for the oral, dermal, and inhalation exposure routes.

Section 8.4.1 describes the types of toxicity values that are used for evaluation of cancer risks, and section 8.4.2 describes the types of toxicity values that are used for evaluation of non-cancer hazards. Appendix G contains toxicity profiles, which provide summaries of the toxicological properties of COPCs.

8.4.1 Toxicity Assessment for Carcinogenic Effects

The toxicity assessment followed the USEPA two-part evaluation to characterize the carcinogenicity of a chemical. The first part involves assigning a weight-of-evidence classification to a chemical, which describes the strength of available information with respect to the association of chemical exposure and human cancer. The second part involves calculation of a CSF or UR to reflect the carcinogenic potency.

8.4.1.1 Weight-of-Evidence

Historically, USEPA has used an alphanumeric system to describe the weight-of-evidence:

Group A - Human Carcinogen. This category indicates there is sufficient evidence from epidemiological studies to support a causal association between an agent and human cancer.

Group B - Probable Human Carcinogen. This category generally indicates there is at least limited evidence from epidemiologic studies of carcinogenicity to humans (Group B1) or that, in the absence of data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C - Possible Human Carcinogen. This category indicates that there is limited evidence of carcinogenicity in animals in the absence of data on humans.

Group D - Not Classified. This category indicates that the evidence for carcinogenicity in animals is inadequate.

Group E - No Evidence of Carcinogenicity to Humans. This category indicates that there is evidence of noncarcinogenicity in at least two adequate animal tests in different species or in both epidemiologic and animal studies.

This assessment also followed the revised Guidelines for Carcinogenic Risk Assessment (USEPA, 2005a), wherein USEPA revised the approach to describing the carcinogenic potential of an agent from an alphanumeric system to a weight-of-evidence-based descriptive narrative. Descriptors are as follows:

Carcinogenic to Humans. This descriptor indicates strong evidence of human carcinogenicity, and is appropriate A) when there is convincing epidemiologic evidence of a causal association between human exposure and cancer; or B) when all of the following conditions are met: (a) there is strong evidence of an association between human exposure and either cancer or the key precursor events of the agent's mode of action but not enough for a causal association, and (b) there is extensive evidence of carcinogenicity in animals, and (c) the mode(s) of carcinogenic action and associated key precursor events have been identified in animals, and (d) there is strong evidence that the key precursor events that precede the cancer response in animals are anticipated to occur in humans and progress to tumors, based on available biological information.

Likely to be Carcinogenic to Humans. This descriptor is appropriate when the weight of the evidence is adequate to demonstrate carcinogenic potential to humans but does not reach the weight of evidence for the descriptor “Carcinogenic to Humans”. The use of the term “likely” as a weight of evidence descriptor does not correspond to a quantifiable probability. Supporting data for this descriptor may include: an agent demonstrating a plausible (but not definitively causal) association between human exposure and cancer, in most cases with some supporting biological, experimental evidence, though not necessarily carcinogenicity data from animal experiments; an agent that has tested positive in animal experiments in more than one species, sex, strain, site, or exposure route, with or without evidence of carcinogenicity in humans; a positive tumor study that raises additional biological concerns beyond that of a statistically significant result, for example, a high degree of malignancy, or an early age at onset; a rare animal tumor response in a single experiment that is assumed to be relevant to humans; or a positive tumor study that is strengthened by other lines of evidence, for example, either plausible (but not definitively causal) association between human exposure and cancer or evidence that the agent or an important metabolite causes events generally known to be associated with tumor formation (such as DNA reactivity or effects on cell growth control) likely to be related to the tumor response in this case.

Suggestive Evidence of Carcinogenic Potential. This descriptor is appropriate when the weight of evidence is suggestive of carcinogenicity; a concern for potential carcinogenic effects in humans is raised, but the data are judged not sufficient for a stronger conclusion. This descriptor covers a spectrum of evidence associated with varying levels of concern for carcinogenicity, ranging from a positive cancer result in the only study on an agent to a single positive cancer result in an extensive database that includes negative studies in other species.

Data Inadequate for an Assessment of Human Carcinogenic Potential. This descriptor is appropriate when available data are judged inadequate for applying one of the other descriptors.

Not Likely to be Carcinogenic in Humans. This descriptor is appropriate when the available data are considered robust for deciding that there is no basis for human hazard concern. In some instances, there can be positive results in experimental animals when there is strong, consistent evidence that each mode of action in experimental animals does not operate in humans. In other cases, there can be convincing evidence in both humans and animals that the agent is not carcinogenic.

The weight of evidence classification in Integrated Risk Information System (IRIS) for a given chemical may reflect either of the two classification schemes identified above, depending on when USEPA most recently reviewed and revised the carcinogenicity assessment for any given chemical.

8.4.1.2 *Carcinogenic Potency*

It has been generally assumed historically that carcinogenic effects are non-threshold effects. This means that any dose, no matter how small, has been assumed to pose a finite probability of generating a response. Thus, no dose of a carcinogen has been thought to be risk-free. More contemporary evaluations that focus on the mechanisms of action by which a chemical may cause cancer have, for some chemicals, identified threshold doses below which carcinogenesis does not occur. In consideration of the nature of the toxicological data that are available for a given chemical, USEPA uses one or more of several different models to identify the relationship between the dose of the chemical and a carcinogenic response.

The toxicological data that are used to evaluate carcinogenic potency generally come from cancer bioassays that are performed using laboratory animals such as specific strains of rats and mice. An advantage of using laboratory animals to identify dose-response relationships is that the substances and doses that the animals are exposed to are controlled, such that if a carcinogenic response occurs, there is more confidence that the response occurred as a result of exposure to a specific substance, and the doses that caused the response are known. Disadvantages of using animal studies include uncertainties with extrapolating a carcinogenic response in animals to a carcinogenic response in humans. This uncertainty is addressed, in part, through the use of relatively high doses of chemicals used in cancer bioassays. Generally, laboratory animals are given maximum tolerated doses (i.e., the highest dose that the animal can tolerate without suffering adverse effects that would otherwise compromise the study) and fractions of the maximum tolerated dose. These doses are typically much higher than any dose that would be experienced by human populations. If a positive dose-response relationship is not identified in animal studies that use these high doses, then there is more confidence that the substance would not cause cancer at the much lower exposure levels potentially experienced by human populations. In contrast, if a positive dose-response relationship is identified in animal studies that use high doses, there is uncertainty in extrapolating the dose-response relationship from high doses to the much lower exposure levels potentially experienced by human populations.

Consequently, human epidemiologic data are a preferred basis for developing estimates of carcinogenic potency. However, the majority of chemicals studied to do not have sufficient epidemiological study data to allow for derivation of dose-response relationships. Many epidemiology studies find causal relationships between exposure to a chemical and a toxicological response, but are confounded by the fact that human populations are exposed to many substances over a lifetime, as well as by the uncertainty inherent in measuring actual human exposures to specific substances (e.g., actual concentrations in workplace air that a population may have been exposed to over a period of many years). These uncertainties often preclude establishing a dose-response relationship that is sufficient to use as the basis of carcinogenic potency estimates. Since laboratory bioassays avoid these uncertainties, they are often used as basis for the derivation of dose-response profiles, despite the availability of human epidemiological data.

The common measures of cancer potency assessment are the CSF (ingestion and dermal exposure) or a UR (commonly applied to inhalation). The CSF is the estimated upper-bound excess lifetime cancer risk (ELCR) associated with a lifetime average daily dose of a chemical agent of 1 mg/kg/day and the inhalation UR is the upper-bound ELCR associated with a lifetime average daily exposure of 1 $\mu g/m^3$ in air. CSF values are expressed as risk per mg/kg/day $[(mg/kg/day)^{-1}]$ and UR values are expressed as risk per $(\mu g/m^3)$ $[(\mu g/m^3)^{-1}]$. USEPA and other regulatory and scientific organizations have typically calculated CSFs and URs for chemicals in weight of evidence Groups A, B1, B2, and “Carcinogenic to humans” and “Likely to be carcinogenic to humans”. For some, but not all chemicals with Group C weight of evidence classification, USEPA and other organizations have also calculated cancer dose-response values.

In this HHRA, CSFs are used to estimate the incremental risks associated with ingestion and dermal exposures, and URs are used to estimate the cancer risks associated with inhalation of COPCs in air (airborne dust).

The CSF and UR values and supporting documentation are provided in Tables 8-15 and 8-16.

8.4.1.3 *Adjustment for Early Life Exposures to Carcinogens with a Mutagenic Mode of Action*

USEPA has developed guidance for characterizing cancer susceptibility associated with early life exposures (e.g., young children) to potentially carcinogenic chemicals (USEPA, 2005b; 2008). The approach developed by USEPA to characterize cancer risks for early life stages includes consideration of differences in physiology and exposure potential between children and adults, as well as differences in susceptibility to tumor development between children and adults. Physiological and behavioral differences are accounted for in the exposure assessment, whereby age-specific exposure parameters (e.g., body weights, ingestion rates, inhalation rates, contact frequencies) are applied to the various age groups evaluated in the risk assessment. Differences in susceptibility to tumor development are accounted for by considering the carcinogenic mode of action in accordance with the mode of action framework developed by USEPA (USEPA, 2005b).

In accordance with the Mode of Action (MOA) framework, for chemicals that initiate carcinogenesis by a mutagenic MOA and for which data concerning differential susceptibility for early life stages is available, USEPA may develop SFs that are applicable to specific ages (e.g., infants and young children, adults). The following COPCs at the Site are considered carcinogenic and operate with a mutagenic MOA: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. USEPA has not developed SF for different age groups for these COPCs. Therefore, the SFs for each COPC are adjusted for specific age groups to account for the mutagenic MOA. A 10 fold adjustment is used for the first two years of life (ages 0-2). A 3 fold adjustment is used after two year through <16 years of ages. After 16 years of age no adjustment is made to the SFs (USEPA, 2005b).

This risk assessment evaluates children (ages 1-7), and adults (ages 7-31) for both the residential and recreational scenarios. The SFs for the previously identified chemicals which have a mutagenic MOA have been adjusted. The SFs for the child receptors have been multiplied by a factor of 4.2 to account for the mutagenic MOA. The value of 4.2 for the child receptor represents a weighted average:

$$\frac{(1\ year\ \times 10) + (5\ years\ \times 3)}{6\ years} = 4.2$$

The same process was used for the adult (7-31) residential and recreational scenarios as shown below:

$$\frac{(9\ years\ \times 3) + (15\ years\ \times 1)}{24\ years} = 1.75$$

The HHRA also evaluates an adolescent trespasser (ages 6-16), for this receptor an ADAF of 3 was used.

8.4.2 Toxicity Assessment for Non-Carcinogenic Effects

Unlike carcinogenic effects, non-carcinogenic effects are threshold effects and were evaluated accordingly. This means that at some level of exposure there is a threshold below which adverse effects would not be expected, and above which adverse effects could potentially occur. Examples of non-carcinogenic (i.e., threshold) effects include liver toxicity, kidney toxicity, reproductive effects, neurotoxicity, and teratogenicity. The same process that is used to identify toxicity data to support carcinogenic potency assessment is also used to identify toxicity data to support the identification of dose-response relationships for non-carcinogenic effects.

Non-cancer toxicity values include RfDs and RfCs. The RfD expressed in units of mg/kg/day, is defined as an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (USEPA, 1989a). Unlike a CSF or UR, which represents a probability of incurring a carcinogenic effect following exposure to a substance, the RfD represents a threshold dose below which adverse health effects are unlikely to occur, and above which the potential for adverse health effects exists. The RfD is derived from the following equation:

$$RfD\ (mg/kg/day) = \frac{NOAEL\ or\ LOAEL}{UF\ and/or\ MF}$$

The No-Observable-Adverse-Effect-Level (NOAEL) represents the dose of a chemical at which there are no statistically or biologically significant differences in the frequency of an adverse effect between the exposed population and its appropriate control. The Lowest Observed Adverse Effect Level (LOAEL) represents the lowest dose at which a statistically significant difference in the frequency of an effect is noted. Both the NOAEL and the LOAEL are reported in terms of mg/kg/day. An uncertainty factor (UF) is used to account for inter-species and intra-species differences, whether the dose was an NOAEL or an LOAEL, and the adequacy of the data. The magnitude of the UF will therefore vary from chemical to chemical, ranging from 3 to 3,000. A modifying factor (MF), ranging from 1 to 10 may also be included to reflect qualitative uncertainties not explicitly addressed in the UFs. The toxicity endpoint upon which the RfD is derived and the UF and/or MF used in the calculation are presented in the dose-response tables provided in Table 8-17.

The RfC, in units of mg/m^3, is analogous to the RfD and is developed through a similar process. However, unlike RfDs, which represent a dose (in mg/kg/day) at which adverse or deleterious effects are unlikely, RfCs represent air concentrations (in mg/m^3) at which adverse or deleterious effects are unlikely [i.e., an air concentration corresponding to a hazard index (HI) = 1.0]. In this HHRA, inhalation RfCs are used to estimate the non-cancer risks associated with inhaling COPCs.

The use of chronic RfDs and RfCs to evaluate the potential for adverse health effects resulting from substantially less-than-lifetime exposures may be overly protective. Subchronic Reference Doses and Subchronic Reference Concentrations (RfD_ss/RfC_ss) have been developed for some chemicals to evaluate the potential non-carcinogenic effects of limited duration exposures. RfD_ss/RfC_ss are similar to chronic RfDs/RfCs; the distinction is the length of exposure duration. The construction worker scenario is the only scenario evaluated in this risk assessment that is associated with subchronic exposures. Therefore, when available, subchronic RfDs and RfCs are used to evaluate potential non-cancer risks for the construction worker. When subchronic values are not available, chronic RfDs and RfCs are used. Chronic RfDs and RfCs are used for all other receptor scenarios.

The RfDs and RfCs and supporting documentation for the chemicals selected as COPCs are provided in Tables 8-17 and 8-18.

8.4.2.1 *Adjustment for Dermal Exposure*

Oral Cancer CSFs and non-cancer RfDs were developed to evaluate risk associated with the ingestion exposure route (typically based on the applied dose). In accordance with USEPA guidance (USEPA, 2004), dermal dose-response values are calculated from oral dose-response values using an oral absorption factor. The dermal dose-response values are appropriate for evaluating the calculated absorbed dose associated with dermal exposures. The oral absorption factor represents the fraction of ingested amount that is absorbed from the gastrointestinal tract following oral administration of a substance. The absorbed dose represents the amount of substance that is potentially available for biological interaction. The calculated dermal dose-response value is appropriate for evaluating the absorbed dermal doses.

Thus, for potentially carcinogenic substances, the dermal dose-response value is calculated as follows:

$$CSF_d = CSF_o \,/\, Oral\ ABS$$

The dermal dose-response value for evaluating non-carcinogenic effects is calculated as follows:

$$RfD_d = RfD_o\ X\ Oral\ ABS$$

Chemical-specific oral ABS values are published by USEPA (USEPA, 2004). In accordance with USEPA guidance (USEPA, 2004), oral dose-response values are only adjusted using an oral ABS value if the COPC has an oral ABS value less than 50 percent. Otherwise, the oral dose-response value is used as the dermal dose-response value.

Dermal CSFs and RfDs are presented in Tables 8-15 and 8-17.

Chemical-Specific Considerations

For some constituents, RfD values differ by exposure medium and/or chemical speciation or form. These attributes apply to the following COPCs in this HHRA:

Cadmium. USEPA publishes two RfD values for cadmium: one is to be used to evaluate cadmium in food, and one is to be used to evaluate cadmium in water. The RfDs for water has been used to evaluate risks for exposures to cadmium in all exposure media at the Site.

Chromium. USEPA publishes separate RfD values for hexavalent chromium and trivalent chromium. Based on USEPA RfDs, hexavalent chromium is associated with a higher order of non-cancer toxicity than is trivalent chromium. An inhalation UR for hexavalent chromium is published in USEPA's IRIS database. There is currently no oral CSF for hexavalent chromium published in the USEPA IRIS database. The investigations conducted to date have included only analysis of soil samples for total chromium. Therefore as a conservative estimate of the risks the IRIS hexavalent chromium RfDs and inhalation UR (inhalation of dust) have been utilized to characterize risks for chromium in this HHRA.

Lead. In accordance with CERCLA risk assessment procedures, risks associated with potential exposures to lead in soil are characterized using lead biokinetic uptake models (USEPA, 2002b; USEPA, 2003a). USEPA publishes two biokinetic uptake models: one is used to evaluate lead uptake in children, and one is used to evaluate lead uptake in adults. The child lead model (integrated exposure uptake biokinetic model (IEUBK) is used to characterize lead risks associated with residential land uses, because children are more susceptible to lead toxicity than adults; lead concentrations that are protective for children are also protective for adults. The adult lead model (ALM) is used to characterize lead risks associated with land uses where exposures to lead-contaminated soil are primarily limited to adults, such as industrial/commercial land uses.

In this HHRA, the IEUBK model is used to characterize potential lead exposures and risks for all land use scenarios that involve children, including residential land use and recreational land use. The ALM is used to evaluate potential lead exposures and risks to all land use scenarios that involve adults-only, including outdoor workers, indoor workers, and construction workers.

Appendix J presents the lead modeling.

8.4.3 Sources of Dose-Response Values

The following hierarchy of sources for dose-response values (USEPA, 2003b) has been utilized in identifying dose-response values for this HHRA.

Tier 1 – IRIS (http://www.epa.gov/iris/). In accordance with USEPA guidance, the main source of dose-response values is IRIS, which is a database established by USEPA containing all validated data on many toxic substances found at hazardous waste sites. This database (USEPA, 2011b), current as of October 2011, was used to identify the CSFs, URs, RfDs, and RfCs applied in this risk assessment.

Tier 2 – National Center for Environmental Assessment (NCEA) provisional peer reviewed toxicity values (PPRTVs) (http://hhpprtv.ornl.gov/). NCEA's PPRTVs are developed by the Superfund Technical Support Center (STSC) for the USEPA Superfund program. STSC's reassessment of USEPA Health Effects Assessment Summary Tables (HEAST) toxicity values, as well as development of PPRTVs in response to Regional or Headquarters Superfund program requests, are consistent with Agency practices on toxicity value development, use the most recent scientific literature, and are supported by both internal and external peer review, providing a high level of confidence in the use of these values in the Superfund Program. The PPRTVs used in this HHRA were obtained from the USEPA-recommended website and are current as of October 2011.

Tier 3 – Other Toxicity Values:

- California Environmental Protection Agency (CALEPA) toxicity values (CALEPA, 2009). CALEPA develops toxicity values for both cancer and non-cancer effects. CALEPA toxicity values were obtained from the CALEPA website at http://www.oehha.ca.gov/risk/chemicalDB//index.asp. The CALEPA toxicity values used in this risk assessment were obtained from the listed source and are current as of October 2011.
- Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) (ATSDR, 2009) address non-cancer effects only, and are available on the ATSDR website at http://www.atsdr.cdc.gov/mrls/index.html. MRL values for intermediate exposure were used as subchronic RfD and RfC values, and MRL values for chronic exposures were used as chronic RfD and RfC values. The MRL values used in this HHRA were obtained from that source in October 2011.
- Toxicity values remaining in current versions of HEAST.

8.5 Risk Characterization

Risk characterization, including uncertainty analysis, is the final step in the risk assessment process. The risk characterization integrates the exposure and toxicity information generated in previous sections to quantitatively evaluate the potential health risks associated with exposure to chemicals at the Site. Risk estimates are then evaluated through a comparison to CERCLA risk management criteria. Section 8.5.1 describes the methodology used to calculate risks for each COPC and to sum risk estimates among COPCs, exposure pathways, and exposure media to derive cumulative receptor risks. Section 8.5.2 provides the risk assessment results for each of the land use scenarios evaluated in the HHRA by exposure area. Section 8.5.3 identifies and discusses uncertainties in the HHRA and their potential impact on the results and conclusions of the risk assessment.

8.5.1 Risk Characterization Methods

Quantitative estimates of both carcinogenic and non-carcinogenic risks are calculated for each exposure scenario selected for evaluation in the exposure assessment, in accordance with USEPA (1989a) guidance.

8.5.1.1 Risk Calculation Methodology

An estimate of the ELCR associated with exposure to each COPC in a given medium is calculated by multiplying the exposure route pathway-specific lifetime average daily dose (e.g., dermal exposure to surface soil) or lifetime average exposure concentration (e.g., inhalation of dust) by its exposure route-specific CSF (e.g., oral CSF) or UR.

$$ELCR = Lifetime\ Average\ Daily\ Dose\ or\ Exposure\ (mg/kg/day\ or\ \mu g/m^3) \times CSF\ (mg/kg/day)^{-1}\ or\ UR\ (\mu g/m^3)^{-1}$$

The ELCR represents an upper bound of the probability of an individual developing cancer over a lifetime as the result of exposure to a COPC. The ELCR is calculated for each carcinogenic COPC for each medium and exposure route combination for each receptor at each exposure area. The ELCR for all COPCs in a given medium are summed to identify a route-specific total ELCR (e.g., soil ingestion) and the ELCR for all exposure routes for a given receptor/medium combination (e.g., soil ingestion and dermal contact) are summed to yield a total medium ELCR (e.g., for surface soil).

The non-cancer HQ associated with exposure to each COPC is calculated by dividing the exposure route pathway-specific average daily dose or exposure concentration by its exposure route-specific RfD or RfC.

$$HQ = Average\ Daily\ Dose\ or\ Exposure\ (mg/kg/day\ or\ \mu g/m^3)\ /\ RfD\ (mg/kg/day)\ or\ RfC\ (\mu g/m^3)$$

The HQ is calculated for each COPC for each medium and exposure route combination for each receptor at each exposure area. For a given medium/receptor/age group combination (e.g., surface soil and adult outdoor worker), HQs for all COPCs are summed by route (e.g., dermal contact) to identify a medium/route HI, and the HIs for multiple exposure routes (e.g., incidental ingestion and dermal contact) are summed to identify a medium-specific total HI (e.g., for surface soil ingestion and dermal contact). Because HIs are not additive across age groups (applies to the trespasser, resident, recreational receptor in this assessment), the higher HI between the two age groups is selected as the representative HI for the receptor. An HI less than 1 indicates that non-carcinogenic toxic effects are unlikely to occur as a result of COPC exposure. HIs greater than 1 may be indicative of a possible non-carcinogenic toxic effect. As the HI increases, so does the likelihood that adverse effects might be associated with exposure.

Risk calculations are documented in Appendix H (RAGS Part D Table 7s) and Appendix I (RAGS Part D Table 9s). The tables in Appendix H and Appendix I are grouped by exposure area in the following order: Area 1, Area 2, Area 3, Area 4, Area 5, background soil area, and Site groundwater.

Tables H-1 through H-111 (called RAGS Part D tables 7s) in Appendix H, present, for a given receptor/age group and exposure point, COPC-specific cancer risk and HQs for each medium/exposure route combination (e.g., surface soil ingestion) and presents cumulative or total cancer risk and screening HI for each medium/exposure route combination (e.g., surface soil ingestion), the cumulative or total cancer risk and screening HI for each medium (e.g., surface soil), and the cumulative or total cancer risk and screening HI for the receptor/age group.

Tables I-1 through I-111 (called RAGS Part D table 9s) in Appendix I present the same calculated risk information in a slightly different structure, but also provides information beyond the simple, screening HI (it is assumed that non-cancer hazards of all COPCs are additive). The Table 9s also identify the primary target organ or organ system associated with non-cancer toxicity of each COPC, and present the total HI for each identified target organ/organ system, or toxic effect type (the assumption is that the effects of COPCs with the same or similar target organ or organ system are additive). Examples of target organ/organ system or toxic effect type are liver, immune system, and developmental. The more detailed information in the Table 9s is most useful if the screening HIs are above 1, but not dramatically so. In such cases, it may be that none of the total HIs segregated by target organ/organ system, or effect type are greater than 1.

The calculated cancer and non-cancer risks are evaluated in the context of risk management criteria established in the NCP and discussed in the preamble to the NCP (USEPA, 1990). The results of the baseline risk assessment are evaluated by comparing them to the USEPA's remedial goals. With respect to cancer risk, USEPA sets remediation goals for total cancer risk "that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-6} to 10^{-4} lifetime excess cancer risk." USEPA sets remediation goals for non-cancer risk "such that exposures present no appreciable risk of significant adverse effects to individuals, based on comparison of exposures to the concentration associated with reliable toxicity information such as USEPA's reference doses." For cumulative risks due to non-carcinogens, "EPA will set the remediation goals at levels for individual chemicals such that cumulative effects of multiple chemicals will not result in adverse effects."

USEPA has stated that "acceptable exposure for non-carcinogens is one to which human populations, including sensitive subgroups such as pregnant women and children may be exposed without adverse effects during a lifetime or part of a lifetime, incorporating an adequate margin of safety." Given the stated remediation goals, the results of the baseline risk assessment are evaluated in accordance with the NCP - cancer risk estimates for a site are compared to an ELCR range of 10^{-6} (one in a million) to 10^{-4} (one in ten-thousand). Total risks at or below 10^{-4} do not generally warrant a response action. Risks greater than 10^{-4} generally warrant development and evaluation of remedial alternatives. Non-cancer risks are compared to a HI value of 1, which corresponds to levels of exposure that people (including sensitive individuals) could experience without expected adverse effects.

8.5.1.2 Lead Risk Calculation

In accordance with CERCLA risk assessment procedures, risks associated with potential exposures to lead in soil are characterized using lead biokinetic uptake models (USEPA, 2002b; 2003a). USEPA publishes two biokinetic uptake models: one is used to evaluate lead uptake in children, and one is used to evaluate lead uptake in adults. The child lead model (integrated exposure uptake biokinetic model (IEUBK); Version 1.0, Build 11) was developed to characterize lead risks associated with residential land use exposures to multiple media. Because children are more susceptible to lead toxicity than adults, lead concentrations that are protective for children are also protective for adults. The ALM is used to characterize lead risks associated with land uses where exposures to lead-contaminated soil are primarily limited to adults, such as industrial/commercial land uses.

The IEUBK and ALM provide estimates of blood lead levels (PbB) that may result from chronic exposures to lead in various exposure media. To evaluate the significance of the estimated blood lead concentrations, the blood lead concentrations are compared to a threshold PbB of 10 micrograms per deciliter (µg/dL). This threshold PbB is a multi-Agency goal that has been designated by the US Centers for Disease Control (CDC) and the ATSDR as a level of concern to protect sensitive populations, including neonates, infants, and children. The protection of sensitive populations is assumed to also provide protection for adults. USEPA indicates that 95% of the exposed population should have a geometric mean PbB that does not exceed 10 µg/dL.

Child Lead Model (IEUBK)

The IEUBK model quantifies lead exposures from multiple pathways, including soil ingestion, drinking water, inhalation (of dust and airborne lead), and diet. The model incorporates default assumptions concerning the amount of lead exposure that comes from drinking water, air, and diet, in order to establish a baseline lead exposure (i.e., lead exposure from sources other than Site media). Lead intake from these other sources accounts for a portion of the allowable blood-lead level of 10 micrograms per liter (µg/L). Contribution of lead exposures from Site media (soil) adds to the total lead uptake, and evaluation of the total lead uptake from all sources allows for a determination of whether Site media contribute to unacceptable lead exposures.

To evaluate lead uptake from soil associated with future residential land uses, the model was run using default values for all parameters except the soil lead concentration, for which the exposure point-specific soil lead EPCs were used; these are presented in Table 8-7 for surface soil and Table 8-8 for subsurface soil.

Table 8-21 provides a summary of the lead modeling results. IEUBK modeling input parameters and results are provided in Appendix J.

Adult Lead Model

The ALM was used to evaluate potential lead uptake and estimated PbBs for the outdoor worker, indoor worker, and construction worker scenarios.

Unlike the IEUBK model, the ALM allows for modification of the exposure frequency. Therefore, the model was run using the surface soil and subsurface soil EPCs with the associated exposure frequency parameter for each receptor. Table 8-22 provides a summary of the lead modeling results. ALM modeling input parameters and results are provided Appendix J.

The ALM provides an estimate of PbB s to the exposed adult, as well as fetal PbB s that might occur to a pregnant adult female. Use of the 10 µg/dL blood lead threshold concentration ensures the protection of fetuses that may be carried by women of child-bearing age (i.e., female who may become pregnant while being exposed to lead in soil at the Site). To help ensure protection for this population, a geometric standard deviation (GSD) of blood lead parameter is used to account for women of child-bearing age that have non-uniform response (e.g., intake and biokinetics) to lead exposures. The values for $PbB_{adult,0}$ and GSD are derived from recent studies concerning blood lead concentrations in adult women in the United States (USEPA, 2002b). Blood lead calculations are performed using a range of $PbB_{adult,0}$ and GSD values to account for homogenous and heterogeneous populations.

8.5.2 *Risk Characterization Results – By Exposure Area*

Tables 8-19 and 8-20 present summaries of risks calculated for the current and future land use exposure scenarios for each exposure area, respectively. Figures 8-2 and 8-3 show the summary of cancer risks and HIs. The subsections that follow identify the calculated risks for the current and future receptors for each exposure area and evaluate the risks relative to the NCP acceptable cancer risk range, and to a HI of 1, and identify principal contributors to risks for scenarios which have a calculated cancer risk greater than $1x10^{-4}$ and/or a HI of 1 or greater. Calculations are documented in RAGS Part D Table 7s and Table 9s, which are contained in Appendices H and I, respectively.

8.5.2.1 *Area 1*

Current land use receptors evaluated for Area 1 include outdoor workers and trespassers (each is potentially exposed to surface soil and the outdoor worker is potentially exposed to subsurface soil). Hypothetical future land use receptors for Area 1 include outdoor workers, indoor workers, construction workers, recreational receptors and residents.

8.5.2.1.1 *Current Outdoor Worker*

As indicated in Table 8-19, cancer risk (1×10^{-6}) for the Current Outdoor Worker at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.02) is below 1. Also as indicated in Table 8-19, cancer risk (1×10^{-6}) for the Current Outdoor Worker at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.02) is below 1.

8.5.2.1.2 *Current Trespasser*

As indicated in Table 8-19, the cumulative cancer risk (3×10^{-6}) for the Adolescent and Adult Trespasser at Area 1 potentially exposed to surface soil via direct contact is within the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.05) for the Trespasser is below 1.

8.5.2.1.3 *Future Outdoor Worker*

As indicated in Table 8-20, cancer risk (7×10^{-6}) for the Future Outdoor Worker at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.1) is below 1. Also as indicated in Table 8-20, cancer risk (8×10^{-6}) for the Future Outdoor Worker at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.1) is below 1.

8.5.2.1.4 *Future Indoor Worker*

As indicated in Table 8-20, cancer risk (5×10^{-6}) for the Future Indoor Worker at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.06) is below 1. Also as indicated in Table 8-20, cancer risk (6×10^{-6}) for the Future Indoor Worker at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.08) is below 1.

8.5.2.1.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (1×10^{-6}) for the Future Construction Worker at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.9) is below 1. Also as indicated in Table 8-20, cancer risk (1×10^{-6}) for the Future Construction Worker at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (1) does not exceed 1.

8.5.2.1.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (9×10^{-6}) for the Future Child and Adult Recreational Receptor at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-20, the cumulative cancer risk (1×10^{-5}) for the Future Child and Adult Recreational Receptor at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.3) is below 1.

8.5.2.1.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (6×10^{-5}) for the Future Child and Adult Resident at Area 1 potentially exposed to surface soil is within the acceptable risk range and the screening HI (1) does not exceed 1. Also as indicated in Table 8-20, the cumulative cancer risk (7×10^{-5}) for the Future Child and Adult Resident at Area 1 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (2) is above 1. The largest contributors to the screening HI is the ingestion of cobalt (Endocrine HI = 0.4) and arsenic (Skin HI = 0.4). As indicated in Table I-17, each of the segregated, target organ-based HIs is below 1. To put the Site risks into context, background risks were calculated for the future resident as presented below in Section 8.5.2.6.7. The screening HI for the Future Resident in the background area is 2 with ingestion of cobalt (Endocrine HI = 0.3) and arsenic (Skin HI = 0.2) large contributors to the HI.

8.5.2.2 Area 2

Current land use receptors evaluated for Area 2 include outdoor workers and trespassers (each is potentially exposed to surface soil and the outdoor worker is potentially exposed to subsurface soil). Future land use receptors for Area 2 include outdoor workers, indoor workers, construction workers, recreational receptors, and residents.

8.5.2.2.1 Current Outdoor Worker

As indicated in Table 8-19, cancer risk (1×10^{-6}) for the Current Outdoor Worker at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.02) is below 1. Also as indicated in Table 8-19, cancer risk (5×10^{-7}) for the Current Outdoor Worker at Area 2 potentially exposed to subsurface soil is below the acceptable risk range and screening HI (0.01) is below 1.

8.5.2.2.2 Current Trespasser

As indicated in Table 8-19, the cumulative cancer risk (2×10^{-6}) for the Adolescent and Adult Trespassers at Area 2 potentially exposed to surface soil via direct contact is below the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.08) for the Trespasser is below 1.

8.5.2.2.3 Future Outdoor Worker

As indicated in Table 8-20, cancer risk (6×10^{-6}) for the Future Outdoor Worker at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.1) is below 1. Also as indicated in Table 8-20, cancer risk (3×10^{-6}) for the Future Outdoor Worker at Area 2 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.08) is below 1.

8.5.2.2.4 Future Indoor Worker

As indicated in Table 8-20, cancer risk (5 x 10^{-6}) for the Future Indoor Worker at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.08) is below 1. Also as indicated in Table 8-20, cancer risk (2 x 10^{-6}) for the Future Indoor Worker at Area 2 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.04) is below 1.

8.5.2.2.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (1 x 10^{-6}) for the Future Construction Worker at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (2) is above 1. The largest contributors to the screening HI are the ingestion exposure for copper (HI of 0.75) and the inhalation of dust-related manganese (HI of 0.34). As shown in Table I-24, each of the segregated, target organ-based HIs is below 1. The EPC for copper in surface soil for Area 2 is 2,318 mg/kg, and the maximum concentration of copper in Area 2 is 11,500 mg/kg at location AI2-108. If the maximum concentration of copper is removed from the dataset the EPC would decrease significantly as would the screening HI. Also as indicated in Table 8-20, cancer risk (6 x 10^{-7}) for the Future Construction Worker at Area 2 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.9) is below 1.

8.5.2.2.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (8 x 10^{-6}) for the Future Child and Adult Recreational Receptor at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.3) is below 1. Also as indicated in Table 8-20, the cumulative cancer risk (4 x 10^{-6}) for the Future Child and Adult Recreational Receptor at Area 2 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.2) is below 1.

8.5.2.2.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (5 x 10^{-5}) for the Future Child and Adult Resident at Area 2 potentially exposed to surface soil is within the acceptable risk range and the screening HI (2) is above 1. The largest contributor to the screening HI is the ingestion exposure for copper (HI of 0.7). As shown in Table I-27, the target organ-based segregated HIs are not greater than 1. The EPC for copper in surface soil for Area 2 is 2,318 mg/kg, and the maximum concentration of copper in Area 2 is 11,500 mg/kg at location AI2-108. If the maximum concentration of copper is removed from the dataset the EPC would decrease significantly as would the screening HI. Also as indicated in Table 8-20, the cumulative cancer risks (2 x 10^{-5}) for the Future Child and Adult Resident at Area 2 potentially exposed to subsurface soil are within the acceptable risk range and screening HI (1) is not greater than 1.

8.5.2.3 Area 3

Current land use receptors evaluated for Area 3 include outdoor workers and trespassers (each is potentially exposed to surface soil and the outdoor worker is potentially exposed to subsurface soil). Future land use receptors for Area 3 include outdoor workers, indoor workers, construction workers, recreational receptors, and residents.

8.5.2.3.1 Current Outdoor Worker

As indicated in Table 8-19, cancer risk (3 x 10^{-6}) for the Current Outdoor Worker at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.03) is below 1. Also as indicated in Table 8-19, cancer risk (3 x 10^{-6}) for the Current Outdoor Worker at Area 3 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.03) is below 1.

8.5.2.3.2 Current Trespasser

As indicated in Table 8-19, the cumulative cancer risk (7 x 10^{-6}) for the Adolescent and Adult Trespasser at Area 3 potentially exposed to surface soil via direct contact is within the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.1) for the Trespasser is below 1.

8.5.2.3.3 Future Outdoor Worker

As indicated in Table 8-20, cancer risk (2 x 10^{-5}) for the Future Outdoor Worker at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-20, cancer risk (9 x 10^{-6}) for the Future Outdoor Worker at Area 3 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.1) is below 1.

8.5.2.3.4 Future Indoor Worker

As indicated in Table 8-20, cancer risk (1 x 10^{-5}) for the Future Indoor Worker at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.1) is below 1. Also as indicated in Table 8-20, cancer risks (6 x 10^{-6}) for the Future Indoor Worker at Area 3 potentially exposed to subsurface soil are within the acceptable risk range and screening HI (0.06) is below 1.

8.5.2.3.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (3 x 10^{-6}) for the Future Construction Worker at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (1) does not exceed 1. Also as indicated in Table 8-20, cancer risk (1 x 10^{-6}) for the Future Construction Worker at Area 3 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (1) does not exceed 1.

8.5.2.3.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (2 x 10^{-5}) for the Future Child and Adult Recreational Receptor at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.4) is below 1. Also as indicated in Table 8-20, the cumulative cancer risk (1 x 10^{-5}) for the Future Child and Adult Recreational Receptor at Area 3 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.2) is below 1.

8.5.2.3.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (1 x 10^{-4}) for the Future Child and Adult Resident at Area 3 potentially exposed to surface soil is within the acceptable risk range and the screening HI (3) is above 1. The largest contributor to the screening HI is the ingestion exposure for arsenic (HI of 1.5 – skin). As shown in Table I-45, the target organ-based segregated HIs are below 1 except for skin (arsenic only). The maximum detected concentration of arsenic in Area 3 surface soil is 132 mg/kg at location AI3-105. The average arsenic concentration of Area 3 is 13.1 mg/kg; however, if the maximum concentration of 132 is removed the average concentration would decrease to 9.1 mg/kg.

An alternative risk calculation was completed by removing the arsenic concentration of 132 mg/kg. The EPC for arsenic in surface soil for Area 3 was recalculated without the arsenic concentration at AI3-105. The recalculated EPC is 16.6 mg/kg. The cancer risk and HI were recalculated using this new EPC. The cumulative cancer risk for the Future Child and Adult Resident at Area 3 with sample AI3-105 removed is 8 x 10^{-5}. The screening HI for the Future Child and Adult Resident at Area 3 with sample AI3-105 removed is 2. However, the target organ-based segregated HIs are all below 1. The target organ-based segregated HI for arsenic is 0.8.

Also as indicated in Table 8-20, the cumulative cancer risks (7 x 10^{-5}) for the Future Child and Adult Resident at Area 3 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (2) is above 1. The largest contributor to the screening HI is the ingestion exposure for arsenic (HI of 0.4). As shown in Table I-53, each of the target organ-based segregated HIs are below 1.

8.5.2.4 Area 4

Current land use receptors evaluated for Area 4 include outdoor workers and trespassers (each is potentially exposed to surface soil and the outdoor worker is potentially exposed to subsurface soil). Future land use receptors for Area 4 include outdoor workers, indoor workers, construction workers, recreational receptors, and residents.

8.5.2.4.1 Current Outdoor Worker

As indicated in Table 8-19, cancer risk (4×10^{-6}) for the Current Outdoor Worker at Area 4 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.01) is below 1. Also as indicated in Table 8-19, cancer risk (2×10^{-6}) for the Current Outdoor Worker at Area 4 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.02) is below 1.

8.5.2.4.2 Current Trespasser

As indicated in Table 8-19, the cumulative cancer risk (1×10^{-5}) for the Adolescent and Adult Trespassers at Area 4 potentially exposed to surface soil via direct contact is within the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.05) for the Trespasser is below 1.

8.5.2.4.3 Future Outdoor Worker

As indicated in Table 8-20, cancer risk (2×10^{-5}) for the Future Outdoor Worker at Area 4 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.09) is below 1. Also as indicated in Table 8-20, cancer risk (1×10^{-5}) for the Future Outdoor Worker at Area 4 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.1) is below 1.

8.5.2.4.4 Future Indoor Worker

As indicated in Table 8-20, cancer risk (2×10^{-5}) for the Future Indoor Worker at Area 4 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.05) is below 1. Also as indicated in Table 8-20, cancer risk (1×10^{-5}) for the Future Indoor Worker at Area 4 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.06) is below 1.

8.5.2.4.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (3×10^{-6}) for the Future Construction Worker at Area 4 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.9) is below 1. Also as indicated in Table 8-20, cancer risk (2×10^{-6}) for the Future Construction Worker at Area 4 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (1) does not exceed 1.

8.5.2.4.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (4×10^{-5}) for the Future Child and Adult Recreational Receptor at Area 4 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-20, cancer risks (3×10^{-5}) for the Future Recreational Receptor at Area 4 potentially exposed to subsurface soil are within the acceptable risk range and screening HI (0.2) is below 1.

8.5.2.4.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (3×10^{-4}) for the Future Child and Adult Resident at Area 4 potentially exposed to surface soil is above the acceptable risk range and the screening HI (1) is not greater than 1. The largest contributor to the cumulative cancer risks is the ingestion exposure for benzo(a)pyrene (ELCR of 1×10^{-4}). Also as indicated in Table 8-20, the cumulative cancer risk (2×10^{-4}) for the Future Child and Adult Resident at Area 3 potentially exposed to subsurface soil is above the acceptable risk range and screening HI (2) is above 1. The largest contributor to the cumulative cancer risks is the ingestion exposure for benzo(a)pyrene (ELCR of 9 x 10^{-5}). The largest contributor to the screening HI is the ingestion exposure for cobalt (HI of 0.5). As shown in Table I-71, all the target organ-based segregated HIs are below 1.

8.5.2.5 <u>*Area 5*</u>

Current land use receptors evaluated for Area 5 include outdoor workers and trespassers (each is potentially exposed to surface soil and the outdoor worker is potentially exposed to subsurface soil). Future land use receptors for Area 5 include outdoor workers, indoor workers, construction workers, recreational receptors, and residents.

8.5.2.5.1 Current Outdoor Worker

As indicated in Table 8-19, cancer risk (5 x 10^{-7}) for the Current Outdoor Worker at Area 5 potentially exposed to surface soil is below the acceptable risk range and the screening HI (0.02) is below 1. Also as indicated in Table 8-19, cancer risk (5 x 10^{-7}) for the Current Outdoor Worker at Area 5 potentially exposed to subsurface soil is below the acceptable risk range and screening HI (0.01) is below 1.

8.5.2.5.2 Current Trespasser

As indicated in Table 8-19, the cumulative cancer risk (1 x 10^{-6}) for the Adolescent and Adult Trespassers at Area 5 potentially exposed to surface soil via direct contact is below the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.06) for the Trespasser is below 1.

8.5.2.5.3 Future Outdoor Worker

As indicated in Table 8-20, cancer risk (3 x 10^{-6}) for the Future Outdoor Worker at Area 5 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.1) is below 1. Also as indicated in Table 8-20, cancer risk (3 x 10^{-6}) for the Future Outdoor Worker at Area 5 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.08) is below 1.

8.5.2.5.4 Future Indoor Worker

As indicated in Table 8-20, cancer risk (2 x 10^{-6}) for the Future Indoor Worker at Area 5 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.06) is below 1. Also as indicated in Table 8-20, cancer risk (2 x 10^{-6}) for the Future Indoor Worker at Area 5 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.04) is below 1.

8.5.2.5.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (7 x 10^{-7}) for the Future Construction Worker at Area 5 potentially exposed to surface soil is below the acceptable risk range and the screening HI (0.7) is below 1. Also as indicated in Table 8-20, cancer risk (6 x 10^{-7}) for the Future Construction Worker at Area 5 potentially exposed to subsurface soil is below the acceptable risk range and screening HI (0.7) is below 1.

8.5.2.5.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (2 x 10^{-6}) for the Future Child and Adult Recreational Receptor at Area 5 potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-20, the cumulative cancer risk (4 x 10^{-6}) for the Future Child and Adult Recreational Receptor at Area 5 potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.2) is below 1.

8.5.2.5.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (2 x 10^{-5}) for the Future Child and Adult Resident at Area 5 potentially exposed to surface soil is within the acceptable risk range and the screening HI (2) is above 1. The largest contributor to the screening HI is the ingestion exposure for cobalt (HI of 0.7). As shown in Table I-81, all of the target organ-based segregated HIs are below 1. Also as indicated in Table 8-20, the cumulative cancer risks (2 x 10^{-5}) for the Future Child and Adult Resident at Area 3 potentially exposed to subsurface soil are within the acceptable risk range and screening HI (1) is not greater than 1.

8.5.2.6 Site Groundwater

There are no current receptors exposed to groundwater. Future land use receptors exposed to Site groundwater include construction workers and residents.

8.5.2.6.1 Future Construction Worker

As indicated in Table 8-20, cancer risk (6 x 10^{-7}) for the Future Construction Worker at the Site potentially exposed to groundwater, via dermal contact, is below the acceptable risk range and the screening HI (0.0001) is below 1.

8.5.2.6.2 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (4 x 10^{-3}) for the Future Child and Adult Resident at the Site potentially exposed to groundwater is above the acceptable risk range and the screening HI (0.3) is below 1. The largest contributor to the cumulative cancer risks is dermal exposure for dibenz(a,h)anthracene (ELCR of 2 x 10^{-3}).

8.5.2.7 Background Area

To provide context for the calculated risks for soil exposures at the Site risks have also been calculated for Current and Future Outdoor Worker, Current Trespasser (Adolescent/Adult), Future Indoor Worker, the Future Construction Worker, Future Recreational Receptors (Child/Adult), and Future Resident (Child/Adult) using the analytical data from the background surface soil and subsurface soil locations. Any surface soil or subsurface soil COPCs that were detected in soil background samples have been included in the risk calculations for the soil background. The calculated risks provide an estimate of risks from an un-impacted area in the vicinity of the Site.

8.5.2.7.1 Current Outdoor Worker

As indicated in Table 8-19, cancer risk (5 x 10^{-6}) for the Current Outdoor Worker at the background area potentially exposed to surface soil is below the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-19, cancer risk (4 x 10^{-6}) for the Current Outdoor Worker at the background area potentially exposed to subsurface soil is below the acceptable risk range and screening HI (0.1) is below 1.

8.5.2.7.2 Current Trespasser

As indicated in Table 8-19, the cumulative cancer risk (2 x 10^{-6}) for the Adolescent and Adult Trespassers at the background area potentially exposed to surface soil via direct contact is below the acceptable risk range. Also as indicated by Table 8-19, the screening HI (0.1) for the Trespasser is below 1.

8.5.2.7.3 Future Outdoor Worker

As indicated in Table 8-20, cancer risk (5 x 10^{-6}) for the Future Outdoor Worker at the background area potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.2) is below 1. Also as indicated in Table 8-20, cancer risk (4 x 10^{-6}) for the Future Outdoor Worker at the background area potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.1) is below 1.

8.5.2.7.4 Future Indoor Worker

As indicated in Table 8-20, cancer risk (4 x 10^{-6}) for the Future Indoor Worker at the background area potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.1) is below 1. Also as indicated in Table 8-20, cancer risk (3 x 10^{-6}) for the Future Indoor Worker at the background area potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.08) is below 1.

8.5.2.7.5 Future Construction Worker

As indicated in Table 8-20, cancer risk (9 x 10^{-7}) for the Future Construction Worker at the background area potentially exposed to surface soil is below the acceptable risk range and the screening HI (1) does not exceed 1. Also as indicated in Table 8-20, cancer risk (8 x 10^{-7}) for the Future Construction Worker at the background area potentially exposed to subsurface soil is below the acceptable risk range and screening HI (1) does not exceed 1.

8.5.2.7.6 Future Recreational Receptor

As indicated in Table 8-20, the cumulative cancer risk (5 x 10^{-6}) for the Future Child and Adult Recreational Receptor at the background area potentially exposed to surface soil is within the acceptable risk range and the screening HI (0.4) is below 1. Also as indicated in Table 8-20, the cumulative cancer risk (5 x 10^{-6}) for the Future Child and Adult Recreational Receptor at the background area potentially exposed to subsurface soil is within the acceptable risk range and screening HI (0.3) is below 1.

8.5.2.7.7 Future Resident

As indicated in Table 8-20, the cumulative cancer risk (4 x 10^{-5}) for the Future Child and Adult Resident at the background area potentially exposed to surface soil is within the acceptable risk range and the screening HI (3) is above 1. The largest contributors to the screening HI are thallium (HQ = 1.8) and cobalt (HQ = 0.27). As shown in Table I-99, all target organ-based segregated HIs are less than 1 except that for thallium. Also as indicated in Table 8-20, the cumulative cancer risk (3 x 10^{-5}) for the Future Child and Adult Resident at the background area potentially exposed to subsurface soil is within the acceptable risk range and screening HI (2) is above 1. The largest contributors to the screening HI are thallium (HQ = 1.0) and cobalt (HQ = 0.34).

8.5.2.8 Risk Characterization for Lead

8.5.2.8.1 Child Lead Model

As shown in Table 8-21 the probability percentage of blood lead concentration greater than 10 µg/dL (child resident) is below 5% for both surface soil and subsurface soil in all exposure areas, with the exception of Area 1. The probability percentage of blood lead concentration greater than 10 µg/dL for surface and subsurface soil in Area 1 are 13.2% and 11.1% receptively.

8.5.2.8.2 Adult Lead Model

As shown in Table 8-22 the probability percentage of fetal blood lead concentration greater than 10 µg/dL is below 5% for both surface soil and subsurface soil in all exposure areas. In addition the adult blood lead concentration from exposure to both surface and subsurface soil is below 10 µg/dL.

8.5.2.9 Evaluation of Background Concentrations

There are two main categories of background chemical concentrations: naturally occurring and anthropogenic. Naturally occurring chemicals are not related to human activities and anthropogenic chemicals are present in the environment as a result of human activities, but are not related to Site activities. The goal of the SRI2 and the FS is to address Site risks from contamination attributable to site activities, but not risks attributable to natural or anthropogenic background conditions.

Characterization of the concentrations of background chemical concentrations is needed to evaluate incremental risk (difference between risks calculated for the Site soils and risks calculated for the background soil conditions). Incremental risks have been calculated for all receptors evaluated in all exposure areas. The incremental risk for the current and future use scenarios are presented in Tables 8-23 and 8-24, respectively. As shown in Tables 8-23 and 8-24, incremental cancer risks for all receptors in all exposure areas are below or within the acceptable risk range, with the exception of the Future Resident exposure to surface and subsurface soil in Area 4. Also shown in Table 8-23 and 8-24, the incremental screening HI values for all receptors in all exposure areas are below 1.

8.5.3 Uncertainty Analysis

This subsection identifies and discusses uncertainties in the risk assessment. These uncertainties are identified to provide perspective on the quantitative risk estimates. Unlike some other assessments, risk assessments rely not just on measured or certain facts, but also on assumptions and estimates, and also policy decisions, in the face of limited or nonexistent data. Historically, many risk assessments have used highly conservative assumptions in the place of unavailable data, with the net result often being a substantial overestimation of potential risks. It is important, however, to evaluate the assumptions and choices made in any risk assessment to evaluate their impact on the results and conclusions.

The following types of uncertainties should be considered in any HHRA:

- uncertainties in the nature and extent of release of COPC;
- uncertainties associated with the identification of future land uses and potential receptors;
- uncertainties in estimating the frequency, duration, and magnitude of possible exposures (including the identification of representative EPCs in environmental media);
- uncertainties associated with assigning exposure parameters to a heterogeneous population that includes both men and women and young and old (e.g., BW and ingestion rates);
- uncertainties in estimating CSFs and URs and/or non-carcinogenic measures of toxicity (e.g., RfDs or RfCs); and
- uncertainties in the assumption of additivity of risks across multiple COPCs and exposure pathways.

8.5.3.1 Data Evaluation and Selection of COPCs

Background conditions have not been specifically considered in the selection or elimination of substances as COPCs. Several of the PAH COPCs [e.g., benzo(a)pyrene], while they are not naturally-occurring substances, are detectable at some concentration in soil samples in urban areas. Also several of the metals (e.g., arsenic) are naturally-occurring in soil samples. Therefore, exposure concentrations of those COPCs represent “total” exposure potential from both site-related and non-site-related sources.

Groundwater data consists of five samples from the Site. PAHs were detected in two of the samples. There is some uncertainty if PAHs are present in groundwater, or whether the PAHs were a result of suspended sediment particles in the groundwater samples.

8.5.3.2 Exposure Assessment

There is insufficient information available to calculate dermal exposures and dermal risks associated with aluminum, antimony, barium, chromium, cobalt, copper, manganese, mercury, thallium, and vanadium in soil (uncertainty in absorption efficiency from soil through the skin). USEPA RAGS Part E guidance indicates for inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value to be applied for evaluating dermal exposure. As part of the 2011 soil investigation mercury speciation was completed. However, USEPA RAGS Part E guidance does not have a dermal absorption factor for elemental, total, or methyl mercury. The guidance suggests the pathway be evaluated qualitatively. Therefore, there is some underestimation of risk associated with dermal exposure to soil for these COPCs.

8.5.3.3 Toxicity Assessment

Risks from chromium have been calculated using toxicity information for hexavalent chromium. No analysis of soil was completed to determine the speciation of chromium. In the absence of this analysis, as a conservative measure the toxicity values for hexavalent chromium were used. The chronic RfD for hexavalent chromium is 0.003 compared to the chronic trivalent RfD of 1.5. In addition hexavalent chromium is considered carcinogenic via inhalation where trivalent chromium is not a carcinogen. Therefore the risks from chromium have been overestimated in this HHRA.

8.5.3.4 Risk Characterization

The risks have been calculated and compared to Superfund risk management criteria and benchmarks to draw conclusions concerning the Site-related risks. The procedures applied during this process are consistent with USEPA guidance and current risk assessment practice. The risk characterization procedures do not appear to substantially overestimate or underestimate health risks for current and future land uses.

8.6 Risk Assessment Conclusions

Consistent with the current and foreseeable future land use, the HHRA has evaluated potential exposures to soil for Current Outdoor Workers, Current Trespasser, Future Outdoor Workers, Future Indoor Workers, Future Construction Workers, Future Recreational Receptors and Future Residents in Area 1, Area 2, Area 3, Area 4, Area 5 and the Background Area. In addition potential dermal exposures to groundwater for the Future Construction Worker and potential potable use of groundwater for the Future Resident were evaluated for the Site.

The conclusions of the HHRA can be summarized as listed below.

- The cancer risk estimates for the Current Outdoor Worker (surface and subsurface soil) and Current Trespasser (surface soil) evaluated in Area 1, Area 2, Area 3, Area 4, and Area 5 are within or below the acceptable risk range.
- The non-cancer HI estimates for the Current Outdoor Worker (surface and subsurface soil) and Current Trespasser (surface soil) evaluated in Area 1, Area 2, Area 3, Area 4, and Area 5 are below a value of 1.
- The cancer risk estimates for the Future Outdoor Worker (surface and subsurface soil), Future Indoor Worker (surface and subsurface soil), Future Construction Worker (surface and subsurface soil) and Future Recreational Receptor (surface and subsurface soil) evaluated in Area 1, Area 2, Area 3, Area 4, and Area 5 are within or below the acceptable risk range.
- The non-cancer HI estimates for the Future Outdoor Worker (surface and subsurface soil), Future Indoor Worker (surface and subsurface soil), Future Construction Worker (surface and subsurface soil) and Future Recreational Receptor (surface and subsurface soil) evaluated in Area 1, Area 2, Area 3, Area 4, and Area 5 are below a value of 1.
- The cancer risk estimate for the Future Resident, (surface and subsurface soil) evaluated in Area 1, Area 2, Area 3, and Area 5 are within or below the acceptable risk range.
- The cancer risk estimate for the Future Resident ([surface (3×10^{-4}) and subsurface soil (2×10^{-4})] evaluated in Area 4 is above the acceptable risk range. The risk driver for cancer risk from exposure to both surface soil and subsurface soil is B(a)P. B(a)P EPCs for surface soil and subsurface soil are 3.0 mg/kg and 2.0 mg/kg respectively. The corresponding EPCs for the background data sets are 0.20 mg/kg and 0.19 mg/kg respectively. The incremental (above background) cancer risk for this receptor and area is 2×10^{-4} and 1×10^{-4} for surface soil and subsurface soil, respectively.
- The non-cancer screening HI and/or the target organ-based segregated HI estimates for the Future Resident are not greater than 1 for surface soil in Areas 1,2, 4, and 5 and they are not greater than 1 for subsurface soil in Areas 1 through 5. The non-cancer screening HI (3) and/or the target organ-based segregated HI (maximum of 1.5 for arsenic) estimates for the Future Resident for surface soil in Area 3 are above 1. This HI is driven by an arsenic concentration of 132 mg/kg in soil sample AI3-105. That

sample was collected immediately adjacent to a wooden deck believed to be constructed of pressure treated wood. If that sample were removed from the risk assessment, the non-cancer screening HI (2) is above one but the target organ-based segregated HI for all COPCs for the Future Resident for surface soil in Area 3 are below 1. No further action would be required under that scenario.

- The adult blood lead model indicates that blood lead level for adults is below the allowable blood lead level of 10 µg/dL for Areas 1 through 5.
- The child blood lead model indicates that the blood lead level for children is below allowable blood lead level of 10 µg/dL for Area 2, Area 3, Area 4, and Area 5.
- The child blood lead model for Area 1 indicates that the blood lead leave for children exposed to surface and subsurface soil is above the allowable blood lead level of 10 µg/dL.
- The cancer risk estimate for the Future Resident (potable groundwater use (4 x 10^{-3}) evaluated at the Site is above the acceptable risk range. The risk driver for cancer risk from exposure to groundwater is dibenz(a,h)anthracene.
- The non-cancer HI estimates for the Future Resident (potable groundwater use) evaluated at the Site are below a value of 1.

8.7 Qualitative Update of Baseline Human Health Risk Assessment

The 2012 soil and groundwater sample results were reviewed and evaluated in order to provide a qualitative update to the HHRA.

8.7.1 Mercury in Soil Samples

A total of 51 surface soil samples plus three field duplicates were collected from within Area 3 and analyzed for mercury. Mercury was detected in all 51 field samples and the three field duplicates at concentrations ranging from 0.15 mg/kg to 1.1 mg/kg. All reported concentrations were assigned a "J" qualifier during validation because the percent recovery in one MS/MSD had recoveries less than the lower QC limit (indicating low bias) and one MS/MSD had recovery higher than the upper QC limit (indicating high bias).

The average concentration of mercury in all of the field samples and field duplicates was 0.45 mg/kg. In comparison, for Area 3 surface soils (Table 8-7), the maximum and mean mercury concentrations were 5 mg/kg and 1.0 mg/kg. The 95 percent Upper Confidence Limit on the mean concentration of mercury (1.7 mg/kg) was previously utilized in the HHRA as the exposure point concentration for surface soil in Area 3. The maximum and mean concentrations of mercury from the 2012 samples are both lower than the corresponding concentrations reported in the HHRA. This suggests that addition of the newly collected mercury data would lower the exposure point concentration for mercury in surface soil in Area 3. Lowering of the exposure point concentration would result in lower estimated exposures and associated risks. The HHRA concluded that mercury in surface soil within Area 3 is not a human health concern for all receptors evaluated. Therefore, the risks for human health are acceptable in either case.

The HHRA evaluated risks associated with potential surface soil exposure for a Current Outdoor Worker, Adolescent and Adult Trespassers, Future Outdoor Worker, Future Indoor Worker, Future Construction Worker, Future Child and Adult Recreational Receptor, and Future Child and Adult Resident. The HHRA concluded that the risk associated with mercury in surface soil at Area 3 was not of concern. The non-cancer hazard quotients for mercury were below 1 for all receptors evaluated in the HHRA. Mercury is not considered a carcinogenic substance, so cancer risk calculations were not necessary for the mercury evaluation.

The 2012 mercury data associated with surface soil samples collected from Area 3 provide substantially denser spatial coverage and greater certainty in the distribution of mercury concentrations in surface soil within the portion of Area 3 where mercury was historically detected at elevated concentrations. Further, the 2012 mercury data support the conclusion of the HHRA that mercury in surface soil within Area 3 is not a human health concern for all receptors evaluated.

8.7.2 Polycyclic Aromatic Hydrocarbons in Groundwater Samples

Four field groundwater samples (two filtered and two unfiltered) and one field duplicate groundwater sample were collected from MR-4R and MW-5 in November 2012. The samples were analyzed by USEPA Method 8270D and results for 18 target PAH compounds were reported for each sample. No PAH compounds were reported in the filtered and unfiltered samples from MW-4R or in the filtered sample from MW-5. Only two PAH compounds, fluoranthene and pyrene, were reported at low concentrations in the unfiltered sample from MW-5. The reported concentrations of fluoranthene and pyrene were 0.039 J µg/L and 0.032 J µg/L, respectively. Both results were “J” qualified by the laboratory, indicating that the results were below the quantitation limit but above the method detection limit.

The HHRA identified benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene as chemicals of potential concern for groundwater. The HHRA evaluated a hypothetical (unlikely) drinking water exposure scenario for the groundwater. Exposure point concentrations for PAHs in groundwater were identified (Table 8-9). The HHRA concluded that for the hypothetical drinking water scenario, the cancer risk would be approximately 4×10^{-3}, which is well above the CERCLA allowable risk range. Benzo(a) pyrene and Dibenz(a,h)anthracene were the predominant cancer risk contributors.

None of the carcinogenic PAHs detected previously were detected in any of the November 2012 groundwater samples. The concentrations of the two detected compounds (detected in only one unfiltered sample) were well below the corresponding USEPA Tapwater RSLs. The RSLs for these compounds are set at a hazard quotient of 1. This means that for even sensitive individuals, long-term consumption of drinking water containing concentrations equal to the RSL would be without appreciable risk of any adverse effects. The fluoranthene concentration of 0.039 J µg/L was orders of magnitude below the corresponding tapwater RSL of 630 µg/L and the reported pyrene concentration of 0.032 J µg/L was also orders of magnitude below the corresponding tapwater RSL of 87 µg/L.

The November 2012 groundwater sample results did not confirm the previously detected compounds and the two compounds detected in the November 2012 sampling are associated with much lower risk (not of concern) than those risks associated with the previously detected compounds.

9.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

9.1 Introduction

This section presents the SLERA for the Site. The purpose of this SLERA is to assess the potential for Site-related chemical constituents of concern in environmental media to affect ecological receptors in the upland portions of the Site. This SLERA does not evaluate the marine environments adjacent to the Site, since a No Further Action ROD has previously been issued for the marine environment in little bay (USACE, 2003).

The documents listed below are used as guidance for conducting this SLERA.

- Ecological Risk Assessment (ERA) Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA, 1997b).
- Framework for Ecological Risk Assessment. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC, EPA/630/R-92/001. February 1992 (USEPA, 1992b).
- Guidelines for Ecological Risk Assessment (USEPA, 1998).
- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update (USEPA, 2001b).
- ECO Updates published between 1991 and 2011 (USEPA, 1991-2011).
- RAGS, Volume II: Environmental Evaluation Manual (USEPA, 1989c).
- Wildlife Exposure Factor Handbook Volumes I and II of II (USEPA, 1993).

NYSDEC has been involved in assessment oversight. The CERCLA guidance (*Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997b), herein referred to as the Process Document, provides an accepted framework for ERA under USEPA programs. The Process Document outlines an eight-step approach to ecological risk assessment. The eight-step approach consists of two tiers. The first tier includes Step 1 (Screening-Level Problem Formulation) and Step 2 (Screening Level Exposure Estimate and Risk Calculation), and is referred to as a SLERA. The second tier is a Baseline Ecological Risk Assessment (BERA) that evaluates chemical of potential ecological concern (COPECs) in greater detail and in the context of site specific factors.

As described in the Process Document, the purpose of the SLERA is to identify all complete exposure pathways and to conduct a conservative assessment of all COPECs. The results of the SLERA are used to determine whether the available information is adequate to make risk management decisions. Based on the SLERA, it may be concluded either that:

- There is a negligible ecological risk and therefore the Site or components of the Site require no further study;
- There is (or might be) a risk of adverse ecological effects, and the ERA process will continue with a BERA; or
- The information is not adequate to make a decision, but the ERA process will continue.

Thus, in accordance with the Process Document, this SLERA:

- Summarizes Site data;
- Characterizes Site conditions;
- Provides a screening level problem formulation, effects evaluation, exposure estimate, and risk calculation;
- Refines the list of contaminants of potential ecological concern based on Site specific conditions; and
- Identifies which contaminants of potential ecological concern found at the Site can be eliminated from further consideration and which should be evaluated further, as part of a BERA.

9.2 Problem Formulation

The problem formulation provides the framework upon which the risk assessment is organized. This section summarizes the Site history, identifies ecological resources at the facility, describes the characteristics of known historical releases, discusses study areas and background area data used in the screening assessment, discusses fate and transport, identifies complete exposure pathways, presents the CSM, and identifies assessment and measurement endpoints.

9.2.1 Site Overview

Fort Totten is located on Willets Point peninsula in the northeastern region of Queens Borough, New York City (Figure 2-1). Fort Totten lies approximately ¾ mile due east of the southern reach of the Throgs Neck Bridge; it is bordered to the south and southwest by Little Bay Park and the Cross Island Parkway, to the west by Little Bay, and to the north and east by Little Neck Bay (Watermark, 2011). The Site is 7.8 acres of property within the northwestern portion of Fort Totten owned by the USCG (Figure 2-2). The Site is bordered to the north, east, and south by the Fort Totten property and to the west by Little Bay.

The DoD acquired Fort Totten between 1857 and 1943 for the coastal defense of Long Island Sound and the eastern entrance to the East River. Fort Totten also served as a post-Civil War hospital, engineering school, and a training site for West Point Cadets. Fort Totten is currently the headquarters of the 77th Army Reserve Command. The Department of the Army conveyed the 9.6 acre Fort Totten CGS property to the USCG in 1986. Previous investigators have divided Site uplands into five exposure areas (Area 1 through Area 5) based on current and former building locations and Site uses (Figure 2-2). The USCG currently owns and operates the Site although a large portion of the Site is inactive.

9.2.2 Environmental Setting

This section describes the dominant habitats and natural communities present at the Site. An AMEC ecologist conducted a qualitative habitat assessment of the Site in 2011. The habitat assessment verified that Site conditions and exposure pathways are consistent with those documented in the 2006 SRI of the Upland Area (USACE, 2006) and the 2009 Draft FS (USACE, 2009).

9.2.2.1 Site Uplands

Site uplands are best described as an urban campus consisting primarily of open field habitat with some roads, a parking area, several buildings, maintained lawns, and a ball field. No surface water bodies are present in the upland portions of the Site. Surrounding land uses are similar to Site land use. Area 1, the fill area, is largely undeveloped however during the habitat assessment it was observed that natural vegetative cover has been removed. Areas 2, 3, 4, and 5 consist primarily of maintained open fields, buildings, maintained lawns, roads, and parking lots.

Existing wildlife habitat is minimal. Wildlife use of the Site is likely transitory and limited to species commonly associated with developed areas moving between nearby wetlands and urban residential areas. Mammals likely to inhabit the Site include raccoon (*Procylon lotor*) and opossum (*Didelphis virginiana*). Other small mammal species, such as mice and eastern cottontail (*Sylvilagus floridanus*), may also occur on-Site. Several bird species have historically been observed at the Site and may spend time foraging, resting, or collecting materials for nesting in the vegetated areas. Species observed include American robin (*Turdus migratorius*), common grackle (*Quisculus quiscula*), black-capped chickadee (*Parus atricapillus*), and tree swallow (*Ifidoprocne bicolor*). No reptiles have been observed at the Site during the various historical field activities, though they also may potentially use the Site for foraging, cover, and breeding purposes. Reptile species that may be present include the eastern garter snake (*Thamnophis s. sirtalis*), eastern milk snake (*Lampropeltist triangulum*), and eastern smooth green snake (*Opheodrys v. vernalis*) (USACE, 2009).

9.2.2.2 *Rare, Threatened, and Endangered Species*

NYSDEC was consulted regarding the occurrence of wildlife resources in the vicinity of the Site. As stated in their September 6, 2011 response (Appendix L), there are no records of rare or state listed animals or plants, significant natural communities, or other significant habitats on or in the immediate vicinity of the Site.

9.2.3 *Previous Investigations and Data Used in the SLERA*

The upland portion of the Site has been the subject of several environmental investigations dating back to 1988 (USACE, 2005). A comprehensive RI for the Site was completed in 2005 and showed that concentrations of PAHs and metals in some surface soil samples were greater than the NYSDEC SCOs (USACE, 2005). In 2009 a Draft FS was conducted for the Site to evaluate remedial alternatives for the risk posed by chemical constituents in soil in the upland portion of the Site (USACE, 2009). Additional data were collected in 2011 as part of the SRI2 to complete the delineation of nature and extent and to support risk assessment activities.

The remainder of this section describes characteristics of historical releases and data used in the SLERA for each upland exposure area, describes background location identification, and discusses data QA/QC. Table 9-1 lists the surface soil samples used in this SLERA by exposure area.

9.2.3.1 *Area 1*

Area 1, referred to as the fill area, is in the north east corner of the Site (Figure 2-2). Area 1 was historically filled with material of an unknown origin (USACE, 2009). During past Site investigations, concentrations of metals and PAHs have been detected in Area 1 soil samples at concentrations greater than NYSDEC SCOs (Watermark, 2011).

In this SLERA, a total of 19 surface soil samples (0-2 ft bgs) collected from 1998 to 2004 are used to evaluate surface soil conditions in Area 1. During the first RI in 1998, five surface soil samples were collected from locations FLA-09, FLA-10, FLA-11, FLA-12, and FLA-13 and analyzed for SVOCs, metals, and total organic carbon (TOC). In 2000, eight additional surface soil samples were collected from locations FLA-46, FLA-47, FLA-48, FLA-49, FLA-50, FLA-51, and FLA-52 and analyzed for SVOCs and metals. In 2004, six additional surface soil samples were collected from locations B-10 and B-11 and analyzed for SVOCs and metals. No additional sampling was conducted for Area 1 in 2011 in support of the SRI2 as both the USACE and NYSDEC agreed that Area 1 had been sufficiently characterized (Watermark, 2011).

9.2.3.2 *Area 2*

Area 2 is located west of Area 1 in the vicinity of the former Building 624 (Figure 2-2). Past investigations have shown concentrations of PAHs and metals in Area 2 soil samples that are greater than NYSDEC SCOs (Watermark, 2011). Historically, pesticides were stored in Building 624 (Watermark, 2011). Heptachlor epoxide is the only pesticide that has been detected above the New York State Screening levels (USACE, 2005).

In this SLERA, a total of 47 surface soil samples (0-2 ft bgs) collected from 1998 to 2011 are used to evaluate surface soil conditions in Area 2. During the first Site investigation in 1998, two surface soil samples were collected from locations SB-04 and SB-05 and analyzed for SVOCs, metals and TOC. An additional five surface soil samples were collected in 1998 from locations SS-02 through SS-06 and analyzed for pesticides. In 2000, 12 samples (locations SS-18 through SS-29) were collected and analyzed for SVOCs and metals and two samples (locations SS-53 and SS-54) were collected and analyzed for pesticides. In 2004, two surface soil samples (location SS-9) were collected and analyzed for SVOCs and metals. Finally, 24 soil samples were collected in 2011 from locations A12-101 through A12-112 and analyzed for TAL metals (Method 3050B/6010C) and PAHs (Method 3540C/8270D). Four of the surface soil samples collected in 2011 (locations AI2-107, AI2-109, AI2-111, and AI2-112) were also submitted for laboratory mercury speciation (elemental, total, and methyl mercury analysis).

9.2.3.3 *Area 3*

Area 3 is located in the southwest portion of the Site (Figure 2-2) and encompasses Buildings 610, 611, and 612, which are currently in use by the USCG. Previous investigations have shown concentrations of metals and PAHs in Area 3 soil samples that are greater than NYSDEC SCOs (Watermark, 2011).

In this SLERA, a total of 46 surface soil samples (0-2 ft bgs) collected from 1998 to 2011 are used to evaluate surface soil conditions in Area 3. During the first Site investigation in 1998, two surface soil samples were collected from locations SB-06 and SB-07 and analyzed for SVOCs and metals. Surface soil sample SB-06 collected in 1998 was also analyzed for TOC. In 2000, 12 surface soil samples (locations SS-30 through SS-45) were collected and analyzed for SVOCs and metals. In 2004, eight surface soil samples (locations B-01 through B-04) were collected and analyzed for SVOCs and metals. Finally, 24 surface soil samples were collected in 2011 (locations A13-101 through A13-112) and analyzed for TAL metals (Method 3050B/6010C) and PAHs (Method 3540C/8270D). Four of the surface soil samples collected in 2011 (locations AI3-104, AI3-105, AI3-111, and AI3-112) were also submitted for laboratory mercury speciation (elemental, total, and methyl mercury analysis).

9.2.3.4 *Area 4*

Area 4 is located in the central portion of the Site and is bordered by North Loop Road to the east, Abbott Road to the south, and Bayside Street to the west (Figure 2-2). Area 4 includes Building 625 in the north and a former building location in the southeast corner. Previous investigations have shown concentrations of metals and PAHs, in Area 4 soil samples that exceed NYSDEC SCOs (Watermark, 2011).

In this SLERA, a total of 57 surface soil samples (0-2 ft bgs) collected from 1998 to 2011 are used to evaluate surface soil conditions in Area 4. During the first Site investigation in 1998, three surface soil samples were collected (locations SB-01 through SB-03) and analyzed for SVOCs, metals and TOC. In 2000, 16 surface soil samples (locations SS-01 through SS-17) were collected and analyzed for metals. 11 of the 16 surface soil samples collected in 2000 (locations SS-01 through SS-05 and SS-12 through SS-17) were also analyzed for SVOCs. In 2004, eight surface soil samples (locations B-05 through B-08) were collected and analyzed for SVOCs and metals. Finally, 29 soil samples were collected in 2011 (locations A14-101 through A14-115) and analyzed for TAL metals (Method 3050B/6010C) and PAHs (Method 3540C/8270D). Four of the surface soil samples collected in 2011 (locations AI4-105, AI4-106, AI4-112, and AI4-115) were also analyzed for mercury speciation (elemental, total, and methyl mercury analysis).

9.2.3.5 *Area 5*

Area 5 is located on the western portion of the Site southeast of Building 615 (Figure 2-2). Building 615 was formerly used as a machine shop where munitions were repaired; however, it is unknown if munitions were ever used at the Site (Watermark, 2011). Previous investigations have shown concentrations of metals, specifically copper, lead, mercury, and zinc in Area 5 soil samples greater than NYSDEC SCOs. Mercury concentrations were associated with former subsurface piping and three subsurface cesspool dry wells located south of Building 615. Most of the mercury release was addressed through remedial actions conducted between May 2006 and March 2007; however, due to obstruction by an underground power line and brick cesspool structures, some mercury-affected soil could not be removed (Watermark, 2011).

In this SLERA, a total of 26 surface soil samples (0-2 ft bgs) collected from 1998 to 2011 are used to evaluate surface soil conditions in Area 5. During the first Site investigation in 1998, one surface soil sample was collected from location SB-08 and analyzed for metals. In 2000, four surface soil samples (locations SS-41 through SS-44) were collected and analyzed for metals. Finally, 21 soil samples were collected in 2011 (locations A15-101 through A15-110) and analyzed for TAL metals (Method 3050B/6010C). Four of the surface soil samples collected in 2011 (locations AI5-105 and AI5-106) were also analyzed for mercury speciation (elemental, total, and methyl mercury analysis). Soil samples that are no longer representative of soil conditions following excavation of the mercury hot spot in 2006 and 2007 have been excluded from this evaluation. No samples collected from Area 5 have been analyzed for SVOCs.

9.2.3.6 *Background Area*

Samples were collected from background areas to determine concentrations of naturally occurring metals from normal geological weathering, as well as concentrations of SVOCs from widespread anthropological non-point sources. The background area was selected based on its similarity to the physical, chemical, geological, and biological characteristics of the Site. The background area selected was a city park near Fort Totten including fill and non-fill areas. All background sample locations were within a 0.5 mile radius of the Site and adjacent to urban features (e.g., streets, buildings, parking lots) similar to those at the Site.

Fifteen background soil sample locations were selected. Two samples were taken at each location: one from 0 to 3 inches bgs and the other 18 to 24 inches bgs, by hand auger. Sampling was conducted on September 16^{th} and 18^{th} 2008. Background samples were analyzed for SVOCs and metals. Table 9-8 presents statistics for the analytical results of the 30 background samples.

9.2.3.7 *Data Quality Assurance/Quality Control*

For samples collected in 2011, the QA/QC samples listed below were collected to evaluate laboratory accuracy, as well as to evaluate field techniques.

- One duplicate sample was collected for every 20 surface soil samples;
- One MS/MSD sample was collected for every 20 soil samples collected for metals analysis; and
- One equipment rinsate sample was collected in each area from a non-disposable piece of sampling equipment after it had been properly decontaminated.

The duplicate samples and MS/MSD samples were collected by dividing the samples into additional laboratory-supplied containers for analysis, logging them into the COC, and keeping them on ice for preservation until they were picked up by a courier for delivery to the laboratory for analysis and reporting.

Equipment rinsate samples were collected by rinsing properly decontaminated non-disposable sampling equipment with laboratory-grade de-ionized water and collecting the rinse water in laboratory-supplied containers for analysis, logging them into the COC, and keeping them on ice for preservation until they were picked up by a courier for delivery to the laboratory for analysis and reporting.

For samples collected in 2011 the QC processes listed below were followed.

- Independent validation of analytical data following the USEPA Region II data validation Standard Operating Procedures.
- Project chemist review of methods used to determine the nature of mercury present at the Site not addressed in USEPA guidelines; and
- Electronic data verification by comparing electronic data provided by the laboratory to hardcopy data packages for accuracy.

Additional detail regarding data QA/QC procedures followed can be found in Section 4.

9.2.4 *Ecotoxicity*

Metals and PAHs are the primary chemicals which are of potential concern at this Site. General toxicological profiles for these groups of compounds are summarized in Appendix K.

9.2.5 *Fate and Transport*

COPECs in surface soil may result from Site specific releases or atmospheric deposition from non-point source anthropogenic sources. Infiltration may transport Site constituents to subsurface soil and groundwater. Some COPEC may be strongly adsorbed to surface soil particles and transported overland through wind or storm water flow. Additional fate and transport discussion is presented in Section 7.0.

9.2.6 Complete Exposure Pathways

Chemicals may move from surface soil to ecological receptors through several major biological exposure mechanisms:

- Uptake of chemicals from soil through roots (vegetation)
- Ingestion of chemicals bound to soil (terrestrial invertebrates, birds, mammals)
- Ingestion of chemicals through consumption of contaminated plants (herbivores, omnivores)
- Ingestion of chemicals through consumption of contaminated prey (all predators)

Although inhalation and dermal absorption pathways are possibly complete for some receptors, these pathways are considered to be minor compared to dietary ingestion and are not evaluated.

Since soil deeper than 2 ft is generally considered outside the biologically active zone for plants and soil invertebrates (Brady & Weil, 2001), subsurface soil was eliminated as a complete exposure pathway. Site receptors have minimal contact with groundwater; therefore groundwater was also eliminated from further review because it is largely an incomplete exposure pathway.

9.2.7 Conceptual Site Model

The ecological CSM (Figure 9-1) illustrates initial estimates of contaminant fate and transport mechanisms, complete exposure pathways, and primary and secondary receptors. Specific assessment and measurement endpoints are not identified because generic endpoints were used. The CSM is based on the current understanding of the site conditions, and serves as a framework for evaluating ecological exposure and risk.

The CSM for the Site describes:

- The source areas (i.e., historical releases).
- Transport mechanisms (processes that introduce contaminants into environmental media).
- Exposure to media (those environmental media through which organisms may be exposed to chemicals).
- Potential receptor organisms based on site ecological investigations.

Under the current land use scenario, Areas 1, 2, 3, 4, and 5 are of limited ecological value. However, since potential future land use at these areas is unknown, they are evaluated in this SLERA.

9.2.8 Assessment and Measurement Endpoints

The Department Of The Army has adopted the following over-arching management goal for ecological risk assessments and the management of chemical releases: "Protect valuable biological resources from unreasonable adverse effects due to the release of hazardous substances associated with Army operations, including past Department of Defense operations for FUDS". The development of management goals for ecological risk assessments is further described in the U.S. Army Biological Technical Assistance Group *Technical Document for Ecological Risk Assessment: Process for Developing Management Goals* (USA BTAG 2005).

Endpoints in the SLERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has occurred or may occur. Assessment endpoints most often relate to attributes of biological populations or communities. They contain an entity (e.g., soil invertebrate population) and an attribute of that entity (e.g., survival rate). The entity in the assessment endpoint is typically an individual species or community, often referred to as an indicator species or indicator community, respectively. Measurement endpoints are related to the assessment endpoint, and are the effects that can be measured or observed (e.g., toxicity in invertebrate bioassays). Measurement endpoints are most often used as surrogates for assessment endpoints since in most cases the assessment endpoint itself cannot be readily measured or observed (Suter, 1993).

Assessment endpoints for the SLERA are generic assessment endpoints associated with screening ecotoxicity endpoints. The endpoints are considered generic because they are based on a variety of organisms and are therefore considered to be representative of entire communities. The assessment and measurement endpoints for this SLERA are presented below:

Assessment Endpoint	Measurement Endpoint
Sustainability (survival, growth, reproduction) of local populations of terrestrial plants, soil invertebrates, and wildlife exposed to upland exposure area surface soil.	Comparison of upland exposure area surface soil concentrations to soil screening benchmarks and to background concentrations.

9.3 Screening-Level Effects Evaluation

Ecotoxicological screening benchmarks from various sources are used in this SLERA to assess the potential for ecological risk to occur from exposure of receptors to chemical constituents in Site surface soil (0-2 ft bgs). Screening values are based on conservative assumptions and represent, where possible, a no-observable-adverse-effects-level (NOAEL) for chronic exposures.

Soil screening values were obtained from the sources in the order presented (summarized in Table 9-2):

The lowest values for plants, soil invertebrates, mammals, or birds from the following source:

- USEPA Eco-SSLs – Ecological Soil Screening Levels (USEPA 2003c, USEPA 2005d-m; USEPA 2007a-c).

For constituents without Eco-SSLs, a screening benchmark was selected as the lowest from the following sources:

- ORNL Toxicological Benchmarks for Screening Potential Effects on Terrestrial Plants (Efroymson, et al., 1997a); and
- ORNL Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects of Soil and Litter Invertebrates and Heterotrophic Process (Efroymson, Will, and Suter, 1997b).

If a benchmark was still unavailable for a constituent, then the lowest values from the following sources were selected:

- USEPA, 2003d. USEPA, Region V, RCRA Ecological Screening Levels. August 22, 2003.
- Friday, G. P. 1998. Ecological Screening Values for Surface Water, Sediment, and Soil. Westinghouse Savannah River Company, Savannah River Technology Center, (WSRC-TR-98-00110), Aiken, SC 29808. Cited in: USEPA 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 Update.

NYSDEC Ecological Soil Cleanup Objectives (ESCOs) are not used in this SLERA as they are not intended for use as screening level benchmarks and other, more appropriate benchmarks (see above), are available. NYSDEC ECSCOs are derived from low-effect levels rather than no-effect levels and therefore may not necessarily be protective of the most sensitive species (NYSDEC, 2006).

9.4 Screening Level Exposure Estimate and Risk Calculation

This section presents how exposure point concentrations (EPCs) were developed, performs the screening level risk calculation, and presents the screening results.

9.4.1 Screening Level Exposure Estimate

Maximum detected analyte concentrations from surface soil data sets were selected as the screening level exposure point concentration (EPC) in each exposure area. Maximum detected concentrations were compared to screening benchmarks described above to select COPECs. COPECs were selected separately for each exposure area. Analytes for which the maximum detected concentration was greater than its respective screening benchmark value were identified as COPECs. Analytes that lacked screening values were retained as COPECs. Analytes with a frequency of detection of 5% of less were excluded as COPECs. Calcium, magnesium, potassium, and sodium were excluded as COPECs because they are macronutrients which naturally occur at high concentrations. Selection of COPECs is documented in Tables 9-3 through 9-7.

9.4.2 Risk Calculation

For analytes selected as COPECs in Tables 9-2 through 9-6, maximum analyte concentrations were compared to screening benchmarks in order to calculate a hazard quotient (HQ):

$$HQ = \frac{\text{Maximum Concentration}}{\text{Benchmark Value}} \qquad \text{(Equation 1)}$$

An HQ less than or equal to 1 indicates that the chemical constituent alone is unlikely to cause adverse ecological effects. Analytes with an HQ greater than 1 could not be eliminated from further consideration and were retained for further consideration. Site HQ calculations are shown in Table 9-9.

9.4.3 Screening and Risk Calculation Results

This section presents the results of the benchmark comparison and risk calculation for surface soil by exposure area and chemical class. Interpretation of these results is presented in the Risk Characterization discussion.

9.4.3.1 Area 1

SVOCs

SVOCs for which maximum concentrations in surface soil are greater than screening benchmarks in Area 1 include anthracene, benzo(a)pyrene, bis(2-Ethylhexyl)phthalate, fluoranthene, naphthalene, phenanthrene, and pyrene; HQs range from 1.6 (naphthalene) to 15 (pyrene). Screening benchmarks are not available for carbazole or dibenzofuran therefore they are also retained as COPEC.

Metals

Metals for which maximum concentrations in surface soil are greater than screening benchmarks in Area 1 include aluminum, antimony, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium and zinc; HQs range from 1.2 (chromium) to 350 (aluminum).

9.4.3.2 Area 2

SVOCs

SVOCs for which maximum concentrations in surface soil are greater than screening benchmarks in Area 2 include anthracene, benzo(a)pyrene, bis(2-Ethylhexyl)phthalate, butylbenzylphthalate, fluoranthene, naphthalene, phenanthrene, and pyrene; HQs range from 1.3 (butylbenzylphthalate) to 29 (pyrene). A screening benchmark was not available for 1-methylnaphthalene therefore it was also retained as COPEC.

Pesticides

Pesticides for which maximum concentrations in surface soil are greater than screening benchmarks in Area 2 include 4,4`-DDD, 4,4`-DDE, 4,4`-DDT, and gamma-BHC; HQs range from 18 (4,4`-DDE) to 104 (gamma-BHC). Screening benchmarks are not available for endrin ketone or gamma-chlordane therefore they are also retained as COPEC.

Metals

Metals for which maximum concentrations in surface soil are greater than screening benchmarks in Area 2 include aluminum, antimony, cadmium, chromium, copper, iron, lead, manganese, mercury, methyl mercury, selenium, vanadium, and zinc; HQs range from 1.1 (chromium) to 411 (copper).

9.4.3.3 Area 3

SVOCs

SVOCs for which maximum concentrations in surface soil are greater than screening benchmarks in Area 3 include anthracene, benzo(a)pyrene, fluoranthene, naphthalene, phenanthrene, and pyrene; HQs range from 2.1 (naphthalene) to 33 (fluoranthene). Screening benchmarks are not available for 1-methylnaphthalene, carbazole, or dibenzofuran therefore they are also retained as COPEC.

Metals

Metals for which maximum concentrations in surface soil are greater than screening benchmarks in Area 3 include aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, methyl mercury, nickel, selenium, vanadium, and zinc; HQs range from 1.2 (barium) to 764 (aluminum).

9.4.3.4 Area 4

SVOCs

SVOCs for which maximum concentrations in surface soil are greater than screening benchmarks in Area 4 include anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, naphthalene, phenanthrene, and pyrene; HQs range from 1.4 (benzo(a)anthracene) to 160 (fluoranthene). Screening benchmarks are not available for 1-methylnaphthalene, carbazole, or dibenzofuran therefore they are also retained as COPEC.

Metals

Metals for which maximum concentrations in surface soil are greater than screening benchmarks in Area 4 include aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc; HQs range from 1.1 (arsenic) to 426 (aluminum).

9.4.3.5 Area 5

Metals

Metals for which maximum concentrations in surface soil are greater than screening benchmarks in Area 5 include aluminum, antimony, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc; HQs range from 1.7 (chromium) to 304 (aluminum).

9.4.4 Refinement of Chemicals of Potential Ecological Concern

Ecological risk assessment is an iterative process and allows and encourages modification as additional site information becomes available. At this stage of the risk assessment process, following the initial risk calculation, the Process Document (USEPA, 1997b) provides for the use of additional calculations, analyses, and data review to refine the list of COPECs based on background comparisons. The following sections further refine the list of COPECs by calculating HQs based on more realistic exposure point concentrations, and by comparing Site chemical conditions to background.

9.4.4.1 Methodology for Evaluation of Average Analyte Concentrations

Comparison of maximum analyte concentrations to screening benchmarks and maximum background concentrations provides the most conservative estimate of risk. An EPC based on average concentrations provides a more accurate representation of concentrations to which ecological receptors would be exposed to at the Site. Maximum concentrations reflect just one point, whereas averages represent exposures which populations of receptors will encounter over a given area, over time.

Analytes selected as COPECs are further evaluated by comparing average (arithmetic mean) concentrations to screening level benchmarks. The average analyte concentrations from surface soil data sets are used as EPCs. Average concentrations are calculated using ½ the sample quantitation limit (SQL) for non-detects. For analytes selected as COPECs, average analyte concentrations were compared to screening benchmarks in order to calculate a hazard quotient (HQ):

$$HQ = \frac{\text{Average Concentration}}{\text{Benchmark Value}} \quad \text{(Equation 2)}$$

9.4.4.2 *Method for Comparison to Background*

HQs were also calculated using maximum and average background concentrations using the same process as Site data (Equation 1 and Equation 2). Then, maximum and average background HQs were compared Site HQs to estimate incremental Site risk above background, as shown in Equation 3:

Incremental Risk HQ = Site Exposure Area HQ – Background HQ (Equation 3)

Background HQs and incremental risk HQs are presented in Table 9-9 and Table 9-10. If the incremental risk HQ is less than or equal to 1 for a COPEC, then it was concluded that the COPEC poses a negligible Site-related risk and can be eliminated from further ecological review.

9.4.4.3 *Refinement Results*

9.4.4.3.1 *Area 1*

SVOCs

SVOCs identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 1 include anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene; HQs based on average concentrations range from 1.2 (anthracene) to 7.3 (pyrene). Maximum incremental risk HQs are less than or equal to 1 for anthracene, phenanthrene and pyrene; maximum incremental risk HQs greater than 1 range from 1.3 (naphthalene) to 3.6 (benzo(a)pyrene). Incremental risk HQs based on average concentrations are greater than 1 for benzo(a)pyrene (3.0), fluoranthene (4.5), phenanthrene (2.5), and pyrene (4.3). The incremental risk HQ based on average concentrations in Area 1 is less than or equal to 1 for anthracene, bis(2-Ethylhexyl)phthalate, and naphthalene. Screening benchmarks are not available for carbazole or dibenzofuran therefore HQs cannot be calculated for these COPECs.

Metals

Metals identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 1 include aluminum, antimony, cadmium, copper, iron, lead, manganese, mercury, selenium, vanadium and zinc. HQs based on average concentrations range from 1.1 (selenium) to 142 (aluminum). Maximum incremental risk HQs are less than or equal to 1 for barium, cadmium, chromium, lead, manganese, selenium, vanadium and zinc; maximum incremental risk HQs greater than 1 range from 9.3 (copper) to 45 (iron). Incremental risk HQs based on average concentrations are greater than 1 for antimony (6.0), cadmium (1.7), copper (2.9), iron (27), lead (32), mercury (6.5), and zinc (4.7). Incremental risk HQs based on average concentrations are less than or equal to 1 for aluminum, barium, chromium, manganese, selenium, and vanadium.

9.4.4.3.2 *Area 2*

SVOCs

SVOCs identified as COPEC in Section 4.3 for which average concentrations in surface soil are greater than screening benchmarks in Area 2 include benzo(a)pyrene, bis(2-Ethylhexyl)phthalate, fluoranthene, phenanthrene, and pyrene. Maximum incremental risk HQs are less than or equal to 1 for anthracene, butylbenzylphthalate, and phenanthrene; maximum incremental risk HQs greater than 1 range from 1.6 (naphthalene) to 18 (bis(2-Ethylhexyl)phthalate). Incremental risk HQs based on average concentrations are greater than 1 for benzo(a)pyrene (1.2), bis(2-Ethylhexyl)phthalate (1.9), and fluoranthene (1.6). Incremental risk HQs based on average concentrations are less than or equal to 1 for anthracene, butylbenzylphthalate, naphthalene, phenanthrene, and pyrene. A screening benchmark was not available for 1-methylnaphthalene therefore HQs could not be calculated for this COPEC.

Pesticides

Pesticides identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 2 include 4,4`-DDD, 4,4`-DDE, 4,4`-DDT, and gamma-BHC; HQs range from 13 (4,4`-DDE) to 84 (gamma-BHC). Background soil samples were not analyzed for pesticides, therefore incremental risk HQs are not calculated. Screening benchmarks are not available for endrin ketone or gamma-chlordane, therefore HQs could not be calculated for these COPECs.

Metals

Metals identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 2 include aluminum, antimony, cadmium, copper, iron, lead, manganese, methyl mercury, vanadium, and zinc. Maximum incremental risk HQs are less than or equal to 1 for aluminum, cadmium, chromium, iron, lead, manganese, and zinc; maximum incremental risk HQs greater than 1 range from 1.1 (selenium) to 408 (copper). HQs based on average concentrations range from 1.2 (cadmium) to 156 (aluminum). Incremental risk HQs based on average concentrations are greater than 1 for antimony (1.2) and copper (10). Incremental risk HQs based on average concentrations are less than or equal to 1 for aluminum, cadmium, chromium, iron, lead, manganese, mercury, selenium, vanadium, and zinc. Background soil samples were not analyzed for methyl mercury therefore incremental risk HQs are not calculated for this COPEC.

9.4.4.3.3 Area 3

SVOCs

SVOCs identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 3 include benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene. HQs based on average concentrations range from 3.3 (benzo(a)pyrene and phenanthrene) to 6.0 (fluoranthene). Maximum incremental risk HQs range from 1.8 (naphthalene) to 23 (fluoranthene). Incremental risk HQs based on average concentrations are greater than 1 for benzo(a)pyrene (2.2), fluoranthene (4.0), phenanthrene (1.5), and pyrene (2.5). Incremental risk HQs based on average concentrations are less than or equal to 1 for anthracene and naphthalene. Screening benchmarks are not available for 1-methylnaphthalene, carbazole, or dibenzofuran therefore HQs cannot be calculated for these COPEC.

Metals

Metals identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 3 include aluminum, antimony, cadmium, copper, iron, lead, manganese, mercury, selenium, vanadium and zinc; HQs based on average concentrations range from 1.1 (cadmium) to 212 (aluminum). Maximum incremental risk HQs are less than or equal to 1 for barium, cobalt, lead, and nickel; maximum incremental risk HQs greater than 1 range from 2.2 (antimony and manganese) to 450 (aluminum). Incremental risk HQs based on average concentrations are greater than 1 for aluminum (9.4), copper (2.1), and mercury (6.5). Incremental risk HQs based on average concentrations are less than or equal to 1 for antimony, arsenic, barium, cadmium, chromium, cobalt, iron, lead, manganese, nickel, selenium, vanadium, and zinc. Methyl mercury was not analyzed for in the background dataset therefore incremental risk HQs could not be calculated for this COPEC.

9.4.4.3.4 Area 4

SVOCs

SVOCs identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 4 include anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene. HQs based on average concentrations range from 2.1 (anthracene) to 15 (pyrene). Maximum incremental risk HQs range from 1.3 (benzo(a)anthracene) to 150 (fluoranthene). Incremental risk HQs based on average concentrations are greater than 1 for anthracene (1.8), benzo(a)pyrene(9.2), fluoranthene (12), phenanthrene (4.2), and pyrene (12). Exposure area and incremental risk HQs based on average concentrations are less than or equal to 1 for benzo(a)anthracene, chrysene, and naphthalene. Screening benchmarks are not available for 1-methylnaphthalene, carbazole, or dibenzofuran; therefore, HQs cannot be calculated for these COPECs.

Metals

Metals identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 4 include aluminum, antimony, iron, lead, manganese, vanadium, and zinc; HQs range from 1.7 (antimony and manganese) to 188 (aluminum). Maximum incremental risk HQs are less than or equal to 1 for antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, selenium, vanadium, and zinc; maximum incremental risk HQs greater than 1 range from 28 (iron) to 112 (aluminum). Incremental risk HQs based on average concentrations are less than or equal to 1 for all metals identified as COPEC in Area 4.

9.4.4.3.5 Area 5

Metals

Metals identified as COPEC for which average concentrations in surface soil are greater than screening benchmarks in Area 5 include aluminum, antimony, copper, iron, lead, mercury, selenium, vanadium and zinc; HQs based on average concentrations range from 1.1 (selenium) to 132 (aluminum). Maximum incremental risk HQs are less than or equal to 1 for aluminum, cadmium, chromium, iron, lead, manganese, vanadium, and zinc; maximum incremental risk HQs greater than 1 range from 1.5 (antimony) to 36 (mercury). Incremental risk HQs based on average concentrations are less than or equal to 1 for all metals identified as COPEC in Area 5 with the exception of mercury (incremental risk HQ = 15).

9.5 Screening Level Exposure Estimate and Risk Calculation

This section evaluates the results of the screening level exposure estimates, and considers uncertainties.

9.5.1 Risk Characterization

Risk to assessment populations can be characterized by integrating the results of the ecological exposure estimates and risk calculations with other pertinent Site data using a weight-of-evidence approach (USEPA, 1997b). The greatest weight was given to the incremental risk HQs based on average concentrations because this risk estimate contributes the least amount of uncertainty. Though still conservative because it is based on a screening level benchmark, the incremental risk HQ based on average concentrations accounts for conditions in each Area absent Site influences. Also, since it relies on average concentrations, the incremental risk HQ based on average concentrations better represents the chemical conditions to which populations of receptors are likely to be exposed to over time.

9.5.1.1 Area 1

Incremental risk HQs based on average concentrations (Table 9-10) are above 1 for benzo(a)pyrene (3.0), fluoranthene (4.5), phenanthrene (2.5), pyrene (4.3), antimony (6.0), cadmium (1.7), copper (2.9), iron (27), lead (32), mercury (6.5), and zinc (4.7). While based on average concentrations, these HQs are also based on screening level benchmarks that assume 100% bioavailability, conservative dietary parameters, conservative home ranges and site use factors, etc. that result in an overestimation of risk. Based on HQs, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it is unlikely that chronic exposures to these SVOCs and metals in Area 1 surface soils would result in significant population level effects.

Incremental risk HQs could not be calculated for carbazole and dibenzofuran as screening benchmarks are unavailable, therefore risk from these COPECs is uncertain.

9.5.1.2 Area 2

Incremental risk HQs based on average concentrations (Table 9-10) are above 1 for benzo(a)pyrene (1.2), bis(2-Ethylhexyl)phthalate (1.9), fluoranthene (1.6), antimony (1.2) and copper (10). While based on average concentrations, these HQs are also based on screening level benchmarks that assume 100% bioavailability, conservative dietary parameters, conservative home ranges and site use factors, etc. that result in an overestimation of risk. Based on HQs, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it is unlikely that chronic exposures to these SVOCs and metals in Area 2 surface soils would result in significant population level effects.

HQs could not be calculated for 1-methylnaphthalene as a screening benchmark was not available; therefore risk from this COPEC is uncertain.

Background soil samples were not analyzed for methyl mercury, therefore incremental risk HQs could not be calculated for this COPEC. The HQ based on the average concentration of methyl mercury in Area 2 soil is 2.0. Although methyl mercury may bioaccumulate, based on the average HQ of 2.0, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it unlikely that chronic exposures to methyl mercury in Area 2 surface soil would result in significant population level effects.

Pesticides identified as COPEC by comparison of maximum detected concentrations in Area 2 include 4,4`-DDD, 4,4`-DDE, 4,4`-DDT, and gamma-BHC. HQs based on average concentrations of these COPEC are as follows: 4,4`-DDD (18), 4,4`-DDE (13), 4,4`-DDT (31), and gamma-BHC (84). Background soil samples were not analyzed for pesticides, therefore incremental risk HQs are not calculated for these COPECs and these COPECs could not be eliminated using screening level tools. HQs could not be calculated for endrin ketone or gamma-chlordane as no screening benchmarks were available therefore, risk from these COPECs is also uncertain.

9.5.1.3 Area 3

Incremental risk HQs based on average concentrations are greater than 1 for benzo(a)pyrene (2.2), fluoranthene (4.0), phenanthrene (1.5), pyrene (2.5), aluminum (9.4), copper (2.1), and mercury (6.5). While based on average concentrations, these HQs are also based on screening level benchmarks that assume 100% bioavailability, conservative dietary parameters, conservative home ranges and site use factors, etc. that result in an overestimation of risk. Based on HQs, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it is unlikely that chronic exposures to these SVOCs and metals in Area 3 surface soils would result in significant population level effects.

HQs could not be calculated for 1-methylnaphthalene, carbazole, or dibenzofuran as a screening benchmarks were not available; therefore risk from these COPEC is uncertain.

Background soil samples were not analyzed for methyl mercury therefore incremental risk HQs are not calculated for this COPEC. The HQ based on the average concentration of methyl mercury in Area 3 soil is 0.61. Although methyl mercury bioaccumulates, based on the average HQ of 0.61, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it unlikely that chronic exposures to methyl mercury in Area 3 surface soil would result in significant population level effects.

9.5.1.4 Area 4

Incremental risk HQs based on average concentrations are greater than 1 for anthracene (1.8), benzo(a)pyrene (9.2), fluoranthene (12), phenanthrene (4.2), and pyrene (12). While based on average concentrations, these HQs are also based on screening level benchmarks that assume 100% bioavailability, conservative dietary parameters, conservative home ranges and site use factors, etc. that result in an overestimation of risk. Based on HQs, and considering the conservative nature of screening benchmarks and the limited wildlife habitat present at the Site, it is unlikely that chronic exposures to these SVOCs Area 4 surface soils would result in significant population level effects.

Incremental risk HQs based on average concentrations are less than or equal to 1 for all metals identified as COPEC in Area 4 soil. Risk from metals in Area 4 soil is therefore likely negligible.

HQs could not be calculated for 1-methylnaphthalene, carbazole, or dibenzofuran as a screening benchmarks were not available; therefore risk from these COPEC is uncertain.

9.5.1.5 Area 5

Incremental risk HQs based on average concentrations are less than or equal to 1 for all metals identified as COPEC in Area 5 with the exception of mercury (15). Given the conservative nature of the screening benchmarks used to calculate this HQ (assumptions of 100% bioavailability, conservative dietary parameters, conservative home ranges and site use factors, etc.) this HQ is likely an overestimation of risk. Considering the conservative nature of the screening benchmark and the limited wildlife habitat present at the Site, it is unlikely that chronic exposures to metals (including mercury) in Area 5 surface soils would result in significant population level effects.

9.5.2 Uncertainties

This section presents and discusses the uncertainties associated with the various measurements, calculations, and assumptions which form the basis of the risk characterization. Awareness of the uncertainties involved in each step of the risk assessment is critical to interpreting and understanding site risk.

The use of maximum concentrations, generic endpoints, and conservative screening benchmarks likely results in an overestimation of site-specific risks. Site specific factors (e.g., spatial distribution of chemicals, physical habitat, receptors present, bioavailability, dietary composition, and ingestion rate of receptors) could result in dramatically lower estimates of risk than those of this SLERA. These factors were sometimes integrated into the risk characterization. Comparison of average analyte concentrations to screening benchmarks were also conducted as average concentrations based on robust datasets such as those used for the exposure areas assessed in this SLERA provide a more accurate representation of concentrations to which ecological receptors would be exposed to at the Site.

Comparison of analyte concentrations to screening benchmarks provides a conservative estimate of risk. Screening benchmarks are generally based on the lowest no-observable-adverse-effects-level (NOAEL) for chronic exposures to a wide range of potential ecological receptors. Calculation of HQs based on analyte concentrations and screening benchmarks assumes an area-use factor of 100 percent, bioavailability of 100 percent, that the receptor life stage is the most sensitive stage, dietary composition is 100 percent, assumes conservative home ranges and site use factors (e.g., migration, hibernation), and that body weight and food ingestion rates are conservative.

Some chemicals could not be ruled our based on ecological screening benchmarks because they lacked benchmarks. However, chemicals which lacked screening benchmarks were evaluated by other tools, including comparison to background, where possible. Identification of a chemical as a COPEC in a SLERA does not necessarily mean that it poses an actionable risk. The purpose of this SLERA is to identify media and chemicals that require further evaluation.

9.6 Ecological Risk Assessment Conclusions

This SLERA, performed for the Fort Totten CGS FUDS, evaluated the potential for chemical constituents of concern detected in soil in upland exposure areas to adversely affect ecological receptors. The SLERA followed the approach outlined in *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997b). In accordance with that document, the SLERA identified complete exposure pathways, conducted a conservative assessment of all COPECs, and identified which COPECs can be eliminated from further consideration and which should be evaluated further in a BERA, using a weight-of-evidence-approach. The greatest weight was given to HQs based on average concentrations and that account for the incremental risk of COPECs above background, thereby reducing the amount of uncertainty in the overall conclusions.

The Army Checklist for Important Ecological Places (Appendix P) was also used to evaluate the site to determine if the identification of valuable ecological resources was warranted. The answer to each checklist item was “No” indicating that there the site does not contain any important ecological places. In accordance with the U.S. Army Biological Technical Assistance Group *Technical Document for Ecological Risk Assessment: Process for Developing Management Goals* (USA BTAG 2005), "If there are no ecologically important places, and no areas at the site are managed for ecological purposes then identification of valuable ecological resources ... is not necessary for further goal development. In the majority of cases, valuable ecological resources will not exist absent an ecologically important place". According to the BTAG guidance noted above, if this is not an important ecological place and there are no valuable ecological resources, an “appropriate management goal in this case is to prevent “unreasonable effects” such as widespread lethal impacts to plants and animals and should be documented as the goal.”

Based on the weight of evidence, including: the old urbanized setting the site is located in, the wide extent of development, the absence of important ecological places as described above, the limited wildlife habitat present, and considering the conservative nature of the SLERA tools:

- Area 1 concentrations of SVOCs and metals are not likely to result in actionable population level effects to ecological receptors. Risk from carbazole and dibenzofuran could not be evaluated because screening benchmarks were not available from standard sources of such values.
- Area 2 concentrations of SVOCs and metals are not likely to result in actionable population effects to ecological receptors. While HQs for pesticides are greater than 1, concentrations of all pesticides retained as COPECs are below screening levels and therefore are not actionable (USACE, 2005). Risk from 1-methylnapthalene could not be evaluated because screening benchmarks were not available.
- Area 3 concentrations of SVOCs and metals are not likely to result in actionable population level effects to ecological receptors. Risk from 1-methylnapthalene, carbazole, and dibenzofuran could not be evaluated because screening benchmarks were not available.
- Area 4 concentrations of SVOCs and metals are not likely to result in actionable population level effects to ecological receptors. Risk from 1-methylnapthalene, carbazole, and dibenzofuran could not be evaluated because screening benchmarks were not available.
- Area 5 concentrations of metals are not likely to result in actionable population level effects to ecological receptors.

10.0 SUMMARY AND RECOMMENDATIONS

This report presents the results of the SRI2 including a CERCLA HHRA, and SLERA for the upland portion of the Site. A summary of the RI, HHRA and SLERA is provided in sub-section 10.1 below. Recommendations for next steps in the CERCLA process for each area are presented and Preliminary Remedial Action Objectives (RAOs) are provided in sub-section 10.2 below.

10.1 RI and Risk Assessment Summary

The purpose of the SRI2 was to collect additional data to further delineate and characterize environmental conditions at the Site and to support an updated HHRA and SLERA. This report documents the SRI2 activities and summarizes the historical and recent SRI2 investigation results and analytical data. The nature and extent of potential contamination of groundwater and soil in Areas 1 through 5 is adequate to complete the remedial investigation process. Listed below is a summary of the SRI2 findings.

- Results of the 2011-2012 soil sampling and analysis and historical data confirmed the presence of elevated metals and PAHs. PAHs are widely distributed in Areas 1 through 4, and were detected in the one location analyzed for PAHs in Area 5. Metals were also widely detected in Areas 1 through 5. Some of the PAHs and metals were detected at concentrations greater than background. Further discussion is provided below.
- Total mercury was detected in all five areas. Concentrations were below or only slightly above background in Areas 1 through 4. Total mercury was detected at concentrations well above background in Area 5. Mercury speciation analysis did not detect elemental mercury in Areas 2 through 4, but methyl mercury was detected in all four areas.
- With respect to Site-wide groundwater, one VOC was detected in MW-2 and MW-4R, PAHs were detected in samples from MW-4R and MW-5, and metals were detected in all five monitoring wells. Concentrations were compared to the NYS Class A groundwater guidance criteria. Benzo(a)anthracene, benzo(b)fluoroanthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, sodium, and chloroform were the only analytes with reported concentrations above the criteria. Because high molecular weight PAHs are not very soluble in water, it appears that the PAH detections are likely related to suspended solids in groundwater rather than dissolved PAHs.
- The 2011-2012 soil data were evaluated along with historical data to characterize the nature and extent of contamination within each area at the Site. PAHs and metals are present at varying concentrations throughout the Site; however, elevated concentrations appear to be focused at specific locations within each individual area.
  - Area 1 has some elevated concentrations (compared to background) of PAHs, primarily in the central and eastern portion of Area, and especially in borings FLA-11, FLA-48, and B-11. However, a statistical analysis of the Area 1 PAH concentrations compared against PAH concentrations in background and Areas 2, 3, 4, and 5 (Appendix M) indicate that the Area 1 concentrations are generally consistent with concentrations elsewhere at Fort Totten. These data support the conclusion that the Area 1 concentrations are representative of urban fill. Elevated (relative to background) metals detections were not isolated to one portion of Area 1. Arsenic, chromium, copper, lead, mercury, and zinc were frequently detected at concentrations greater than Unrestricted SCOs and/or RSLs, and all exceeded background in at least one sample. Of these, copper, lead, and zinc were detected at concentrations above background in greater than 50 percent of the sample locations, but only arsenic and lead exceeded the RSL. Lead impacts were detected primarily in surface soils [0-1 feet below ground surface (ft bgs)] in the southeastern and southwestern portions of Area 1 in borings B-10 and B-11. Arsenic soil concentrations in Area 1 are generally consistent with background concentrations, with only one the subsurface soil sample from B-11 exceeding background.
  - Area 2 has low concentrations of pesticides in a small number of historical soil samples. Two surface soil samples from Area 2 contained elevated concentrations of PAHs (locations SB-05 and SS-29); however, the remainder of the soil samples have PAH concentrations that are

generally consistent with background conditions. A statistical analysis of the Area 2 PAH concentrations compared against PAH concentrations in background and Areas 1, 3, 4, and 5 (Appendix M) indicate that the Area 2 concentrations are generally consistent with PAH concentrations elsewhere at Fort Totten. These data support the conclusion that the Area 2 concentrations are representative of urban fill. Arsenic, chromium, copper, lead, mercury, and zinc were frequently detected at concentrations greater than Unrestricted SCOs and/or RSLs. Of these, only arsenic, copper, and mercury exceeded background (arsenic exceeded background at one location, copper at two locations, and mercury at five locations) indicating that metals concentrations are generally consistent with background. Only arsenic, copper, and lead exceeded their RSLs, and of these, only arsenic was widely detected above its RSL. Although copper concentrations in Area 2 are generally consistent with background concentrations, the two samples collected from AI2-108 (0 to 2 inches) are clearly statistical outliers with concentrations of 11,500 mg/kg and 958 mg/kg respectively. Both of these samples were collected from the same interval at the AI2-108 location and represent a normal sample and a field duplicate.

- Area 3 has some elevated (relative to background) PAH soil concentrations in surface soils. A statistical analysis of the Area 3 PAH concentrations compared against PAH concentrations in background and Areas 1, 2, 4, and 5 (Appendix M) indicate that the Area 3 concentrations are generally consistent with PAH concentrations elsewhere at Fort Totten. These data support the conclusion that the Area 3 concentrations are representative of urban fill. Up to and including the May 2011 sampling event, arsenic, chromium, copper, lead, mercury, and zinc were frequently detected at concentrations greater than Unrestricted SCOs and/or RSLs, but concentrations above background were detected in only a minority of the sample locations (arsenic exceeded background at ten locations, chromium at two, copper at three, lead at one, mercury at five, and zinc at one location). The results indicate that with the possible exception of arsenic, most of the metals concentrations are generally consistent with background except in two locations: the vicinity of the flag pole west of Building 611 and the deck east of Building 611. In particular, the deck east of Building 611 is believed to be constructed of pressure treated lumber which is the most likely reason why arsenic, chromium, and copper are elevated in sample AI3-105. Area-wide, only arsenic and lead exceeded their RSLs, and of these, only arsenic was widely detected above its RSL.

  None of the November 2012 sample results for total mercury exceeded background and none exceeded the NYSDEC SCO for Commercial use. 49 of the 51 field samples had total mercury concentrations above the Unrestricted Use SCOs, but below the Residential Use SCOs. Concentrations slightly exceeded the Residential Use SCOs at two locations: AI3-214 (0.84J mg/k at 5-6 inches bgs) and AI3-202 (1.1J mg/kg at 5-6 inches bgs). At both of these locations, the soil sampled above and below these intervals was below the Residential Use SCOs.

- Area 4 has elevated (relative to background) PAH soil concentrations at numerous locations throughout the area. Concentrations of several PAHs are higher than corresponding concentrations in the background locations and Areas 1, 2, 3, and 5. Coal, coal ash, and asphalt were observed in soil borings and observation holes dug throughout Area 4 at locations with elevated PAH soil concentrations, indicating the elevated PAH concentrations are likely attributable to fill materials. A statistical analysis of the Area 4 PAH concentrations compared against PAH concentrations in background and Areas 1, 2, 3, and 5 (Appendix M) indicates that the Area 4 concentrations are somewhat inconsistent with PAH concentrations elsewhere at Fort Totten. Arsenic, chromium, lead, mercury, and zinc were frequently detected at concentrations greater than Unrestricted SCOs and/or RSLs. Of these, only arsenic and chromium exceeded background (arsenic exceeded background at one location and chromium at two locations) indicating that metals concentrations are generally consistent with background. Only arsenic was detected above its RSL.

- Area 5 had one historical sample analyzed for PAHs. Three PAHs were detected in the sample at concentrations above their RSLs, but none exceeded background. Arsenic, chromium, copper, lead, mercury, and zinc were frequently detected at concentrations greater than Unrestricted SCOs and/or RSLs, and all occurred above background at one or more locations (arsenic exceeded background at one location, chromium at one, copper at four, lead at three, mercury at eight, and zinc at three locations). Only arsenic and lead exceeded their RSLs, and of these, only arsenic was widely detected above its RSL. Although cobalt concentrations are generally consistent with background concentrations, there are five locations with cobalt concentrations that are greater than background concentrations; of these, only one location exceeded the RSL. The results of the 2011 soil sampling south of Building 615 indicate that residual mercury contamination is not widespread beyond the limits of previous sampling. AI5-105 and AI5-106 sample locations were the only 2011 locations to have mercury detected, and neither of these locations exceeded background or the RSL.

- In summary, SVOCs were detected at concentrations greater than background in one or more samples in Areas 1 through 4. Using benzo(a)pyrene as an indicator of PAH concentrations, Areas 1 through 3 have slightly elevated concentrations with respect to background, and Area 4 has significantly higher concentrations with respect to background. Metals were detected in one or more samples in Areas 1 through 5 at concentrations greater than background. Metals most frequently detected above background include lead, copper, arsenic, and mercury. Arsenic concentrations are generally consistent with background, with the exception of Area 3 where concentrations are somewhat greater than background, with five reported concentrations that are notably higher than the remainder of the reported concentrations. Lead concentrations are generally consistent with background in Areas 3 through 5. Areas 1 and 2 have concentrations somewhat greater than background. Copper concentrations are generally consistent with background with the exception of Area 1 where concentrations are overall greater than corresponding background and Area 2 where there are two statistical outliers. Total mercury concentrations are generally consistent with background except for Area 5, where elevated concentrations are still present south of Building 615.

With respect to site-wide groundwater, PAHs were detected in the May 2011 samples from MW-4R and MW-5. The highest concentrations were recorded at MW-5, where benzo(a)anthracene, benzo(b)fluoroanthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations above the NYS Class A groundwater guidance criteria. High molecular weight PAHs are not very soluble in water, therefore it is likely that these PAH detections are related to suspended solids in groundwater rather than dissolved PAHs. Metals were detected in all five monitoring wells, but only sodium exceeded the New York State Class A groundwater criteria (MW-1, MW-4, and MW-5). Chloroform was the only VOC detected above the New York State Class A groundwater criteria (MW-2 and MW-4).

Monitoring wells MW-4R and MW-5 were resampled in November 2012. Both field filtered and unfiltered samples were collected from each well. No PAH compounds were reported in the filtered and unfiltered samples from MW-4R or in the filtered sample from MW-5. Only two PAH compounds, fluoranthene and pyrene, were reported at low concentrations in the unfiltered sample from MW-5. The reported concentrations of fluoranthene and pyrene were 0.039 J μg/L and 0.032 J μg/L, respectively.

The HHRA has evaluated potential exposures to soil for Current Outdoor Workers (landscapers), Current Trespasser, Future Outdoor Workers, Future Indoor Workers, Future Construction Workers, Future Recreational Receptors, and Future Residents in five exposure areas at the Site (Area 1, Area 2, Area 3, Area 4, Area 5) and the Background Area. In addition, potential dermal exposures to groundwater for the Future Construction Worker and potential potable use of groundwater for the Future Resident were evaluated for the Site. Findings from the HHRA are listed below.

- Cancer risks and non-cancer hazard indices (HIs) for current land use receptors at all five exposure areas are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI of 1;

- Cancer risks and non-cancer HIs for future land use receptors and five exposure areas are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI of 1 with the two exceptions identified below:
  - The cancer risk estimates for the Future Resident [surface soil (3×10^{-4}) and subsurface soil (2×10^{-4})] evaluated in Area 4 are above the acceptable risk range. The risk driver for cancer risk from exposure to both surface soil and subsurface soil is benzo(a)pyrene. The incremental (above background) cancer risk for this receptor and area is 2×10^{-4} and 1×10^{-4} for surface soil and subsurface soil, respectively.
  - The non-cancer screening HI (3) and/or the target organ-based segregated HI (maximum of 1.5 for arsenic) estimates for the Future Resident for surface soil in Area 3 are above 1. This HI is driven by an arsenic concentration of 132 milligram per kilogram (mg/kg) in soil sample AI3-105, which appears to be an anomalous result that is not representative of conditions throughout Area 3 soils (the sample was collected adjacent to a deck presumably constructed of pressure treated lumber). If sample AI3-105 is removed from the data set, the target organ-based segregated HI for all COPCs, including arsenic is below 1.
- Risks associated with exposure to lead were evaluated using USEPA blood lead models for both adults and children. The blood lead levels for adults and children were below the allowable blood lead concentration of 10 µg/dL for all five exposure areas except for the Future Child Resident in Area 1. Lead soil concentrations in Area 1 are overall greater than the corresponding RSLs and background.
- The calculated HIs for the background soil data (ranging from 2 to 3) for hypothetical future residents were also greater than 1 (HIs for the age groups ranged from 2 to 3). Because the calculated HIs are similar for the five areas of the site and for the background soil data set, the incremental non-cancer risk associated with soil in the five areas is considered to be negligible.
- Cancer risks and non-cancer hazard indices (HIs) for the hypothetical Future Construction Worker dermal contact exposure with site-wide shallow groundwater are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI of 1.
- No current or foreseeable use of groundwater has been identified. Municipal water is available at the Site, there is no current use of groundwater at the Site, and potential salt water intrusion and low well yield would preclude future use of the groundwater for potable or non-potable purposes. However, as a conservative measure, a hypothetical future scenario of potable use of groundwater was evaluated. The cancer risk estimate for the Future Resident [potable groundwater use (4×10^{-3})] evaluated at the Site is above the acceptable risk range. The risk driver for cancer risk from exposure to groundwater is dibenz(a,h)anthracene. The non-cancer HI estimates for the Future Resident (potable groundwater use) evaluated at the Site are below a value of 1.
- The 2012 soil sample results were reviewed and evaluated in order to provide a qualitative update to the HHRA. The maximum and mean mercury concentrations of soils samples collected in Area 3 in 2012 were lower than the exposure point concentration, suggesting that the addition of the newly collected mercury data would result in an even lower exposure point concentration than was previously calculated for mercury in surface soil in Area 3. Lowering of the exposure point concentration would result in lower estimated exposures and associated risks. The 2012 mercury data support the conclusion of the HHRA that mercury in surface and subsurface soil within Area 3 is not a human health concern for all receptors evaluated.
- The 2012 groundwater sample results were reviewed and evaluated in order to provide a qualitative update to the HHRA. None of the carcinogenic PAHs detected previously were detected in any of the November 2012 groundwater samples. The concentrations of the two detected compounds (detected in only one unfiltered sample) were well below the corresponding USEPA Tapwater RSLs. The RSLs for these compounds are set at a hazard quotient of 1. This means that for even sensitive individuals, long-term consumption of drinking water containing concentrations equal to the RSL would be without

appreciable risk of any adverse effects. The fluoranthene concentration of 0.039J µg/L was orders of magnitude below the corresponding tapwater RSL of 630 µg/L and the reported pyrene concentration of 0.032J µg/L was also orders of magnitude below the corresponding tapwater RSL of 87 µg/L. The two compounds detected in the November 2012 sampling are associated with much lower risk (not of concern) than those risks associated with the previously detected compounds.

A SLERA was performed in a manner consistent with USEPA, CERCLA, and NYSDEC guidance for the Site to evaluate the potential for chemical constituents of concern detected in surface soil in upland exposure areas to adversely affect ecological receptors. For current Site conditions, there is little undeveloped terrestrial habitat and there is no aquatic habitat or wetlands within this uplands Site. The SLERA, for each of five exposure areas and the background data set, identified complete exposure pathways, conducted a conservative assessment of all detected analytical parameters in soil samples by comparing both maximum and arithmetic mean concentrations to ecological screening benchmarks and background, and assessed the need for further evaluation of ecological risks using a weight-of-evidence-approach. Based on the weight of evidence, considering the conservative nature of SLERA tools, and given the limited wildlife habitat present at the Site:

- Concentrations of SVOCs in Area 1, 2, 3, 4, and 5 are not likely to result in actionable population level effects to ecological receptors. Risk from three SVOCs (1-methylnapthalene, carbazole, and dibenzofuran) could not be evaluated because screening benchmarks were not available.
- Concentrations of metals in Area 1, 2, 3, 4, and 5 are not likely to result in actionable population level effects to ecological receptors.
- While hazard quotients (HQs) for pesticides in Area 2 surface soil are greater than 1, concentrations of all pesticides retained as chemical of potential ecological concern (COPECs) are below screening levels and therefore are not actionable (USACE, 2005).
- No further evaluation of potential adverse effects to ecological receptors from chemical constituents of concern detected in surface soil in upland exposure areas is necessary.

The human health surface and subsurface EPCs for each area and the background dataset were compared to the NYSDEC SCOs. A discussion of the comparison is presented below:

- In Area 1 surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the copper EPC is greater than the Unrestricted Use SCO, the chromium and lead EPCs are greater than the Residential Use SCOs, and the mercury EPC is greater than the Restricted Residential Use SCO. In Area 1 subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the chromium and cobalt EPCs are greater than the Residential Use SCOs, the lead and mercury EPCs are greater than the Restricted Residential Use SCOs, and the copper EPC is greater than the Commercial Use SCO.
- In Area 2 surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the chromium and lead EPCs are greater than the Unrestricted Use SCOs, the indeno(1,2,3-cd)pyrene and mercury EPCs are greater than the Restricted Residential Use SCOs, and the copper EPC is greater than the Industrial Use SCO. In Area 2 subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the chromium, lead, and mercury EPCs are greater than the Unrestricted Use SCOs.
- In Area 3 surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the copper and lead EPCs are greater than the Unrestricted Use SCOs, the chromium EPC is greater than the Residential Use SCO, and the arsenic EPC exceeds the Industrial Use SCO. In Area 3 subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the chromium and lead EPCs are greater than the Unrestricted Use SCOs, the mercury EPC is greater than the Restricted Residential Use SCO, and the copper EPC exceeds the Commercial Use SCO.

- In Area 4 surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the lead EPC is greater than the Unrestricted Use SCO, the chrysene, chromium and mercury EPCs are greater than the Residential Use SCOs, the benzo(a)anthracene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene EPCs are greater than the Restricted Residential Use SCOs, and the benzo(a)pyrene EPC is greater than the Industrial Use SCO. In Area 4 subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the lead and mercury EPCs are greater than the Unrestricted Use SCOs, the chrysene and chromium EPCs are greater than the Residential Use SCOs, the benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene EPCs are greater than the Restricted Residential SCOs, and the benzo(a)pyrene EPC is greater than the Industrial Use SCO.
- In Area 5 surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the copper and lead EPCs are greater than the Unrestricted Use SCOs, the chromium EPC is greater than the Residential Use SCO, and the mercury EPC is greater than the Commercial Use SCO. In Area 5 subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the chromium EPC is greater than Unrestricted Use SCO and the mercury EPC is greater than the Commercial Use SCO.
- In background surface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the lead and mercury EPCs are greater than the Unrestricted Use SCOs and the chromium EPC is greater than the Residential Use SCO. In background subsurface soil, the EPCs for each COC are less than all five NYSDEC SCOs except for the following analytes: the lead and mercury EPCs are greater than the Unrestricted Use SCOs and the chromium EPC is greater than the Residential Use SCO.

Associated with the SRI2, an investigation of the ball field east of Area 4 for anomalies potentially related to ordnance was conducted in December 12, 2012. An ordnance and explosives investigation team from the USACE (Baltimore District) excavated the areas where the anomalies were identified and discovered cultural debris that was not ordnance related (pipes, nails, wire, an antique roller skate, and reinforced concrete). The findings of the December 12, 2012 follow-up anomaly investigation (including photographs) are provided in the USACE Daily Quality Assurance Oversight Report dated 12 December 2012 (Appendix N). Based on these findings, no further actions are recommended for the ball field.

10.2 Recommendations

Based on the data and evaluations presented in this report, it is recommended that a Feasibility Study (FS) be conducted to identify and evaluate appropriate remedial alternatives for addressing lead in Area 1 soils. The recommendations for each area and for groundwater are summarized below.

- An FS is recommended for lead in Area 1 soils because the blood lead level for future child exposure to soil is above the allowable blood lead concentration. Lead soil concentrations in Area 1 are overall greater than the corresponding RSL and background. NYSDEC has communicated to USACE (email communication 9/20/2013), that it is the Department's position that Area 1 requires an action that would make it suitable for passive recreation (because it lies within an area zoned as open space), meaning that it would need to meet Restricted Residential SCOs, or be capped with one foot of soils that meet those SCOs and have Institutional Controls implemented to eliminate potential exposure.
- No-action is recommended for Area 2 because the cancer risks and non-cancer HIs for current and potential future land use receptors are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer HI value of 1.
- No-action is recommended for Area 3 because the only risk greater than risk limits (arsenic-specific hazard quotient greater than one for a future residential land use scenario) is driven by a single elevated detection of arsenic associated with a pressure treated deck. In the absence of that detection, the cancer risks and non-cancer HIs for future land use receptors at Area 3 would be within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer HI value of 1. Additional investigation and

qualitative risk evaluation of mercury in Area 3 confirmed the conclusion of the 2011 BHHRA; mercury in surface soil within Area 3 is not a human health concern for all receptors evaluated.

- No-action is recommended for Area 4 because the risk from PAHs is attributable to urban fill.
- No-action is recommended for Area 5 because the HHRA indicated there are no unacceptable risks or hazards from the remaining soil in Area 5 and the SLERA indicated that concentrations of metals in Area 5 are not likely to result in actionable population level effects to ecological receptors. It is noted that previous remedial actions completed in 2006 and 2007 (Appendix N Field Reports) have resulted in the removal of mercury contaminated soil associated with an historical release at Building 615. Underground structures, including a buried electrical line, active sewer line, and former cess pools prevented complete removal of soils in this area. These structures are still in place and will limit or prevent future soil removal within the source area. It is also noted that previous air monitoring within Building 615 indicated that there were no detectable concentrations of mercury greater than the state screening level (USACE, 2006) and that surface water sampling in Little Bay did not detect significant concentrations of mercury (USACE, 2005). Because Area 5 contains low-levels of residual mercury in the subsurface, a letter from the U. S. Coast Guard has been requested by USACE to describe the site management controls that are currently in-place to address these low levels of mercury. Upon receipt, this letter will be forwarded to NYSDEC, and added to this report.
- No-action is recommended for area groundwater because there is no current exposure and no potential for future exposure and a qualitative risk evaluation of 2012 groundwater sampling results indicates risk from exposure to groundwater is not of concern.

Table 10-1 summarizes the risk assessment results by area and for groundwater, and identifies the proposed next steps in the CERCLA process.

In preparation for a feasibility study, RAOs were developed. The RAOs are focused on human health because the results of the SLERA indicate that in general, concentrations are not likely to result in actionable population level effects.

The following RAO is proposed for the Fort Totten FUDS:

- Area 1: Prevent or reduce potential future residential human exposure to soil with lead concentrations such that the probability of an individual child (aged 0 to 84 months) exceeding a blood lead level of 10 µg/dL is 5 percent or less.

The Feasibility Study will include a no action alternative to serve as a baseline against which all other alternatives will be compared. Various combinations of land-use controls, engineering controls, and active remedial measures will also be evaluated. The Army's preferred remedy will be presented in the Proposed Plan which will be made available for public comment. The final remedy, when selected, will be documented in the Decision Document, which will be signed by the USACE.

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TABLES

SECTION 1

Table 1-1
Site-Specific Background Concentrations
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Calculated Background Concentrations in Shallow Soil	Calculated Background Concentrations in Deep Soils
Depth:	0-3 inches	18-24 inches
Metals		
Aluminum	13,200	16,830
Antimony	1.68	0.65
Arsenic	10.73	7.60
Barium	113.70	160.10
Beryllium	0.62	0.75
Cadmium	2.50	0.77
Calcium	12,100	16,223
Chromium	32.76	29.58
Cobalt	9.12	12.20
Copper	84.44	67.33
Iron	23,696	23,254
Lead	522.50	448.90
Magnesium	4,802	4,433
Manganese	626.70	586.40
Mercury	1.20	2.26
Nickel	33.68	96.41
Potassium	1,286	2,194
Selenium	--	0.44
Silver	--	0.21
Sodium	250	277.20
Thallium	--	0.89
Vanadium	55.95	37.44
Zinc	289.40	308.40
PAHs		
2-Methylnaphthalene	--	0.01
Acenaphthene	0.08	0.05
Acenaphthylene	0.03	0.03
Anthracene	0.15	0.40
Benzo(a)anthracene	0.50	0.92
Benzo(a)pyrene	0.43	0.72
Benzo(b)fluoranthene	0.74	0.94
Benzo(g,h,i)perylene	0.23	0.20
Benzo(k)fluoranthene	0.17	0.32
bis(2-ethylhexyl) phthalate	0.61	0.09
Butylbenzyl Phthalate	0.24	0.03
Carbazole	--	0.07
Chrysene	0.42	0.78
Dibenzo(a,h)Anthracene	0.04	0.04
di-n-Butyl Phthalate	0.08	0.01
Fluoranthene	0.70	1.46
Fluorene	0.06	0.07
Indeno(1,2,3-cd)pyrene	0.18	0.34
Naphthalene	--	0.02
Phenanthrene	0.71	1.45
Pyrene	1.04	2.32

Notes:
Calculated background concentrations were calculated using the 95% Upper Tolerance Limit (UTL) with 90% coverage.
All Concentrations are in mg/kg
UTLs were obtained from Watermark's Final Remedial Investigation Work Plan and manually entered.

Prepared by / Date: KMW 10/28/11
Checked by / Date: EYM 11/3/11

Table 1-2
Summary of Screening Criteria for Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	New York State Soil Cleanup Objectives					USEPA Regional Screening Levels	
	Unrestricted (mg/Kg)	Residential (mg/Kg)	Restricted Residential (mg/Kg)	Commercial (mg/Kg)	Industrial (mg/Kg)	Residential Soil (mg/Kg)	Industrial Soil (mg/Kg)
Volatile Organics (mg/Kg)							
2-Butanone	0.12	100	100	500	1000	28000 n	200000 nms
Acetone	0.05	100	100	500	1000	61000 n	630000 nms
Benzene	0.06	2.9	4.8	44	89	1.1 c*	5.4 c*
Carbon disulfide	NC	NC	NC	NC	NC	820 ns	3700 ns
Chloroform	0.37	10	49	350	700	0.29 c	1.5 c
Ethyl benzene	1	30	41	390	780	5.4 c	27 c
Methylene chloride	0.05	51	100	500	1000	11 c	53 c
Toluene	0.7	100	100	500	1000	5000 ns	45000 ns
Trichloroethene	0.47	10	21	200	400	2.8 c**	14 c**
Vinyl chloride	0.02	0.21	0.9	13	27	0.06 c	1.7 c
Semivolatile Organics (mg/Kg)							
1,2-Dichlorobenzene	1.1	100	100	500	1000	1900 ns	9800 ns
1-Methylnaphthalene	NC	NC	NC	NC	NC	22 c	99 c
2-Methylnaphthalene	NC	NC	NC	NC	NC	310 n	4100 ns
4-Chloro-3-methylphenol	NC	NC	NC	NC	NC	6100 n	62000 n
4-Methylphenol	0.33	34	100	500	1000	310 n	3100 n
Acenaphthene	20	100	100	500	1000	3400 n	33000 n
Acenaphthylene	100	100	100	500	1000	NC	NC
Anthracene	100	100	100	500	1000	17000 n	170000 nm
Benzo(a)anthracene	1	1	1	5.6	11	0.15 c	2.1 c
Benzo(a)pyrene	1	1	1	1	1.1	0.015 c	0.21 c
Benzo(b)fluoranthene	1	1	1	5.6	11	0.15 c	2.1 c
Benzo(ghi)perylene	100	100	100	500	1000	NC	NC
Benzo(k)fluoranthene	0.8	1	3.9	56	110	1.5 c	21 c
Bis(2-Ethylhexyl)phthalate	NC	NC	NC	NC	NC	35 c*	120 c
Butylbenzylphthalate	NC	NC	NC	NC	NC	260 c*	910 c
Carbazole	NC	NC	NC	NC	NC	NC	NC
Chrysene	1	1	3.9	56	110	15 c	210 c
Dibenz(a,h)anthracene	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c
Dibenzofuran	7	14	59	350	1000	78 n	1000 ns
Di-n-butylphthalate	NC	NC	NC	NC	NC	6100 n	62000 n
Di-n-octylphthalate	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	100	100	100	500	1000	2300 n	22000 n
Fluorene	30	100	100	500	1000	2300 n	22000 n
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c
Naphthalene	12	100	100	500	1000	3.6 c*	18 c*
Pentachlorophenol	0.8	2.4	6.7	6.7	55	0.89 c	2.7 c
Phenanthrene	100	100	100	500	1000	NC	NC
Phenol	0.33	100	100	500	1000	18000 n	180000 nm
Pyrene	100	100	100	500	1000	1700 n	17000 n
Pesticides (mg/Kg)							
4,4`-DDD	0.0033	2.6	13	92	180	2 c	7.2 c
4,4`-DDE	0.0033	1.8	8.9	62	120	1.4 c	5.1 c
4,4`-DDT	0.0033	1.7	7.9	47	94	1.7 c*	7 c*
Endrin aldehyde	NC	NC	NC	NC	NC	NC	NC
Endrin ketone	NC	NC	NC	NC	NC	NC	NC
Gamma-BHC	NC	NC	NC	NC	NC	NC	NC
Gamma-Chlordane	NC	NC	NC	NC	NC	NC	NC
Heptachlor epoxide	NC	NC	NC	NC	NC	0.053 c*	0.19 c*
Inorganics (mg/Kg)							
Aluminum	NC	NC	NC	NC	NC	77000 n	990000 nm
Antimony	NC	NC	NC	NC	NC	31 n	410 n
Arsenic	13	16	16	16	16	0.39 c*	1.6 c
Barium	350	350	400	400	10000	15000 n	190000 nm
Beryllium	7.2	14	72	590	2700	160 n	2000 n
Cadmium	2.5	2.5	4.3	9.3	60	70 n	800 n
Calcium	NC	NC	NC	NC	NC	NC	NC
Chromium	1	22	110	400	800	120000 nm	1500000 nm
Cobalt	NC	NC	NC	NC	NC	23 n	300 n
Copper	50	270	270	270	10000	3100 n	41000 n
Iron	NC	NC	NC	NC	NC	55000 n	720000 nm
Lead	63	400	400	1000	3900	400 nL	800 nL
Magnesium	NC	NC	NC	NC	NC	NC	NC
Manganese	1600	2000	2000	10000	10000	1800 n	23000 n
Nickel	30	140	310	310	10000	1500 n	20000 n
Potassium	NC	NC	NC	NC	NC	NC	NC
Selenium	3.9	36	180	1500	6800	390 n	5100 n
Silver	2	36	180	1500	6800	390 n	5100 n
Sodium	NC	NC	NC	NC	NC	NC	NC
Thallium	NC	NC	NC	NC	NC	0.78 n	10 n
Vanadium	NC	NC	NC	NC	NC	390 n	5200 n
Zinc	109	2200	10000	10000	10000	23000 n	310000 nm
Mercury (mg/Kg)							
Mercury (total)	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns
Mercury (elemental)	0.81	0.81	0.81	2.8	5.7	NC	NC
Mercury, Inorganic Salts	0.12	1.2	5.8	47	220	23 n	310 n
Methyl mercury	NC	NC	NC	NC	NC	7.8 n	100 n
Total Organic Carbon (mg/Kg)							
Total Organic Carbon	NC	NC	NC	NC	NC	NC	NC

New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR), Chapter IV, Subpart 375-6 Remedial Program Soil Cleanup Objectives

United States Environmental Protection Agency Regions 3, 6, and 9. 2011. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June 2011.

- c = RSL is based on an excess lifetime cancer risk of 1 in 1 million.
- c* = where n RSL < 100X c RSL.
- c** = where n RSL < 10X c RSL.
- n = RSL is based on a non-cancer hazard quotient of 1.
- nL = U.S. EPA used an Integrated Exposure Uptake Biokinetic (IEUBK) model to derive a residential soil value for lead based on predictions of blood lead concentrations in children exposed to lead from various sources (http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf).
- nm = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit.
- ns = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
- nms = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit and concentration may exceed Csat.

mg/Kg = milligram per kilogram
NC = No Criteria Available

Prepared by / Date: KJC 10/25/11
Checked by / Date: KMW 11/02/11

SECTION 5

Table 5-1
Summary of May 2011 Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Background		New York State Soil Cleanup Objectives					USEPA Regional Screening Levels		AI2-101 AI2-101(0-2) 05/13/11 0-0.17 ft	AI2-102 AI2-102(0-2) 05/13/11 0-0.17 ft	AI2-103 AI2-103(0-2) 05/13/11 0-0.17 ft	AI2-104 AI2-104(0-2) 05/13/11 0-0.17 ft	AI2-105 AI2-105(0-2) 05/13/11 0-0.17 ft
	Shallow	**Deep**	Unrestricted (mg/Kg)	Residential (mg/Kg)	Restricted Residential (mg/Kg)	Commercial (mg/Kg)	Industrial (mg/Kg)	Residential	Industrial					
SVOCs (mg/Kg)														
1-Methylnaphthalene	--	--	NC	NC	NC	NC	NC	22 c	99 c	0.0119 J	0.0027 U	0.01 J	0.0066 J	0.0023 J
2-Methylnaphthalene	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns	0.0138 J	0.0027 UJ	0.016 J	0.0076 J	0.0043 J
Acenaphthene	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n	0.011 J	0.009 J	0.015 J	0.0079 J	0.0037 J
Acenaphthylene	0.02767	0.02874	100	100	100	500	1000	NC	NC	**0.069**	0.024	**0.12**	0.026	0.056
Anthracene	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm	0.061	0.038	0.098	0.041	0.034
Benzo(a)anthracene	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	0.27	0.18	0.44	0.18	0.19
Benzo(a)pyrene	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	0.33	0.2	**0.52**	0.22	0.23
Benzo(b)fluoranthene	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	0.32	0.19	0.48	0.21	0.23
Benzo(ghi)perylene	0.2324	0.2015	100	100	100	500	1000	NC	NC	**0.4**	0.21	**0.59**	**0.26**	**0.26**
Benzo(k)fluoranthene	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c	**0.17** J	0.11 J	**0.32** J	0.14 J	0.073 J
Chrysene	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	0.36	0.21	**0.46**	0.24	0.21
Dibenz(a,h)anthracene	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c	**0.093**	**0.052**	**0.13**	**0.066**	**0.065**
Fluoranthene	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	0.53	0.36	**0.81**	0.44	0.34
Fluorene	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n	0.015 J	0.01 J	0.021	0.0096 J	0.0062 J
Indeno(1,2,3-cd)pyrene	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	**0.3**	0.16	**0.44**	**0.2**	**0.2**
Naphthalene	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*	0.02 J	0.012 J	0.032 J	0.011 J	0.01 J
Phenanthrene	0.7072	1.448	100	100	100	500	1000	NC	NC	0.18 J	0.16 J	0.26 J	0.21 J	0.074 J
Pyrene	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	0.42 J	0.3 J	0.62 J	0.29 J	0.26 J
Metals (mg/Kg)														
Aluminum	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	10800	8450	8860	8860	8190
Antimony	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.46 J	1.1 J	0.57 J	0.63 J	0.47 UJ
Arsenic	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	5.5	6.5	6	6.4	4.7
Barium	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	113	87.5	95.2	82.5	68.4
Beryllium	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.56	0.61	**0.75**	**0.66**	0.58
Cadmium	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n	1.1	0.69	0.68	0.52 J	0.48 J
Calcium	12100	16223	NC	NC	NC	NC	NC	NC	NC	7440	6300	3970	3330	2740
Chromium	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	21.4	17.7	18.4	17.3	19.9
Cobalt	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	**9.5**	7.7	5.8 J	5.6 J	6.3
Copper	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	53.4	46.6	35	31.8	26.2
Iron	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	19400	18600	13500	13600	14100
Lead	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	223	180	195	295	73.2
Magnesium	4802	4433	NC	NC	NC	NC	NC	NC	NC	4490	2520	2260	2000	2540
Manganese	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	391	406	524	415	380
Nickel	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	23.1	22.7	20.5	18.7	21.3
Potassium	1286	2194	NC	NC	NC	NC	NC	NC	NC	1050	782	652 J	698	1190
Selenium	--	0.439	3.9	36	180	1500	6800	390 n	5100 n	0.99 U	0.75 J	0.62 J	0.47 J	0.82 U
Silver	--	0.211	2	36	180	1500	6800	390 n	5100 n	0.31 J	0.45 J	0.13 U	0.44 J	0.12 U
Sodium	250	277.2	NC	NC	NC	NC	NC	NC	NC	**383** J	91.3 J	65.5 J	67.6 J	77.3 J
Vanadium	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	**61.7**	36.8	33.6	35.1	34.3
Zinc	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	**301**	264	149	187	92.6
Mercury (mg/Kg)														
Mercury	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	0.41	0.32	0.5	0.34	0.3
Methyl mercury	--	--	NC	NC	NC	NC	NC	7.8 n	100 n	NA	NA	NA	NA	NA
Elemental Mercury	--	--	0.81	0.81	0.81	2.8	5.7	NC	NC	NA	NA	NA	NA	NA

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Table 5-1
Summary of May 2011 Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI2-106 AI2-106(0-2) 05/13/11 0-0.17 ft	AI2-107 AI2-107(0-2) 05/11/11 0-0.17 ft	AI2-108 AI2-108(0-2) 05/12/11 0-0.17 ft	AI2-108 DUP-AI2-1(0-2) 05/12/11 0-0.17 ft	AI2-109 AI2-109(0-2) 05/11/11 0-0.17 ft	AI2-110 AI2-110(0-2) 05/12/11 0-0.17 ft	AI2-111 AI2-111(0-2) 05/11/11 0-0.17 ft	AI2-112 AI2-112(0-2) 05/11/11 0-0.17 ft	AI2-101 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-102 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-103 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-104 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-105 AI2-101(6-24) 05/13/11 0.5-2 ft
SVOCs (mg/Kg)													
1-Methylnaphthalene	0.024 U	0.029 U	0.0021 J	0.0024 J	0.0038 J	0.037 U	0.011 J	0.014 J	0.0057 U	0.0013 J	0.0018 J	0.0011 J	0.001 J
2-Methylnaphthalene	0.024 UJ	0.029 U	0.0033 J	0.0039 J	0.0053 J	0.037 U	0.011 J	0.019	0.0057 UJ	0.0019 J	0.0032 J	0.0016 J	0.0016 J
Acenaphthene	0.024 U	0.029 U	0.0038 J	0.0032 J	0.0011 J	0.037 U	0.0064 J	0.0083 J	0.0057 U	0.0011 J	0.002 J	0.0026 J	0.0018 J
Acenaphthylene	**0.031** J	**0.075** J	**0.047**	**0.05**	0.01	0.062 U	0.024	**0.037**	0.015 J	0.0047 J	**0.032**	0.0094	0.015
Anthracene	0.022 J	0.064 J	0.055	0.055	0.011	0.035 J	0.025	0.038	0.01 J	0.0062 J	0.019	0.017	0.0081
Benzo(a)anthracene	0.11 J	0.23	0.031	0.031	0.042	0.16 J	0.1	0.13	0.059	0.032	0.1	0.071	0.051
Benzo(a)pyrene	0.12 J	0.27	0.041	0.043	0.048	0.24 J	0.12	0.14	0.07	0.038	0.12	0.15	0.057
Benzo(b)fluoranthene	0.035 J	0.43	0.08	0.081	0.086	0.37	0.19	0.24	0.051	0.03	0.12	0.23	0.058
Benzo(ghi)perylene	0.18	0.21	0.081	0.072	0.042	0.19 J	0.095	0.12	0.087	0.046	0.13	0.14	0.063
Benzo(k)fluoranthene	0.047 J	0.049 U	0.0018 U	0.0018 U	0.0018 U	0.062 U	0.0039 U	0.0042 U	0.027 J	0.017 J	0.047 J	0.06 J	0.019 J
Chrysene	0.15 J	0.24	0.044	0.053	0.053	0.21 J	0.13	0.16	0.073	0.043	0.12	0.12	0.056
Dibenz(a,h)anthracene	0.027 J	0.058 U	0.013	0.011	0.0078	0.074 U	0.025	0.032	0.017 J	0.011	0.031	0.039	0.016
Fluoranthene	0.22	0.39	0.074	0.061	0.092	0.32	0.21	0.27	0.099	0.065	0.16	0.09	0.083
Fluorene	0.04 U	0.049 U	0.0045 J	0.0036 J	0.0016 J	0.062 U	0.0069 J	0.012 J	0.0095 U	0.0021 J	0.0036 J	0.0033 J	0.0024 J
Indeno(1,2,3-cd)pyrene	0.11 J	0.18 J	0.053	0.051	0.034	0.18 J	0.078	0.097	0.064	0.034	0.099	0.11	0.052
Naphthalene	0.024 UJ	0.029 U	0.0081	0.0077	0.0056 J	0.037 U	0.01 J	0.019	0.0057 UJ	0.0022 J	0.0086 J	0.0034 J	0.0044 J
Phenanthrene	0.087 J	0.14 J	0.028 J	0.019 J	0.032	0.14 J	0.098	0.13	0.032 J	0.026 J	0.034 J	0.029 J	0.022 J
Pyrene	0.15 J	0.34	0.078	0.078	0.062	0.32	0.17	0.22	0.085 J	0.051 J	0.14 J	0.09 J	0.07 J
Metals (mg/Kg)													
Aluminum	7340	5890	4070	4510	4800	7440	6320	6290	10900	9490	9150	9690	9180
Antimony	0.37 J	0.61 J	**5.7** J	**18.2** J	0.63 J	0.57 J	0.87 J	0.58 J	0.37 UJ	0.33 J	0.29 J	**0.72** J	0.43 UJ
Arsenic	4.4	3.3	**11.7**	**11.3**	4.2	5.5	5.1	5.2	3.2	4.4	2.9	3.4	3.1
Barium	85.7	87.9	71.4	63.3	64.9	113	80.5	138	70.8	52.3	79.5	102	66
Beryllium	0.5	0.37 J	0.51	0.49	0.48	0.57 J	0.48	0.44 J	0.59	0.57	**0.87**	**0.8**	0.7
Cadmium	0.63	1.9	0.65 J	0.52 J	0.29 J	0.55 J	0.71	0.6 J	0.17 J	0.13 J	0.072 J	0.036 J	0.086 J
Calcium	5020	**14600**	2220	2520	2110	5050	4010	4010	2080	1560	4390	2320	1560
Chromium	14	23.7	9.8	9	10.2	19	14.6	15.4	21.8	17.1	15.3	16.2	17.7
Cobalt	6.2	5.2 J	6.8	6.2	6.6	5.5 J	6	5.7 J	7.2	6.7	4.8 J	5.4 J	6
Copper	40.3	46.9 J	**11500** J	**958** J	75.9 J	46.6	51.6 J	42.2 J	25.4	19.2	19.6	18.5	23.7
Iron	13300	13200	10000	11800	11100	14900	12100	13100	16400	15100	11800	13000	13100
Lead	170	334 J	418	380	214 J	315	242 J	278 J	40.3	57.6	73.2	123	29.8
Magnesium	2690	**5140**	916	1330	1260	2130	2430	1770	3230	2310	2220	2380	2420
Manganese	265	332 J	84.8 J	104 J	221 J	401	259 J	305 J	316	283	557	532	435
Nickel	16.6	17.3	18.8	18.8	17.6	18.6	17.4	16.8	21.3	16.4	15	16.6	18.1
Potassium	791	928	403 J	490 J	511 J	859	679	786	802	556 J	409 J	514 J	725
Selenium	0.73 U	0.8 J	1.5	1.3	0.63 J	0.68 J	0.77 J	0.65 J	0.65 U	0.8 U	0.83 U	0.78 U	0.75 U
Silver	0.085 J	0.12 J	0.34 J	0.12 J	0.22 J	0.15 U	0.21 J	0.1 J	0.093 U	0.11 U	0.12 U	0.11 U	0.11 U
Sodium	**290** J	41.7 J	164 J	197 J	53.8 J	54.3 J	47.8 J	81.1 J	153 J	76.7 J	98.7 J	214 J	54.2 J
Vanadium	37.9	23.9	21	20.5	26.3	30.6	30.7	28.9	30.6	25.3	20	21.3	23.6
Zinc	145	172 J	256	213	104 J	197	233 J	177 J	57	64.7	42.3	46.3	45.2
Mercury (mg/Kg)													
Mercury	1.1	0.323 J	NA	NA	**2.08** J	NA	**1.63** J	0.358 J	0.11	0.083	0.46	0.18	0.39
Methyl mercury	NA	6.02E-03 J	NA	NA	4.86E-03 J	NA	1.10E-02 J	7.37E-04 J	NA	NA	NA	NA	NA
Elemental Mercury	NA	0.0003 U	NA	NA	0.0004 U	NA	0.0004 U	0.0004 U	NA	NA	NA	NA	NA

Table 5-1
Summary of May 2011 Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI2-106 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-107 AI2-107(6-24) 05/11/11 0.5-2 ft	AI2-108 AI2-108(6-24) 05/12/11 0.5-2 ft	AI2-108 DUP-AI2-2(6-24) 05/12/11 0.5-2 ft	AI2-109 AI2-109(6-24) 05/11/11 0.5-2 ft	AI2-110 AI2-110(6-24) 05/12/11 0.5-2 ft	AI2-111 AI2-111(6-24) 05/11/11 0.5-2 ft	AI2-112 AI2-112(6-24) 05/11/11 0.5-2 ft
SVOCs (mg/Kg)								
1-Methylnaphthalene	0.014	0.024 J	0.0018 J	0.0012 U	0.0012 U	0.002 J	0.0063 J	0.0012 U
2-Methylnaphthalene	0.0068 J	**0.015** J	0.0016 J	0.0011 J	0.0012 U	0.0022 J	0.0062 J	0.0012 U
Acenaphthene	0.0011 U	0.0054 J	0.0064 J	0.00087 J	0.0012 U	0.0076 J	0.035	0.0012 U
Acenaphthylene	0.0077	**0.089**	0.0036 J	0.0042 J	0.002 U	0.0025 J	0.0081	0.002 U
Anthracene	0.0067 J	0.054	0.0089	0.0054 J	0.0012 U	0.015	0.082	0.00098 J
Benzo(a)anthracene	0.025	0.24	0.049	0.037	0.0064 J	0.039	0.16	0.0041 J
Benzo(a)pyrene	0.031	0.31	0.049	0.044	0.0068 J	0.039	0.16	0.0036 J
Benzo(b)fluoranthene	0.03	0.45	0.077	0.065	0.011	0.054	0.23	0.006 J
Benzo(ghi)perylene	0.043	**0.22**	0.036	0.034	0.0047 J	0.028	0.1	0.0026 J
Benzo(k)fluoranthene	0.013 J	0.0096 U	0.0019 U	0.0019 U	0.002 U	0.002 U	0.0019 U	0.002 U
Chrysene	0.037	0.29	0.052	0.046	0.0052 J	0.038	0.16	0.0034 J
Dibenz(a,h)anthracene	0.0098	**0.06**	0.011	0.0094	0.0024 U	0.0036 J	0.027	0.0024 U
Fluoranthene	0.052	0.44	0.087 J	0.058 J	0.0084	0.077	0.44	0.0044 J
Fluorene	0.0019 U	0.0096 U	0.0037 J	0.0016 J	0.002 U	0.0054 J	0.027	0.002 U
Indeno(1,2,3-cd)pyrene	0.032	0.19	0.032	0.028	0.0042 J	0.023	0.088	0.0031 J
Naphthalene	0.0034 J	0.012 J	0.004 J	0.0032 J	0.0012 U	0.0021 J	0.0075 J	0.0012 U
Phenanthrene	0.028 J	0.14	0.058 J	0.021 J	0.0028 J	0.065	0.36	0.0027 J
Pyrene	0.039 J	0.35	0.09 J	0.059 J	0.0063 J	0.075	0.32	0.0037 J
Metals (mg/Kg)								
Aluminum	8040	8770	8700	8540	10400	10800	6920	9830
Antimony	0.44 UJ	0.2 J	0.35 J	**24.1** J	0.48 UJ	0.48 UJ	**0.86** J	0.48 UJ
Arsenic	3.3	4.2	3.1	3.8	2.3	3.2	5.5	2.6
Barium	66.9	94	70.3	69.9	71.3	78.1	63.6	89.9
Beryllium	0.55	0.63	0.61	0.61	**0.89**	**0.82**	0.5	**0.75**
Cadmium	0.12 J	0.3 J	0.033 J	0.081 U	0.096 U	0.086 J	0.35 J	0.095 U
Calcium	2630	3780	2340 J	1870 J	873	837	6550	1990
Chromium	24.8	26	16.2	16.7	19.4	19.1	16.3	20.3
Cobalt	7.4	6.5	6.4	6.4	6	5.8 J	6.9	6.9
Copper	29.3	46.4 J	59.6	55.8	28.6 J	18.3	**75.1** J	17.4 J
Iron	14000	15300	14600	14400	14900	14300	13100	14300
Lead	53.6	225 J	115 J	282 J	27.4 J	51.6	207 J	108 J
Magnesium	3030	2850	2780	2670	2170	2350	**4720**	2600
Manganese	369	319 J	378	372	472 J	541	274 J	486 J
Nickel	22.2	19.4	17	18.5	16.9	16.2	21.5	19.7
Potassium	1110	623	725	714	617	602	642	872
Selenium	0.77 U	**0.81** J	0.73 U	0.71 U	0.84 U	0.83 U	**0.91** J	0.83 U
Silver	0.11 U	0.11 J	0.1 U	0.1 U	0.12 U	0.12 U	0.087 J	0.12 U
Sodium	106 J	237 J	153 J	111 J	72.2 U	40.6 J	123 J	52.9 J
Vanadium	25.2	27.5	22.5	20.8	20.3	22.7	23.4	21.7
Zinc	63	117 J	70.2	75.2	32 J	77.3	258 J	58 J
Mercury (mg/Kg)								
Mercury	0.29	0.165 J	NA	NA	0.374 J	NA	1.76 J	0.0819 J
Methyl mercury	NA	1.03E-03 J	NA	NA	8.30E-05 J	NA	1.39E-03 J	6.30E-05 UJ
Elemental Mercury	NA	0.0004 U	NA	NA	0.0004 U	NA	0.0004 U	0.0003 U

New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR), Chapter IV, Subpart 375-6 Remedial ProgramSoil Cleanup Objectives

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Commercial NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO

mg/Kg = milligram per kilogram
U = not detected, value is the limit of detection
J = value is estimated
NA = sample was not analyzed for
NC = no criteria available
blank cells - indicate analyte wan not analyzed for in that sample

United States Environmental Protection Agency Regions 3, 6, and 9. 2011.
Regional Screening Levels for Chemical Contaminants at Superfund Sites.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June 2011.

c = RSL is based on an excess lifetime cancer risk of 1 in 1 million.
c* = where n RSL < 100X c RSL.
c** = where n RSL < 10X c RSL.
n = RSL is based on a non-cancer hazard quotient of 1.
nL = U.S. EPA used an Integrated Exposure Uptake Biokinetic (IEUBK) model to derive a residential soil value for lead based on predictions of blood lead concentrations in children exposed to lead from various sources.
(http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf).

nm = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit.
ns = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
nms = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit and concentration may exceed Csat.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/02/11

Table 5-2
Summary of May 2011 Analytical Results in Soil - Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Background		New York State Soil Cleanup Objectives					USEPA Regional Screening Levels		AI3-101 AI3-101(0-2) 05/10/11	AI3-102 AI3-102(0-2) 05/10/11	AI3-103 AI3-103(0-2) 05/10/11	AI3-104 AI3-104(0-2) 05/10/11	AI3-105 AI3-105(0-2) 05/10/11	AI3-106 AI3-106(0-2) 05/11/11	AI3-107 AI3-107(0-2) 05/11/11
	Shallow	Deep	Unrestricted (mg/Kg)	Residential (mg/Kg)	Restricted Residential (mg/Kg)	Commercial (mg/Kg)	Industrial (mg/Kg)	Residential	Industrial	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft
SVOCs (mg/Kg)																
1-Methylnaphthalene	--	--	NC	NC	NC	NC	NC	22 c	99 c	0.011 J	0.0067 J	0.18 J	0.0032 J	0.015	0.015	0.0065 J
2-Methylnaphthalene	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns	0.013 J	0.0094 J	0.22 J	0.0039 J	0.016 J	0.048	0.009 J
Acenaphthene	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n	0.035 J	0.011 J	**0.094** J	0.0029 J	0.011 J	0.0058 J	0.006 J
Acenaphthylene	0.02767	0.02874	100	100	100	500	1000	NC	NC	**0.028**	**0.21**	**0.19** J	0.019	**0.098**	0.018	**0.028** J
Anthracene	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm	0.14 J	0.12 J	**0.39** J	0.018 J	0.091 J	0.022	0.034 J
Benzo(a)anthracene	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	**0.68** J	0.45 J	**1.5** J	0.064 J	0.35 J	0.1	0.11
Benzo(a)pyrene	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	**0.74** J	**0.53** J	**1.8** J	0.075 J	0.38 J	0.12	0.14
Benzo(b)fluoranthene	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	**1.3** J	**0.86** J	**2.9** J	0.13 J	0.62 J	0.2	0.21
Benzo(ghi)perylene	0.2324	0.2015	100	100	100	500	1000	NC	NC	**0.68**	**0.44**	**1.6**	0.07	**0.32**	0.094	0.13
Chrysene	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	**0.74** J	**0.49** J	**2** J	0.072 J	0.39 J	0.1	0.14
Dibenz(a,h)anthracene	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c	**0.18**	**0.15**	0.25 U	0.017	**0.1**	0.023	0.027 J
Fluoranthene	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	**1.9** J	**0.94** J	**3.3** J	0.13 J	0.67 J	0.18	0.2
Fluorene	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n	0.044 J	0.021 J	**0.14** J	0.0038 J	0.015 J	0.0055 J	0.0082 J
Indeno(1,2,3-cd)pyrene	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	**0.62**	**0.47**	**1.2**	0.07	**0.31**	0.083	0.1
Naphthalene	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*	0.021 J	0.015 J	0.21 J	0.0052 J	0.015 J	0.019	0.0075 U
Phenanthrene	0.7072	1.448	100	100	100	500	1000	NC	NC	**0.94** J	0.35 J	**1.9** J	0.057 J	0.28 J	0.084	0.096
Pyrene	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	**1.3** J	0.74 J	**3.1** J	0.1 J	0.52 J	0.17	0.19
Metals (mg/Kg)																
Aluminum	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	10300	9890	**38200**	9260	11100	7660	7840
Antimony	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.53 J	0.47 UJ	**2.1** J	0.45 UJ	0.45 J	0.46 J	0.54 J
Arsenic	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	6.1	6.3	**53.7**	6	132	5.6	6.6
Barium	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	41.4	48	**390**	47.8	70.5	51.7	55.7
Beryllium	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	**0.65**	**0.71**	**2.7**	0.62	**0.8**	0.48	0.56 J
Cadmium	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n	0.12 J	0.14 J	**8.6**	0.13 J	0.27 J	0.33 J	0.75
Calcium	12100	16223	NC	NC	NC	NC	NC	NC	NC	468 J	1020 J	**15000** J	692 J	852 J	2520	2490
Chromium	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	23.8	20.1	**136**	17	**56.4**	20.4	23.3
Cobalt	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	5.2 J	5.6 J	**23.7** J	5.1 J	5.3 J	5.9	5.4 J
Copper	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	28.4	23.8	**268**	19.5	**85**	31.7 J	37.8 J
Iron	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	16500	15000	**62600**	13900	15300	15000	15400
Lead	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	86.7 J	73.3 J	**2140** J	102 J	170 J	174 J	411 J
Magnesium	4802	4433	NC	NC	NC	NC	NC	NC	NC	2490 J	2470 J	**9140** J	2090 J	2120 J	2400	2260
Manganese	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	206	272	**1140**	224	244	275 J	290 J
Nickel	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	19.6	18.2	**78.5**	13.9	17	17.7	18.1
Potassium	1286	2194	NC	NC	NC	NC	NC	NC	NC	839	604	**3950**	622	558 J	1230	924
Selenium	--	0.439	3.9	36	180	1500	6800	390 n	5100 n	0.47 J	0.4 J	3.2 J	0.79 U	0.57 J	0.8 U	1 U
Silver	--	0.211	2	36	180	1500	6800	390 n	5100 n	0.12 U	0.12 U	0.83 J	0.11 U	0.12 U	0.12 J	0.15 U
Sodium	250	277.2	NC	NC	NC	NC	NC	NC	NC	46 J	54.5 J	**932** J	23.8 J	38.7 J	15.5 J	55.3 J
Vanadium	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	47	30.6	154	24	32.5	25.3	24.7
Zinc	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	54.4 J	68.9 J	**1370** J	69.8 J	112 J	168 J	219 J
Mercury (mg/Kg)																
Mercury (total)	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	NA	NA	NA	0.25 J	0.673 J	NA	NA
Methyl mercury	--	--	NC	NC	NC	NC	NC	7.8 n	100 n	NA	NA	NA	0.00106 J	0.00079 J	NA	NA
Elemental Mercury	--	--	0.81	0.81	0.81	2.8	5.7	NC	NC	NA	NA	NA	0.0003 U	0.0004 U	NA	NA

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Table 5-2
Summary of May 2011 Analytical Results in Soil - Area 3
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Queens, New York

Parameter	AI3-108 AI3-108(0-2) 05/10/11 0-0.17 ft	AI3-108 DUP-AI3-2 05/10/11 0-0.17 ft	AI3-109 AI3-109(0-2) 05/10/11 0-0.17 ft	AI3-110 AI3-110(0-2) 05/11/11 0-0.17 ft	AI3-111 AI3-111(0-2) 05/10/11 0-0.17 ft	AI3-112 AI3-112(0-2) 05/10/11 0-0.17 ft	AI3-101 AI3-101(6-24) 05/10/11 0.5-2 ft	AI3-102 AI3-102(6-24) 05/10/11 0.5-2 ft	AI3-103 AI3-103(6-24) 05/10/11 0.5-2 ft	AI3-104 AI3-104(6-24) 05/10/11 0.5-2 ft	AI3-105 AI3-105(6-24) 05/10/11 0.5-2 ft	AI3-106 AI3-106(6-24) 05/11/11 0.5-2 ft	AI3-107 AI3-107(6-24) 05/11/11 0.5-2 ft
SVOCs (mg/Kg)													
1-Methylnaphthalene	0.0065 J	0.012 U	0.0068 J	0.0069 J	0.0087 J	0.0042 J	0.0036 J	0.0045 J	0.024 U	0.0036 J	0.0093	0.039	0.003 J
2-Methylnaphthalene	0.0079 J	0.012 UJ	0.0087 J	0.011	0.015 J	0.0054 J	0.004 J	0.0058 J	**0.015** J	0.0051 J	0.012 J	**0.14**	0.0038 J
Acenaphthene	0.0078 UJ	0.012 UJ	0.016 J	0.0083	0.011 UJ	0.0033 J	0.0068 J	0.0071 J	0.024 UJ	0.0034 J	0.0047 J	0.012	0.0023 J
Acenaphthylene	**0.042** J	**0.041** J	**0.076**	**0.079**	**0.11**	0.023	0.0075 J	**0.22**	**0.067** J	0.017	**0.06**	0.012	0.0074 J
Anthracene	0.041 J	0.037 J	0.1 J	0.059	0.066 J	0.018 J	0.023 J	0.12 J	0.058 J	0.016 J	0.041 J	0.047	0.0087
Benzo(a)anthracene	0.17 J	0.17 J	0.39 J	0.22	0.25 J	0.088 J	0.11 J	0.46 J	0.19 J	0.064 J	0.16 J	0.088	0.039
Benzo(a)pyrene	0.17 J	0.19 J	0.4 J	0.27	0.31 J	0.1 J	0.12 J	0.54 J	0.24 J	0.07 J	0.18 J	0.079	0.045
Benzo(b)fluoranthene	0.29 J	0.31 J	0.62 J	0.42	0.5 J	0.17 J	0.2 J	0.88 J	0.34 J	0.13 J	0.27 J	0.13	0.066
Benzo(ghi)perylene	0.14	0.15	**0.31**	0.23	**0.25**	0.082	0.11	**0.4**	**0.22**	0.069	0.14	0.07	0.04
Chrysene	0.18 J	0.2 J	0.39 J	0.22	0.29 J	0.1 J	0.11 J	0.48 J	0.2 J	0.074 J	0.19 J	0.087	0.041
Dibenz(a,h)anthracene	0.039 J	**0.041** J	0.037	**0.068**	**0.058** J	0.025	0.03	**0.13**	**0.045** J	0.014	**0.043**	0.016	0.0084 J
Fluoranthene	0.3 J	0.29 J	**0.78** J	0.33	0.34 J	0.16 J	0.26 J	0.91 J	0.31 J	0.14 J	0.23 J	0.17	0.065
Fluorene	0.01 J	0.02 UJ	0.024 J	0.011	0.018 UJ	0.0043 J	0.0081 J	0.024 J	0.04 UJ	0.0048 J	0.0089 J	0.017	0.0023 J
Indeno(1,2,3-cd)pyrene	0.13	0.12	**0.29**	**0.21**	**0.21**	0.075	0.096	**0.39**	0.16	0.061	0.12	0.061	0.029
Naphthalene	0.0078 UJ	0.012 UJ	0.014 J	0.0095	0.019 J	0.0072 J	0.0069 J	0.011 J	0.024 UJ	0.007 J	0.011 J	**0.053**	0.0038 J
Phenanthrene	0.14 J	0.14 J	0.36 J	0.11	0.18 J	0.058 J	0.16 J	0.35 J	0.18 J	0.073 J	0.091 J	0.16	0.029
Pyrene	0.25 J	0.25 J	0.61 J	0.28	0.34 J	0.13 J	0.2 J	0.68 J	0.26 J	0.11 J	0.2 J	0.13	0.063
Metals (mg/Kg)													
Aluminum	10700	9740	9690	7480	9400	11900	11500	10500	10900	8610	11500	8340	10100
Antimony	0.41 J	0.44 UJ	0.44 UJ	0.56 J	0.41 J	0.22 J	0.47 UJ	0.43 UJ	0.29 J	0.2 J	0.21 J	0.42 J	0.37 J
Arsenic	7.3 J	2.3 J	4.6	6.3	**22.5**	8.2	4.4	5.5	**17.4**	5.1	**18.9**	**10.4**	**7.7**
Barium	44.7	43.8	47.4	52.8	56.8	52.4	41.4	46.9	105	40.1	75.3	49.3	55.7
Beryllium	**0.8**	**0.81**	**0.68**	0.48 J	0.6	**0.86**	0.73	**0.78**	0.57	0.6	**0.79**	0.5	0.53
Cadmium	0.12 J	0.088 U	0.22 J	0.26 J	0.59	0.066 J	0.04 J	0.083 J	0.5 J	0.099 J	0.21 J	0.51 J	0.24 J
Calcium	415 J	237 J	962 J	2320	2610 J	530 J	314 J	814 J	2420 J	450 J	1260 J	5840	5100
Chromium	18.5 J	13.9	21	24.4	18.8	23.3	22.1	19.4	20.3	16.9	26.2	19.1	21
Cobalt	3.7 J	3.5 J	6.5	5.5 J	3.9 J	5.8 J	5 J	5.8	4.3 J	6	5.8	6.7	6 J
Copper	34.2 J	10 J	20.6	27.8 J	36.3	28.9	19.4	23.4	37.6	22.3	33.6	47.9 J	29.3 J
Iron	13400 J	10600	14600	14600	13400	16100	16500	14800	14200	14700	15600	16500	17300
Lead	111 J	16.4 J	76.8 J	228 J	150 J	99.6 J	30.7 J	44.7 J	265 J	132 J	114 J	212 J	168 J
Magnesium	2050 J	1800 J	2550 J	2250	1800 J	2620 J	2570 J	2470 J	1820 J	1990 J	2530 J	3610	2720
Manganese	170 J	213 J	335	290 J	222	340	188	281	217	293	210	269 J	382 J
Nickel	14.9 J	11.5	19.1	16.3	13.6	18.4	17.9	19	14.2	14.4	18.5	18.8	17.6
Potassium	406 J	306 J	691	1120	553	677	651	576	672	717	534 J	824	863
Selenium	0.9 J	0.77 U	0.78 U	0.45 J	0.48 J	0.73 J	0.83 U	0.42 J	0.41 J	0.76 U	0.8 U	**0.76** J	**0.49** J
Silver	0.14 U	0.11 U	0.11 U	0.48 J	0.097 U	0.12 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 J	0.12 U
Sodium	45.1 J	16.2 J	51.4 J	33.6 J	554	56.8 J	32.6 J	51.7 J	115 J	65.5 U	58.6 J	21.9 J	102 J
Vanadium	35.2 J	16.6 J	39.8	23.1	33.3	35.4	28.6	24.3	30.7	23.3	25.6	36.7	29.3
Zinc	50.3 J	34.6 J	69.2 J	110 J	274 J	53.3 J	42.3 J	59.1 J	179 J	63.5 J	97.3 J	246 J	98.6 J
Mercury (mg/Kg)													
Mercury (total)	NA	NA	NA	NA	0.378 J	0.885 J	NA	NA	NA	0.262 J	0.299 J	NA	NA
Methyl mercury	NA	NA	NA	NA	0.00226 J	0.00205 J	NA	NA	NA	0.000354 J	0.000781 J	NA	NA
Elemental Mercury	NA	NA	NA	NA	0.0003 U	0.0003 U	NA	NA	NA	0.0003 U	0.0003 U	NA	NA

Table 5-2
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Parameter	AI3-108 AI3-108(6-24) 05/10/11 0.5-2 ft	AI3-108 DUP-AI3-1 05/10/11 0.5-2 ft	AI3-109 AI3-109(6-24) 05/10/11 0.5-2 ft	AI3-110 AI3-110(6-24) 05/11/11 0.5-2 ft	AI3-111 AI3-111(6-24) 05/10/11 0.5-2 ft	AI3-112 AI3-112(6-24) 05/10/11 0.5-2 ft	AI3-106 AI3-106(2-4) 05/11/11 2-4 ft	AI3-107 AI3-107(2-4) 05/11/11 2-4 ft	AI3-110 AI3-110(2-4) 05/11/11 2-4 ft
SVOCs (mg/Kg)									
1-Methylnaphthalene	0.001 J	0.00091 J	0.0031 J	0.0068 J	0.065	0.0013 U	NA	NA	NA
2-Methylnaphthalene	0.0012 J	0.001 J	0.0042 J	0.014	**0.076** J	0.00088 J	NA	NA	NA
Acenaphthene	0.0017 J	0.0012 UJ	0.004 J	0.0056 J	**0.19** J	0.0013 UJ	NA	NA	NA
Acenaphthylene	0.0047 J	0.0055 J	0.028	**0.058**	**0.56**	0.0031 J	NA	NA	NA
Anthracene	0.0073 J	0.0035 J	0.025 J	0.038	**0.67** J	0.0022 J	NA	NA	NA
Benzo(a)anthracene	0.036 J	0.017 J	0.11 J	0.17	**1.4** J	0.0071 J	NA	NA	NA
Benzo(a)pyrene	0.038 J	0.018 J	0.12 J	0.2	**1.4** J	0.011 J	NA	NA	NA
Benzo(b)fluoranthene	0.062 J	0.03 J	0.2 J	0.33	**2.2** J	0.019 J	NA	NA	NA
Benzo(ghi)perylene	0.031 J	0.013 J	0.085	0.15	**0.98**	0.0089	NA	NA	NA
Chrysene	0.046 J	0.018 J	0.12 J	0.16	**1.3** J	0.011 J	NA	NA	NA
Dibenz(a,h)anthracene	0.0084 J	0.0025 UJ	0.024	0.041	**0.23**	0.0026 U	NA	NA	NA
Fluoranthene	0.075 J	0.028 J	0.21 J	0.21	**2.4** J	0.014 J	NA	NA	NA
Fluorene	0.0023 J	0.0021 UJ	0.0067 J	0.0074 J	**0.21** J	0.0022 UJ	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.029 J	0.0069 J	0.074	0.14	**0.89**	0.0085 J	NA	NA	NA
Naphthalene	0.0022 J	0.0012 UJ	0.0061 J	0.011	**0.1** J	0.0013 UJ	NA	NA	NA
Phenanthrene	0.044 J	0.011 J	0.089 J	0.069	**1.8** J	0.0059 J	NA	NA	NA
Pyrene	0.061 J	0.024 J	0.17 J	0.2	1.9 J	0.011 J	NA	NA	NA
Metals (mg/Kg)									
Aluminum	11300	9950	10200	9210	9610	12500	6650	9230	5940
Antimony	0.44 UJ	0.45 J	0.45 UJ	0.4 J	0.44 UJ	0.5 UJ	**1.2** J	0.19 J	0.24 J
Arsenic	2.8 J	6.2 J	4.3	**8.4**	6.7	2.6	4.2	3.4	5.3
Barium	49.8	42.7	42.4	56.2	76.8	57.3	48.1	57.3	53
Beryllium	**0.87**	**0.76**	0.74	0.53	0.65	**1.1**	0.44	0.56	0.45
Cadmium	0.034 J	0.12 J	0.16 J	0.21 J	0.19 J	0.099 U	0.11 J	0.091 U	0.14 J
Calcium	267 J	400 J	582 J	1960	6690 J	331 J	3270	1910	2180
Chromium	16.4	17.2 J	19.6	20.1	24.5	22.1	15.1	17.9	15.3
Cobalt	4.1 J	3.4 J	6.3	6.1	7.7	6.8	6	5.5 J	5.2 J
Copper	12.6 J	31.4 J	22	28.6 J	27.8	9.8	**166** J	24.3 J	36.4 J
Iron	12200	12300 J	14500	15700	16500	14800	17300	14500	12900
Lead	21.3 J	104 J	55.7 J	122 J	68.2 J	15.5 J	152 J	55.9 J	86.4 J
Magnesium	2120 J	1900 J	2430 J	2310	**6390** J	2590 J	3150	2400	2340
Manganese	245 J	157 J	307	325 J	324	463	278 J	221 J	231 J
Nickel	13.3	13.9 J	17.2	17.2	22.5	18.7	25.6	16.1	16.6
Potassium	356 J	385 J	503 J	938	1770	544 J	797	706	1040
Selenium	0.77 U	**0.5** J	0.78 U	0.37 J	0.76 U	0.87 U	**0.47** J	**0.46** J	**0.44** J
Silver	0.11 U	0.12 U	0.11 U	0.078 J	0.11 U	0.12 U	0.085 J	0.11 U	0.11 U
Sodium	66.3 U	28.9 J	109 J	31.1 J	**436** J	19 J	88.7 J	57.3 J	29.2 J
Vanadium	19.8 J	32.6 J	34.9	27	32	25.3	20.4	22.1	20
Zinc	40.3 J	48.2 J	53.8 J	91.2 J	127 J	45 J	142 J	66.3 J	72.1 J
Mercury (mg/Kg)									
Mercury (total)	NA	NA	NA	NA	0.357 J	0.128 J	NA	NA	NA
Methyl mercury	NA	NA	NA	NA	0.000238 J	0.000179 J	NA	NA	NA
Elemental Mercury	NA	NA	NA	NA	0.0002 U	0.0003 U	NA	NA	NA

New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR), Chapter IV, Subpart 375-6 Remedial ProgramSoil Cleanup Objectives

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
[boxed] indicates concentration is above the Industrial RSL
[green] indicates concentration is above the Unrestricted NYSDEC SCO
[blue] indicates concentration is above the Residential NYSDEC SCO
[yellow] indicates concentration is above the Restricted Residential NYSDEC SCO
[orange] indicates concentration is above the Commercial NYSDEC SCO
[pink] indicates concentration is above the Industrial NYSDEC SCO

mg/Kg = milligram per kilogram
U = not detected, value is the limit of detection
J = value is estimated
NA = sample was not analyzed for that analyte.
NC = no criteria available
blank cells - indicate analyte wan not analyzed for in that sample

United States Environmental Protection Agency Regions 3, 6, and 9. 2011.
Regional Screening Levels for Chemical Contaminants at Superfund Sites.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June 2011.

c = RSL is based on an excess lifetime cancer risk of 1 in 1 million.
c* = where n RSL < 100X c RSL.
c** = where n RSL < 10X c RSL.
n = RSL is based on a non-cancer hazard quotient of 1.
nL = U.S. EPA used an Integrated Exposure Uptake Biokinetic (IEUBK) model to derive a residential soil value for lead based on predictions of blood lead concentrations in children exposed to lead from various sources. (http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf).
nm = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit.
ns = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
nms = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit and concentration may exceed Csat.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/02/11

Table 5-3
Summary of November 2012 Analytical Results in Soil - Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Location	Sample Identifier	Sample Date	Sample Depth (bgs)	Mercury (mg/Kg)
AI3-202	AI3-202(2-3")	11/28/12	0.17 to 0.25 ft	0.51J
AI3-202	AI3-202(5-6")	11/28/12	0.42 to 0.50 ft	1.1J
AI3-202	AI3-202(6-12")	11/28/12	0.50 to 1 ft	0.31J
AI3-203	AI3-203(3-4")	11/28/12	0.25 to 0.33 ft	0.48J
AI3-203	AI3-203(6-12")	11/28/12	0.50 to 1 ft	0.46J
AI3-204	AI3-204(2-4")	11/28/12	0.17 to 0.33 ft	0.4J
AI3-204	AI3-204(6-8")	11/28/12	0.50 to 0.67 ft	0.36J
AI3-204	AI3-204(8-12")	11/28/12	0.67 to 1 ft	0.5J
AI3-206	AI3-206(2-4")	11/29/12	0.17 to 0.33 ft	0.38J
AI3-206	AI3-206(5-6")	11/29/12	0.42 to 0.50 ft	0.28J
AI3-206	AI3-206(6-12")	11/29/12	0.50 to 1 ft	0.73J
AI3-207	AI3-207(2-4")	11/28/12	0.17 to 0.33 ft	0.36J
AI3-207	AI3-FD-03	11/28/12	0.17 to 0.33 ft	0.36J
AI3-207	AI3-207(6-12")	11/28/12	0.50 to 1 ft	0.74J
AI3-208	AI3-208(2-4")	11/28/12	0.17 to 0.33 ft	0.47J
AI3-208	AI3-FD-02	11/28/12	0.17 to 0.33 ft	0.45J
AI3-208	AI3-208(6-11")	11/28/12	0.50 to 1.08 ft	0.49J
AI3-209	AI3-209(3-5")	11/28/12	0.25 to 0.42 ft	0.42J
AI3-209	AI3-209(6-12")	11/28/12	0.50 to 1 ft	0.54J
AI3-211	AI3-211(3-5")	11/28/12	0.25 to 0.42 ft	0.33J
AI3-211	AI3-211(6-12")	11/28/12	0.50 to 1 ft	0.59J
AI3-212	AI3-212(2-4")	11/28/12	0.17 to 0.33 ft	0.29J
AI3-212	AI3-212(6-8")	11/28/12	0.60 to 0.67 ft	0.42J
AI3-212	AI3-212(8-12")	11/28/12	0.67 to 1 ft	0.23J
AI3-213	AI3-213(2-3")	11/28/12	0.17 to 0.25 ft	0.32J
AI3-213	AI3-FD-01	11/28/12	0.17 to 0.25 ft	0.34J
AI3-213	AI3-213(6-8")	11/28/12	0.50 to 0.67 ft	0.47J
AI3-213	AI3-213(8-14")	11/28/12	0.67 to 1.17 ft	0.25J
AI3-214	AI3-214(2-4")	11/28/12	0.17 to 0.33 ft	0.62J
AI3-214	AI3-214(5-6")	11/28/12	0.42 to 0.50 ft	0.84J
AI3-214	AI3-214(6-12")	11/28/12	0.50 to 1 ft	0.37J
AI3-215	AI3-215(2-4")	11/28/12	0.17 to 0.33 ft	0.43J
AI3-215	AI3-215(5-6")	11/28/12	0.42 to 0.50 ft	0.48J
AI3-215	AI3-215(6-12")	11/28/12	0.50 to 1 ft	0.55J
AI3-216	AI3-216(3-5")	11/29/12	0.25 to 0.42 ft	0.42J
AI3-216	AI3-216(6-12")	11/29/12	0.50 to 1 ft	0.71J
AI3-217	AI3-217(2-4")	11/28/12	0.17 to 0.33 ft	0.33J
AI3-217	AI3-217(5-6")	11/28/12	0.42 to 0.50 ft	0.51J
AI3-217	AI3-217(6-12")	11/28/12	0.50 to 1 ft	0.5J
AI3-218	AI3-218(2-3")	11/28/12	0.17 to 0.25 ft	0.3J
AI3-218	AI3-218(4-6")	11/28/12	0.33 to 0.50 ft	0.33J
AI3-218	AI3-218(6-12")	11/28/12	0.50 to 1 ft	0.46J
AI3-219	AI3-219(2-4")	11/28/12	0.17 to 0.33 ft	0.41J
AI3-219	AI3-219(7-8")	11/28/12	0.58 to 0.67 ft	0.51J
AI3-219	AI3-219(8-12")	11/28/12	0.67 to 1 ft	0.73J
AI3-222	AI3-222(2-4")	11/28/12	0.17 to 0.33 ft	0.28J
AI3-222	AI3-222(4-6")	11/28/12	0.33 to 0.50 ft	0.34J
AI3-222	AI3-222(6-12")	11/28/12	0.50 to 1 ft	0.66J
AI3-223	AI3-223(2-4")	11/28/12	0.17 to 0.33 ft	0.19J
AI3-223	AI3-223(6-8")	11/28/12	0.50 to 0.67 ft	0.19J
AI3-223	AI3-223(8-12")	11/28/12	0.67 to 1 ft	0.15J
AI3-224	AI3-224(2-4")	11/28/12	0.17 to 0.33 ft	0.4J
AI3-224	AI3-224(6-8")	11/28/12	0.60 to 0.67 ft	0.5J
AI3-224	AI3-224(8-12")	11/28/12	0.67 to 1 ft	0.65J

bgs = below ground surface
J = value is estimated
mg/Kg = milligram per kilogram

Bold indicates concentration is above Background (shallow 1.6 mg/kg, deep 2.26 mg/kg)
<u>Underline</u> indicates concentration is above the Residential RSL (10 mg/kg)
indicates concentration is above the Industrial RSL (43 mg/kg)
indicates concentration is above the Unrestricted NYSDEC SCO (0.18 mg.kg)
indicates concentration is above the Residential NYSDEC SCO (0.81 mg/kg)
indicates concentration is above the Restricted Residential NYSDEC SCO (0.81 mg/kg)
indicates concentration is above the Commercial NYSDEC SCO (2.8 mg/kg)
indicates concentration is above the Industrial NYSDEC SCO (5.7 mg/kg)

Table 5-4
Summary of May 2011 Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Background		New York State Soil Cleanup Objectives					USEPA Regional Screening Levels		AI4-101 AI4-101(0-2) 05/10/11	AI4-102 AI4-102(0-2) 05/12/11	AI4-103 AI4-103(0-2) 05/12/11	AI4-104 AI4-104(0-2) 05/12/11	AI4-105 AI4-105(0-2) 05/11/11	AI4-106 AI4-106(0-2) 05/11/11	AI4-107 AI4-107(0-2) 05/12/11	AI4-108 AI4-108(0-2) 05/12/11
	Shallow	**Deep**	Unrestricted (mg/Kg)	Residential (mg/Kg)	Restricted Residential (mg/Kg)	Commercial (mg/Kg)	Industrial (mg/Kg)	Residential	Industrial	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft
SVOCs (mg/Kg)																	
1-Methylnaphthalene	--	--	NC	NC	NC	NC	NC	22 c	99 c	NA	0.0068 J	0.023	0.029	0.027	0.11 J	0.0066 J	0.0095
2-Methylnaphthalene	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns	NA	0.0096 J	0.022	0.036	0.035	0.14 J	0.0076 J	0.0123
Acenaphthene	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n	NA	0.0058 J	0.0098 J	0.0044 J	0.0088 J	**0.23** J	0.0092	0.012
Acenaphthylene	0.02767	0.02874	100	100	100	500	1000	NC	NC	NA	**0.065**	**0.16**	**0.035**	**0.25**	**3.3**	**0.034**	**0.17**
Anthracene	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm	NA	0.042	0.086	0.021	0.1	**1.4**	0.029	**0.16**
Benzo(a)anthracene	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	NA	0.19	0.33	0.099	**0.56**	**7.3**	0.11	0.35
Benzo(a)pyrene	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	NA	0.25	0.42	0.13	**0.77**	**9.8**	0.14	**0.51**
Benzo(b)fluoranthene	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	NA	0.37	0.73	0.2	**1.3**	**15**	0.21	**1.2**
Benzo(ghi)perylene	0.2324	0.2015	100	100	100	500	1000	NC	NC	NA	0.22	**0.34**	0.12	**0.75**	**9.1**	0.14	**0.45**
Benzo(k)fluoranthene	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c	NA	0.0038 U	**0.8**	0.002 U	0.0039 U	0.076 U	0.0021 U	0.002 U
Chrysene	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	NA	0.23	**0.6**	0.12	**0.57**	**8.2**	0.14	**0.57**
Dibenz(a,h)anthracene	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c	NA	**0.051**	**0.081**	0.022	**0.17**	**2**	0.027	**0.13**
Fluoranthene	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	NA	0.37	**0.95**	0.18	**0.97**	**16**	0.23	0.65
Fluorene	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n	NA	0.0072 J	0.019	0.0054 J	0.019	**0.3**	0.0087	0.017
Indeno(1,2,3-cd)pyrene	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	NA	0.18	**0.29**	0.099	**0.66**	**7.4**	0.11	**0.43**
Naphthalene	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*	NA	0.011 J	0.022	0.025	0.031	0.21 J	0.0084 J	0.017
Phenanthrene	0.7072	1.448	100	100	100	500	1000	NC	NC	NA	0.13	0.33	0.075	0.22	**5.2**	0.11	0.19
Pyrene	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	NA	0.35	1	0.2	0.86	**14**	0.23	0.62
Metals (mg/Kg)																	
Aluminum	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	7610	NA	NA	NA	NA	NA	NA	NA
Antimony	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.22 J	NA	NA	NA	NA	NA	NA	NA
Arsenic	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	3.6	NA	NA	NA	NA	NA	NA	NA
Barium	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	64.1	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n	0.19 J	NA	NA	NA	NA	NA	NA	NA
Calcium	12100	16223	NC	NC	NC	NC	NC	NC	NC	6900 J	NA	NA	NA	NA	NA	NA	NA
Chromium	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	17.3	NA	NA	NA	NA	NA	NA	NA
Cobalt	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	5.6 J	NA	NA	NA	NA	NA	NA	NA
Copper	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	29	NA	NA	NA	NA	NA	NA	NA
Iron	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	12700	NA	NA	NA	NA	NA	NA	NA
Lead	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	94.6 J	NA	NA	NA	NA	NA	NA	NA
Magnesium	4802	4433	NC	NC	NC	NC	NC	NC	NC	**5090** J	NA	NA	NA	NA	NA	NA	NA
Manganese	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	351	NA	NA	NA	NA	NA	NA	NA
Nickel	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	15.8	NA	NA	NA	NA	NA	NA	NA
Potassium	1286	2194	NC	NC	NC	NC	NC	NC	NC	919	NA	NA	NA	NA	NA	NA	NA
Sodium	250	277.2	NC	NC	NC	NC	NC	NC	NC	172 J	NA	NA	NA	NA	NA	NA	NA
Vanadium	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	21.1	NA	NA	NA	NA	NA	NA	NA
Zinc	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	116 J	NA	NA	NA	NA	NA	NA	NA
Mercury (mg/Kg)																	
Mercury	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	NA	NA	NA	NA	0.19 J	0.181 J	NA	NA
Methyl mercury	--	--	NC	NC	NC	NC	NC	7.8 n	100 n	NA	NA	NA	NA	0.000708 J	0.000535 J	NA	NA
Elemental Mercury	--	--	0.81	0.81	0.81	2.8	5.7	NC	NC	NA	NA	NA	NA	0.0003 U	0.0004 U	NA	NA

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Table 5-4
Summary of May 2011 Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI4-109 AI4-109(0-2) 05/12/11 0-0.17 ft	AI4-110 AI4-110(0-2) 05/12/11 0-0.17 ft	AI4-111 AI4-111(0-2) 05/12/11 0-0.17 ft	AI4-112 AI4-112(0-2) 05/11/11 0-0.17 ft	AI4-113 AI4-113(0-2) 05/12/11 0-0.17 ft	AI4-114 AI4-114(0-2) 05/12/11 0-0.17 ft	AI4-115 AI4-115(0-2) 05/11/11 0-0.17 ft	AI4-115 DUP-AI4-1 05/11/11 0-0.17 ft	AI4-101 AI4-101(6-24) 05/10/11 0.5-2 ft	AI4-102 AI4-102(6-24) 05/12/11 0.5-2 ft	AI4-103 AI4-103(6-24) 05/12/11 0.5-2 ft	AI4-104 AI4-104(6-24) 05/12/11 0.5-2 ft	AI4-105 AI4-105(6-24) 05/11/11 0.5-2 ft	AI4-106 AI4-106(6-24) 05/11/11 0.5-2 ft
SVOCs (mg/Kg)														
1-Methylnaphthalene	0.0171	0.0144	0.459	0.0085 J	0.0094	0.0062 J	0.0023 J	0.0034 J	NA	0.0021 J	0.0079	0.0047 J	0.008	0.016 J
2-Methylnaphthalene	0.021	0.0126	0.803	0.011 J	0.0061 J	0.0066 J	0.0028 J	0.0044 J	NA	0.0023 J	0.0059 J	0.0061 J	0.01	**0.032** J
Acenaphthene	0.011	0.053	**2**	0.0079 J	0.0088	0.0085	0.0026 J	0.0088 J	NA	0.0011 U	0.003 J	0.0012 U	0.0042 J	0.043 J
Acenaphthylene	**0.043**	**0.099**	**0.1**	**0.13**	**0.13**	**0.13**	0.025	**0.029**	NA	0.021	**0.051**	0.013	**0.11**	**1.5**
Anthracene	0.041	0.12	**4**	0.065	0.062	0.072	0.017 J	0.03 J	NA	0.012	0.022	0.0057 J	0.04	**0.62**
Benzo(a)anthracene	0.22	0.46	**6**	0.3	0.36	0.29	0.096	0.11	NA	0.079	0.12	0.029	0.24	**4.7**
Benzo(a)pyrene	0.27	**0.54**	**4.6**	**0.45**	**0.49**	0.42	0.13	0.14	NA	0.1	0.16	0.043	0.36	**6.4**
Benzo(b)fluoranthene	0.44	**0.76**	**2.9**	0.67	0.54	0.6	0.19	0.21	NA	0.15	0.22	0.064	0.58	**8.8**
Benzo(ghi)perylene	0.2	**0.39**	**2.6**	**0.43**	**0.61**	**0.33**	0.1	0.11	NA	0.083	0.12	0.041	**0.35**	**5.3**
Benzo(k)fluoranthene	0.0018 U	0.002 U	**1.4**	0.0038 U	**0.17**	0.002 U	0.004 U	0.004 U	NA	0.0019 U	0.0019 U	0.0019 U	0.0019 U	0.027 U
Chrysene	0.29	**0.49**	**4.7**	0.3	0.41	0.33	0.11	0.12	NA	0.082	0.16	0.039	0.29	**4.3**
Dibenz(a,h)anthracene	**0.057**	**0.11**	**1.3**	**0.098**	**0.18**	**0.099**	0.024	0.024	NA	0.015	0.022	0.01	**0.077**	**1.2**
Fluoranthene	0.38	**1**	**11**	0.39	**0.89**	0.55	0.16 J	0.22 J	NA	0.11	0.22	0.051	0.41	**6.6**
Fluorene	0.01	0.04	**1.9**	0.012 J	0.011	0.014	0.0031 J	0.0092 J	NA	0.0026 J	0.007 J	0.0014 J	0.0066 J	**0.091** J
Indeno(1,2,3-cd)pyrene	0.18	**0.33**	**2.5**	**0.35**	**0.51**	**0.3**	0.085	0.09	NA	0.07	0.1	0.035	0.29	**4.4**
Naphthalene	0.017	0.016	1.9	0.019	0.0077 J	0.0097	0.0049 J	0.0065 J	NA	0.0034 J	0.0074 J	0.0046 J	0.012	**0.083** J
Phenanthrene	0.14	0.66	**12**	0.11	0.23	0.2	0.05 J	0.11 J	NA	0.033	0.1	0.015	0.069	1.1
Pyrene	0.35	0.87	**9.2**	0.39	0.55	0.47	0.13	0.17	NA	0.12	0.27	0.057	0.36	**6.1**
Metals (mg/Kg)														
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	10300	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	0.37 UJ	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	3.1	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	69.4	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	0.055 J	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	3360 J	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	20.7	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	6.2	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	19.6	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	13900	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	39 J	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	3680 J	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	476	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	16.8	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	724	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	**360** J	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	22.4	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	61.3 J	NA	NA	NA	NA	NA
Mercury (mg/Kg)														
Mercury	NA	NA	NA	0.117 J	NA	NA	0.0864 J	0.0826 J	NA	NA	NA	NA	0.0938 J	0.0661 J
Methyl mercury	NA	NA	NA	0.000464 J	NA	NA	0.00038 J	0.000293 J	NA	NA	NA	NA	0.000322 J	0.00031 J
Elemental Mercury	NA	NA	NA	0.0004 U	NA	NA	0.0004 U	0.0003 U	NA	NA	NA	NA	0.0002 U	0.0003 U

Table 5-4
Summary of May 2011 Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI4-107 AI4-107(6-24) 05/12/11 0.5-2 ft	AI4-108 AI4-108(6-24) 05/12/11 0.5-2 ft	AI4-109 AI4-109(6-24) 05/12/11 0.5-2 ft	AI4-110 AI4-110(6-24) 05/12/11 0.5-2 ft	AI4-111 AI4-111(6-24) 05/12/11 0.5-2 ft	AI4-112 AI4-112(6-24) 05/11/11 0.5-2 ft	AI4-113 AI4-113(6-24) 05/12/11 0.5-2 ft	AI4-114 AI4-114(6-24) 05/12/11 0.5-2 ft	AI4-115 AI4-115(6-24) 05/11/11 0.5-2 ft
SVOCs (mg/Kg)									
1-Methylnaphthalene	0.0037 J	0.0174 U	0.0037 J	0.0065 J	0.025	0.0014 J	0.00086 J	0.0011 J	0.0025 J
2-Methylnaphthalene	0.0051 J	0.0174 U	0.0042 J	0.0089	**0.0375**	0.0025 J	0.0014 J	0.0014 J	0.003 J
Acenaphthene	0.0012 U	0.024 J	0.0031 J	0.0032 J	**0.12**	0.0019 J	0.0036 J	0.0028 J	0.0056 J
Acenaphthylene	0.027	**0.27**	0.008	0.019	**0.034**	**0.039**	**0.067**	0.014	0.016
Anthracene	0.017	0.27	0.0088	0.012	0.21	0.017	0.03	0.012	0.02
Benzo(a)anthracene	0.073	**1.3**	0.043	0.051	0.41	0.096	0.2	0.051	0.069
Benzo(a)pyrene	0.095	**0.98**	0.056	0.068	0.35	0.14	0.24	0.065	0.094
Benzo(b)fluoranthene	0.14	**3.2**	0.093	0.094	0.32	0.21	0.24	0.097	0.14
Benzo(ghi)perylene	0.097	**0.76**	0.049	0.053	**0.3**	0.13	**0.28**	0.05	0.069
Benzo(k)fluoranthene	0.002 U	0.029 U	0.002 U	0.002 U	0.2	0.0019 U	0.1	0.002 U	0.0038 U
Chrysene	0.079	**3.2**	0.06	0.057	0.38	0.082	0.19	0.065	0.084
Dibenz(a,h)anthracene	0.017	**0.18**	0.013	0.011	**0.11**	0.029	**0.078**	0.012	0.014 J
Fluoranthene	0.13	**5.8**	0.081	0.085	0.86	0.098	0.32	0.1	0.14
Fluorene	0.0021 J	0.05 J	0.0032 J	0.004 J	**0.094**	0.0033 J	0.0036 J	0.0028 J	0.006 J
Indeno(1,2,3-cd)pyrene	0.076	**0.67**	0.047	0.047	0.27	0.11	0.24	0.044	0.059
Naphthalene	0.0059 J	**0.024** J	0.004 J	0.0041 J	**0.042**	0.0057 J	0.0032 J	0.0019 J	0.004 J
Phenanthrene	0.04	0.41	0.033	0.05	0.64	0.022	0.03	0.05	0.067
Pyrene	0.12	**5.9**	0.081	0.084	0.48	0.11	0.23	0.095	0.12
Metals (mg/Kg)									
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury (mg/Kg)									
Mercury	NA	NA	NA	NA	NA	0.0775 J	NA	NA	0.0654 J
Methyl mercury	NA	NA	NA	NA	NA	0.000409 J	NA	NA	0.000639 J
Elemental Mercury	NA	NA	NA	NA	NA	0.0003 U	NA	NA	0.0003 U

New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR), Chapter IV, Subpart 375-6 Remedial ProgramSoil Cleanup Objectives

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Commercial NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO

mg/Kg = milligram per kilogram
U = not detected, value is the limit of detection
J = value is estimated
NA = sample was not analyzed for that analyte.
NC = no criteria available
blank cells - indicate analyte wan not analyzed for in that sample

United States Environmental Protection Agency Regions 3, 6, and 9. 2011.
Regional Screening Levels for Chemical Contaminants at Superfund Sites.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June 2011.

c = RSL is based on an excess lifetime cancer risk of 1 in 1 million.
c* = where n RSL < 100X c RSL.
c** = where n RSL < 10X c RSL.
n = RSL is based on a non-cancer hazard quotient of 1.
nL = U.S. EPA used an Integrated Exposure Uptake Biokinetic (IEUBK) model to derive a residential soil value for lead based on predictions of blood lead concentrations in children exposed to lead from various sources. (http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf).
nm = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit.
ns = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
nms = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit and concentration may exceed Csat.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/02/11

Table 5-5
Area 4 Observation Hole Locations and Findings
Final Remediation Investigation Report
Engineer School, Fort Totten
Queens, New York

Location	Sample Depth (ft bgs)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	May 2011 Observed Fill Material	November 2012 Observations
AI4-106	0-0.17	**9.8**	**15**	**7.4**		Crushed stone up to 2 inches diameter and coal/asphalt at 9 inches bgs
	0.5-2	**6.4**	**8.8**	**4.4**	angular crushed stone (0.5 to 1.5 ft bgs) with clean, fine-medium sand (1.5 to 2 ft bgs) that appeared to be a prepared bed for the stone	
SS-12	0-0.17	**6.4**	**8.7**	**4.6**		Crushed stone up to 2 inches diameter and coal/asphalt at 8 inches bgs
SS-15	0-0.17	**5.1**	**6.6**	**4.1**		Did not dig because adjacent to SS-12
AI4-111	0-0.17	**4.6**	**2.9**	**2.5**	coal	Coal ash, coal and brick at 6-9 inches bgs
	0.5-2	0.35	0.32	0.27		
SS-14	0-0.17	**1.9**	**2.8**	**1.6**		Did not dig because adjacent to SS-12
B-06	0-1	**1.5**	**1.2**	**0.75**		Coal and ashphalt at 9 inches bgs
SS-13	0-0.17	**1.5**	**2.3**	**1.2**		Did not dig because adjacent to SS-12
SS-05	0-0.17	**1.3**	**1.8**	**0.78**		Did not dig because adjacent to B-05
B-05	0-1	**1.1**	0.71	**1**		Coal, concrete, shell at 9 inches bgs

Table 5-5
Area 4 Observation Hole Locations and Findings
Final Remediation Investigation Report
Engineer School, Fort Totten
Queens, New York

Location	Sample Depth (ft bgs)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	May 2011 Observed Fill Material	November 2012 Observations
AI4-108	0-0.17	**0.51**	**1.2**	**0.43**		Dense brick layer with coal at 7-10 inches bgs. Metal wire above brick layer; length unknown
	0.5-2	**0.98**	**3.2**	**0.67**	brick	
SS-03	0-0.17	**0.7**	**1.1**	**0.4**		Did not dig because adjacent to B-06
AI4-105	0-0.17	**0.51**	**1.3**	**0.66**		Did not dig because adjacent to SS-12
	0.5-2	0.36	0.58	0.29		
AI4-113	0-0.17	**0.49**	0.54	**0.51**		Coal, brick fragment at 6-8 inches bgs
	0.5-2	0.24	0.24	0.24		
AI4-112	0-0.17	**0.45**	0.67	**0.35**		Coal and glass at 7-9 inches bgs
	0.5-2	0.14	0.21	0.11	possible asphalt	
AI4-102	0-0.17	0.25	0.37	**0.18**	brick, metal	Coal, asphalt-coated rocks, rusty nail, glass fragments at 5 inches bgs
	0.5-2	0.1	0.15	0.07	brick, metal, possibly ash	

Notes:

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

Bold indicates concentration is above Background

Underline indicates concentration is above the Residential RSL

indicates concentration is above the Industrial RSL

indicates concentration is above the Restricted Residential NYSDEC SCO

indicates concentration is above the Commercial NYSDEC SCO

indicates concentration is above the Industrial NYSDEC SCO

Table 5-6
Summary of May 2011 Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Background		New York State Soil Cleanup Objectives					USEPA Regional Screening Levels		AI5-101 AI5-101(0-6) 05/10/11 0-0.5 ft	AI5-102 AI5-102(0-2) 05/10/11 0-0.17 ft	AI5-103 AI5-103(0-2) 05/10/11 0-0.17 ft	AI5-104 AI5-104(0-2) 05/10/11 0-0.17 ft	AI5-105 AI5-105(0-2) 05/11/11 0-0.17 ft	AI5-105 DUP-AI5-1(0-2) 05/11/11 0-0.17 ft	AI5-106 AI5-106(0-2) 05/11/11 0-0.17 ft	AI5-106 AI5-106(0-6) 05/11/11 0-0.5 ft	AI5-107 AI5-107(0-2) 05/11/11 0-0.17 ft
	Shallow	**Deep**	Unrestricted (mg/Kg)	Residential (mg/Kg)	Restricted Residential (mg/Kg)	Commercial (mg/Kg)	Industrial (mg/Kg)	Residential	Industrial									
Metals (mg/Kg)																		
Aluminum	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	4100	2160	2930	3740	5360	6050	NA	7520	4570
Antimony	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.24 J	0.42 UJ	0.4 UJ	0.4 UJ	1.2 J	0.74 J	NA	0.44 UJ	1.4 J
Arsenic	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	**13.3**	2.9	1.7	2.8	3.9	3.8	NA	3	3.1
Barium	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	42.7	49.8	23.5	45.9	55.8	51.5	NA	47.3	47.7
Beryllium	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.32 U	0.22 U	0.19 U	0.22 U	0.36 J	0.37 J	NA	0.46	0.31 J
Cadmium	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n	0.48 J	0.072 J	0.054 J	0.037 J	0.53 J	0.55 J	NA	0.22 J	1.7
Calcium	12100	16223	NC	NC	NC	NC	NC	NC	NC	11100 J	10600 J	**27200** J	**15800** J	**30500**	**35300**	NA	8170	**16000**
Chromium	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	11.6	7.1	7.6	5.6	18.1	18.9	NA	17.7	29.7
Cobalt	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	4 J	2.7 J	3 J	4.1 J	3.6 J	3.8 J	NA	**13**	4 J
Copper	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	38	17.3	11.7	23.7	**90.7** J	**89.2** J	NA	21.6 J	69.4 J
Iron	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	7720	3870	6670	6180	9240	9160	NA	15600	8850
Lead	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	81.9 J	21.2 J	53.3 J	22.6 J	366 J	360 J	NA	143 J	**587** J
Magnesium	4802	4433	NC	NC	NC	NC	NC	NC	NC	1240 J	760 J	**12700** J	1550 J	2420 J	3550 J	NA	2340	1780
Manganese	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	101	48	160	78.7	155 J	162 J	NA	438 J	140 J
Nickel	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	12.2	8.4	14	10.5	13.9	14.3	NA	18.9	22.8
Potassium	1286	2194	NC	NC	NC	NC	NC	NC	NC	401 J	326 J	427 J	486 J	451 J	535 J	NA	1280	387 J
Selenium	--	0.439	3.9	36	180	1500	6800	390 n	5100 n	0.63 J	0.73 U	0.7 U	0.69 U	0.65 J	0.64 J	NA	0.77 U	0.69 J
Silver	--	0.211	2	36	180	1500	6800	390 n	5100 n	0.12 U	0.1 U	0.1 U	0.072 J	0.19 J	0.17 J	NA	0.11 U	0.22 J
Sodium	250	277.2	NC	NC	NC	NC	NC	NC	NC	235 J	**431** J	179 J	**379** J	206 J	201 J	NA	226 J	45.9 J
Vanadium	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	19.2	11.1	40.1	20.1	15.1	17.2	NA	22	36.1
Zinc	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	80.2 J	26.6 J	29.9 J	28.6 J	158 J	167 J	NA	120 J	283 J
Mercury (mg/Kg)																		
Mercury	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	NA	NA	NA	NA	0.28 J	0.348 J	0.178 J	NA	NA
Methyl mercury	--	--	NC	NC	NC	NC	NC	7.8 n	100 n	NA	NA	NA	NA	0.000169 J	0.000153 J	0.000059 UJ	NA	NA
Elemental Mercury	--	--	0.81	0.81	0.81	2.8	5.7	NC	NC	NA	NA	NA	NA	0.0004 U	0.0003 U	0.0003 U	NA	NA

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Table 5-6
Summary of May 2011 Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	AI5-108	AI5-109	AI5-110	AI5-101	AI5-102	AI5-103	AI5-104	AI5-105	AI5-105	AI5-106	AI5-107	AI5-108	AI5-109	AI5-110	AI5-101	AI5-102	AI5-103
	AI5-108(0-2)	AI5-109(0-2)	AI5-110(0-2)	AI5-101(6-24)	AI5-102(6-24)	AI5-103(6-24)	AI5-104(6-24)	AI5-105(6-24)	DUP-AI5-2(6-24)	AI5-106(6-24)	AI5-107(6-24)	AI5-108(6-24)	AI5-109(6-24)	AI5-110(6-24)	AI5-101(2-6)	AI5-102(2-6)	AI5-103(2-6)
	05/11/11	05/10/11	05/11/11	05/10/11	05/10/11	05/10/11	05/10/11	05/11/11	05/11/11	05/11/11	05/11/11	05/11/11	05/10/11	05/11/11	05/10/11	05/10/11	05/10/11
Parameter	0-0.17 ft	0-0.17 ft	0-0.17 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	0.5-2 ft	2-6 ft	2-6 ft	2-6 ft
Metals (mg/Kg)																	
Aluminum	7660	6070	2990	9430	5700	9580	15200	8080	8590	9590	7700	7970	8610	9370	6850	7740	6530
Antimony	0.44 UJ	0.43 J	0.25 J	0.42 UJ	0.43 UJ	0.44 UJ	0.47 UJ	0.25 J	0.35 J	**1.9** J	0.44 UJ	0.2 J	0.43 UJ	0.44 UJ	0.43 UJ	0.42 UJ	0.45 UJ
Arsenic	3.2	5.5	6.5	3.9	2	2.4	2.9	2.2 J	3.1 J	3.4	2.8	3.2	2.7	2.8	2.5	1.9	2
Barium	53.4	56.8	53.8	31.8	15.8 J	84.1	156	71.3 J	41.8 J	50.7	48.9	39	40.9	46.5	27.2	24.1	32.2
Beryllium	0.48	0.37 U	0.37 J	0.34 U	0.29 U	0.49 U	0.72	0.45	0.49	0.48	0.47	0.46	0.4 U	0.51	0.33 U	0.34 U	0.35 U
Cadmium	0.74	0.47 J	0.21 J	0.084 U	0.085 U	0.088 U	0.094 U	0.088 U	0.48 J	0.088 U	0.087 U	0.45 J	0.097 J	0.088 U	0.086 U	0.084 U	0.089 U
Calcium	6140	3250 J	4660	508 J	567 J	4700 J	2940 J	3350 J	986 J	865	661	1070	1540 J	2070	1280 J	4960 J	980 J
Chromium	15.4	18.2	7.3	18.6	10.5	28.9	**45.2**	21.1	18.2	19.8	17.8	17.6	18.1	19.9	19.9	19.1	14.1
Cobalt	4.7 J	5.7 J	3.4 J	5.4	**15.8**	8.5	**13.4**	7.6 J	6.1 J	5.8	6.5	6.3	4.7 J	6.8	3.6 J	11.4	4.4 J
Copper	27.3 J	**227**	44.6 J	10.4	7.4	24.9	35.7	66.9 J	25.7 J	17.7 J	18.7 J	18.1 J	21.1	19.5 J	13.9	14.1	28.8
Iron	14000	13600	6140	14800	9160	17700	**25200**	17200	19000	16500	17300	22100	13900	16900	11200	11900	12000
Lead	88 J	350 J	55.3 J	7.6 J	4.1 J	39.6 J	72.8 J	106 J	55.4 J	106 J	26.7 J	85.6 J	56 J	22.7 J	7.5 J	5.5 J	78.3 J
Magnesium	2030	2010 J	706	2390 J	1210 J	**5540** J	**7280** J	4010 J	2260 J	2530	2140	2090	2290 J	2990	2020 J	2340 J	1880 J
Manganese	227 J	206	56 J	143	253	339	510	205 J	316 J	267 J	421 J	324 J	186	186 J	103	209	177
Nickel	14.2	21.3	12	11.4	9.8	25.5	36.4	19.7	16.1	18.3	20.3	15.8	14.3	18.7	11.3	19.1	11.3
Potassium	688	836	325 J	688	507 J	**2880**	**5320**	**2290** J	848 J	1140	1140	805	775	1180	587	647	711
Selenium	0.78 U	0.83 U	1.9	0.73 U	0.75 U	0.77 U	0.83 U	**0.64** J	0.78 U	0.77 U	0.76 U	0.77 U	0.75 U	**0.68** J	0.75 U	0.73 U	0.78 U
Silver	0.11 U	0.11 J	0.19 J	0.1 U	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.11 U
Sodium	129 J	**496** J	**286** J	**567**	70.4 J	**488** J	**451** J	**373** J	64.2 J	207 J	**310** J	72.7 J	**435** J	267 J	70.3 J	185 J	97.1 J
Vanadium	20.1	27.2	14.9	24	16.5	30.7	**44.9**	28.3 J	21.8 J	24.3	23.4	21.5	22.5	25.6	17.9	22.5	17.2
Zinc	213 J	**316** J	45.7 J	31.7 J	19.4 J	53.2 J	116 J	71.3 J	507 J	126 J	31.5 J	**339** J	58.4 J	41 J	30.2 J	29 J	92.3 J
Mercury (mg/Kg)																	
Mercury	NA	NA	NA	NA	NA	NA	NA	1.72 J	NA	1.26 J	NA	NA	NA	NA	NA	NA	NA
Methyl mercury	NA	NA	NA	NA	NA	NA	NA	0.000209 J	NA	0.000062 UJ	NA	NA	NA	NA	NA	NA	NA
Elemental Mercury	NA	NA	NA	NA	NA	NA	NA	0.0003 U	NA	0.0003 U	NA	NA	NA	NA	NA	NA	NA

Table 5-6
Summary of May 2011 Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI5-104 AI5-104(2-6) 05/10/11 2-6 ft	AI5-105 AI5-105(2-6) 05/11/11 2-6 ft	AI5-106 AI5-106(2-6) 05/11/11 2-6 ft	AI5-107 AI5-107(2-6) 05/11/11 2-6 ft	AI5-108 AI5-108(2-6) 05/11/11 2-6 ft	AI5-109 AI5-109(2-6) 05/10/11 2-6 ft	AI5-110 AI5-110(2-6) 05/11/11 2-6 ft
Metals (mg/Kg)							
Aluminum	6260	7290	7220	8740	9770	8210	3660
Antimony	0.44 UJ	0.45 UJ	0.31 J	**1.1** J	0.25 J	0.41 UJ	0.46 UJ
Arsenic	2.4	2	2.3	1.6	3.5	2.3	2
Barium	32.5	43.6	43.3	68.3	43	36.6	102
Beryllium	0.33 U	0.44 J	0.5	0.53	0.51	0.36 U	0.29 J
Cadmium	0.088 U	0.091 U	0.09 U	0.087 U	0.15 J	0.21 J	0.093 U
Calcium	1260 J	1070	2570	1660	1900	14900 J	629
Chromium	15.8	20	15.7	24.9	19.8	12.5	11.4
Cobalt	5.3 J	4.9 J	5 J	9.3	6.6	3.1 J	5.9
Copper	12	15.7 J	32.9 J	17.4 J	24.3 J	13.8	16.3 J
Iron	13000	13400	14000	16900	20100	10200	14800
Lead	18.8 J	24.7 J	81.6 J	8.5 J	60.1 J	35.5 J	5.3 J
Magnesium	2200 J	2420	2300	3270	2450	2150 J	1170
Manganese	190	193 J	278 J	233 J	350 J	129	476 J
Nickel	11.9	14.2	13.5	25.7	18.1	10.4	13.6
Potassium	1030	1230	873	**2260**	837	431 J	712
Selenium	0.77 U	0.79 U	0.79 U	0.76 U	**0.45** J	0.72 U	0.81 U
Silver	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.12 U
Sodium	97.1 J	155 J	**410** J	**370** J	114 J	**356** J	100 J
Vanadium	20.6	20.7	17.4	28.7	24	16.3	11.5
Zinc	38.9 J	38.3 J	61.9 J	38.1 J	195 J	261 J	24.2 J
Mercury (mg/Kg)							
Mercury	NA	NA	NA	NA	NA	NA	NA
Methyl mercury	NA	NA	NA	NA	NA	NA	NA
Elemental Mercury	NA	NA	NA	NA	NA	NA	NA

New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR), Chapter IV, Subpart 375-6 Remedial ProgramSoil Cleanup Objectives

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
[box] indicates concentration is above the Industrial RSL
[green] indicates concentration is above the Unrestricted NYSDEC SCO
[blue] indicates concentration is above the Residential NYSDEC SCO
[yellow] indicates concentration is above the Restricted Residential NYSDEC SCO
[orange] indicates concentration is above the Commercial NYSDEC SCO
[pink] indicates concentration is above the Industrial NYSDEC SCO

mg/Kg = milligram per kilogram
U = not detected, value is the limit of detection
J = value is estimated
NA = sample was not analyzed for that analyte.
NC = no criteria available
blank cells - indicate analyte wan not analyzed for in that sample

United States Environmental Protection Agency Regions 3, 6, and 9. 2011.
Regional Screening Levels for Chemical Contaminants at Superfund Sites.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June 2011.

c = RSL is based on an excess lifetime cancer risk of 1 in 1 million.
c* = where n RSL < 100X c RSL.
c** = where n RSL < 10X c RSL.
n = RSL is based on a non-cancer hazard quotient of 1.
nL = U.S. EPA used an Integrated Exposure Uptake Biokinetic (IEUBK) model to derive a residential soil value for lead based on predictions of blood lead concentrations in children (http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf).
nm = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit.
ns = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
nms = RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed ceiling limit and concentration may exceed Csat.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/02/11

Table 5-7
Summary of May 2011 Analytical Results in Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	NYS Class A GW	MW-1 5/9/2011	MW-2 5/9/2011	MW-3 5/9/2011	MW-4R 5/9/2011	MW-5 5/9/2011
Volatile Organics (mg/L)						
Chloroform	0.007	0.0015 U	0.014	0.0015 U	0.014 J	0.0015 U
Polyaromatic Hydrocarbons (mg/L)						
Benzo(a)anthracene	0.000002	0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00022
Benzo(a)pyrene		0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00018 J
Benzo(b)fluoranthene	0.000002	0.000028 U	0.000028 U	0.000029 U	0.000033 J	0.00024
Benzo(ghi)perylene		0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00031
Benzo(k)fluoranthene	0.000002	0.000095 U	0.000094 U	0.000096 U	0.000095 U	0.00028
Chrysene	0.000002	0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00023
Dibenz(a,h)anthracene		0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00026
Fluoranthene	0.05	0.000028 U	0.000028 U	0.000029 U	0.000044 J	0.00004 J
Indeno(1,2,3-cd)pyrene	0.000002	0.000028 U	0.000028 U	0.000029 U	0.000028 U	0.00027
Pyrene	0.05	0.000028 U	0.000028 U	0.000029 U	0.000037 J	0.000044 J
Metals, Total (mg/L)						
Aluminum		0.0729 J	0.0641 J	0.0661 J	0.111 J	0.0656 J
Barium	1	0.0488 J	0.0066 J	0.0555 J	0.0509 J	0.0471 J
Calcium		17	12.4	52.5	72.1	26.3
Chromium	0.05	0.0025 U	0.0013 J	0.0059	0.0043 J	0.001 J
Cobalt		0.0025 U	0.0025 U	0.0025 U	0.0008 J	0.0025 U
Copper	0.2	0.005 U	0.005 U	0.005 U	0.0133 J	0.005 U
Iron	0.3	0.04 U	0.04 U	0.04 U	0.108 J	0.04 U
Lead	0.025	0.003 U	0.003 U	0.003 U	0.0018 J	0.003 U
Magnesium	35	9.44	4.08 J	22.4	22.3	17.1
Manganese	0.3	0.0038 J	0.002 U	0.002 U	0.0083 J	0.0199
Mercury	0.0007	0.000075 U	0.000075 U	0.000075 U	0.000039 J	0.000075 U
Nickel	0.1	0.0041 J	0.003 U	0.003 U	0.0133 J	0.0076 J
Potassium		2 J	0.948 J	1.66 J	3.42 J	1.36 J
Sodium	20	31.7	7.02	9.83	85.6	36.6
Zinc	2	0.012 U	0.012 U	0.012 U	0.0326	0.012 U

mg/L = milligram per Liter
U = not detected, value is the limit of detection
J = value is estimated

blank cells - indicate analyte was not analyzed for in that sample
indicates concentration is above the NYS Class A GW Standard

Table 5-8
Summary of November 2012 Analytical Results in Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	NYS Class A GW	MW-4R MW-4R-FIL 11/28/2012	MW-4R MW-4R-UNF 11/28/2012	MW-5 MW-5-FIL 11/28/2012	MW-5 MW-5-UNF 11/28/2012	MW-5 FD-01 11/28/2012
Polyaromatic Hydrocarbons (mg/L)						
1-Methylnaphthalene		0.000048UJ	0.000044UJ	0.000049UJ	0.000046UJ	0.000049UJ
2-Methylnaphthalene		0.000026U	0.000033U	0.000037U	0.000034U	0.000037U
Acenaphthene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Acenaphthylene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Anthracene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Benzo(a)anthracene	0.000002	0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Benzo(a)pyrene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Benzo(b)fluoranthene	0.000002	0.000048UJ	0.000044UJ	0.000049UJ	0.000046UJ	0.000049UJ
Benzo(ghi)perylene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Benzo(k)fluoranthene	0.000002	0.00012U	0.00011U	0.00012U	0.00011U	0.00012U
Chrysene	0.000002	0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Dibenz(a,h)anthracene		0.000048UJ	0.000044UJ	0.000049UJ	0.000046UJ	0.000049UJ
Fluoranthene	0.05	0.000048U	0.000044U	0.000049U	0.000039J	0.000049U
Fluorene		0.00006U	0.000056U	0.000061U	0.000057U	0.000062U
Indeno(1,2,3-cd)pyrene	0.000002	0.00006UJ	0.000056UJ	0.000061UJ	0.000057UJ	0.000062UJ
Naphthalene		0.000048U	0.000044U	0.000049U	0.000046U	0.000049U
Phenanthrene		0.00009U	0.000083U	0.000091U	0.000086U	0.000093U
Pyrene	0.05	0.000048U	0.000044U	0.000049U	0.000032J	0.000049U

Notes:
mg/L = milligram per Liter
U = not detected, value is the limit of detection
J = value is estimated

FIL = field filtered
UNF = not field filtered
FD-01 = field duplicate sample

SECTION 6

Table 6-1
Summary of Analytical Results in Soil - Area 1
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Average of All Samples	Background Shallow	Background Deep	NYS SCO Unrestricted	NYS SCO Residential	NYS SCO Residential Restricted	NYS SCO Commercial	NYS SCO Industrial	USEPA RSL Residential	USEPA RSL Industrial	FLA-09 FLA-SB-09-01 08/01/98 0-0.5 ft	FLA-09 FLA-SB-09-02 08/01/98 0-0.5 ft	FLA-10 FLA-SB-10-01 08/01/98 0-0.5 ft	FLA-11 FLA-SB-11-01 08/01/98 0-0.5 ft	FLA-12 FLA-SB-12-01 08/01/98 0-0.5 ft
Volatile Organics (mg/kg)																		
2-Butanone	2 / 9	0.0092 : 0.72	0.0028 - 0.01	0.082	--	--	0.12	100	100	500	1000	28000 n	200000 nms					
Acetone	8 / 9	0.033 : 0.033	0.0057 - 0.7	0.15	--	--	0.05	100	100	500	1000	61000 n	630000 nms					
Benzene	2 / 9	0.0046 : 0.36	0.0032 - 0.0043	0.041	--	--	0.06	2.9	4.8	44	89	1.1 c*	5.4 c*					
Carbon disulfide	1 / 9	0.0046 : 0.36	0.01 - 0.01	0.041	--	--	NC	NC	NC	NC	NC	820 ns	3700 ns					
Toluene	1 / 9	0.0046 : 0.36	0.0022 - 0.0022	0.040	--	--	0.7	100	100	500	1000	5000 ns	45000 ns					
Trichloroethene	1 / 9	0.0046 : 0.36	0.0033 - 0.0033	0.041	--	--	0.47	10	21	200	400	2.8 c**	14 c**					
Vinyl chloride	1 / 9	0.0046 : 0.36	0.01 - 0.01	0.041	--	--	0.02	0.21	0.9	13	27	0.06 c	1.7 c					
Semivolatile Organics (mg/kg)																		
1,2-Dichlorobenzene	1 / 17	0.00402 : 0.44	0.0061 - 0.0061	0.10	--	--	1.1	100	100	500	1000	1900 ns	9800 ns					
2-Methylnaphthalene	8 / 14	0.033 : 0.44	0.042 - 0.15	0.078	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns					
4-Chloro-3-methylphenol	7 / 18	0.033 : 0.44	0.0064 - 0.015	0.099	--	--	NC	NC	NC	NC	NC	6100 n	62000 n					
4-Methylphenol	1 / 18	0.00278 : 0.44	0.0078 - 0.0078	0.10	--	--	0.33	34	100	500	1000	310 n	3100 n					
Acenaphthene	10 / 19	0.033 : 0.44	0.029 - 0.49	0.15	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n					
Acenaphthylene	12 / 18	0.033 : 0.43	0.014 - 0.053	0.060	0.02767	0.02874	100	100	100	500	1000	NC	NC					
Anthracene	21 / 23	0.033 : 0.0406	0.012 - 0.88	0.19	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm	0.13 J	0.14 J	0.14 J		
Benzo(a)anthracene	25 / 26	0.033 : 0.033	0.089 - 1.48	0.51	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	**0.53**	**0.58**	0.5	0.26 J	0.18 J
Benzo(a)pyrene	24 / 26	0.033 : 0.0406	0.093 - 1.28	0.47	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	**0.52**	**0.57**	**0.6**	0.31 J	0.22 J
Benzo(b)fluoranthene	24 / 26	0.66 : 0.66	0.073 - 2.2	0.60	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	0.7	**0.78**	**0.85**	0.39 J	0.32 J
Benzo(ghi)perylene	23 / 26	0.033 : 0.56	0.069 - 0.84	0.31	0.2324	0.2015	100	100	100	500	1000	NC	NC	**0.36** J	**0.43**	**0.31** J	0.23 J	0.13 J
Benzo(k)fluoranthene	22 / 26	0.0406 : 0.66	0.068 - 0.43	0.21	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c	**0.27** J	**0.26** J	**0.33** J	0.15 J	0.12 J
Bis(2-Ethylhexyl)phthalate	21 / 23	0.0406 : 2	0.038 - 1.8	0.27	0.61	0.0869	NC	NC	NC	NC	NC	35 c*	120 c			0.084 J		0.11 J
Butylbenzylphthalate	6 / 19	0.00209 : 0.44	0.023 - 0.089	0.087	0.2359	0.03433	NC	NC	NC	NC	NC	260 c*	910 c					
Carbazole	11 / 17	0.033 : 0.43	0.038 - 0.22	0.095	--	0.06649	NC	NC	NC	NC	NC	NC	NC					
Chrysene	25 / 26	0.033 : 0.033	0.11 - 1.48	0.53	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	**0.57**	**0.64**	**0.59**	0.33 J	0.25 J
Dibenz(a,h)anthracene	11 / 22	0.0184 : 0.66	0.055 - 0.25	0.16	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c	**0.11** J	**0.12** J	**0.11** J		
Dibenzofuran	9 / 19	0.033 : 0.44	0.011 - 0.28	0.10	--	--	7	14	59	350	1000	78 n	1000 ns					
Di-n-butylphthalate	10 / 18	0.0406 : 0.44	0.035 - 0.36	0.18	0.08313	0.01057	NC	NC	NC	NC	NC	6100 n	62000 n					
Fluoranthene	25 / 26	0.033 : 0.033	0.11 - 3.26	0.87	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	**0.84**	**0.94**	**0.86**	0.37 J	0.33 J
Fluorene	12 / 19	0.033 : 0.43	0.026 - 0.58	0.13	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n					
Indeno(1,2,3-cd)pyrene	23 / 25	0.0119 : 0.0406	0.086 - 1	0.35	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	**0.28** J	**0.36** J	**0.31** J	**0.23** J	0.15 J
Naphthalene	20 / 24	0.033 : 0.35	0.0099 - 0.38	0.099	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*	0.1 J	0.11 J	0.12 J	0.13 J	
Phenanthrene	24 / 25	0.033 : 0.033	0.056 - 2.7	0.70	0.7072	1.448	100	100	100	500	1000	NC	NC	0.61	0.69	0.51	0.23 J	0.15 J
Pyrene	25 / 26	0.033 : 0.033	0.089 - 2.7	0.95	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	0.98	**1.1**	0.97	0.46	0.35 J
Metals (mg/kg)																		
Aluminum	29 / 29		3950 - 17500	7183	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	6580	5340	4400	5690	7750
Antimony	29 / 29		0.19 - 8.9	2.1	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	**1.8** N	1.5 N	**2.6** N	**1.9** N	1 N
Arsenic	27 / 27		0.21 - 10.1	6.0	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	5.5	4.5	6.7	6.8	5.7
Barium	29 / 29		30.9 - 449	196	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	**192**	**142**	**283**	**258**	110
Beryllium	26 / 29	0.0267 : 0.0267	0.095 - 0.78	0.31	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.43 B	0.31 B	0.37 B	0.43 B	0.37 B
Cadmium	23 / 23		0.06 - 2.6	1.2	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n	1	0.33 B	0.92	1.1	
Calcium	29 / 29		1310 - 29700	9090	12100	16223	NC	NC	NC	NC	NC	NC	NC	6750 X	**27700** X	4890 X	6590 X	2980 X
Chromium	29 / 29		11.7 - 33.5	23	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	18.8 X	15.7 X	23.4 X	27.8 X	21.3 X
Cobalt	29 / 29		3.7 - 10.1	6.6	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	5.7 B	4.8 B	5.4 B	6.4	7.1
Copper	29 / 29		11.8 - 346	113	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	**108**	49.1	**198**	**115**	30.1
Iron	29 / 29		6780 - 34800	22106	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	**26700**	20000	**26400**	**34300**	16100
Lead	29 / 29		2.8 - 1540	523	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	352	266	**566**	**700**	222
Magnesium	29 / 29		1780 - 14000	4229	4802	4433	NC	NC	NC	NC	NC	NC	NC	2960 N	2660 N	2500 N	3740 N	2770 N
Manganese	29 / 29		87.3 - 618	290	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	276	229	238	259	296
Nickel	29 / 29		12.8 - 31.5	20	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	17.2	13.8	19.6	21.6	20.1
Potassium	29 / 29		716 - 3520	1194	1286	2194	NC	NC	NC	NC	NC	NC	NC	872 E	833 E	756 E	1030 E	**1700** E
Selenium	19 / 20	1.65 : 1.65	0.14 - 1.7	0.70	--	0.439	3.9	36	180	1500	6800	390 n	5100 n	0.25 B			0.3 B	
Silver	9 / 22	0.19 : 2.7	0.18 - 1	0.38	--	0.211	2	36	180	1500	6800	390 n	5100 n			0.47 B	0.55 B	0.18 B
Sodium	28 / 29	31.4 : 31.4	80 - 230	157	250	277.2	NC	NC	NC	NC	NC	NC	NC	198	153	172	214	138
Thallium	15 / 24	0.17 : 6	0.11 - 2.9	0.47	--	0.892	NC	NC	NC	NC	NC	0.78 n	10 n			0.11 B	0.15 B	0.18 B
Vanadium	29 / 29		13.9 - 33.8	24	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	25.2	22.4	21.2	23.7	33
Zinc	29 / 29		19.2 - 850	351	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	**325**	224	**494**	**488**	148
Mercury (mg/Kg)																		
Mercury	29 / 29		0.01 - 2.5	0.77	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	**1.5**	0.8	**1.3**	0.95	0.72
Mercury, Inorganic Salts	29 / 29		0.01 - 2.5	0.77	--	--	0.12	1.2	5.8	47	220	23 n	310 n	1.5	0.8	1.3	0.95	0.72

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.
Only results above Background, NYSDEC SCO's, or USEPA RSL's are listed

Table 6-1
Summary of Analytical Results in Soil - Area 1
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	FLA-13	FLA-46	FLA-47	FLA-48	FLA-48	FLA-48	FLA-49	FLA-50	FLA-51	FLA-52	B-10	B-10	B-11	B-11	B-11	B-11	FLA-09
	FLA-SB-13-01	FLA-SS-46-01	FLA-SS-47-01	FLA-SS-48-01	FSS-SS-48-22	FSS-SS-48-33	FLA-SS-49-01	FLA-SS-50-01	FLA-SS-51-01	FLA-SS-52-01	Ad2004-SS-10-SH	Ad2004-SS-30-SH	Ad2004-SS-11-SH	Ad2004-SS-13-SH	Ad2004-SS-31-SH	Ad2004-SS-B11-SH	FLA-SB-09-05
	08/01/98	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	06/21/04	06/21/04	06/21/04	06/21/04	06/21/04	08/26/04	08/01/98
Parameter	0-0.5 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-1 ft	0-1 ft	0-1 ft	0-1 ft	0-1 ft	0-1 ft	15-16 ft
Volatile Organics (mg/kg)																	
2-Butanone																	0.013 U
Acetone																	0.033 U
Benzene																	0.0065 U
Carbon disulfide																	0.0065 U
Toluene																	0.0065 U
Trichloroethene																	0.0065 U
Vinyl chloride																	0.0065 U
Semivolatile Organics (mg/kg)																	
1,2-Dichlorobenzene		0.35 U	0.44 U	0.42 U	0.4 U		0.43 U	0.43 U	0.43 U	0.39 U	0.033 U		0.00402 U	0.0406 U	0.00402 U	0.00436 U	
2-Methylnaphthalene	0.082 J	0.35 U	0.44 U	0.057 J	0.057 J	0.063 U	0.053 J	0.088 J	0.083 J	0.042 J	0.033 U						
4-Chloro-3-methylphenol		0.35 U	0.44 U	0.42 U	0.4 U	0.07 U	0.43 U	0.43 U	0.43 U	0.39 U	0.0067 J		0.0079 J	0.0406 U	0.015 J	0.0066 J	
4-Methylphenol		0.35 U	0.44 U	0.42 U	0.4 U	0.16 U	0.43 U	0.43 U	0.43 U	0.39 U	0.033 U		0.00586 U	0.0406 U	0.00586 U	0.00278 U	
Acenaphthene		0.35 U	0.44 U	0.13 J	0.081 J	0.49 B	0.43 U	0.43 U	0.43 U	0.39 U	0.033 U		0.046	0.0406 U	0.19	0.029 J	
Acenaphthylene		0.048 J	0.053 J	0.047 J	0.4 U	0.071 U	0.052 J	0.43 U	0.047 J	0.39 U	0.016 J		0.024 J	0.0406 U	0.038	0.022 J	
Anthracene	0.11 J	0.051 J	0.14 J	0.23 J	0.24 J	0.69 B	0.086 J	0.072 J	0.14 J	0.068 J	0.012 J		0.16	0.0406 U	0.54	0.11	
Benzo(a)anthracene	0.35 J	0.27 J	0.44	0.77	0.79	1.48 B	0.32 J	0.31 J	0.54	0.26 J	0.089		0.55	0.411	1.4	0.34	
Benzo(a)pyrene	0.38 J	0.33 J	0.48	0.87	0.83	1.28 B	0.39 J	0.36 J	0.55	0.29 J	0.14		0.37	0.0406 U	1.2	0.31	
Benzo(b)fluoranthene	0.48	0.39	0.67	1.1	1	2.2 B	0.54	0.4 J	0.83	0.46	0.073		0.5	0.615	0.66 JN	0.36	
Benzo(ghi)perylene	0.31 J	0.2 J	0.34 J	0.63	0.53	0.84 B	0.26 J	0.31 J	0.43 J	0.24 J	0.069 J		0.36	0.0406 U	0.56 JN	0.2	
Benzo(k)fluoranthene	0.19 J	0.17 J	0.25 J	0.43	0.39 J	0.052 U	0.19 J	0.19 J	0.27 J	0.16 J	0.068 J		0.092 J	0.0406 U	0.3 JN	0.23	
Bis(2-Ethylhexyl)phthalate	0.2 J	0.038 J	0.21 J	0.098 J	0.072 J	2 U	0.11 J	0.11 J	1.8	0.45	0.053 J		0.39	0.0406 U	0.34	0.12	
Butylbenzylphthalate		0.35 U	0.44 U	0.42 U	0.4 U	0.056 U	0.43 U	0.43 U	0.073 J	0.061 J	0.024 J		0.078	0.0406 U	0.00824 U	0.00209 U	
Carbazole		0.35 U	0.046 J	0.12 J	0.14 J		0.43 U	0.43 U	0.098 J	0.042 J	0.033 U		0.068	0.0406 U	0.22	0.038	
Chrysene	0.45	0.33 J	0.53	0.81	0.88	1.48 B	0.38 J	0.35 J	0.66	0.36 J	0.12 J		0.54 J	0.482	1.3	0.31	
Dibenz(a,h)anthracene	0.1 J	0.35 U	0.44 U	0.18 J	0.17 J	0.25 B	0.43 U	0.43 U	0.11 J	0.39 U	0.66 U		0.0184 U	0.0406 U	0.078 JN	0.055 J	
Dibenzofuran		0.35 U	0.44 U	0.049 J	0.047 J	0.073 U	0.43 U	0.43 U	0.43 U	0.39 U	0.033 U		0.017 J	0.0406 U	0.13	0.011 J	
Di-n-butylphthalate		0.35 U	0.44 U	0.043 J	0.053 J	0.046 U	0.43 U	0.43 U	0.43 U	0.39 U	0.34		0.35	0.0406 U	0.066	0.26	
Fluoranthene	0.53	0.42	0.75	1.2	1.2	3.26	0.46	0.41 J	1.1	0.45	0.16		1	0.818	2.7	0.61	
Fluorene		0.35 U	0.052 J	0.092 J	0.085 J	0.36 B	0.43 U	0.43 U	0.055 J	0.39 U	0.033 U		0.045	0.0406 U	0.25	0.026 J	
Indeno(1,2,3-cd)pyrene	0.29 J	0.21 J	0.4 J	0.7	0.59	0.94 B	0.3 J	0.26 J	0.42 J	0.24 J	0.086 J		0.39 J	0.0406 U	1 JN	0.2	
Naphthalene	0.16 J	0.35 U	0.085 J	0.16 J	0.14 J	0.38 B	0.11 J	0.15 J	0.065 J	0.044 J	0.033 U		0.019 J	0.0406 U	0.13	0.0099 J	
Phenanthrene	0.46	0.28 J	0.5	0.94	1	2.66	0.28 J	0.26 J	0.7	0.33 J	0.056		0.49	0.596	2.5	0.3	
Pyrene	0.75	0.55	0.81	1.4	1.5	2.66	0.55	0.58	1.1	0.73	0.16 J		0.95	0.81	2.6	0.5	
Metals (mg/kg)																	
Aluminum	5740	8380	5210	5130	4490	7530	5410	4780	4520	4800	12700	12600	8460	8310 J	8190		
Antimony	2.1 N	0.48 BN	3.7 N	1.3 N	0.98 N	1.9 B	0.96 N	0.96 N	0.71 N	0.35 N	0.73	0.77	6.3	4.1	2.6		
Arsenic	7.3	4.4	5.7	9.5	7.4	10.1	7.8	6.5	6.2	2.8	4	4.1	6.7	8.53	6.8		
Barium	316	69.4	133	232	186	318	185	241	77.7	99.6	256	220	449	180 J	268		
Beryllium	0.46 B	0.4 B	0.3 B	0.42 B	0.33 B	0.78	0.54 B	0.33 B	0.23 B	0.19 B	0.19 J	0.29 J	0.0267 U	0.447	0.0267 U		
Cadmium	0.54 B	0.16 B	1.6	1.5	1.3	2.08	0.7	0.93	1	0.65	1.4	1.3	2.4	2.03	2.6		
Calcium	5750 X	1800	22500	4530	22700	5670	15300	5390	10800	7500	3810	3520	13100	29700 J	13700		
Chromium	26.1 X	17.8	17	26.7	22.8	31.8	17.9	20.8	14.6	11.7	19	19 J	30	30.6	32 J		
Cobalt	6.7	6.2	5.3 B	7.5	5.2 B	8.6	4.8 B	5.5 B	3.7 B	4.2 B	7.4	7.7	8.2	7.4 J	7.8		
Copper	103	49.9 E	157 E	156 E	122 E	174	72.9 E	87.9 E	38.3 E	34 E	36	38	346	287	315		
Iron	27400	14000	18200	23500	20100	34800	31800	20500	10600	10800	16700	18200	28600	25100 J	25000		
Lead	743	168 N	649 N	595 N	483 N	714	448 N	550 N	236 N	252 N	1540	642	1160	1020 J	1090		
Magnesium	2900 N	2440	4750	2460	13100	2950	3590	1970	3390	4050	2960	3450	4280	14000 J	4640		
Manganese	250	212 N	454 N	300 N	216 N	314	223 N	231 N	271 N	240 N	536	618	379	293 J	350		
Nickel	21.3	15	21.5	22.2	17.3	27.1	19	20.3	16	12.8	24 J	21 J	26 J	24.8 J	25 J		
Potassium	867 E	1180	1580	885	795	1180	1070	892	716	1170	1310 J	1230	1380 J	1200 J	1260		
Selenium		0.39 B	0.41 B	0.62	0.56 B	1.3 B	0.52 B	0.8	1.1	0.63	0.67 J	0.7 J	0.7 J	1.7	0.75 J		
Silver	0.23 B	0.19 U	0.19 U	0.57 B	0.3 B	1	0.19 U	0.19 U	0.19 U	0.19 U	0.362 U	0.45 U	0.66 J	1 R	2.7 U		
Sodium	177	148	201	188	168	230	137	165	143	120 B	80	101	111	177 J	121		
Thallium	0.13 B	0.17 U	0.2 U	0.18 U	0.18 U	6 U	0.19 U	0.19 U	0.19 U	0.18 U	0.14 J	0.17 J	0.15 J	2.9	0.14 J		
Vanadium	24	21.5	19.9	22.1	18.4	33.8	28.3	20	24.6	18.5	24 J	23 J	30 J	27.5 J	30 J		
Zinc	386	101	355	458	379	535	295	369	230	340	480	470	564	498 J	581		
Mercury (mg/Kg)																	
Mercury	1.1	0.99	0.52	0.92	0.82	0.729	0.63	0.74	0.69	0.25	2.4	2.5	0.57	0.566	0.53		
Mercury, Inorganic Salts	1.1	0.99	0.52	0.92	0.82	0.729	0.63	0.74	0.69	0.25	2.4	2.5	0.57	0.566	0.53		

Watermark

Table 6-1
Summary of Analytical Results in Soil - Area 1
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	FLA-09	FLA-10	FLA-10	FLA-11	FLA-11	FLA-11	FLA-12	FLA-12	FLA-13	B-10	B-11	B-11	B-11	B-11
	FLA-SB-09-07	FLA-SB-10-02	FLA-SB-10-03	FLA-SB-11-02	FLA-SB-11-03	FLA-SB-11-05	FLA-SB-12-02	FLA-SB-12-03	FLA-SB-13-03	Ad2004-SS-10-DP	Ad2004-SS-11-DP	Ad2004-SS-13-DP	Ad2004-SS-31-DP	Ad2004-SS-B11-DP
	08/01/98	08/01/98	08/01/98	08/01/98	08/01/98	08/01/98	08/01/98	08/01/98	08/01/98	06/21/04	06/21/04	06/21/04	06/21/04	08/26/04
Parameter	20-21 ft	2-3 ft	16-18 ft	2-3 ft	2-3 ft	16-18 ft	2-3 ft	14-15 ft	17-17.5 ft	1-2 ft	1-2 ft	1-2 ft	1-2 ft	1-2 ft
Volatile Organics (mg/kg)														
2-Butanone	0.012 U	0.011 U	0.0093 U	0.67 U	0.72 U	0.0028 J	0.01 J		0.0092 U					
Acetone	0.012 J	0.021 B	0.0057 J	0.41 J	0.7 J	0.024	0.125		0.0084 J					
Benzene	0.006 U	0.0053 U	0.0047 U	0.33 U	0.36 U	0.0032 J	0.0043 J		0.0046 U					
Carbon disulfide	0.01	0.0053 U	0.0047 U	0.33 U	0.36 U	0.0053 U	0.0091 U		0.0046 U					
Toluene	0.006 U	0.0053 U	0.0047 U	0.33 U	0.36 U	0.0053 U	0.0022 J		0.0046 U					
Trichloroethene	0.006 U	0.0053 U	0.0047 U	0.33 U	0.36 U	0.0053 U	0.0033 J		0.0046 U					
Vinyl chloride	0.006 U	0.0053 U	0.0047 U	0.33 U	0.36 U	0.0053 U	0.01		0.0046 U					
Semivolatile Organics (mg/kg)														
1,2-Dichlorobenzene										0.033 U	0.0061 J		0.00402 U	0.00436 U
2-Methylnaphthalene						**0.15** J				0.033 U	0.033 U			
4-Chloro-3-methylphenol										0.033 U	0.0078 J		0.0092 J	0.0064 J
4-Methylphenol										0.033 U	0.033 U		0.0078 J	0.00278 U
Acenaphthene						**0.37** J				0.033 U	0.049		**0.057**	**0.068** J
Acenaphthylene										0.033 U	0.024 J		0.016 J	0.014 J
Anthracene						**0.88**				0.033 U	0.13		0.11	0.18 J
Benzo(a)anthracene	0.093					**1.1**				0.033 U	*0.56*		*0.51*	*0.54* J
Benzo(a)pyrene	*0.093*					**0.77**				0.033 U	*0.57*		*0.35*	*0.38* J
Benzo(b)fluoranthene	0.092					**1**				0.66 U	*0.49*		*0.26*	*0.35* J
Benzo(ghi)perylene	0.12					**0.43**				0.033 U	**0.4**		**0.24**	**0.25** J
Benzo(k)fluoranthene	0.094					**0.36** J				0.66 U	0.19 J		0.22	0.3 J
Bis(2-Ethylhexyl)phthalate	**0.094**					**0.19** J				**0.32**	**0.15**		**0.19**	**0.1** J
Butylbenzylphthalate	**0.089**									0.023 J	0.033 U		0.00824 U	0.00209 U
Carbazole										0.033 U	0.053		**0.068**	0.065 J
Chrysene	0.11					**1.2**				0.033 U	0.41 J		0.38	0.43
Dibenz(a,h)anthracene										0.66 U	0.66 U		**0.09**	**0.068** J
Dibenzofuran						0.28 J				0.033 U	0.015		0.016 J	0.03 J
Di-n-butylphthalate										**0.29**	**0.36**		**0.035**	**0.18** J
Fluoranthene	0.11 J					**1.9**				0.033 U	0.69		0.7	0.87
Fluorene						**0.58**				0.033 U	0.035		0.04	0.062
Indeno(1,2,3-cd)pyrene						**0.44**				0.0119 UJ	**0.46** J		*0.31*	*0.28*
Naphthalene						**0.16** J				0.033 U	**0.029** J		**0.022** J	**0.026** J
Phenanthrene						**2.7**				0.033 U	0.37		0.39	0.59
Pyrene	0.089 J					**2.7**				0.033 U	0.73 J		0.8	0.86
Metals (mg/kg)														
Aluminum	9170		4910			5070		3950	4830	**17500**	8970	8990	8900	
Antimony	**1.2** N		0.44 BN			**0.95** N		0.61 BN	0.58 BN	0.19 J	**8.9**	**3.12** J	**7.2**	
Arsenic	*0.67* B		0.21 B			*3.2*				*3.9*	**8.3**	**9.62**	**8.1**	
Barium	95.2		41.9			160		30.9	43.3	56	**358**	**341** J	**337**	
Beryllium	0.36 B		0.14 B			0.24 B		0.11 B	0.14 B	0.0267 U	0.095 J	0.657	0.26 J	
Cadmium										0.06 J	**1.3**	**1.48**	**1.3**	
Calcium	2840 X		2070 X			2250 X		2490 X	1460 X	1310	12300	10100 J	14100	
Chromium	29.4 X		14.8 X			19.5 X		17 X	13.1 X	24	**32**	**33.5** J	**31** J	
Cobalt	10.1		4 B			6.2		4.1 B	4.8 B	9.9	9.7	8.46 J	9.2	
Copper	23.6		11.8			**82.2**		14.4	14.2	15	**271**	**164**	**178**	
Iron	21400		11400			17600		11000	6780	**29200**	**34100**	**29300** J	**31500**	
Lead	12.5		3.6			155		2.8	7.9	26	**1060**	**753** J	**737**	
Magnesium	**4990** N		2110 N			1780 N		2330 N	2090 N	3370	**6640**	**6160** J	**7620**	
Manganese	240		141			318		87.3	257	349	296	245 J	302	
Nickel	31.5		17			23.1		16.1	15.2	17 J	21 J	24	21 J	
Potassium	**3520** E		1270 E			1100 E		1190 E	1310 E	1510 J	1040 J	868	912	
Selenium										0.14 J	**0.86** J	1.65 U	**0.85** J	
Silver										0.362 U	**0.39** J	**0.638** R	1.5 U	
Sodium	206		163			159		144	170	31.4 U	195	183 J	166	
Thallium	0.23 B								0.11 B	0.13 J	0.13 J	**2.76**	0.14 J	
Vanadium	30.3		15.8			18.8		14.9	13.9	31 J	29 J	29.3 J	30 J	
Zinc	49.3		19.2			**850**		19.3	29.4	50	**478**	**539** J	**435**	
Mercury (mg/Kg)														
Mercury	0.05		0.01			0.09		0.02	0.03	0.097 J	1	0.837	0.86	
Mercury, Inorganic Salts	0.05		0.01			0.09		0.02	0.03	0.097 J	1	0.837	0.86	

Notes:
mg/Kg = milligram per kilogram
U = not detected
J = value is estimated
R = value is rejected
N = Spike sample recovery not within control limits
B = Analyte was detected in the method blank
* = Duplicate analysis not within control limit
D = Concentration reported from a secondary dilution
E = Compound exceeded the calibration range of the instrument
X = Defined by the laboratory
P = Value from a Gas Chromatograph (GC) analysis when there is greater than 25% difference between the two GC columns

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Commercial NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO
NC = no criteria available
blank cells - Indicate analyte was not analyzed for in that sample.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/01/11

Table 6-2
Summary of Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineering School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Average of All Samples	Background Shallow	Background Deep	New York State Soil Cleanup Objectives Unrestricted	NYS SCO Residential	NYS SCO Residential Restricted	NYS SCO Commercial	NYS SCO Industrial	USEPA Regional Screening Levels Residential	USEPA RSL Industrial	SB-04 FSS-SB-04-01 08/01/98 0-0.5 ft	SB-05 FSS-SB-05-01 08/01/98 0-0.5 ft	624-SS-01 624-SS-01-01 08/26/98 0-0.5 ft	624-SS-02 624-SS-02-01 08/26/98 0-0.5 ft	624-SS-03 624-SS-03-01 08/26/98 0-0.5 ft	624-SS-03 624-SS-03-02 08/26/98 0-0.5 ft	624-SS-04 624-SS-04-01 08/26/98 0-0.5 ft
Volatile Organics (mg/kg)																				
Acetone	3 / 4	0.01 : 0.01	0.003 - 0.046	0.024	--	--	0.05	100	100	500	1000	61000 n	630000 nms							
Chloroform	1 / 4	0.0046 : 0.0051	0.0011 - 0.0011	0.0021	--	--	0.37	10	49	350	700	0.29 c	1.5 c							
Ethyl benzene	2 / 4	0.0046 : 0.0049	0.0016 - 0.0026	0.0022	--	--	1	30	41	390	780	5.4 c	27 c							
Semivolatile Organics (mg/kg)																				
1-Methylnaphthalene	18 / 26	0.0012 : 0.037	0.001 - 0.024	0.0065	--	--	NC	NC	NC	NC	NC	22 c	99 c							
2-Methylnaphthalene	24 / 43	0.0012 : 0.46	0.0011 - 0.11	0.059	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns		0.11 J					
4-Chloro-3-methylphenol	1 / 17	0.033 : 0.52	0.0096 - 0.0096	0.17	--	--	NC	NC	NC	NC	NC	6100 n	62000 n							
4-Methylphenol	1 / 17	0.00586 : 0.46	0.055 - 0.055	0.16	--	--	0.33	34	100	500	1000	310 n	3100 n							
Acenaphthene	19 / 43	0.0011 : 0.52	0.00087 - 0.035	0.073	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n							
Acenaphthylene	27 / 44	0.002 : 0.46	0.0025 - 0.41	0.086	0.02767	0.02874	100	100	100	500	1000	NC	NC		**0.19** J					
Anthracene	32 / 44	0.0012 : 0.46	0.00098 - 0.24	0.076	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm		**0.24** J					
Benzo(a)anthracene	44 / 45	0.033 : 0.033	0.0041 - 1.6	0.20	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	0.082 J	**1.5**					
Benzo(a)pyrene	44 / 45	0.033 : 0.033	0.0036 - 1.6	0.22	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	0.09 J	**1.6**					
Benzo(b)fluoranthene	44 / 45	0.066 : 0.066	0.006 - 2.2	0.31	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	0.14 J	**2.2**					
Benzo(ghi)perylene	41 / 45	0.00934 : 0.42	0.0026 - 1.2	0.18	0.2324	0.2015	100	100	100	500	1000	NC	NC	0.1 J	**1.2**					
Benzo(k)fluoranthene	28 / 44	0.0018 : 0.066	0.013 - 0.92	0.10	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c		**0.92**					
Bis(2-Ethylhexyl)phthalate	20 / 20		0.021 - 17	1.5	0.61	0.0869	NC	NC	NC	NC	NC	35 c*	120 c	0.087 J	0.35 J					
Butylbenzylphthalate	13 / 18	0.00824 : 0.4	0.012 - 0.3	0.094	0.2359	0.03433	NC	NC	NC	NC	NC	260 c*	910 c		0.15 J					
Carbazole	6 / 17	0.00799 : 0.46	0.034 - 0.1	0.12	--	0.06649	NC	NC	NC	NC	NC	NC	NC							
Chrysene	43 / 45	0.033 : 0.38	0.0034 - 1.9	0.24	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	0.12 J	**1.9**					
Dibenz(a,h)anthracene	26 / 43	0.0024 : 0.66	0.0036 - 0.28	0.096	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c							
Di-n-butylphthalate	5 / 17	0.34 : 0.46	0.033 - 0.34	0.19	0.08313	0.01057	NC	NC	NC	NC	NC	6100 n	62000 n							
Fluoranthene	44 / 45	0.033 : 0.033	0.0044 - 2	0.33	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	0.13 J	**2**					
Fluorene	18 / 43	0.0019 : 0.52	0.0016 - 0.027	0.074	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n							
Indeno(1,2,3-cd)pyrene	42 / 45	0.0119 : 0.033	0.0031 - 1.3	0.17	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	0.097 J	**1.3**					
Naphthalene	25 / 44	0.0012 : 0.46	0.0021 - 0.19	0.064	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*		0.11 J					
Phenanthrene	44 / 45	0.033 : 0.033	0.0027 - 1	0.16	0.7072	1.448	100	100	100	500	1000	NC	NC	0.1 J	**1**					
Phenol	1 / 16	0.033 : 0.52	0.069 - 0.069	0.17	--	--	0.33	100	100	500	1000	18000 n	180000 nm							
Pyrene	45 / 45		0.0037 - 2.9	0.35	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	0.17 J	**2.9**					
Pesticides (mg/kg)																				
4,4`-DDD	2 / 3	0.2 : 0.2	0.02 - 0.071	0.064	--	--	0.0033	2.6	13	92	180	2 c	7.2 c			U	U	U	U	U
4,4`-DDE	2 / 3	0.2 : 0.2	0.022 - 0.044	0.055	--	--	0.0033	1.8	8.9	62	120	1.4 c	5.1 c			U	U	U	U	U
4,4`-DDT	10 / 10		0.2 - 1.4	0.73	--	--	0.0033	1.7	7.9	47	94	1.7 c*	7 c*			1	1	0.79	1.4	0.2
Endrin aldehyde	1 / 3	0.0043 : 0.2	0.0082 - 0.0082	0.037	--	--	NC	NC	NC	NC	NC	NC	NC			U	U	U	U	U
Endrin ketone	2 / 3	0.2 : 0.2	0.013 - 0.032	0.048	--	--	NC	NC	NC	NC	NC	NC	NC			U	U	U	U	U
Gamma-BHC	2 / 3	0.2 : 0.2	0.0032 - 0.0052	0.036	--	--	NC	NC	NC	NC	NC	NC	NC			U	U	U	U	U
Gamma-Chlordane	1 / 3	0.0021 : 1	0.0087 - 0.0087	0.17	--	--	NC	NC	NC	NC	NC	NC	NC			U	U	U	U	U
Heptachlor epoxide	3 / 4	0.2 : 0.2	0.016 - 0.12	0.067	--	--	NC	NC	NC	NC	NC	0.053 c*	0.19 c*			U	U	U	U	U
Metals (mg/kg)																				
Aluminum	48 / 48		48 - 14400	7776	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	6300	5930					
Antimony	40 / 47	0.37 : 0.48	0.2 - 24.1	1.6	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	**1.8** N	1 N					
Arsenic	48 / 48		0.32 - 11.7	4.4	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	3	3.8					
Barium	48 / 48		48.7 - 295	94	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	**295**	73.4					
Beryllium	48 / 48		0.17 - 0.89	0.47	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.32 B	0.27 B					
Cadmium	42 / 45	0.081 : 0.096	0.033 - 1.9	0.43	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n		0.43 B					
Calcium	48 / 48		837 - 14600	4214	12100	16223	NC	NC	NC	NC	NC	NC	NC	2190 X	**13400** X					
Chromium	48 / 48		9 - 33.2	18.5	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	29.4 X	15.6 X					
Cobalt	48 / 48		3.7 - 12.2	6.1	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	4.9 B	4.3 B					
Copper	48 / 48		9.6 - 11500	297	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	47.3	43.1					
Iron	48 / 48		10000 - 23700	14485	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	12200	15600					
Lead	48 / 48		4.9 - 494	214	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	494	325					
Magnesium	48 / 48		916 - 7000	2827	4802	4433	NC	NC	NC	NC	NC	NC	NC	1740 N	**7000** N					
Manganese	48 / 48		84.8 - 617	337	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	152	265					
Nickel	48 / 48		12.5 - 33.7	17.9	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	16.5	14.7					
Potassium	48 / 48		403 - 4020	852	1286	2194	NC	NC	NC	NC	NC	NC	NC	515 E	706 E					
Selenium	32 / 46	0.65 : 0.99	0.19 - 1.5	0.57	--	0.439	3.9	36	180	1500	6800	390 n	5100 n	0.4 B	0.27 B					
Silver	13 / 44	0.093 : 1	0.085 - 0.45	0.13	--	0.211	2	36	180	1500	6800	390 n	5100 n							
Sodium	46 / 48	31.4 : 72.2	38 - 383	139	250	277.2	NC	NC	NC	NC	NC	NC	NC	152	206					
Thallium	4 / 46	0.13 : 6	0.1 - 0.23	0.50	--	0.892	NC	NC	NC	NC	NC	0.78 n	10 n							
Vanadium	48 / 48		17.7 - 61.7	27	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	26.9	25.5					
Zinc	48 / 48		25.4 - 301	133	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	110	213					
Mercury (mg/Kg)																				
Mercury	42 / 42		0.01 - 2.7	0.65	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	**2.3**	0.35					
Mercury, Inorganic Salts	22 / 22		0.01 - 2.7	0.72	--	--	0.12	1.2	5.8	47	220	23 n	310 n	2.3	0.35					
Methyl mercury	7 / 8	0.000063 : 0.000063	0.000083 - 0.011	0.0031	--	--	NC	NC	NC	NC	NC	7.8 n	100 n							
Elemental Mercury	0 / 8	0.0003 : 0.0004		0.00019	--	--	NC	NC	NC	NC	NC	NC	NC							

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.
Only results above Background, NYSDEC SCO's, or USEPA RSL's are listed

Table 6-2
Summary of Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineering School, Fort Totten
Queens, New York

	624-SS-05	624-SS-06	SS-18	SS-18	SS-18	SS-19	SS-20	SS-21	SS-22	SS-23	SS-24	SS-24	SS-24	SS-25	SS-26	SS-27	SS-28	SS-29	624-SS-53	624-SS-54	624-SS-54
	624-SS-05-01	624-SS-06-01	FSS-SS-18-01	FSS-SS-18-22	FSS-SS-18-33	FSS-SS-19-01	FSS-SS-20-01	FSS-SS-21-01	FSS-SS-22-01	FSS-SS-23-01	FSS-SS-24-01	FSS-SS-24-22	FSS-SS-24-33	FSS-SS-25-01	FSS-SS-26-01	FSS-SS-27-01	FSS-SS-28-01	FSS-SS-29-01	624-SS-53-01	624-SS-54-01	624-SS-54-33
	08/26/98	08/26/98	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/01/00	07/22/00	07/22/00	07/22/00
Parameter	0-0.5 ft	0-0.5 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft	0-0.17 ft
Volatile Organics (mg/kg)																					
Acetone																					
Chloroform																					
Ethyl benzene																					
Semivolatile Organics (mg/kg)																					
1-Methylnaphthalene																					
2-Methylnaphthalene			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.044 J	0.059 J	0.4 U	0.05 J	0.058 J			
4-Chloro-3-methylphenol			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	0.41 U	0.4 U	0.43 U	0.52 U			
4-Methylphenol			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	0.41 U	0.4 U	0.43 U	0.055 J			
Acenaphthene			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	0.41 U	0.4 U	0.43 U	0.52 U			
Acenaphthylene			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	**0.072** J	0.4 U	**0.059** J	**0.41** J			
Anthracene			0.41 U	0.42 U		0.4 U	0.38 U	0.072 J	0.4 U	0.071 J	0.46 U	0.45 U		0.088 J	0.086 J	0.4 U	0.082 J	**0.19** J			
Benzo(a)anthracene			0.12 J	0.11 J		0.12 J	0.12 J	0.48	0.16 J	0.23 J	0.16 J	0.14 J		0.29 J	0.3 J	0.099 J	0.32 J	**1.6**			
Benzo(a)pyrene			0.14 J	0.16 J		0.13 J	0.11 J	**0.62**	0.19 J	0.23 J	0.19 J	0.17 J		0.3 J	0.34 J	0.11 J	0.38 J	**1.5**			
Benzo(b)fluoranthene			0.23 J	0.21 J		0.22 J	0.18 J	**0.98**	0.29 J	0.36	0.32 J	0.27 J		0.47	0.6	0.19 J	0.63	**2.2**			
Benzo(ghi)perylene			0.11 J	0.42 U		0.064 J	0.058 J	**0.45**	0.12 J	0.14 J	0.14 J	0.13 J		0.19 J	**0.31** J	0.093 J	**0.25** J	**1**			
Benzo(k)fluoranthene			0.072 J	0.1 J		0.08 J	0.079 J	**0.34** J	0.1 J	0.15 J	0.094 J	0.096 J		**0.17** J	**0.21** J	0.082 J	**0.22** J	**0.68**			
Bis(2-Ethylhexyl)phthalate			0.13 J	0.13 J		0.1 J	**17** E	0.13 J	0.2 J	0.049 J	0.23 J	0.21 J		0.2 J	0.18 J	0.15 J	0.3 J	**9.8** E			
Butylbenzylphthalate			0.043 J	0.062 J		0.4 U	0.088 J	0.37 U	0.067 J	0.34 U	0.11 J	0.054 J		0.069 J	0.051 J	0.044 J	0.069 J	**0.3** J			
Carbazole			0.41 U	0.42 U		0.4 U	0.38 U	0.057 J	0.4 U	0.034 J	0.46 U	0.45 U		0.051 J	0.058 J	0.4 U	0.046 J	0.1 J			
Chrysene			0.15 J	0.15 J		0.16 J	0.38 U	**0.54**	0.22 J	0.28 J	0.23 J	0.22 J		0.38 J	**0.44**	0.16 J	**0.46**	**1.5**			
Dibenz(a,h)anthracene			0.41 U	0.42 U		0.4 U	0.38 U	**0.15** J	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	**0.09** J	0.4 U	**0.072** J	**0.28** J			
Di-n-butylphthalate			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	0.41 U	0.4 U	0.064 J	0.066 J			
Fluoranthene			0.19 J	0.18 J		0.27 J	0.2 J	**0.75**	0.32 J	0.46	0.26 J	0.25 J		0.59	0.6	0.21 J	0.68	**2**			
Fluorene			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.45 U		0.43 U	0.41 U	0.4 U	0.43 U	0.52 U			
Indeno(1,2,3-cd)pyrene			0.11 J	0.12 J		0.075 J	0.068 J	**0.48**	0.14 J	0.16 J	0.14 J	0.14 J		**0.23** J	**0.35** J	0.087 J	**0.28** J	**1.2**			
Naphthalene			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.072 J	0.46 U	0.45 U		0.43 U	0.058 J	0.4 U	0.044 J	0.19 J			
Phenanthrene			0.12 J	0.1 J		0.16 J	0.097 J	0.38	0.19 J	0.3 J	0.16 J	0.15 J		0.44	0.37 J	0.11 J	0.32 J	0.62			
Phenol			0.41 U	0.42 U		0.4 U	0.38 U	0.37 U	0.4 U	0.34 U	0.46 U	0.069 J		0.43 U	0.41 U	0.4 U	0.43 U	0.52 U			
Pyrene			0.29 J	0.3 J		0.27 J	0.24 J	0.81	0.36 J	0.51	0.33 J	0.27 J		0.53	0.59	0.19 J	0.69	**2.7**			
Pesticides (mg/kg)																					
4,4`-DDD	U	U																	0.071 P	0.02 P	0.2 U
4,4`-DDE	U	U																	0.044 P	0.022 P	0.2 U
4,4`-DDT	0.65	0.8																	0.47 EP	0.24 EP	0.7
Endrin aldehyde	U	U																	0.0082 P	0.0043 U	0.2 U
Endrin ketone	U	U																	0.032 P	0.013 P	0.2 U
Gamma-BHC	U	U																	0.0052 P	0.0032	0.2 U
Gamma-Chlordane	U	U																	0.0087 P	0.0021 U	1 U
Heptachlor epoxide	0.12	U																	0.031	0.016	0.2 U
Metals (mg/kg)																					
Aluminum			7080 E	6920 E	9550	8840	7740	6850	6420	48	5700	5890	7960	7050	6640	5860	5290	6620			
Antimony			0.57 BN	0.47 BN	1.2 B	0.67 BN	1 N	0.88 N	0.59 BN	**1.7** N	0.55 BN	0.63 BN	1 B	0.74 BN		0.34 BN	1 N	1.2 N			
Arsenic			2.7	2.6	3.4	3.6	4.5	4.6	4.3	5.6	3.9	3.8	4.5	5.4	6.3	4	6	6.9			
Barium			**138**	**125**	**160**	**132**	**124**	**136**	92.9	86.9	75.2	82.3	94.4	92.2	105	70.2	96.7	107			
Beryllium			0.27 B	0.25 B	0.5	0.36 B	0.32 B	0.31 B	0.25 B	0.19 B	0.2 B	0.22 B	0.46	0.25 B	0.26 B	0.23 B	0.23 B	0.3 B			
Cadmium			0.32 B	0.31 B	0.47 B	0.23 B	0.27 B	0.27 B	0.57 B	0.44 B	0.43 B	0.42 B	0.67	0.55 B	0.52 B	0.35 B	0.88	0.9			
Calcium			2020 E	2220 E	2420	1990	2160	1950	4420	1790	7660	8420	8690	9870	7990	6380	5280	9470			
Chromium			25.3	28.1	29	22.8	19	22.9	17.9	12.7	13.1	13.4	16	15.1	15.6	12.6	15	17.1			
Cobalt			4.6 B	4.8 B	6.7	6.1	6.6	6	5.2 B	4.7 B	3.7 B	4.3 B	7.1	5.6 B	5.5 B	4.9 B	4.7 B	3.9 B			
Copper			43.2 E	38 E	43.9	50.9	46.2	46	33.7	80.3	29	29	37.7	45.4	53.3	29.6	50.4	44.8			
Iron			13400	13200	15500	15600	16400	15100	13100	19100	13100	12600	15400	17200	15600	13700	12700	12700			
Lead			333	292	335	344	400	400	148	471	156	163	170	191	373	152	469	251			
Magnesium			1980 E	2060 E	2430	2550 E	2300 E	2100 E	2260 E	1530 E	3560 E	3920 E	4030	4800 E	**4890** E	3680 E	1960 E	2170 E			
Manganese			153	352	173	199 N	348 N	220 N	304 N	229 N	296 N	295 N	356	327 N	308 N	332 N	295 N	445 N			
Nickel			15.8	17.4	20.8	16.7	16.2	16.4	19	12.9	13.8	13.8	19.3	16.2	16.1	12.5	14.4	16.8			
Potassium			816	925	982	799	722	769	1040	757	854	889	1020	1230	901	740	830	953			
Selenium			0.65	0.55	0.85 B	0.47 B	0.52 B	0.46 B	0.48 B	0.48 B	0.4 B	0.38 B	1 B	0.23 B	0.44 B	0.48 B	0.88	0.98			
Silver			0.19 U	0.17 U	1 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.2 B	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U			
Sodium			144	140	180	224	190	193	206	119	161	152	160	243	204	160	153	207			
Thallium			0.14 U	0.13 U	6 U	0.18 U	0.17 U	0.17 U	0.17 U	0.15 U	0.2 U	0.21 U	6 U	0.2 U	0.18 U	0.18 U	0.19 U	0.24 U			
Vanadium			23.8	23.6	34.1	33.8	28.6	30.5	31.2	21.9	18.5	19	26.3	23.7	21.6	17.7	29.2	28.7			
Zinc			111	103	122	219 N	163 N	133 N	123 N	207 N	111 N	116 N	127	166 N	208 N	99.1 N	203 N	178 N			
Mercury (mg/Kg)																					
Mercury			0.77	0.66	0.619	0.85	0.83	0.93	0.48	**2.7**	0.35	0.4	0.35	0.89	0.49	0.33	**1.8**	0.62			
Mercury, Inorganic Salts			0.77	0.66	0.619	0.85	0.83	0.93	0.48	2.7	0.35	0.4	0.35	0.89	0.49	0.33	1.8	0.62			
Methyl mercury																					
Elemental Mercury																					

Table 6-2
Summary of Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineering School, Fort Totten
Queens, New York

Parameter	B-09 Ad2004-SS-29-SH 06/21/04 0-1 ft	B-09 Ad2004-SS-9-SH 06/21/04 0-1 ft	AI2-101 AI2-101(0-2)" 05/13/11 0-0.17 ft	AI2-102 AI2-102(0-2)" 05/13/11 0-0.17 ft	AI2-103 AI2-103(0-2)" 05/13/11 0-0.17 ft	AI2-104 AI2-104(0-2)" 05/13/11 0-0.17 ft	AI2-105 AI2-105(0-2)" 05/13/11 0-0.17 ft	AI2-106 AI2-106(0-2)" 05/13/11 0-0.17 ft	AI2-107 AI2-107(0-2) 05/11/11 0-0.17 ft	AI2-108 AI2-108(0-2) 05/12/11 0-0.17 ft	AI2-108 DUP-AI2-1(0-2) 05/12/11 0-0.17 ft	AI2-109 AI2-109(0-2) 05/11/11 0-0.17 ft	AI2-110 AI2-110(0-2) 05/12/11 0-0.17 ft	AI2-111 AI2-111(0-2) 05/11/11 0-0.17 ft	AI2-112 AI2-112(0-2) 05/11/11 0-0.17 ft	SB-04 FSS-SB-04-02 08/01/98 2-3 ft	SB-04 FSS-SB-04-03 08/01/98 16-17 ft	SB-05 FSS-SB-05-02 08/01/98 2-3 ft	SB-05 FSS-SB-05-03 08/01/98 18-20 ft
Volatile Organics (mg/kg)																			
Acetone																0.043	0.003 J	0.046	0.01 U
Chloroform																0.0049 U	0.0011 J	0.0046 U	0.0051 U
Ethyl benzene																0.0049 U	0.0046 U	0.0026 J	0.0016 J
Semivolatile Organics (mg/kg)																			
1-Methylnaphthalene			0.0119 J	0.0027 U	0.01 J	0.0066 J	0.0023 J	0.024 U	0.029 U	0.0021 J	0.0024 J	0.0038 J	0.037 U	0.011 J	0.014 J				
2-Methylnaphthalene		0.033 U	0.0138 J	0.0027 UJ	0.016 J	0.0076 J	0.0043 J	0.024 UJ	0.029 U	0.0033 J	0.0039 J	0.0053 J	0.037 U	0.011 J	0.019				
4-Chloro-3-methylphenol	0.0096 J	0.033 U																	
4-Methylphenol	0.00586 U	0.033 U																	
Acenaphthene	0.00631 U	0.033 U	0.011 J	0.009 J	0.015 J	0.0079 J	0.0037 J	0.024 U	0.029 U	0.0038 J	0.0032 J	0.0011 J	0.037 U	0.0064 J	0.0083 J				
Acenaphthylene	0.00731 U	0.033 U	**0.069**	0.024	**0.12**	0.026	**0.056**	**0.031** J	**0.075** J	**0.047**	**0.05**	0.01	0.062 U	0.024	**0.037**				
Anthracene	0.00868 U	0.033 U	0.061	0.038	0.098	0.041	0.034	0.022 J	0.064 J	0.055	0.055	0.011	0.035 J	0.025	0.038				
Benzo(a)anthracene	0.021 J	0.031 J	0.27	0.18	0.44	0.18	0.19	0.11 J	0.23	0.031	0.031	0.042	0.16 J	0.1	0.13				
Benzo(a)pyrene	0.023 J	0.038 J	0.33	0.2	**0.52**	0.22	0.23	0.12 J	0.27	0.041	0.043	0.048	0.24 J	0.12	0.14				
Benzo(b)fluoranthene	0.024 J	0.037 J	0.32	0.19	0.48	0.21	0.23	0.035 J	0.43	0.08	0.081	0.086	0.37	0.19	0.24				
Benzo(ghi)perylene	0.00934 U	0.033 U	**0.4**	0.21	**0.59**	**0.26**	**0.26**	0.18	0.21	0.081	0.072	0.042	0.19 J	0.095	0.12				
Benzo(k)fluoranthene	0.0161 U	0.019 J	**0.17** J	0.11 J	**0.32** J	0.14 J	0.073 J	0.047 J	0.049 U	0.0018 U	0.0018 U	0.0018 U	0.062 U	0.0039 U	0.0042 U				
Bis(2-Ethylhexyl)phthalate	0.026 J	0.026 J															**0.46**		
Butylbenzylphthalate	0.00824 U	0.012 J																	
Carbazole	0.00799 U	0.033 U																	
Chrysene	0.019 J	0.036 J	0.36	0.21	**0.46**	0.24	0.21	0.15 J	0.24	0.044	0.053	0.053	0.21 J	0.13	0.16				
Dibenz(a,h)anthracene	0.0184 U	0.66 U	**0.093**	**0.052**	**0.13**	**0.066**	**0.065**	0.027 J	0.058 U	0.013	0.011	0.0078	0.074 U	0.025	0.032				
Di-n-butylphthalate	0.033	**0.34**																	
Fluoranthene	0.033	0.039	0.53	0.36	**0.81**	0.44	0.34	0.22	0.39	0.074	0.061	0.092	0.32	0.21	0.27				
Fluorene	0.0116 U	0.033 U	0.015 J	0.01 J	0.021	0.0096 J	0.0062 J	0.04 U	0.049 U	0.0045 J	0.0036 J	0.0016 J	0.062 U	0.0069 J	0.012 J				
Indeno(1,2,3-cd)pyrene	0.0119 U	0.033 U	**0.3**	0.16	**0.44**	**0.2**	**0.2**	0.11 J	0.18 J	0.053	0.051	0.034	0.18 J	0.078	0.097				
Naphthalene	0.00642 U	0.033 U	0.02 J	0.012 J	0.032 J	0.011 J	0.01 J	0.024 UJ	0.029 U	0.0081	0.0077	0.0056 J	0.037 U	0.01 J	0.019				
Phenanthrene	0.016 J	0.021 J	0.18 J	0.16 J	0.26 J	0.21 J	0.074 J	0.087 J	0.14 J	0.028 J	0.019 J	0.032	0.14 J	0.098	0.13				
Phenol		0.033 U																	
Pyrene	0.038	0.04 J	0.42 J	0.3 J	0.62 J	0.29 J	0.26 J	0.15 J	0.34	0.078	0.078	0.062	0.32	0.17	0.22				
Pesticides (mg/kg)																			
4,4`-DDD																			
4,4`-DDE																			
4,4`-DDT																			
Endrin aldehyde																			
Endrin ketone																			
Gamma-BHC																			
Gamma-Chlordane																			
Heptachlor epoxide																			
Metals (mg/kg)																			
Aluminum		**14400**	10800	8450	8860	8860	8190	7340	5890	4070	4510	4800	7440	6320	6290		6650		10700
Antimony		0.66	0.46 J	1.1 J	0.57 J	0.63 J	0.47 UJ	0.37 J	0.61 J	**5.7** J	**18.2** J	0.63 J	0.57 J	0.87 J	0.58 J		**0.73**		**1.2** N
Arsenic		3	5.5	6.5	6	6.4	4.7	4.4	3.3	**11.7**	**11.3**	4.2	5.5	5.1	5.2		0.32 B		0.62 B
Barium		97	113	87.5	95.2	82.5	68.4	85.7	87.9	71.4	63.3	64.9	113	80.5	**138**		48.7		113
Beryllium		0.46 J	0.56	0.61	**0.75**	**0.66**	0.58	0.5	0.37 J	0.51	0.49	0.48	0.57 J	0.48	0.44 J		0.24 B		0.44 B
Cadmium		0.23 J	1.1	0.69	0.68	0.52 J	0.48 J	0.63	1.9	0.65 J	0.52 J	0.29 J	0.55 J	0.71	0.6 J				
Calcium		2320	7440	6300	3970	3330	2740	5020	**14600**	2220	2520	2110	5050	4010	4010		1450		3050 X
Chromium		19	21.4	17.7	18.4	17.3	19.9	14	23.7	9.8	9	10.2	19	14.6	15.4		20.5		**33.2** X
Cobalt		6.8	**9.5**	7.7	5.8 J	5.6 J	6.3	6.2	5.2 J	6.8	6.2	6.6	5.5 J	6	5.7 J		6.8		12.2
Copper		19	53.4	46.6	35	31.8	26.2	40.3	46.9 J	**11500** J	**958** J	75.9 J	46.6	51.6 J	42.2 J		12.8		26.2
Iron		15800	19400	18600	13500	13600	14100	13300	13200	10000	11800	11100	14900	12100	13100		13500		**23700**
Lead		93	223	180	195	295	73.2	170	334 J	418	380	214 J	315	242 J	278 J		4.9		6.2
Magnesium		2370	4490	2520	2260	2000	2540	2690	**5140**	916	1330	1260	2130	2430	1770		2560 X		**5950** N
Manganese		617	391	406	524	415	380	265	332 J	84.8 J	104 J	221 J	401	259 J	305 J		365		393
Nickel		17 J	23.1	22.7	20.5	18.7	21.3	16.6	17.3	18.8	18.8	17.6	18.6	17.4	16.8		18.3		33.7
Potassium		588 J	1050	782	652 J	698	1190	791	928	403 J	490 J	511 J	859	679	786		1490		**4020** E
Selenium		0.52 J	0.99 U	0.75 J	0.62 J	0.47 J	0.82 U	0.73 U	0.8 J	1.5	1.3	0.63 J	0.68 J	0.77 J	0.65 J				
Silver		0.362 U	0.31 J	0.45 J	0.13 U	0.44 J	0.12 U	0.085 J	0.12 J	0.34 J	0.12 J	0.22 J	0.15 U	0.21 J	0.1 J				
Sodium		38 J	**383** J	91.3 J	65.5 J	67.6 J	77.3 J	**290** J	41.7 J	164 J	197 J	53.8 J	54.3 J	47.8 J	81.1 J		172		167
Thallium		0.15 J	1.4 U	1.3 U	1.3 U	1.2 U	1.2 U	1 U	1.4 U	0.95 U	1 U	1.1 U	1.5 U	1.2 U	1.2 U		0.13 B		0.23 B
Vanadium		26 J	**61.7**	36.8	33.6	35.1	34.3	37.9	23.9	21	20.5	26.3	30.6	30.7	28.9		19.3		36.1
Zinc		69	**301**	264	149	187	92.6	145	172 J	256	213	104 J	197	233 J	177 J		25.4		54.4
Mercury (mg/Kg)																			
Mercury		0.14	0.41	0.32	0.5	0.34	0.3	1.1	0.323 J			**2.08** J		**1.63** J	0.358 J		0.02		0.01
Mercury, Inorganic Salts		0.14															0.02		0.01
Methyl mercury									0.00602 J			0.00486 J		0.011 J	0.000737 J				
Elemental Mercury									0.0003 U			0.0004 U		0.0004 U	0.0004 U				

Table 6-2
Summary of Analytical Results in Soil - Area 2
Final Remedial Investigation Report
Engineering School, Fort Totten
Queens, New York

Parameter	B-09 Ad2004-SS-9-DP 06/21/04 1-2 ft	AI2-101 AI2-101(6-24) 05/13/11 0.5-2 ft	AI2-102 AI2-102(6-24) 05/13/11 0.5-2 ft	AI2-103 AI2-103(6-24) 05/13/11 0.5-2 ft	AI2-104 AI2-104(6-24) 05/13/11 0.5-2 ft	AI2-105 AI2-105(6-24) 05/13/11 0.5-2 ft	AI2-106 AI2-106(6-24) 05/13/11 0.5-2 ft	AI2-107 AI2-107(6-24) 05/11/11 0.5-2 ft	AI2-108 AI2-108(6-24) 05/12/11 0.5-2 ft	AI2-108 DUP-AI2-2(6-24) 05/12/11 0.5-2 ft	AI2-109 AI2-109(6-24) 05/11/11 0.5-2 ft	AI2-110 AI2-110(6-24) 05/12/11 0.5-2 ft	AI2-111 AI2-111(6-24) 05/11/11 0.5-2 ft	AI2-112 AI2-112(6-24) 05/11/11 0.5-2 ft
Volatile Organics (mg/kg)														
Acetone														
Chloroform														
Ethyl benzene														
Semivolatile Organics (mg/kg)														
1-Methylnaphthalene		0.0057 U	0.0013 J	0.0018 J	0.0011 J	0.001 J	0.014	0.024 J	0.0018 J	0.0012 U	0.0012 U	0.002 J	0.0063 J	0.0012 U
2-Methylnaphthalene	0.033 U	0.0057 UJ	0.0019 J	0.0032 J	0.0016 J	0.0016 J	0.0068 J	**0.015** J	0.0016 J	0.0011 J	0.0012 U	0.0022 J	0.0062 J	0.0012 U
4-Chloro-3-methylphenol	0.033 U													
4-Methylphenol	0.033 U													
Acenaphthene	0.033 U	0.0057 U	0.0011 J	0.002 J	0.0026 J	0.0018 J	0.0011 U	0.0054 J	0.0064 J	0.00087 J	0.0012 U	0.0076 J	0.035	0.0012 U
Acenaphthylene	0.033 U	0.015 J	0.0047 J	**0.032**	0.0094	0.015	0.0077	**0.089**	0.0036 J	0.0042 J	0.002 U	0.0025 J	0.0081	0.002 U
Anthracene	0.033 U	0.01 J	0.0062 J	0.019	0.017	0.0081	0.0067 J	0.054	0.0089	0.0054 J	0.0012 U	0.015	0.082	0.00098 J
Benzo(a)anthracene	0.033 U	0.059	0.032	0.1	0.071	0.051	0.025	0.24	0.049	0.037	0.0064 J	0.039	0.16	0.0041 J
Benzo(a)pyrene	0.033 U	0.07	0.038	0.12	0.15	0.057	0.031	$\boxed{0.31}$	0.049	0.044	0.0068 J	0.039	0.16	0.0036 J
Benzo(b)fluoranthene	0.066 U	0.051	0.03	0.12	0.23	0.058	0.03	0.45	0.077	0.065	0.011	0.054	0.23	0.006 J
Benzo(ghi)perylene	0.033 U	0.087	0.046	0.13	0.14	0.063	0.043	**0.22**	0.036	0.034	0.0047 J	0.028	0.1	0.0026 J
Benzo(k)fluoranthene	0.066 U	0.027 J	0.017 J	0.047 J	0.06 J	0.019 J	0.013 J	0.0096 U	0.0019 U	0.0019 U	0.002 U	0.002 U	0.0019 U	0.002 U
Bis(2-Ethylhexyl)phthalate	0.021 J													
Butylbenzylphthalate	0.033 U													
Carbazole	0.033 U													
Chrysene	0.033 U	0.073	0.043	0.12	0.12	0.056	0.037	0.29	0.052	0.046	0.0052 J	0.038	0.16	0.0034 J
Dibenz(a,h)anthracene	0.66 U	0.017 J	0.011	0.031	0.039	0.016	0.0098	**0.06**	0.011	0.0094	0.0024 U	0.0036 J	0.027	0.0024 U
Di-n-butylphthalate	**0.32**													
Fluoranthene	0.033 U	0.099	0.065	0.16	0.09	0.083	0.052	0.44	0.087 J	0.058 J	0.0084	0.077	0.44	0.0044 J
Fluorene	0.033 U	0.0095 U	0.0021 J	0.0036 J	0.0033 J	0.0024 J	0.0019 U	0.0096 U	0.0037 J	0.0016 J	0.002 U	0.0054 J	0.027	0.002 U
Indeno(1,2,3-cd)pyrene	0.033 U	0.064	0.034	0.099	0.11	0.052	0.032	0.19	0.032	0.028	0.0042 J	0.023	0.088	0.0031 J
Naphthalene	0.033 U	0.0057 UJ	0.0022 J	0.0086 J	0.0034 J	0.0044 J	0.0034 J	0.012 J	0.004 J	0.0032 J	0.0012 U	0.0021 J	0.0075 J	0.0012 U
Phenanthrene	0.033 U	0.032 J	0.026 J	0.034 J	0.029 J	0.022 J	0.028 J	0.14	0.058 J	0.021 J	0.0028 J	0.065	0.36	0.0027 J
Phenol	0.033 U													
Pyrene	0.0095 J	0.085 J	0.051 J	0.14 J	0.09 J	0.07 J	0.039 J	0.35	0.09 J	0.059 J	0.0063 J	0.075	0.32	0.0037 J
Pesticides (mg/kg)														
4,4`-DDD														
4,4`-DDE														
4,4`-DDT														
Endrin aldehyde														
Endrin ketone														
Gamma-BHC														
Gamma-Chlordane														
Heptachlor epoxide														
Metals (mg/kg)														
Aluminum	12600	10900	9490	9150	9690	9180	8040	8770	8700	8540	10400	10800	6920	9830
Antimony	0.34 J	0.37 UJ	0.33 J	0.29 J	**0.72** J	0.43 UJ	0.44 UJ	0.2 J	0.35 J	**24.1** J	0.48 UJ	0.48 UJ	**0.86** J	0.48 UJ
Arsenic	$\boxed{2.1}$	$\boxed{3.2}$	$\boxed{4.4}$	$\boxed{2.9}$	$\boxed{3.4}$	$\boxed{3.1}$	$\boxed{3.3}$	$\boxed{4.2}$	$\boxed{3.1}$	$\boxed{3.8}$	$\boxed{2.3}$	$\boxed{3.2}$	$\boxed{5.5}$	$\boxed{2.6}$
Barium	64	70.8	52.3	79.5	102	66	66.9	94	70.3	69.9	71.3	78.1	63.6	89.9
Beryllium	0.17 J	0.59	0.57	**0.87**	**0.8**	0.7	0.55	0.63	0.61	0.61	**0.89**	**0.82**	0.5	**0.75**
Cadmium	0.049 J	0.17 J	0.13 J	0.072 J	0.036 J	0.086 J	0.12 J	0.3 J	0.033 J	0.081 U	0.096 U	0.086 J	0.35 J	0.095 U
Calcium	1010	2080	1560	4390	2320	1560	2630	3780	2340 J	1870 J	873	837	6550	1990
Chromium	17	21.8	17.1	15.3	16.2	17.7	24.8	26	16.2	16.7	19.4	19.1	16.3	20.3
Cobalt	7.6	7.2	6.7	4.8 J	5.4 J	6	7.4	6.5	6.4	6.4	6	5.8 J	6.9	6.9
Copper	9.6	25.4	19.2	19.6	18.5	23.7	29.3	46.4 J	59.6	55.8	28.6 J	18.3	**75.1** J	17.4 J
Iron	17100	16400	15100	11800	13000	13100	14000	15300	14600	14400	14900	14300	13100	14300
Lead	11	40.3	57.6	73.2	123	29.8	53.6	225 J	115 J	282 J	27.4 J	51.6	207 J	108 J
Magnesium	2670	3230	2310	2220	2380	2420	3030	2850	2780	2670	2170	2350	**4720**	2600
Manganese	349	316	283	557	532	435	369	319 J	378	372	472 J	541	274 J	486 J
Nickel	14 J	21.3	16.4	15	16.6	18.1	22.2	19.4	17	18.5	16.9	16.2	21.5	19.7
Potassium	626 J	802	556 J	409 J	514 J	725	1110	623	725	714	617	602	642	872
Selenium	0.19 J	0.65 U	0.8 U	0.83 U	0.78 U	0.75 U	0.77 U	**0.81** J	0.73 U	0.71 U	0.84 U	0.83 U	**0.91** J	0.83 U
Silver	0.362 U	0.093 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 J	0.1 U	0.1 U	0.12 U	0.12 U	0.087 J	0.12 U
Sodium	31.4 U	153 J	76.7 J	98.7 J	214 J	54.2 J	106 J	237 J	153 J	111 J	72.2 U	40.6 J	123 J	52.9 J
Thallium	0.1 J	0.93 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1 U	1 U	1.2 U	1.2 U	1.1 U	1.2 U
Vanadium	21 J	30.6	25.3	20	21.3	23.6	25.2	27.5	22.5	20.8	20.3	22.7	23.4	21.7
Zinc	29	57	64.7	42.3	46.3	45.2	63	117 J	70.2	75.2	32 J	77.3	258 J	58 J
Mercury (mg/Kg)														
Mercury	0.028 J	0.11	0.083	0.46	0.18	0.39	0.29	0.165 J			0.374 J		1.76 J	0.0819 J
Mercury, Inorganic Salts	0.028 J													
Methyl mercury								0.00103 J			0.000083 J		0.00139 J	0.000063 UJ
Elemental Mercury								0.0004 U			0.0004 U		0.0004 U	0.0003 U

Notes
mg/Kg = milligram per kilogram
U = not detected
J = value is estimated
R = value is rejected
N = Spike sample recovery not within control limits
B = Analyte was detected in the method blank
* = Duplicate analysis not within control limi
D = Concentration reported from a secondary dilution
E = Compound exceeded the calibration range of the instrument
X = Defined by the laboratory
P = Value from a Gas Chromatograph (GC) analysis when there is greater than 25% difference between the two GC columns

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Commercial NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO

NC = no criteria available
blank cells - Indicate analyte was not analyzed for in that sample.
Two duplicate samples were collected for SS-18-01 and SS-24-01.
SS-18-01 and SS-24-01 were the primary samples.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/01/11

Table 6-3
Summary of Analytical Results in Soil (before 2012)- Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Average of All Samples	Background Shallow	Background Deep	New York State Soil Cleanup Objectives: Unrestricted	Residential	Residential Restricted	Commercial	Industrial	USEPA Regional Screening Levels: Residential	Industrial	SB-06 FSS-SB-06-01 08/01/98 0-0.5 ft	SB-07 FSS-SB-07-01 08/01/98 0-0.5 ft	SB-07 FSS-SB-07-02 08/01/98 0-0.5 ft
Volatile Organics (mg/kg)																
2-Butanone	1 / 5	0.0093 : 0.013	0.0025 - 0.0025	0.0047	--	--	0.12	100	100	500	1000	28000 n	200000 nms			
Acetone	5 / 5		0.0037 - 0.081	0.035	--	--	0.05	100	100	500	1000	61000 n	630000 nms			
Ethyl benzene	3 / 5	0.0046 : 0.005	0.0027 - 0.0031	0.0027	--	--	1	30	41	390	780	5.4 c	27 c			
Vinyl chloride	1 / 5	0.0046 : 0.0052	0.0055 - 0.0055	0.0031	--	--	0.02	0.21	0.9	13	27	0.06 c	1.7 c			
Semivolatile Organics (mg/kg)																
1-Methylnaphthalene	23 / 26	0.0013 : 0.024	0.00091 - 0.18	0.016	--	--	NC	NC	NC	NC	NC	22 c	99 c			
2-Methylnaphthalene	33 / 47	0.012 : 0.39	0.00088 - 0.22	0.051	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns			
4-Chloro-3-methylphenol	4 / 21	0.033 : 0.39	0.0056 - 0.008	0.12	--	--	NC	NC	NC	NC	NC	6100 n	62000 n			
Acenaphthene	25 / 47	0.0012 : 0.39	0.0017 - 0.19	0.063	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n			
Acenaphthylene	42 / 49	0.033 : 0.39	0.001 - 0.56	0.080	0.02767	0.02874	100	100	100	500	1000	NC	NC	**0.075** J		
Anthracene	44 / 47	0.033 : 0.38	0.0022 - 0.67	0.083	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm			
Benzo(a)anthracene	49 / 51	0.033 : 0.033	0.0071 - 1.5	0.30	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	0.24 J	0.44	0.48
Benzo(a)pyrene	49 / 51	0.033 : 0.033	0.011 - 1.8	0.32	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	0.26 J	**0.46**	**0.51**
Benzo(b)fluoranthene	49 / 51	0.66 : 0.66	0.019 - 2.9	0.51	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	0.39	**0.83**	**0.87**
Benzo(ghi)perylene	48 / 50	0.033 : 0.033	0.0089 - 1.6	0.23	0.2324	0.2015	100	100	100	500	1000	NC	NC	0.22 J	0.21 J	
Benzo(k)fluoranthene	23 / 51	0.0019 : 0.66	0.049 - 0.54	0.11	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c	0.14 J	**0.26** J	**0.29** J
Bis(2-Ethylhexyl)phthalate	25 / 25		0.028 - 0.87	0.23	0.61	0.0869	NC	NC	NC	NC	NC	35 c*	120 c	0.15 J	0.27 J	0.21 J
Butylbenzylphthalate	14 / 21	0.033 : 0.39	0.015 - 0.15	0.082	0.2359	0.03433	NC	NC	NC	NC	NC	260 c*	910 c			
Carbazole	11 / 21	0.033 : 0.39	0.0075 - 0.17	0.11	--	0.06649	NC	NC	NC	NC	NC	NC	NC			
Chrysene	49 / 51	0.033 : 0.033	0.011 - 2	0.36	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	0.31 J	**0.66**	**0.72**
Dibenz(a,h)anthracene	34 / 47	0.0025 : 0.66	0.0084 - 0.23	0.099	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c			
Dibenzofuran	3 / 21	0.033 : 0.39	0.016 - 0.16	0.12	--	--	7	14	59	350	1000	78 n	1000 ns			
Di-n-butylphthalate	11 / 21	0.35 : 0.39	0.028 - 0.091	0.11	0.08313	0.01057	NC	NC	NC	NC	NC	6100 n	62000 n			
Di-n-octylphthalate	1 / 21	0.033 : 0.39	0.01 - 0.01	0.12	--	--	NC	NC	NC	NC	NC	NC	NC			
Fluoranthene	50 / 51	0.033 : 0.033	0.014 - 3.3	0.58	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	0.34 J	**0.93**	**0.96**
Fluorene	27 / 47	0.0021 : 0.39	0.0023 - 0.21	0.063	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n			
Indeno(1,2,3-cd)pyrene	49 / 51	0.033 : 0.033	0.0069 - 1.2	0.24	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	**0.23** J	**0.25** J	**0.26** J
Naphthalene	34 / 47	0.0012 : 0.39	0.0022 - 0.21	0.037	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*			
Phenanthrene	49 / 51	0.033 : 0.033	0.0059 - 1.9	0.31	0.7072	1.448	100	100	100	500	1000	NC	NC	0.22 J	0.34 J	0.33 J
Pyrene	50 / 51	0.033 : 0.033	0.011 - 3.1	0.54	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	0.46	**1.1**	**1.2**
Metals (mg/kg)																
Aluminum	55 / 55		5370 - 38200	10218	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	6470	8850	10400
Antimony	45 / 55	0.43 : 0.5	0.07 - 2.1	0.44	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.65 N	0.93999	0.87
Arsenic	54 / 54		1.2 - 132	10.3	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	3.6	**11.7**	**12.1**
Barium	55 / 55		25 - 390	56	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	47.2	33.4	38
Beryllium	55 / 55		0.046 - 2.7	0.52	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.29 B	0.36 B	0.4 B
Cadmium	47 / 50	0.088 : 0.099	0.02 - 8.6	0.40	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n			
Calcium	55 / 55		237 - 15000	1772	12100	16223	NC	NC	NC	NC	NC	NC	NC	3500	390	420
Chromium	55 / 55		12.6 - 136	22	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	17.1	17.5	19.8
Cobalt	55 / 55		1.8 - 23.7	5.6	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	5.4	2.9 B	3.5 B
Copper	55 / 55		3.9 - 2470	85	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	26.5	67.4	68.5
Iron	55 / 55		6930 - 62600	15753	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	13700	13800	15800
Lead	55 / 55		0.8 - 2140	156	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	443	136	0.8
Magnesium	55 / 55		1410 - 9140	2519	4802	4433	NC	NC	NC	NC	NC	NC	NC	2720 X	1700 X	2010 X
Manganese	55 / 55		58.9 - 1140	262	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	269	154	159
Nickel	55 / 55		7.8 - 78.5	16.9	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	10.7	9.7	11.8
Potassium	55 / 55		306 - 3950	791	1286	2194	NC	NC	NC	NC	NC	NC	NC	925	325	442
Selenium	40 / 52	0.76 : 1	0.094 - 3.2	0.60	--	0.439	3.9	36	180	1500	6800	390 n	5100 n		0.76	0.62
Silver	6 / 50	0.097 : 0.362	0.078 - 0.83	0.11	--	0.211	2	36	180	1500	6800	390 n	5100 n			
Sodium	49 / 55	31.4 : 66.3	15.5 - 932	108	250	277.2	NC	NC	NC	NC	NC	NC	NC	144	110	114
Thallium	13 / 55	0.16 : 5.9	0.092 - 0.2	0.40	--	0.892	NC	NC	NC	NC	NC	0.78 n	10 n	0.15 B	0.12 B	0.14 B
Vanadium	55 / 55		14.5 - 154	31	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	22.8	36.6	37.9
Zinc	55 / 55		19.4 - 1370	112	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	114	42.5	47.7
Mercury (mg/Kg)																
Mercury	33 / 34	0.0077 : 0.0077	0.01 - 5	0.92	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	0.48	**2.6**	**2.3**
Mercury, Inorganic Salts	25 / 26	0.0077 : 0.0077	0.01 - 5	1.1	--	--	0.12	1.2	5.8	47	220	23 n	310 n	0.48	2.6	2.3
Methyl mercury	8 / 8		0.000179 - 0.00226	0.00096	--	--	NC	NC	NC	NC	NC	7.8 n	100 n			
Elemental Mercury	0 / 8	0.0002 : 0.0004		0.00015	--	--	NC	NC	NC	NC	NC	NC	NC			

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.
Only results above Background, NYSDEC SCO's, or USEPA RSL's are listed

Table 6-3
Summary of Analytical Results in Soil (before 2012)- Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	SS-30 FSS-SS-30-01 07/01/00 0-0.17 ft	SS-31 FSS-SS-31-01 07/01/00 0-0.17 ft	SS-32 FSS-SS-32-01 07/01/00 0-0.17 ft	SS-33 FSS-SS-33-01 07/01/00 0-0.17 ft	SS-34 FSS-SS-34-01 07/01/00 0-0.17 ft	SS-35 FSS-SS-35-01 07/01/00 0-0.17 ft	SS-35 FSS-SS-35-22 07/01/00 0-0.17 ft	SS-36 FSS-SS-36-01 07/01/00 0-0.17 ft	SS-37 FSS-SS-37-01 07/01/00 0-0.17 ft	SS-38 FSS-SS-38-01 07/01/00 0-0.17 ft	SS-39 FSS-SS-39-01 07/01/00 0-0.17 ft	SS-40 FSS-SS-40-01 07/01/00 0-0.17 ft	SS-45 FSS-SS-45-01 07/01/00 0-0.17 ft	B-01 Ad2004-SS-1-SH 06/21/04 0-1 ft	B-02 Ad2004-SS-2-SH 06/21/04 0-1 ft	B-03 Ad2004-SS-3-SH 06/21/04 0-1 ft
Volatile Organics (mg/kg)																
2-Butanone																
Acetone																
Ethyl benzene																
Vinyl chloride																
Semivolatile Organics (mg/kg)																
1-Methylnaphthalene																
2-Methylnaphthalene	0.045 J	0.11 J	0.043 J	0.036 J	0.15 J	0.37 U	0.37 U	0.047 J	0.37 U	0.38 U	0.37 U	0.041 J	0.39 U	0.033 U	0.033 U	0.033 U
4-Chloro-3-methylphenol	0.35 U	0.35 U	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.37 U	0.39 U	0.39 U	0.033 U	0.0056 J	0.0068 J
Acenaphthene	0.35 U	**0.14** J	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.37 U	0.39 U	0.39 U	0.006 J	0.011 J	0.033 U
Acenaphthylene	**0.055** J	**0.073** J	**0.11** J	**0.12** J	**0.043** J	**0.043** J	**0.042** J	**0.061** J	**0.079** J	0.38 U	**0.29** J	0.39 U	0.39 U	0.0089 J	0.001	0.012 J
Anthracene	0.056 J	**0.39**	0.081 J	0.071 J	0.064 J	0.053 J	0.045 J	0.1 J	0.069 J	0.38 U	**0.18** J	0.04 J	0.096 J	0.021 J	0.048	0.016 J
Benzo(a)anthracene	0.25 J	**0.63**	0.3 J	0.26 J	0.12 J	0.25 J	0.23 J	0.5	**0.73**	0.15 J	**0.86**	0.26 J	0.42	0.13	0.43	0.12
Benzo(a)pyrene	0.26 J	**0.55**	0.37	0.36 J	0.12 J	0.26 J	0.23 J	**0.48**	**0.7**	0.16 J	**0.91**	0.26 J	**0.48**	0.14 J	0.35	0.12 J
Benzo(b)fluoranthene	0.43	0.69	0.59	0.5	0.22 J	0.45	0.44	**0.83**	**1.1**	0.27 J	**1.4**	0.46	**0.76**	0.11 J	0.28	0.099 J
Benzo(ghi)perylene	0.17 J	**0.27** J	**0.26** J	**0.25** J	0.085 J	0.19 J	0.19 J	**0.26** J	**0.31** J	0.078 J	**0.5**	0.15 J	**0.31** J	0.11 J	**0.26** J	0.097 J
Benzo(k)fluoranthene	0.16 J	**0.26** J	**0.17** J	**0.19** J	0.064 J	0.16 J	0.15 J	**0.32** J	**0.42**	0.12 J	**0.54**	0.16 J	**0.26** J	0.061 J	**0.18** J	0.057 J
Bis(2-Ethylhexyl)phthalate	0.21 J	0.2 J	0.19 J	0.13 J	0.059 J	0.11 J	0.14 J	**0.77**	0.21 J	0.2 J	**0.87**	**0.83**	0.12 J	0.11 J	0.058 J	0.041
Butylbenzylphthalate	0.099 J	0.081 J	0.076 J	0.15 J	0.37 U	0.37 U	0.053 J	0.15 J	0.073 J	0.07 J	0.37 U	0.056 J	0.39 U	0.034	0.016 J	0.016 J
Carbazole	0.35 U	0.17	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.075 J	0.11 J	0.38 U	0.11 J	0.39 U	0.09 J	0.011 J	0.029 J	0.011 J
Chrysene	0.36	**0.66**	**0.42**	0.35 J	0.19 J	0.35 J	0.33 J	**0.67**	**0.84**	0.21 J	**1.1**	0.38 J	**0.57**	0.12 J	0.38 J	0.12 J
Dibenz(a,h)anthracene	0.35 U	**0.097** J	**0.077** J	0.36 U	0.37 U	0.37 U	0.37 U	**0.095** J	0.37 U	0.38 U	**0.18** J	0.39 U	**0.08** J	0.036 J	**0.14** J	0.033 J
Dibenzofuran	0.35 U	0.16 J	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.37 U	0.39 U	0.39 U	0.033 U	0.033 U	0.033 U
Di-n-butylphthalate	0.039 J	0.35 U	0.37 U	0.36 U	0.37 U	0.37 U	0.049 J	0.052 J	0.37 U	0.38 U	0.37 U	0.39 U	0.39 U	0.049	0.053	0.036
Di-n-octylphthalate	0.35 U	0.35 U	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.37 U	0.39 U	0.39 U	0.01 J	0.033 U	0.033 U
Fluoranthene	0.46	**1.2**	0.48	0.42	0.24 J	0.49	0.45	**1**	**1.1**	0.33 J	**1.6**	0.6	**1.1**	0.19	0.59	0.19
Fluorene	0.35 U	**0.21** J	0.37 U	0.36 U	0.37 U	0.37 U	0.37 U	0.039 J	0.37 U	0.38 U	**0.065** J	0.39 U	0.39 U	0.033 U	0.012 J	0.033 U
Indeno(1,2,3-cd)pyrene	**0.22** J	**0.32** J	**0.3** J	**0.29** J	0.095 J	**0.24** J	**0.24** J	**0.34** J	**0.4**	0.1 J	**0.68**	0.18 J	**0.37** J	0.14 J	**0.35** J	0.12 J
Naphthalene	0.046 J	0.11 J	0.054 J	0.05 J	0.11 J	0.039 J	0.039 J	0.059 J	0.087 J	0.38 U	0.055 J	0.044 J	0.39 U	0.00589 UJ	0.011 J	0.033 U
Phenanthrene	0.25 J	**1.4**	0.24 J	0.23 J	0.18 J	0.29 J	0.23 J	0.63	0.29 J	0.14 J	**0.93**	0.29 J	0.69	0.092	0.17	0.082
Pyrene	0.45	**1.3**	0.49	0.44	0.25 J	0.54	0.49	**1.1**	**1.3**	0.38	**1.7**	0.53	1	0.2 J	0.56 J	0.2 J
Metals (mg/kg)																
Aluminum	7800	7480	6710	6540	6070	9770	9850	11000	7870	9370	9980	9900	8810	10400	9820	**15500**
Antimony	0.53 BN	0.49 BN	0.49 BN	0.49 BN	0.35 BN	0.27 BN	0.28 BN	0.29 BN	0.38 BN	0.3 BN	0.24 BN	0.45 BN	0.36 BN	0.68	0.59	0.7
Arsenic	**11**	8.5	9.4	6.2	5.5	**12.3**	**12**	**11.7**	6.9	6.1	5.2	7.2	5.7	5.3	4.2	5.4
Barium	49.6	54.3	48.1	48.8	52.7	38.3	39.8	51.5	36.1	46.5	48.6	44.4	43.2	56	47	37
Beryllium	0.28 B	0.31 B	0.25 B	0.24 B	0.2 B	0.34 B	0.32 B	0.53 B	0.37 B	0.42 B	0.52 B	0.47 B	0.43 B	0.046 J	0.087 J	0.097 J
Cadmium	0.35 B	0.32 B	0.3 B	0.19 B	0.29 B		0.42 B	0.17 B	0.04 B	0.08 B	0.06 B	0.02 B	0.11 B	0.99	0.35 J	0.12 J
Calcium	1840	2550	2430	1940	1730	329	367	466	290	477	921	486	601	3660	2180	430
Chromium	17.9	19	18.3	17	18	18.6	18.8	21.1	16.8	17.1	19.6	22.2	20.2	20	15	21
Cobalt	4.1 B	5.4	4 B	4.6 B	5 B	3.1 B	3.2 B	4.3 B	3.9 B	4.3 B	6.4	6.5	5.2 B	6.7	5.4	6.4
Copper	31.4	44.5	27	21.7	41.1	83.8	78.4	36.9 E	36.5 E	36.2 E	22.6 E	36.3 E	28.8 E	38	50	32
Iron	13800	15200	12600	12800	13100	15200	14600	15900	12500	13400	15800	16300	14100	18400	13300	17900
Lead	139	122	120	89.6	118	122	134	206 N	143 N	162 N	68.7 N	123 N	81.6 N	286	120	51
Magnesium	1770 E	1990 E	1820 E	1860 E	2020 E	1780 E	1770 E	1920	1650	1890	2340	2320	2070	3110	2710	2730
Manganese	211 N	225 N	244 N	251 N	255 N	151 N	155 N	191 N	165 N	222 N	313 N	256 N	247 N	317	183	306
Nickel	13.7	16.3	14.9	14.3	15.6	11	11.2	13.9	11.3	13.3	17.9	17.4	18.2	17 J	13 J	17 J
Potassium	546	658	721	821	1050	368	363	450	340	457	734	736	806	**1390** J	741 J	696 J
Selenium	0.6	0.46 B	0.45 B	0.37 B	0.18 B	1.2	0.98	1	1	0.89	0.66	1.3	0.73	0.37 J	0.37 J	0.93 J
Silver	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.362 U	0.362 U	0.362 U
Sodium	155	153	134	138	132	114	125	121	104 B	126	125	121	119	43 J	60	31.4 U
Thallium	0.16 U	0.16 U	0.17 U	0.16 U	0.16 U	0.16 U	0.17 U	0.17 U	0.16 U	0.17 U	0.17 U	0.17 U	0.17 U	0.14 J	0.13 J	0.2 J
Vanadium	35.4	36.9	27.8	22.9	18.5	33.3	33.8	38.9	32.8	24.9	28	47.1	47.7	26 J	26 J	27 J
Zinc	94.8 N	91.7 N	87.6 N	79 N	131 N	46.7 N	49.4 N	68.2	48.9	67.6	75.8	57.2	58.2	173	91	43
Mercury (mg/Kg)																
Mercury	0.56	0.33	0.38	0.36	0.26	**2**	**2**	0.99	**2.3**	**5**	0.22	0.89	0.12	0.56	**2**	0.52
Mercury, Inorganic Salts	0.56	0.33	0.38	0.36	0.26	2	2	0.99	2.3	5	0.22	0.89	0.12	0.56	2	0.52
Methyl mercury																
Elemental Mercury																

Table 6-3
Summary of Analytical Results in Soil (before 2012)- Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	B-04 Ad2004-SS-4-SH 06/21/04 0-1 ft	AI3-101 AI3-101(0-2) 05/10/11 0-0.17 ft	AI3-102 AI3-102(0-2) 05/10/11 0-0.17 ft	AI3-103 AI3-103(0-2) 05/10/11 0-0.17 ft	AI3-104 AI3-104(0-2) 05/10/11 0-0.17 ft	AI3-105 AI3-105(0-2) 05/10/11 0-0.17 ft	AI3-106 AI3-106(0-2) 05/11/11 0-0.17 ft	AI3-107 AI3-107(0-2) 05/11/11 0-0.17 ft	AI3-108 AI3-108(0-2) 05/10/11 0-0.17 ft	AI3-108 DUP-AI3-2 05/10/11 0-0.17 ft	AI3-109 AI3-109(0-2) 05/10/11 0-0.17 ft	AI3-110 AI3-110(0-2) 05/11/11 0-0.17 ft	AI3-111 AI3-111(0-2) 05/10/11 0-0.17 ft	AI3-112 AI3-112(0-2) 05/10/11 0-0.17 ft	SB-06 FSS-SB-06-02 08/01/98 2-3 ft
Volatile Organics (mg/kg)															
2-Butanone															0.013 U
Acetone															0.038
Ethyl benzene															0.0027 J
Vinyl chloride															0.0055 J
Semivolatile Organics (mg/kg)															
1-Methylnaphthalene		0.011 J	0.0067 J	0.18 J	0.0032 J	0.015	0.015	0.0065 J	0.0065 J	0.012 U	0.0068 J	0.0069 J	0.0087 J	0.0042 J	
2-Methylnaphthalene	0.033 U	0.013 J	0.0094 J	0.22 J	0.0039 J	0.016 J	0.048	0.009 J	0.0079 J	0.012 UJ	0.0087 J	0.011	0.015 J	0.0054 J	
4-Chloro-3-methylphenol	0.033 U														
Acenaphthene	0.018 J	0.035 J	0.011 J	**0.094** J	0.0029 J	0.011 J	0.0058 J	0.006 J	0.0078 UJ	0.012 UJ	0.016 J	0.0083	0.011 UJ	0.0033 J	
Acenaphthylene	0.033 U	**0.028**	**0.21**	**0.19** J	0.019	**0.098**	0.018	**0.028** J	**0.042** J	**0.041** J	**0.076**	**0.079**	**0.11**	0.023	
Anthracene	0.059	0.14 J	0.12 J	**0.39** J	0.018 J	0.091 J	0.022	0.034 J	0.041 J	0.037 J	0.1 J	0.059	0.066 J	0.018 J	
Benzo(a)anthracene	0.33	**0.68** J	0.45 J	**1.5** J	0.064 J	0.35 J	0.1	0.11	0.17 J	0.17 J	0.39 J	0.22	0.25 J	0.088 J	
Benzo(a)pyrene	0.29 J	**0.74** J	**0.53** J	**1.8** J	0.075 J	0.38 J	0.12	0.14	0.17 J	0.19 J	0.4 J	0.27	0.31 J	0.1 J	
Benzo(b)fluoranthene	0.28	**1.3** J	**0.86** J	**2.9** J	0.13 J	0.62 J	0.2	0.21	0.29 J	0.31 J	0.62 J	0.42	0.5 J	0.17 J	
Benzo(ghi)perylene	0.23 J	**0.68**	**0.44**	**1.6**	0.07	**0.32**	0.094	0.13	0.14	0.15	**0.31**	0.23	**0.25**	0.082	
Benzo(k)fluoranthene	**0.26** J	0.0039 U	0.002 U	0.21 U	0.0019 U	0.002 U	0.002 U	0.013 U	0.013 U	0.02 U	0.0039 U	0.002 U	0.018 U	0.002 U	
Bis(2-Ethylhexyl)phthalate	0.028 J														
Butylbenzylphthalate	0.033 U														
Carbazole	0.052														
Chrysene	0.32 J	**0.74** J	**0.49** J	**2** J	0.072 J	0.39 J	0.1	0.14	0.18 J	0.2 J	0.39 J	0.22	0.29 J	0.1 J	
Dibenz(a,h)anthracene	**0.1** J	**0.18**	**0.15**	0.25 U	0.017	**0.1**	0.023	0.027 J	0.039 J	**0.041** J	0.037	**0.068**	**0.058** J	0.025	
Dibenzofuran	0.016 J														
Di-n-butylphthalate	0.028 J														
Di-n-octylphthalate	0.033 U														
Fluoranthene	**0.76**	**1.9** J	**0.94** J	**3.3** J	0.13 J	0.67 J	0.18	0.2	0.3 J	0.29 J	**0.78** J	0.33	0.34 J	0.16 J	
Fluorene	0.021 J	0.044 J	0.021 J	**0.14** J	0.0038 J	0.015 J	0.0055 J	0.0082 J	0.01 J	0.02 UJ	0.024 J	0.011	0.018 UJ	0.0043 J	
Indeno(1,2,3-cd)pyrene	**0.24** J	**0.62**	**0.47**	**1.2**	0.07	**0.31**	0.083	0.1	0.13	0.12	**0.29**	**0.21**	**0.21**	0.075	
Naphthalene	0.011 J	0.021 J	0.015 J	0.21 J	0.0052 J	0.015 J	0.019	0.0075 U	0.0078 UJ	0.012 UJ	0.014 J	0.0095	0.019 J	0.0072 J	
Phenanthrene	0.49	**0.94** J	0.35 J	**1.9** J	0.057 J	0.28 J	0.084	0.096	0.14 J	0.14 J	0.36 J	0.11	0.18 J	0.058 J	
Pyrene	0.58 J	**1.3** J	0.74 J	**3.1** J	0.1 J	0.52 J	0.17	0.19	0.25 J	0.25 J	0.61 J	0.28	0.34 J	0.13 J	
Metals (mg/kg)															
Aluminum	**15100**	10300	9890	**38200**	9260	11100	7660	7840	10700	9740	9690	7480	9400	11900	
Antimony	0.63	0.53 J	0.47 UJ	**2.1** J	0.45 UJ	0.45 J	0.46 J	0.54 J	0.41 J	0.44 UJ	0.44 UJ	0.56 J	0.41 J	0.22 J	
Arsenic	3.8	6.1	6.3	**53.7**	6	**132**	5.6	6.6	7.3 J	2.3 J	4.6	6.3	**22.5**	8.2	
Barium	45	41.4	48	**390**	47.8	70.5	51.7	55.7	44.7	43.8	47.4	52.8	56.8	52.4	
Beryllium	0.13 J	**0.65**	**0.71**	**2.7**	0.62	**0.8**	0.48	0.56 J	**0.8**	**0.81**	**0.68**	0.48 J	0.6	**0.86**	
Cadmium	0.16 J	0.12 J	0.14 J	**8.6**	0.13 J	0.27 J	0.33 J	0.75	0.12 J	0.088 U	0.22 J	0.26 J	0.59	0.066 J	
Calcium	552	468 J	1020 J	**15000** J	692 J	852 J	2520	2490	415 J	237 J	962 J	2320	2610 J	530 J	
Chromium	21	23.8	20.1	**136**	17	**56.4**	20.4	23.3	18.5 J	13.9	21	24.4	18.8	23.3	
Cobalt	8.1	5.2 J	5.6 J	**23.7** J	5.1 J	5.3 J	5.9	5.4 J	3.7 J	3.5 J	6.5	5.5 J	3.9 J	5.8 J	
Copper	28	28.4	23.8	**268**	19.5	**85**	31.7 J	37.8 J	34.2 J	10 J	20.6	27.8 J	36.3	28.9	
Iron	21500	16500	15000	**62600**	13900	15300	15000	15400	13400 J	10600	14600	14600	13400	16100	
Lead	45	86.7 J	73.3 J	**2140** J	102 J	170 J	174 J	411 J	111 J	16.4 J	76.8 J	228 J	150 J	99.6 J	
Magnesium	3500	2490 J	2470 J	**9140** J	2090 J	2120 J	2400	2260	2050 J	1800 J	2550 J	2250	1800 J	2620 J	
Manganese	266	206	272	**1140**	224	244	275 J	290 J	170 J	213 J	335	290 J	222	340	
Nickel	18 J	19.6	18.2	**78.5**	13.9	17	17.7	18.1	14.9 J	11.5	19.1	16.3	13.6	18.4	
Potassium	1110 J	839	604	**3950**	622	558 J	1230	924	406 J	306 J	691	1120	553	677	
Selenium	0.43 J	0.47 J	0.4 J	3.2 J	0.79 U	0.57 J	0.8 U	1 U	0.9 J	0.77 U	0.78 U	0.45 J	0.48 J	0.73 J	
Silver	0.362 U	0.12 U	0.12 U	0.83 J	0.11 U	0.12 U	0.12 J	0.15 U	0.14 U	0.11 U	0.11 U	0.48 J	0.097 U	0.12 U	
Sodium	31.4 U	46 J	54.5 J	**932** J	23.8 J	38.7 J	15.5 J	55.3 J	45.1 J	16.2 J	51.4 J	33.6 J	**554**	56.8 J	
Thallium	0.16 J	1.2 U	1.2 U	5.9 U	1.1 U	1.2 U	1.1 U	1.5 U	1.4 U	1.1 U	1.1 U	1.2 U	0.97 U	1.2 U	
Vanadium	29 J	47	30.6	**154**	24	32.5	25.3	24.7	35.2 J	16.6 J	39.8	23.1	33.3	35.4	
Zinc	55	54.4 J	68.9 J	**1370** J	69.8 J	112 J	168 J	219 J	50.3 J	34.6 J	69.2 J	110 J	274 J	53.3 J	
Mercury (mg/Kg)															
Mercury	0.24				0.25 J	0.673 J							0.378 J	0.885 J	
Mercury, Inorganic Salts	0.24														
Methyl mercury					0.00106 J	0.00079 J							0.00226 J	0.00205 J	
Elemental Mercury					0.0003 U	0.0004 U							0.0003 U	0.0003 U	

Table 6-3
Summary of Analytical Results in Soil (before 2012)- Area 3
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Parameter	SB-06 FSS-SB-06-03 08/01/98 6-7 ft	SB-07 FSS-SB-07-04 08/01/98 2-3 ft	SB-07 FSS-SB-07-05 08/01/98 2-3 ft	SB-07 FSS-SB-07-07 08/01/98 17-17.5 ft	B-01 Ad2004-SS-1-DP 06/21/04 1-2 ft	B-02 Ad2004-SS-2-DP 06/21/04 1-2 ft	B-03 Ad2004-SS-3-DP 06/21/04 1-2 ft	B-04 Ad2004-SS-4-DP 06/21/04 1-2 ft	AI3-101 AI3-101(6-24) 05/10/11 0.5-2 ft	AI3-102 AI3-102(6-24) 05/10/11 0.5-2 ft	AI3-103 AI3-103(6-24) 05/10/11 0.5-2 ft	AI3-104 AI3-104(6-24) 05/10/11 0.5-2 ft	AI3-105 AI3-105(6-24) 05/10/11 0.5-2 ft	AI3-106 AI3-106(6-24) 05/11/11 0.5-2 ft
Volatile Organics (mg/kg)														
2-Butanone	0.0098 U	0.01 U	0.0025 J	0.0093 U										
Acetone	0.01	0.081	0.043	0.0037 J										
Ethyl benzene	0.0031 J	0.005 U	0.0028 J	0.0046 U										
Vinyl chloride	0.0049 U	0.005 U	0.0052 U	0.0046 U										
Semivolatile Organics (mg/kg)														
1-Methylnaphthalene									0.0036 J	0.0045 J	0.024 U	0.0036 J	0.0093	0.039
2-Methylnaphthalene					0.033 U	**0.045**	0.033 U	0.033 U	0.004 J	0.0058 J	**0.015** J	0.0051 J	0.012 J	**0.14**
4-Chloro-3-methylphenol					0.008 J	0.0066 J	0.033 U	0.033 U						
Acenaphthene					0.033 U	0.018 J	0.033 U	0.033 U	0.0068 J	0.0071 J	0.024 UJ	0.0034 J	0.0047 J	0.012
Acenaphthylene	**0.086** J				0.033 U	**0.16**	0.033 U	0.033 U	0.0075 J	**0.22**	**0.067** J	0.017	**0.06**	0.012
Anthracene					0.013 J	0.1	0.033 U	0.033 U	0.023 J	0.12 J	0.058 J	0.016 J	0.041 J	0.047
Benzo(a)anthracene	0.31 J				0.075	0.61	0.033 U	0.033 U	0.11 J	0.46 J	0.19 J	0.064 J	0.16 J	0.088
Benzo(a)pyrene	0.28 J				0.1	0.5	0.033 U	0.033 U	0.12 J	0.54 J	0.24 J	0.07 J	0.18 J	0.079
Benzo(b)fluoranthene	0.4 J				0.073 J	0.45	0.66 U	0.66 U	0.2 J	0.88 J	0.34 J	0.13 J	0.27 J	0.13
Benzo(ghi)perylene	0.18 J				0.073 J	**0.31** J	0.033 U	0.033 U	0.11	**0.4**	**0.22**	0.069	0.14	0.07
Benzo(k)fluoranthene	0.16 J				0.049 J	0.23 J	0.66 U	0.66 U	0.002 U	0.002 U	0.04 U	0.0019 U	0.002 U	0.0019 U
Bis(2-Ethylhexyl)phthalate	**0.35** J				0.074 J	**0.11** J	0.063 J	**0.24**						
Butylbenzylphthalate					0.015 J	0.031 J	0.033 U	0.033 U						
Carbazole					0.0075 J	0.04	0.033 U	0.033 U						
Chrysene	0.35 J				0.08 J	0.51 J	0.033 U	0.033 U	0.11 J	0.48 J	0.2 J	0.074 J	0.19 J	0.087
Dibenz(a,h)anthracene					0.026 J	**0.19** J	0.66 U	0.66 U	0.03	**0.13**	**0.045** J	0.014	**0.043**	0.016
Dibenzofuran					0.033 U	0.016 J	0.033 U	0.033 U						
Di-n-butylphthalate					**0.06**	**0.091**	**0.032** J	**0.042** J						
Di-n-octylphthalate					0.033 U	0.033 U	0.033 U	0.033 U						
Fluoranthene	0.47				0.12	1	0.018 J	0.033 U	0.26 J	0.91 J	0.31 J	0.14 J	0.23 J	0.17
Fluorene					0.033 U	0.036	0.033 U	0.033 U	0.0081 J	0.024 J	0.04 UJ	0.0048 J	0.0089 J	0.017
Indeno(1,2,3-cd)pyrene	0.22 J				0.072 J	**0.44** J	0.033 U	0.033 U	0.096	**0.39**	0.16	0.061	0.12	0.061
Naphthalene					0.033 U	0.018 J	0.033 U	0.033 U	0.0069 J	0.011 J	0.024 UJ	0.007 J	0.011 J	**0.053**
Phenanthrene	0.25 J				0.064	0.44	0.033 U	0.033 U	0.16 J	0.35 J	0.18 J	0.073 J	0.091 J	0.16
Pyrene	0.53				0.13 J	0.79 J	0.015 J	0.033 U	0.2 J	0.68 J	0.26 J	0.11 J	0.2 J	0.13
Metals (mg/kg)														
Aluminum	6760			5370	14800	9680	14900	13600	11500	10500	10900	8610	11500	8340
Antimony	0.25 BN			0.51 B	0.61	0.64	0.07 J	0.098 J	0.47 UJ	0.43 UJ	0.29 J	0.2 J	0.21 J	0.42 J
Arsenic	1.2				**10**	4.4	2.1	2.4	4.4	5.5	**17.4**	5.1	**18.9**	**10.4**
Barium	31.1			27.5	80	58	46	25	41.4	46.9	105	40.1	75.3	49.3
Beryllium	0.19 B			0.1 B	0.11 J	0.18 J	0.28 J	0.14 J	0.73	**0.78**	0.57	0.6	**0.79**	0.5
Cadmium	0.14 B				**0.84**	0.46 J	0.07 J	0.051 J	0.04 J	0.083 J	0.5 J	0.099 J	0.21 J	0.51 J
Calcium	1200			339	3340	2390	314	440	314 J	814 J	2420 J	450 J	1260 J	5840
Chromium	12.6			16.3	25	16	19	16	22.1	19.4	20.3	16.9	26.2	19.1
Cobalt	1.8 B			3.8 B	7.5	6.4	6.7	7.3	5 J	5.8	4.3 J	6	5.8	6.7
Copper	35.7			3.9	**2470**	63	10	15	19.4	23.4	37.6	22.3	33.6	47.9 J
Iron	6930			7590	20100	16200	17100	22100	16500	14800	14200	14700	15600	16500
Lead	44.2			3.6	139	176	14	8.6	30.7 J	44.7 J	265 J	132 J	114 J	212 J
Magnesium	1410 X			1780 X	3380	2465	2690	3780	2570 J	2470 J	1820 J	1990 J	2530 J	3610
Manganese	58.9			130	339	228	293	198	188	281	217	293	210	269 J
Nickel	7.8			13.2	20 J	15 J	16 J	13 J	17.9	19	14.2	14.4	18.5	18.8
Potassium	361			962	1450 J	833 J	668 J	1200 J	651	576	672	717	534 J	824
Selenium					**0.62** J	**0.51** J	0.43 J	0.094 J	0.83 U	0.42 J	0.41 J	0.76 U	0.8 U	**0.76** J
Silver					0.362 U	0.362 U	0.362 U	0.362 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 J
Sodium	**296**			105	68	119	31.4 U	31.4 U	32.6 J	51.7 J	115 J	65.5 U	58.6 J	21.9 J
Thallium	0.12 B			0.14 B	0.19 J	0.14 J	0.13 J	0.092 J	1.2 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Vanadium	17.5			14.5	36 J	27 J	22 J	24 J	28.6	24.3	30.7	23.3	25.6	36.7
Zinc	50.4			19.4	231	105	43	40	42.3 J	59.1 J	179 J	63.5 J	97.3 J	246 J
Mercury (mg/Kg)														
Mercury	0.29			0.01	0.8	**2.7**	0.077 J	0.0077 U				0.262 J	0.299 J	
Mercury, Inorganic Salts	0.29			0.01	0.8	2.7	0.077 J	0.0077 U						
Methyl mercury												0.000354 J	0.000781 J	
Elemental Mercury												0.0003 U	0.0003 U	

Table 6-3
Summary of Analytical Results in Soil (before 2012)- Area 3
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Parameter	AI3-107 AI3-107(6-24) 05/11/11 0.5-2 ft	AI3-108 AI3-108(6-24) 05/10/11 0.5-2 ft	AI3-108 DUP-AI3-1 05/10/11 0.5-2 ft	AI3-109 AI3-109(6-24) 05/10/11 0.5-2 ft	AI3-110 AI3-110(6-24) 05/11/11 0.5-2 ft	AI3-111 AI3-111(6-24) 05/10/11 0.5-2 ft	AI3-112 AI3-112(6-12) 05/10/11 0.5-1 ft	AI3-112 AI3-112(6-24) 05/10/11 0.5-2 ft	AI3-106 AI3-106(2-4) 05/11/11 2-4 ft	AI3-107 AI3-107(2-4) 05/11/11 2-4 ft	AI3-110 AI3-110(2-4) 05/11/11 2-4 ft
Volatile Organics (mg/kg)											
2-Butanone											
Acetone											
Ethyl benzene											
Vinyl chloride											
Semivolatile Organics (mg/kg)											
1-Methylnaphthalene	0.003 J	0.001 J	0.00091 J	0.0031 J	0.0068 J	0.065	0.0013 U				
2-Methylnaphthalene	0.0038 J	0.0012 J	0.001 J	0.0042 J	0.014	**0.076** J	0.00088 J				
4-Chloro-3-methylphenol											
Acenaphthene	0.0023 J	0.0017 J	0.0012 UJ	0.004 J	0.0056 J	**0.19** J	0.0013 UJ				
Acenaphthylene	0.0074 J	0.0047 J	0.0055 J	0.028	**0.058**	**0.56**	0.0031 J				
Anthracene	0.0087	0.0073 J	0.0035 J	0.025 J	0.038	**0.67** J	0.0022 J				
Benzo(a)anthracene	0.039	0.036 J	0.017 J	0.11 J	0.17	**1.4** J	0.0071 J				
Benzo(a)pyrene	0.045	0.038 J	0.018 J	0.12 J	0.2	**1.4** J	0.011 J				
Benzo(b)fluoranthene	0.066	0.062 J	0.03 J	0.2 J	0.33	**2.2** J	0.019 J				
Benzo(ghi)perylene	0.04	0.031 J	0.013 J	0.085	0.15	**0.98**	0.0089				
Benzo(k)fluoranthene	0.0022 U	0.002 U	0.0021 U	0.002 U	0.0019 U	0.0093 U	0.0022 U				
Bis(2-Ethylhexyl)phthalate											
Butylbenzylphthalate											
Carbazole											
Chrysene	0.041	0.046 J	0.018 J	0.12 J	0.16	**1.3** J	0.011 J				
Dibenz(a,h)anthracene	0.0084 J	0.0084 J	0.0025 UJ	0.024	0.041	**0.23**	0.0026 U				
Dibenzofuran											
Di-n-butylphthalate											
Di-n-octylphthalate											
Fluoranthene	0.065	0.075 J	0.028 J	0.21 J	0.21	**2.4** J	0.014 J				
Fluorene	0.0023 J	0.0023 J	0.0021 UJ	0.0067 J	0.0074 J	**0.21** J	0.0022 UJ				
Indeno(1,2,3-cd)pyrene	0.029	0.029 J	0.0069 J	0.074	0.14	**0.89**	0.0085 J				
Naphthalene	0.0038 J	0.0022 J	0.0012 UJ	0.0061 J	0.011	**0.1** J	0.0013 UJ				
Phenanthrene	0.029	0.044 J	0.011 J	0.089 J	0.069	**1.8** J	0.0059 J				
Pyrene	0.063	0.061 J	0.024 J	0.17 J	0.2	1.9 J	0.011 J				
Metals (mg/kg)											
Aluminum	10100	11300	9950	10200	9210	9610	12500		6650	9230	5940
Antimony	0.37 J	0.44 UJ	0.45 J	0.45 UJ	0.4 J	0.44 UJ	0.5 UJ		**1.2** J	0.19 J	0.24 J
Arsenic	**7.7**	2.8 J	6.2 J	4.3	**8.4**	6.7	2.6		4.2	3.4	5.3
Barium	55.7	49.8	42.7	42.4	56.2	76.8	57.3		48.1	57.3	53
Beryllium	0.53	**0.87**	**0.76**	0.74	0.53	0.65	**1.1**		0.44	0.56	0.45
Cadmium	0.24 J	0.034 J	0.12 J	0.16 J	0.21 J	0.19 J	0.099 U		0.11 J	0.091 U	0.14 J
Calcium	5100	267 J	400 J	582 J	1960	6690 J	331 J		3270	1910	2180
Chromium	21	16.4	17.2 J	19.6	20.1	24.5	22.1		15.1	17.9	15.3
Cobalt	6 J	4.1 J	3.4 J	6.3	6.1	7.7	6.8		6	5.5 J	5.2 J
Copper	29.3 J	12.6 J	31.4 J	22	28.6 J	27.8	9.8		**166** J	24.3 J	36.4 J
Iron	17300	12200	12300 J	14500	15700	16500	14800		17300	14500	12900
Lead	168 J	21.3 J	104 J	55.7 J	122 J	68.2 J	15.5 J		152 J	55.9 J	86.4 J
Magnesium	2720	2120 J	1900 J	2430 J	2310	**6390** J	2590 J		3150	2400	2340
Manganese	382 J	245 J	157 J	307	325 J	324	463		278 J	221 J	231 J
Nickel	17.6	13.3	13.9 J	17.2	17.2	22.5	18.7		25.6	16.1	16.6
Potassium	863	356 J	385 J	503 J	938	1770	544 J		797	706	1040
Selenium	**0.49** J	0.77 U	**0.5** J	0.78 U	0.37 J	0.76 U	0.87 U		**0.47** J	**0.46** J	**0.44** J
Silver	0.12 U	0.11 U	0.12 U	0.11 U	0.078 J	0.11 U	0.12 U		0.085 J	0.11 U	0.11 U
Sodium	102 J	66.3 U	28.9 J	109 J	31.1 J	**436** J	19 J		88.7 J	57.3 J	29.2 J
Thallium	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U		1.1 U	1.1 U	1.1 U
Vanadium	29.3	19.8 J	32.6 J	34.9	27	32	25.3		20.4	22.1	20
Zinc	98.6 J	40.3 J	48.2 J	53.8 J	91.2 J	127 J	45 J		142 J	66.3 J	72.1 J
Mercury (mg/Kg)											
Mercury						0.357 J		0.128 J			
Mercury, Inorganic Salts											
Methyl mercury						0.000238 J		0.000179 J			
Elemental Mercury						0.0002 U		0.0003 U			

Notes
mg/Kg = milligram per kilogram
U = not detected
J = value is estimated
R = value is rejected
N = Spike sample recovery not within control limits
B = Analyte was detected in the method blank
* = Duplicate analysis not within control limit
D = Concentration reported from a secondary dilution
E = Compound exceeded the calibration range of the instrument
X = Defined by the laboratory
P = Value from a Gas Chromatograph (GC) analysis when there is greater than 25% difference between the two GC columns

indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO
Prepared by / Date: KJC 10/10/11

Table 6-4
Summary of Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Average of All Samples	Background Shallow	Background Deep	NYS SCO Unrestricted	NYS SCO Residential	NYS SCO Residential Restricted	NYS SCO Commercial	NYS SCO Industrial	USEPA RSL Residential	USEPA RSL Industrial	SB-01 FSS-SB-01-01 08/01/98 0-0.5 ft	SB-02 FSS-SB-02-01 08/01/98 0-0.5 ft	SB-03 FSS-SB-03-01 08/01/98 0-0.5 ft	SS-01 FSS-SS-01-01 07/01/00 0-0.17 ft	SS-02 FSS-SS-02-01 07/01/00 0-0.17 ft	SS-03 FSS-SS-03-01 07/01/00 0-0.17 ft
Volatile Organics (mg/Kg)																			
2-Butanone	2 / 6	0.0094 : 0.01	0.0037 - 0.004	0.0045	--	--	0.12	100	100	500	1000	28000 n	200000 nms						
Acetone	6 / 6		0.0036 - 0.089	0.044	--	--	0.05	100	100	500	1000	61000 n	630000 nms						
Trichloroethene	3 / 6	0.0043 : 0.0052	0.0014 - 0.0022	0.0022	--	--	0.47	10	21	200	400	2.8 c**	14 c**						
Vinyl chloride	3 / 6	0.0043 : 0.0052	0.0021 - 0.0061	0.0033	--	--	0.02	0.21	0.9	13	27	0.06 c	1.7 c						
Semivolatile Organics (mg/Kg)																			
1-Methylnaphthalene	28 / 29	0.0174 : 0.0174	0.00086 - 0.459	0.028	--	--	NC	NC	NC	NC	NC	22 c	99 c						
2-Methylnaphthalene	36 / 46	0.0174 : 0.39	0.0014 - 0.803	0.091	--	0.01423	NC	NC	NC	NC	NC	310 n	4100 ns				0.38 U	0.37 U	0.39 U
4-Chloro-3-methylphenol	3 / 22	0.00551 : 0.4	0.0059 - 0.0094	0.11	--	--	NC	NC	NC	NC	NC	6100 n	62000 n				0.38 U	0.37 U	0.39 U
4-Methylphenol	1 / 22	0.00537 : 0.4	0.03 - 0.03	0.11	--	--	0.33	34	100	500	1000	310 n	3100 n				0.38 U	0.37 U	0.39 U
Acenaphthene	33 / 51	0.0011 : 0.4	0.0019 - 2	0.096	0.084	0.05448	20	100	100	500	1000	3400 n	33000 n				0.38 U	0.37 U	0.39 U
Acenaphthylene	48 / 51	0.033 : 0.38	0.008 - 3.3	0.32	0.02767	0.02874	100	100	100	500	1000	NC	NC				0.38 U	**0.046** J	**0.096** J
Anthracene	47 / 52	0.033 : 0.39	0.0057 - 4	0.22	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm				0.38 U	0.37 U	0.09 J
Benzo(a)anthracene	54 / 54		0.028 - 7.3	0.99	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c	0.11 J		0.25 J	0.13 J	0.22 J	**0.56**
Benzo(a)pyrene	54 / 54		0.041 - 9.8	1.3	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c	0.13 J		0.31 J	0.19 J	0.31 J	**0.7**
Benzo(b)fluoranthene	55 / 55		0.036 - 16	1.7	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c	0.21 J	0.11 J	0.44	0.27 J	0.46	**1.1**
Benzo(ghi)perylene	54 / 54		0.033 - 9.1	0.97	0.2324	0.2015	100	100	100	500	1000	NC	NC	0.095 J		0.2 J	0.12 J	0.18 J	**0.39**
Benzo(k)fluoranthene	28 / 53	0.0018 : 0.076	0.029 - 2.7	0.33	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c			0.16 J	0.089 J	**0.18** J	**0.36** J
Bis(2-Ethylhexyl)phthalate	26 / 26		0.026 - 0.58	0.14	0.61	0.0869	NC	NC	NC	NC	NC	35 c*	120 c	0.58	0.094 J	0.13 J	0.087 J	0.085 J	0.17 J
Butylbenzylphthalate	8 / 22	0.00756 : 0.4	0.0086 - 0.068	0.092	0.2359	0.03433	NC	NC	NC	NC	NC	260 c*	910 c				0.38 U	0.37 U	0.39 U
Carbazole	13 / 21	0.033 : 0.39	0.01 - 160	16.0	--	0.06649	NC	NC	NC	NC	NC	NC	NC				0.38 U	0.37 U	65 J
Chrysene	55 / 55		0.033 - 8.2	1.1	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c	0.15 J	0.11 J	0.33 J	0.14 J	0.29 J	**0.67**
Dibenz(a,h)anthracene	46 / 52	0.37 : 0.66	0.01 - 2	0.26	0.03904	0.04165	0.33	0.33	0.33	0.56	1.1	0.015 c	0.21 c				0.38 U	0.37 U	**0.041** J
Dibenzofuran	11 / 22	0.00803 : 0.39	0.0084 - 0.14	0.086	--	--	7	14	59	350	1000	78 n	1000 ns				0.38 U	0.37 U	0.39 U
Di-n-butylphthalate	13 / 22	0.37 : 0.4	0.03 - 0.23	0.13	0.08313	0.01057	NC	NC	NC	NC	NC	6100 n	62000 n				0.38 U	0.37 U	0.39 U
Fluoranthene	55 / 55		0.04 - 16	1.6	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n	0.23 J	0.14 J	0.45	0.25 J	0.48	**1.1**
Fluorene	40 / 51	0.033 : 0.4	0.0014 - 1.9	0.091	0.06418	0.06518	30	100	100	500	1000	2300 n	22000 n				0.38 U	0.37 U	0.39 U
Indeno(1,2,3-cd)pyrene	54 / 54		0.024 - 7.4	0.93	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c	0.1 J		**0.22** J	0.12 J	**0.2** J	**0.4**
Naphthalene	44 / 51	0.033 : 0.39	0.0019 - 1.9	0.10	--	0.01936	12	100	100	500	1000	3.6 c*	18 c*				0.38 U	0.37 U	0.39 U
Pentachlorophenol	1 / 22	0.00552 : 2	0.022 - 0.022	0.53	--	--	0.8	2.4	6.7	6.7	55	0.89 c	2.7 c				1.9 U	1.8 U	2 U
Phenanthrene	55 / 55		0.012 - 12	0.62	0.7072	1.448	100	100	100	500	1000	NC	NC	0.12 J	0.081 J	0.15 J	0.11 J	0.21 J	0.57
Phenol	1 / 17	0.033 : 0.4	0.04 - 0.04	0.14	--	--	0.33	100	100	500	1000	18000 n	180000 nm				0.38 U	0.37 U	0.39 U
Pyrene	55 / 55		0.038 - 14	1.8	1.044	2.319	100	100	100	500	1000	1700 n	17000 n	0.26 J	0.13 J	0.49	0.27 J	0.5	**1.3**
Metals (mg/Kg)																			
Aluminum	37 / 37		4880 - 21300	9007	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	11400	8660	9760	7650 E	7750 E	8400 E
Antimony	34 / 36	0.12 : 0.37	0.15 - 1.3	0.52	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.93 N	1.1	0.12 UN	0.39 BN	0.42 BN	0.34 BN
Arsenic	36 / 36		0.53 - 19.2	4.7	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	2.9	2.9	4.8	2.9	3.4	4.9
Barium	37 / 37		42.9 - 138	80	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	**129**	83.6	98.6	**121**	80.9	106
Beryllium	35 / 37	0.4 : 0.54	0.053 - 0.53	0.25	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.53 B	0.37 B	0.45 B	0.29 B	0.29 B	0.3 B
Cadmium	31 / 31		0.047 - 0.86	0.35	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n		0.14 B		0.21 B	0.16 B	0.41 B
Calcium	37 / 37		983 - 6900	2658	12100	16223	NC	NC	NC	NC	NC	NC	NC	1270 X	2320	2480 X	1250 E	1050 E	1450 E
Chromium	37 / 37		12.7 - 33	19.2	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	28.2 X	25.8	20.4 X	19.5	19.9	21.5
Cobalt	37 / 37		3.3 - 12	6.4	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	8.2	8	7	6	5.1 B	6
Copper	37 / 37		14.4 - 50.9	27	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	20.8	29	34.5	14.5 E	21.7 E	50.9 E
Iron	37 / 37		10700 - 30800	16211	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	23100	18500	19100	11800	12400	13300
Lead	37 / 37		2.9 - 305	145	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	175	119	177	206	137	235
Magnesium	37 / 37		1460 - 5670	2755	4802	4433	NC	NC	NC	NC	NC	NC	NC	3360 N	2760 X	2790 N	1920 E	2000 E	2080 E
Manganese	37 / 37		207 - 566	371	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	493	391	470	352	321	335
Nickel	37 / 37		11.4 - 29.7	17.2	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	23.7	20.2	18.7	15	17.5	17.5
Potassium	37 / 37		724 - 3330	1224	1286	2194	NC	NC	NC	NC	NC	NC	NC	843 E	**1440**	**1350** E	739	1060	1020
Selenium	29 / 31	0.65 : 0.81	0.19 - 1.1	0.55	--	0.439	3.9	36	180	1500	6800	390 n	5100 n				0.63	0.47 B	0.6
Silver	2 / 31	0.093 : 1.7	0.27 - 0.28	0.16	--	0.211	2	36	180	1500	6800	390 n	5100 n				0.19 U	0.33 U	0.35 U
Sodium	36 / 37	31.4 : 31.4	32 - 404	150	250	277.2	NC	NC	NC	NC	NC	NC	NC	116 B	128	135	118	197	200
Thallium	14 / 35	0.12 : 6	0.12 - 0.31	0.22	--	0.892	NC	NC	NC	NC	NC	0.78 n	10 n		0.12 B	0.15 B	0.14 U	0.12 U	0.13 U
Vanadium	37 / 37		19.2 - 40	27	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	34.7	29.6	33.7	24.2	23.3	27.5
Zinc	37 / 37		25.5 - 200	112	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	99.5	94.2	122	116	91.3	169
Mercury (mg/Kg)																			
Mercury	42 / 43	0.06 : 0.06	0.004 - 0.86	0.25	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	0.16	0.35	0.77	0.06 U	0.08 B	0.39
Mercury, Inorganic Salts	33 / 34	0.06 : 0.06	0.004 - 0.86	0.29	--	--	0.12	1.2	5.8	47	220	23 n	310 n	0.16	0.35	0.77	0.06 U	0.08 B	0.39
Methyl mercury	9 / 9		0.000293 - 0.000708	0.00045	--	--	NC	NC	NC	NC	NC	7.8 n	100 n						
Elemental Mercury	0 / 9	0.0002 : 0.0004		0.00016	--	--	NC	NC	NC	NC	NC	NC	NC						

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Only results above Background, NYSDEC SCO's, or USEPA RSL's are listed

Table 6-4
Summary of Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	SS-04 FSS-SS-04-01 07/01/00 0-0.17 ft	SS-05 FSS-SS-05-01 07/01/00 0-0.17 ft	SS-06 FSS-SS-06-01 07/01/00 0-0.17 ft	SS-07 FSS-SS-07-01 07/01/00 0-0.17 ft	SS-08 FSS-SS-08-01 07/01/00 0-0.17 ft	SS-09 FSS-SS-09-01 07/01/00 0-0.17 ft	SS-10 FSS-SS-10-01 07/01/00 0-0.17 ft	SS-11 FSS-SS-11-01 07/01/00 0-0.17 ft	SS-12 FSS-SS-12-01 07/01/00 0-0.17 ft	SS-12 FSS-SS-12-22 07/01/00 0-0.17 ft	SS-12 FSS-SS-12-33 07/01/00 0-0.17 ft	SS-13 FSS-SS-13-01 07/01/00 0-0.17 ft	SS-14 FSS-SS-14-01 07/01/00 0-0.17 ft	SS-15 FSS-SS-15-01 07/01/00 0-0.17 ft	SS-16 FSS-SS-16-01 07/01/00 0-0.17 ft	SS-17 FSS-SS-17-01 07/01/00 0-0.17 ft	B-05 Ad2004-SS-25-SH 06/21/04 0-1 ft	B-05 Ad2004-SS-5-SH 06/21/04 0-1 ft	B-06 Ad2004-SS-6-SH 06/21/04 0-1 ft
Volatile Organics (mg/Kg)																			
2-Butanone																			
Acetone																			
Trichloroethene																			
Vinyl chloride																			
Semivolatile Organics (mg/Kg)																			
1-Methylnaphthalene																			
2-Methylnaphthalene	0.38 U	0.39 U							0.32 J	0.37 J	0.37	0.16 J	0.13 J	0.14 J	0.077 J	0.33 J			
4-Chloro-3-methylphenol	0.38 U	0.39 U							0.37 U	0.4 U	0.07 U	0.38 U	0.4 U	0.38 U	0.37 U	0.39 U	0.0094 J	0.0059 J	0.0082 J
4-Methylphenol	0.38 U	0.39 U							0.37 U	0.4 U	0.03 B	0.38 U	0.4 U	0.38 U	0.37 U	0.39 U	0.00537 U	0.00537 U	0.00537 U
Acenaphthene	0.38 U	0.39 U							0.038 J	0.4 U	0.02 B	0.38 U	0.4 U	0.38 U	0.37 U	0.39 U	0.03 J	0.014 J	0.022 J
Acenaphthylene	0.38 U	**0.32** J							**1.5**	**1.6**	**2.45**	**0.4**	**0.49**	**1.2**	**0.12** J	**0.049** J	**0.34**	**0.27**	**0.18**
Anthracene	0.042 J	0.13 J							**0.39**	**0.48**	**0.84**	0.13 J	0.13 J	**0.35** J	0.04 J	0.39 U	**0.28**	0.15	0.12
Benzo(a)anthracene	0.2 J	**0.97**							**4.1**	**4.6**	**7.1**	**0.89**	**1.2**	**3.5**	0.3 J	0.2 J	**1.4**	**1**	**0.97**
Benzo(a)pyrene	0.25 J	**1.3**							**6.4** E	**6.6** E	**9**	**1.5**	**1.9**	**5.1** E	**0.46**	0.21 J	**0.93**	**1.1**	**1.5**
Benzo(b)fluoranthene	0.38	**1.8**							**8.7** E	**9** E	**16**	**2.3**	**2.8**	**6.6** E	0.69	0.37 J	0.71	**0.88**	**1.2**
Benzo(ghi)perylene	0.15 J	**0.66**							**4.5** E	**4.9** E	**6.74**	**1.2**	**1.5**	**4.1**	**0.36** J	0.16 J	**0.84**	**0.74**	**0.69**
Benzo(k)fluoranthene	0.13 J	**0.63**							**2.7**	**2.7**	0.052 U	**0.87**	**1.1**	**2.4**	**0.24** J	0.14 J	**0.42**	**0.93**	**0.6**
Bis(2-Ethylhexyl)phthalate	0.11 J	0.092 J							0.18 J	0.16 J	0.18 B	0.19 J	0.14 J	0.18 J	0.12 J	0.093 J	0.12	0.057 J	0.094
Butylbenzylphthalate	0.38 U	0.39 U							0.37 U	0.4 U	0.03 B	0.038 J	0.056 J	0.068 J	0.37 U	0.39 U	0.00756 U	0.012 J	0.013 J
Carbazole	0.38 U	0.39 U							160 J	0.13 J		0.077 J	0.056 J	110 J	0.37 U	0.39 U	0.08	0.061	0.062
Chrysene	0.23 J	**1.1**							**4.5** E	**4.9** E	**7.17**	**1.2**	**1.4**	**3.7**	0.38	0.31 J	**1.4**	**1.1**	**0.88**
Dibenz(a,h)anthracene	0.38 U	**0.063** J							**1**	**1.2**	**1.27**	**0.083** J	**0.3** J	**0.94**	0.37 U	**0.043** J	**0.25**	**0.39**	**0.078**
Dibenzofuran	0.38 U	0.39 U							0.11 J	0.11 J	0.14 B	0.054 J	0.047 J	0.074 J	0.37 U	0.1 J	0.0085 J	0.011 J	0.016 J
Di-n-butylphthalate	0.38 U	0.05 J							0.37 U	0.4 U	0.03 B	0.044 J	0.4 U	0.055 J	0.37 U	0.39 U	0.036	0.046	**0.12**
Fluoranthene	0.44	**1.4**							**4.7** E	**4.8**	**11**	**1.5**	**1.4**	**3.6**	0.46	0.31 J	**1.8**	**1.6**	**1.9**
Fluorene	0.38 U	0.39 U							**0.092** J	**0.097** J	**0.09** B	0.038 J	0.4 U	**0.068** J	0.37 U	0.041 J	0.031 J	0.04	0.032 J
Indeno(1,2,3-cd)pyrene	0.15 J	**0.78**							**4.6** E	**5** E	**7.34**	**1.2**	**1.6**	**4.1**	**0.37** J	0.16 J	**1**	**0.82**	**0.75**
Naphthalene	0.38 U	0.052 J							0.29 J	0.32 J	0.39	0.15 J	0.13 J	0.19 J	0.061 J	0.14 J	0.01 J	0.012 J	0.022 J
Pentachlorophenol	1.9 U	2 U							1.9 U	2 U	0.31 U	1.9 U	2 U	1.9 U	1.8 U	1.9 U	0.00552 U	0.00552 U	0.022 J
Phenanthrene	0.28 J	0.55							**1.3**	**1.2**	**1.56**	0.49	0.4	**0.82**	0.17 J	0.44	0.51	0.49	0.5
Phenol	0.38 U	0.39 U							0.37 U	0.4 U	0.04 B	0.38 U	0.4 U	0.38 U	0.37 U	0.39 U			
Pyrene	0.48	**1.8**							**8** E	**8.8** E	**11**	**2.3**	**2.5**	**6.9** E	0.68	0.46	**1.8**	**1.4**	**1.8**
Metals (mg/Kg)																			
Aluminum	9990 E	8790 E	7210 E	5020 E	5470 E	4900 E	6180 E	6180 E	5160 E	4880 E	7250	6290 E	6390 E	5340 E	8100 E	7420 E		**14000**	**14500**
Antimony	0.36 BN	0.41 BN	0.62 BN	0.36 BN	0.25 BN	0.31 BN	0.77 N	0.23 BN	0.34 BN	0.46 BN		0.49 BN	0.41 BN	0.23 BN	0.39 BN	0.37 BN		0.61	0.71
Arsenic	4	7.2	4.5	3.8	3.8	3.4	4.2	3.8	4.2	4.2	5.7	**19.2**	5.4	4.3	5	9.6		7.9	6.9
Barium	65.9	95.7	87.7	57.8	43.8	45.1	85.8	42.9	57.6	60.3	85.8	69	87.9	62.3	76.9	73.9		105	74
Beryllium	0.4 B	0.39 B	0.26 B	0.2 B	0.2 B	0.14 B	0.21 B	0.24 B	0.16 B	0.17 B	0.38 B	0.26 B	0.31 B	0.19 B	0.3 B	0.32 B		0.17 J	0.1 J
Cadmium	0.14 B	0.35 B	0.24 B	0.21 B	0.18 B	0.28 B	0.47 B	0.14 B	0.59	0.64	0.86	0.64	0.85	0.75	0.3 B	0.22 B		0.49 J	0.37 J
Calcium	1460 E	2060 E	2760 E	1300 E	1280 E	2310 E	3070 E	1190 E	5160 E	4760 E	5340	4790 E	4710 E	5050 E	2630 E	983 E		4090	2970
Chromium	22.1	21.6	18.3	14.9	15.4	12.9	15	14.1	12.7	13.4	20.7	17	15.7	13.5	18.6	17.4		21	20
Cobalt	6.7	6.3	5.5 B	4.2 B	4.5 B	3.3 B	4.2 B	4.5 B	3.8 B	4.1 B	6.7	5.4	5.2	4.3 B	5.7	4.9 B		7.6	7.7
Copper	17.9 E	24.9 E	25.9 E	22.8 E	19.5 E	19 E	28.6 E	16.4 E	28.9 E	31.5 E	38.2	36.8 E	32.2 E	32.4 E	25.7 E	22.9 E		34	37
Iron	15200	14800	16300	15300	13600	10700	11300	12100	11800	11000	14200	13900	14000	13000	16900	14000		17800	17900
Lead	85.8	187	172	141	117	93.8	229	95.4	152	164	191	169	198	189	167	129		171	108
Magnesium	2370 E	2320 E	2230 E	1490 E	1730 E	1460 E	1630 E	1600 E	2530 E	2560 E	2910	3100 E	2760 E	2450 E	2220 E	1710 E		4060	3390
Manganese	419	408	332	265	229	207	306	317	246	249	312	297	298	253	365	364		466	424
Nickel	18.2	15.1	15.9	13.3	13	11.4	12.9	11.6	13.2	12.9	19.9	16.9	15.7	14.3	14.7	11.6		19 J	17 J
Potassium	1040	1140	1050	831	984	851	1140	907	945	933	1110	**1360**	**1450**	1000	1220	936		**1330** J	967 J
Selenium	0.59	0.64	0.55 B	0.48	0.39 B	0.69	0.5 B	0.58	0.73	0.55	1.1 B	0.6	0.63	0.71	0.82	0.64		0.59 J	0.52 J
Silver	0.34 U	0.33 U	0.18 U	0.15 U	0.15 U	0.18 U	0.2 U	0.17 U	0.19 U	0.17 U	0.28 B	0.17 U	0.33 U	0.15 U	0.36 U	0.19 U		0.362 U	0.362 U
Sodium	147	155	161	97.2	97.1	112 B	164	108	174	129	200	153	175	156	141	122		**404**	157
Thallium	0.13 U	0.14 U	0.14 U	0.12 U	0.12 U	0.14 U	0.15 U	0.13 U	0.13 U	0.13 U	6 U	0.13 U	0.14 U	0.13 U	0.14 U	0.14 U		0.18 J	0.18 J
Vanadium	28.3	27.4	25.9	23.9	26.5	19.2	20.7	24.3	22.7	23.2	34.5	30	29.1	26.4	29.7	25.4		32 J	35 J
Zinc	70.2	142	135	101	94.1	121	155	59.4	129	133	160	144	164	131	150	81.1		144	98
Mercury (mg/Kg)																			
Mercury	0.08 B	0.35	0.64	0.3	0.21	0.24	0.48	0.18	0.16	0.13	0.174	0.12	0.11	0.1 B	0.21	0.37		0.38	0.29
Mercury, Inorganic Salts	0.08 B	0.35	0.64	0.3	0.21	0.24	0.48	0.18	0.16	0.13	0.174	0.12	0.11	0.1 B	0.21	0.37		0.38	0.29
Methyl mercury																			
Elemental Mercury																			

Table 6-4
Summary of Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	B-07 Ad2004-SS-27-SH 06/21/04 0-1 ft	B-07 Ad2004-SS-7-SH 06/21/04 0-1 ft	B-08 Ad2004-SS-8-SH 06/21/04 0-1 ft	AI4-101 AI4-101(0-2) 05/10/11 0-0.17 ft	AI4-102 AI4-102(0-2) 05/12/11 0-0.17 ft	AI4-103 AI4-103(0-2) 05/12/11 0-0.17 ft	AI4-104 AI4-104(0-2) 05/12/11 0-0.17 ft	AI4-105 AI4-105(0-2) 05/11/11 0-0.17 ft	AI4-106 AI4-106(0-2) 05/11/11 0-0.17 ft	AI4-107 AI4-107(0-2) 05/12/11 0-0.17 ft	AI4-108 AI4-108(0-2) 05/12/11 0-0.17 ft	AI4-109 AI4-109(0-2) 05/12/11 0-0.17 ft	AI4-110 AI4-110(0-2) 05/12/11 0-0.17 ft	AI4-111 AI4-111(0-2) 05/12/11 0-0.17 ft	AI4-112 AI4-112(0-2) 05/11/11 0-0.17 ft	AI4-113 AI4-113(0-2) 05/12/11 0-0.17 ft	AI4-114 AI4-114(0-2) 05/12/11 0-0.17 ft	AI4-115 AI4-115(0-2) 05/11/11 0-0.17 ft
Volatile Organics (mg/Kg)																		
2-Butanone																		
Acetone																		
Trichloroethene																		
Vinyl chloride																		
Semivolatile Organics (mg/Kg)																		
1-Methylnaphthalene					0.0068 J	0.023	0.029	0.027	0.11 J	0.0066 J	0.0095	0.0171	0.0144	0.459	0.0085 J	0.0094	0.0062 J	0.0023 J
2-Methylnaphthalene		0.033 U			0.0096 J	0.022	0.036	0.035	0.14 J	0.0076 J	0.0123	0.021	0.0126	0.803	0.011 J	0.0061 J	0.0066 J	0.0028 J
4-Chloro-3-methylphenol		0.033 U	0.00551 U															
4-Methylphenol		0.033 U	0.00537 U															
Acenaphthene		0.033 U	0.0086 J		0.0058 J	0.0098 J	0.0044 J	0.0088 J	**0.23** J	0.0092	0.012	0.011	0.053	**2**	0.0079 J	0.0088	0.0085	0.0026 J
Acenaphthylene		0.017 J	**0.029** J		**0.065**	**0.16**	**0.035**	**0.25**	**3.3**	**0.034**	**0.17**	**0.043**	**0.099**	**0.1**	**0.13**	**0.13**	**0.13**	0.025
Anthracene		0.017 J	0.031 J		0.042	0.086	0.021	0.1	**1.4**	0.029	**0.16**	0.041	0.12	**4**	0.065	0.062	0.072	0.017 J
Benzo(a)anthracene		0.14	0.2		0.19	0.33	0.099	**0.56**	**7.3**	0.11	0.35	0.22	0.46	**6**	0.3	0.36	0.29	0.096
Benzo(a)pyrene		0.16 J	0.19		0.25	0.42	0.13	**0.77**	**9.8**	0.14	**0.51**	0.27	**0.54**	**4.6**	**0.45**	**0.49**	0.42	0.13
Benzo(b)fluoranthene		0.093 J	0.2		0.37	0.73	0.2	**1.3**	**15**	0.21	**1.2**	0.44	**0.76**	**2.9**	0.67	0.54	0.6	0.19
Benzo(ghi)perylene		0.12 J	0.14		0.22	**0.34**	0.12	**0.75**	**9.1**	0.14	**0.45**	0.2	**0.39**	**2.6**	**0.43**	**0.61**	**0.33**	0.1
Benzo(k)fluoranthene		0.081 J	0.092		0.0038 U	**0.8**	0.002 U	0.0039 U	0.076 U	0.0021 U	0.002 U	0.0018 U	0.002 U	**1.4**	0.0038 U	**0.17**	0.002 U	0.004 U
Bis(2-Ethylhexyl)phthalate		0.062 J	0.15															
Butylbenzylphthalate		0.016 J	0.00756 U															
Carbazole		0.01 J	0.02 J															
Chrysene		0.16 J	0.22		0.23	**0.6**	0.12	**0.57**	**8.2**	0.14	**0.57**	0.29	**0.49**	**4.7**	0.3	0.41	0.33	0.11
Dibenz(a,h)anthracene		0.66 U	**0.044** J		**0.051**	**0.081**	0.022	**0.17**	**2**	0.027	**0.13**	**0.057**	**0.11**	**1.3**	**0.098**	**0.18**	**0.099**	0.024
Dibenzofuran		0.033 U	0.00803 U															
Di-n-butylphthalate		**0.19**	0.056															
Fluoranthene		0.21	0.33		0.37	**0.95**	0.18	**0.97**	**16**	0.23	0.65	0.38	**1**	**11**	0.39	**0.89**	0.55	0.16 J
Fluorene		0.033 U	0.014 J		0.0072 J	0.019	0.0054 J	0.019	**0.3**	0.0087	0.017	0.01	0.04	**1.9**	0.012 J	0.011	0.014	0.0031 J
Indeno(1,2,3-cd)pyrene		0.14 J	0.14		0.18	**0.29**	0.099	**0.66**	**7.4**	0.11	**0.43**	0.18	**0.33**	**2.5**	**0.35**	**0.51**	**0.3**	0.085
Naphthalene		0.033 U	0.0089 J		0.011 J	0.022	0.025	0.031	0.21 J	0.0084 J	0.017	0.017	0.016	1.9	0.019	0.0077 J	0.0097	0.0049 J
Pentachlorophenol		0.033 U	0.00552 U															
Phenanthrene		0.07	0.18		0.13	0.33	0.075	0.22	**5.2**	0.11	0.19	0.14	0.66	**12**	0.11	0.23	0.2	0.05 J
Phenol		0.033 U																
Pyrene		0.23 J	0.38		0.35	1	0.2	0.86	**14**	0.23	0.62	0.35	0.87	**9.2**	0.39	0.55	0.47	0.13
Metals (mg/Kg)																		
Aluminum	12500	**13600**	12400	7610														
Antimony	1.3	1.1	0.72	0.22 J														
Arsenic	5.3	5.1	5.5	3.6														
Barium	94	95	**138**	64.1														
Beryllium	0.11 J	0.068 J	0.31 J	0.4 U														
Cadmium	0.33 J	0.32 J	0.54	0.19 J														
Calcium	1810	2140	2870	6900 J														
Chromium	18 J	19	20	17.3														
Cobalt	7.6	7.9	7.9	5.6 J														
Copper	32	35	37	29														
Iron	18700	**24900**	19300	12700														
Lead	208	222	305	94.6 J														
Magnesium	2430	3190	2700	**5090** J														
Manganese	412	566	471	351														
Nickel	17 J	18 J	20	15.8														
Potassium	1140	**1340** J	1230	919														
Selenium	0.5 J	0.49 J	0.43 J	0.81 U														
Silver	1.7 U	0.362 U	0.45 U	0.12 U														
Sodium	40 J	31.4 U	72	172 J														
Thallium	0.17 J	0.17 J	0.16 J	1.2 U														
Vanadium	29 J	29 J	37	21.1														
Zinc	151	148	199	116 J														
Mercury (mg/Kg)																		
Mercury	0.65	0.79	0.43					0.19 J	0.181 J						0.117 J			0.0864 J
Mercury, Inorganic Salts	0.65	0.79	0.43															
Methyl mercury								0.000708 J	0.000535 J						0.000464 J			0.00038 J
Elemental Mercury								0.0003 U	0.0004 U						0.0004 U			0.0004 U

Table 6-4
Summary of Analytical Results in Soil - Area 4
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Queens, New York

Parameter	AI4-115 DUP-AI4-1 05/11/11 0-0.17 ft	SB-01 FSS-SB-01-02 08/01/98 2-3 ft	SB-01 FSS-SB-01-03 08/01/98 15-16 ft	SB-02 FSS-SB-02-02 08/01/98 2-3 ft	SB-02 FSS-SB-02-03 08/01/98 14-15 ft	SB-03 FSS-SB-03-02 08/01/98 2-3 ft	SB-03 FSS-SB-03-04 08/01/98 14-16 ft	SB-03 FSS-SB-03-05 08/01/98 14-16 ft	SB-03 FSS-SB-03-07 08/01/98 14-16 ft	B-05 Ad2004-SS-5-DP 06/21/04 1-2 ft	B-06 Ad2004-SS-6-DP 06/21/04 1-2 ft	B-07 Ad2004-SS-7-DP 06/21/04 1-2 ft	B-08 Ad2004-SS-8-DP 06/21/04 1-2 ft	AI4-101 AI4-101(6-24) 05/10/11 0.5-2 ft	AI4-102 AI4-102(6-24) 05/12/11 0.5-2 ft	AI4-103 AI4-103(6-24) 05/12/11 0.5-2 ft	AI4-104 AI4-104(6-24) 05/12/11 0.5-2 ft	AI4-105 AI4-105(6-24) 05/11/11 0.5-2 ft	AI4-106 AI4-106(6-24) 05/11/11 0.5-2 ft
Volatile Organics (mg/Kg)																			
2-Butanone		0.0097 U		0.0037 J	0.01 U		0.004 J	0.0097 U	0.0094 U										
Acetone		0.039		0.031	0.0036 J		0.089	0.08	0.021										
Trichloroethene		0.0014 J		0.0043 U	0.0052 U		0.0051 U	0.0022 J	0.002 J										
Vinyl chloride		0.0021 J		0.0043 U	0.0052 U		0.0051 U	0.0061	0.0041 J										
Semivolatile Organics (mg/Kg)																			
1-Methylnaphthalene	0.0034 J														0.0021 J	0.0079	0.0047 J	0.008	0.016 J
2-Methylnaphthalene	0.0044 J									0.033 U	0.033 U	0.033 U			0.0023 J	0.0059 J	0.0061 J	0.01	**0.032** J
4-Chloro-3-methylphenol										0.033 U	0.033 U	0.033 U	0.00551 U						
4-Methylphenol										0.033 U	0.033 U	0.033 U	0.00537 U						
Acenaphthene	0.0088 J									0.033 U	0.033 U	0.033 U	0.011 J		0.0011 U	0.003 J	0.0012 U	0.0042 J	0.043 J
Acenaphthylene	**0.029**									0.033 U	0.016 J	0.026 J	**0.049**		0.021	**0.051**	0.013	**0.11**	**1.5**
Anthracene	0.03 J					0.13 J				0.033 U	0.033 U	0.016 J	0.045		0.012	0.022	0.0057 J	0.04	**0.62**
Benzo(a)anthracene	0.11					0.57				0.028 J	0.13	0.33	0.39		0.079	0.12	0.029	0.24	**4.7**
Benzo(a)pyrene	0.14					0.62				0.041 J	0.15 J	0.3 J	0.36		0.1	0.16	0.043	0.36	**6.4**
Benzo(b)fluoranthene	0.21					0.91				0.036 J	0.13 J	0.19 J	0.36		0.15	0.22	0.064	0.58	**8.8**
Benzo(ghi)perylene	0.11					**0.44**				0.033 J	0.14 J	**0.25** J	**0.26**		0.083	0.12	0.041	**0.35**	**5.3**
Benzo(k)fluoranthene	0.004 U					**0.35** J				0.029 J	0.14 J	0.18 J	0.21		0.0019 U	0.0019 U	0.0019 U	0.0019 U	0.027 U
Bis(2-Ethylhexyl)phthalate						**0.36** J				0.039	**0.17** J	0.026 J	**0.089**						
Butylbenzylphthalate										0.033 U	0.033 U	0.033 U	0.0086 J						
Carbazole										0.033 U	0.033 U	0.023 J	0.028 J						
Chrysene	0.12					0.73				0.033 J	0.12 J	0.29 J	0.48		0.082	0.16	0.039	0.29	**4.3**
Dibenz(a,h)anthracene	0.024					**0.13** J				0.66 U	**0.058** J	**0.12** J	**0.084**		0.015	0.022	0.01	**0.077**	**1.2**
Dibenzofuran										0.033 U	0.033 U	0.033 U	0.0084 J						
Di-n-butylphthalate										**0.068**	**0.16**	**0.23**	**0.032** J						
Fluoranthene	0.22 J					1.1				0.04	0.17	0.44	0.75		0.11	0.22	0.051	0.41	**6.6**
Fluorene	0.0092 J									0.033 U	0.033 U	0.033 U	0.028 J		0.0026 J	0.007 J	0.0014 J	0.0066 J	**0.091** J
Indeno(1,2,3-cd)pyrene	0.09					**0.46**				0.024 J	0.12 J	0.28 J	0.29		0.07	0.1	0.035	0.29	**4.4**
Naphthalene	0.0065 J									0.033 U	0.033 U	0.0072 J	**0.08**		0.0034 J	0.0074 J	0.0046 J	0.012	**0.083** J
Pentachlorophenol										0.033 U	0.033 U	0.033 U	0.00552 U						
Phenanthrene	0.11 J					0.73				0.012 J	0.03 J	0.058	0.45		0.033	0.1	0.015	0.069	1.1
Phenol										0.033 U	0.033 U	0.033 U							
Pyrene	0.17					1.2				0.038 J	0.16 J	0.44 J	0.76		0.12	0.27	0.057	0.36	**6.1**
Metals (mg/Kg)																			
Aluminum			5610		5840	8470			7040	**21300**	**18400**	11700	11800	10300					
Antimony			**0.77** N		0.55 B	**1.2** N			0.61 BN	0.15 J	0.23 J	**0.68**	0.55	0.37 UJ					
Arsenic			0.53 B		0.59 B	4.9				2.4	3	3	4.9	3.1					
Barium			52		50.3	90			52.8	73	61	88	120	69.4					
Beryllium			0.16 B		0.22 B	0.42 B			0.19 B	0.11 J	0.053 J	0.13 J	0.21 J	0.54 U					
Cadmium										0.047 J	0.13 J	0.13 J	0.44 J	0.055 J					
Calcium			2120 X		1780	2110 X			1650 X	1430	1460	2380	2600	3360 J					
Chromium			17.3 X		17	17.8 X			18.2 X	**33**	**31**	20	21	20.7					
Cobalt			7		7.5	6.3 B			6.9	12	11	8.6	7.3	6.2					
Copper			15.7		14.4	35.4			24.2	23	21	29	30	19.6					
Iron			15900		14900	15600			16400	**30800**	**25900**	20900	17900	13900					
Lead			3.5		3.4	183			2.9	14	24	152	298	39 J					
Magnesium			2960 N		2630 X	2240 N			3340 N	**5670**	4280	3680	2620	3680 J					
Manganese			389		482	404			293	485	452	440	380	476					
Nickel			21.1		20.9	16.4			29.7	24 J	22 J	19 J	17	16.8					
Potassium			2020 E		1950	1170 E			1640 E	**3330** J	1450 J	1680 J	1060	724					
Selenium						**0.73**				0.19 J	0.38 J	0.38 J	0.27 J	0.65 U					
Silver						**0.27** B				0.362 U	0.362 U	0.362 U	0.45 U	0.093 U					
Sodium			**299**		113 B	139			203	229	32 J	55	70	**360** J					
Thallium			0.12 B		0.17 B				0.31 B	0.25 J	0.19 J	0.17 J	0.15 J	0.93 U					
Vanadium			19.3		20	28.8			24.8	**40** J	37 J	23 J	24	22.4					
Zinc			26.6		25.5	115			26.2	44	49	71	200	61.3 J					
Mercury (mg/Kg)																			
Mercury	0.0826 J		0.004 B			0.86			0.01	0.021 J	0.068 J	0.27	0.3					0.0938 J	0.0661 J
Mercury, Inorganic Salts			0.004 B			0.86			0.01	0.021 J	0.068 J	0.27	0.3						
Methyl mercury	0.000293 J																	0.000322 J	0.00031 J
Elemental Mercury	0.0003 U																	0.0002 U	0.0003 U

Table 6-4
Summary of Analytical Results in Soil - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI4-107 AI4-107(6-24) 05/12/11 0.5-2 ft	AI4-108 AI4-108(6-24) 05/12/11 0.5-2 ft	AI4-109 AI4-109(6-24) 05/12/11 0.5-2 ft	AI4-110 AI4-110(6-24) 05/12/11 0.5-2 ft	AI4-111 AI4-111(6-24) 05/12/11 0.5-2 ft	AI4-112 AI4-112(6-24) 05/11/11 0.5-2 ft	AI4-113 AI4-113(6-24) 05/12/11 0.5-2 ft	AI4-114 AI4-114(6-24) 05/12/11 0.5-2 ft	AI4-115 AI4-115(6-24) 05/11/11 0.5-2 ft
Volatile Organics (mg/Kg)									
2-Butanone									
Acetone									
Trichloroethene									
Vinyl chloride									
Semivolatile Organics (mg/Kg)									
1-Methylnaphthalene	0.0037 J	0.0174 U	0.0037 J	0.0065 J	0.025	0.0014 J	0.00086 J	0.0011 J	0.0025 J
2-Methylnaphthalene	0.0051 J	0.0174 U	0.0042 J	0.0089	**0.0375**	0.0025 J	0.0014 J	0.0014 J	0.003 J
4-Chloro-3-methylphenol									
4-Methylphenol									
Acenaphthene	0.0012 U	0.024 J	0.0031 J	0.0032 J	**0.12**	0.0019 J	0.0036 J	0.0028 J	0.0056 J
Acenaphthylene	0.027	**0.27**	0.008	0.019	**0.034**	**0.039**	**0.067**	0.014	0.016
Anthracene	0.017	0.27	0.0088	0.012	0.21	0.017	0.03	0.012	0.02
Benzo(a)anthracene	0.073	**1.3**	0.043	0.051	0.41	0.096	0.2	0.051	0.069
Benzo(a)pyrene	0.095	**0.98**	0.056	0.068	0.35	0.14	0.24	0.065	0.094
Benzo(b)fluoranthene	0.14	**3.2**	0.093	0.094	0.32	0.21	0.24	0.097	0.14
Benzo(ghi)perylene	0.097	**0.76**	0.049	0.053	**0.3**	0.13	**0.28**	0.05	0.069
Benzo(k)fluoranthene	0.002 U	0.029 U	0.002 U	0.002 U	0.2	0.0019 U	0.1	0.002 U	0.0038 U
Bis(2-Ethylhexyl)phthalate									
Butylbenzylphthalate									
Carbazole									
Chrysene	0.079	**3.2**	0.06	0.057	0.38	0.082	0.19	0.065	0.084
Dibenz(a,h)anthracene	0.017	**0.18**	0.013	0.011	**0.11**	0.029	**0.078**	0.012	0.014 J
Dibenzofuran									
Di-n-butylphthalate									
Fluoranthene	0.13	**5.8**	0.081	0.085	0.86	0.098	0.32	0.1	0.14
Fluorene	0.0021 J	0.05 J	0.0032 J	0.004 J	**0.094**	0.0033 J	0.0036 J	0.0028 J	0.006 J
Indeno(1,2,3-cd)pyrene	0.076	**0.67**	0.047	0.047	0.27	0.11	0.24	0.044	0.059
Naphthalene	0.0059 J	**0.024** J	0.004 J	0.0041 J	**0.042**	0.0057 J	0.0032 J	0.0019 J	0.004 J
Pentachlorophenol									
Phenanthrene	0.04	0.41	0.033	0.05	0.64	0.022	0.03	0.05	0.067
Phenol									
Pyrene	0.12	**5.9**	0.081	0.084	0.48	0.11	0.23	0.095	0.12
Metals (mg/Kg)									
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Mercury (mg/Kg)									
Mercury						0.0775 J			0.0654 J
Mercury, Inorganic Salts									
Methyl mercury						0.000409 J			0.000639 J
Elemental Mercury						0.0003 U			0.0003 U

Notes
mg/Kg = milligram per kilogram
U = not detected
J = value is estimated
R = value is rejected
N = Spike sample recovery not within control limits
B = Analyte was detected in the method blank
* = Duplicate analysis not within control limit
D = Concentration reported from a secondary dilution
E = Compound exceeded the calibration range of the instrument
X = Defined by the laboratory
P = Value from a Gas Chromatograph (GC) analysis when there is greater than 25% difference between the two GC columns

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
[box] indicates concentration is above the Industrial RSL
[green] indicates concentration is above the Unrestricted NYSDEC SCO
[blue] indicates concentration is above the Residential NYSDEC SCO
[yellow] indicates concentration is above the Restricted Residential NYSDEC SCO
[orange] indicates concentration is above the Commercial NYSDEC SCO
[pink] indicates concentration is above the Industrial NYSDEC SCO

NC = no criteria available
blank cells - Indicate analyte was not analyzed for in that sample
Two duplicate samples were collected for SS-18-01 and SS-24-01.
SS-18-01 and SS-24-01 were the primary samples.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/01/11

Table 6-5
Summary of Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Average of All Samples	Background Shallow	Background Deep	New York State Soil Cleanup Objectives Unrestricted	NYS SCO Residential	NYS SCO Residential Restricted	NYS SCO Commercial	NYS SCO Industrial	USEPA Regional Screening Levels Residential	USEPA RSL Industrial	SB-08 FSS-SB-08-01 08/01/98 0-0.5 ft	SS-41 FSS-SS-41-01 07/01/00 0-0.17 ft	SS-42 FSS-SS-42-01 07/01/00 0-0.17 ft	SS-43 FSS-SS-43-01 07/01/00 0-0.17 ft	SS-44 FSS-SS-44-01 07/01/00 0-0.17 ft
Volatile Organics (mg/Kg)																		
Acetone	2 / 2		0.012 - 0.013	0.013	--	--	0.05	100	100	500	1000	61000 n	630000 nms					
Methylene chloride	1 / 3	0.0047 : 0.0048	0.00011 - 0.00011	0.0016	--	--	0.05	51	100	500	1000	11 c	53 c					
Vinyl chloride	1 / 2	0.0047 : 0.0047	0.012 - 0.012	0.0072	--	--	0.02	0.21	0.9	13	27	0.06 c	1.7 c					
Semivolatile Organics (mg/Kg)																		
Anthracene	2 / 2		0.065 - 0.067	0.066	0.1515	0.4015	100	100	100	500	1000	17000 n	170000 nm					
Benzo(a)anthracene	2 / 2		0.25 - 0.27	0.26	0.5034	0.9177	1	1	1	5.6	11	0.15 c	2.1 c					
Benzo(a)pyrene	2 / 2		0.22 - 0.23	0.23	0.4277	0.72	1	1	1	1	1.1	0.015 c	0.21 c					
Benzo(b)fluoranthene	2 / 2		0.31 - 0.37	0.34	0.7393	0.9443	1	1	1	5.6	11	0.15 c	2.1 c					
Benzo(ghi)perylene	2 / 2		0.091 - 0.1	0.096	0.2324	0.2015	100	100	100	500	1000	NC	NC					
Benzo(k)fluoranthene	2 / 2		0.15 - 0.16	0.16	0.1655	0.3204	0.8	1	3.9	56	110	1.5 c	21 c					
Bis(2-Ethylhexyl)phthalate	1 / 1		0.078 - 0.078	0.078	0.61	0.0869	NC	NC	NC	NC	NC	35 c*	120 c					
Chrysene	2 / 2		0.29 - 0.29	0.29	0.4155	0.7812	1	1	3.9	56	110	15 c	210 c					
Fluoranthene	2 / 2		0.47 - 0.5	0.49	0.7041	1.462	100	100	100	500	1000	2300 n	22000 n					
Indeno(1,2,3-cd)pyrene	1 / 1		0.066 - 0.066	0.066	0.1824	0.3446	0.5	0.5	0.5	5.6	11	0.15 c	2.1 c					
Phenanthrene	2 / 2		0.26 - 0.26	0.26	0.7072	1.448	100	100	100	500	1000	NC	NC					
Phenol	2 / 2		0.52 - 0.53	0.53	--	--	0.33	100	100	500	1000	18000 n	180000 nm					
Pyrene	2 / 2		0.54 - 0.78	0.66	1.044	2.319	100	100	100	500	1000	1700 n	17000 n					
Metals (mg/Kg)																		
Aluminum	39 / 39		2160 - 15200	6765	13200	16830	NC	NC	NC	NC	NC	77000 n	990000 nm	9380	2280	6750	2540	5880
Antimony	18 / 39	0.21 : 0.47	0.2 - 1.9	0.41	1.684	0.654	NC	NC	NC	NC	NC	31 n	410 n	0.46 BN	0.39 BN	0.21 UN	0.92 N	0.61 N
Arsenic	39 / 39		1.4 - 13.3	3.3	10.73	7.599	13	16	16	16	16	0.39 c*	1.6 c	2	4.4	5.5	5.2 X	3.5 X
Barium	39 / 39		15.8 - 156	52	113.7	160.1	350	350	400	400	10000	15000 n	190000 nm	37.7	79 N	80.2 N	84.8 X	62.8 X
Beryllium	25 / 39	0.19 : 0.49	0.19 - 0.72	0.32	0.62	0.749	7.2	14	72	590	2700	160 n	2000 n	0.34 B	0.19 B	0.41 B	0.24 B	0.22 B
Cadmium	21 / 37	0.084 : 0.094	0.037 - 1.7	0.27	2.5	0.77	2.5	2.5	4.3	9.3	60	70 n	800 n		0.31 B	0.86	0.34 B	0.97
Calcium	39 / 39		508 - 35300	6192	12100	16223	NC	NC	NC	NC	NC	NC	NC	993	3250 EN	3970 EN	2910 N	1210 N
Chromium	39 / 39		4.9 - 45.2	17.0	32.76	29.58	1	22	110	400	800	120000 nm	1500000 nm	18.1	7.9 E	17.5 E	4.9	17
Cobalt	39 / 39		2.7 - 35.5	7.0	9.122	12.2	NC	NC	NC	NC	NC	23 n	300 n	5 B	**10**	**35.5**	5.8	6.4
Copper	39 / 39		7.4 - 310	43	84.44	67.33	50	270	270	270	10000	3100 n	41000 n	9.5	**310** E	83.7 E	29.9	**91**
Iron	39 / 39		3870 - 25200	12968	23696	23254	NC	NC	NC	NC	NC	55000 n	720000 nm	15300	5790	13400	6210 X	13400 X
Lead	39 / 39		4.1 - 793	133	522.5	448.9	63	400	400	1000	3900	400 nL	800 nL	13.6	**536**	**793**	442 X	265 X
Magnesium	39 / 39		485 - 12700	2646	4802	4433	NC	NC	NC	NC	NC	NC	NC	2350 X	490	2130	485 X	1970 X
Manganese	39 / 39		46.6 - 510	218	626.7	586.4	1600	2000	2000	10000	10000	1800 n	23000 n	209	80.3 N	245 N	46.6 N	205 N
Nickel	39 / 39		7 - 36.4	15.7	33.68	96.41	30	140	310	310	10000	1500 n	20000 n	12.7	9.5	17.3	7	15.1
Potassium	39 / 39		325 - 5320	989	1286	2194	NC	NC	NC	NC	NC	NC	NC	760	376	1140	364	1080
Selenium	12 / 37	0.38 : 0.83	0.45 - 1.9	0.51	--	0.439	3.9	36	180	1500	6800	390 n	5100 n		0.5	0.88	0.47 B	1.3
Silver	9 / 37	0.1 : 0.13	0.072 - 2.4	0.20	--	0.211	2	36	180	1500	6800	390 n	5100 n		2.4	1.2	0.13 U	0.13 U
Sodium	39 / 39		45.9 - 567	248	250	277.2	NC	NC	NC	NC	NC	NC	NC	227	154	171	**304**	133
Thallium	1 / 37	0.12 : 1.2	0.012 - 0.012	0.49	--	0.892	NC	NC	NC	NC	NC	0.78 n	10 n		0.17 U	0.012 B	0.12 UW	0.12 U
Vanadium	39 / 39		11 - 44.9	22	55.95	37.44	NC	NC	NC	NC	NC	390 n	5200 n	21.4	16 N	19.6 N	11	19.4
Zinc	39 / 39		19.4 - 507	115	289.4	308.4	109	2200	10000	10000	10000	23000 n	310000 nm	37.6	154 N	223 N	109 N	179 N
Mercury (mg/Kg)																		
Mercury	23 / 23		0.088 - 12.2	2.5	1.2	2.26	0.18	0.81	0.81	2.8	5.7	10 ns	43 ns	**1.6**	0.77 X	**4.5** X	0.59 N	**4.8** N
Mercury, Inorganic Salts	18 / 18		0.088 - 12.2	2.9	--	--	0.12	1.2	5.8	47	220	23 n	310 n	1.6	0.77 X	4.5 X	0.59 N	4.8 N
Methyl mercury	3 / 5	0.000059 : 0.000062	0.000153 - 0.000209	0.00012	--	--	NC	NC	NC	NC	NC	7.8 n	100 n					
Elemental Mercury	0 / 5	0.0003 : 0.0004		0.00016	--	--	NC	NC	NC	NC	NC	NC	NC					

Table pages are intended to be viewed horizontally. To minimize page count, the columns reporting Frequency of Detection, Range of Reporting Limits, Range of Detected Concentrations, Average Concentrations, Background Data, NYSDEC SCOs, and USEPA RSLs are provided on Page 1 only.

Only results above Background, NYSDEC SCO's, or USEPA RSL's are listed

Table 6-5
Summary of Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	615-SB-16 615SB16 03/22/07 0-7 ft	615-SB-17 615SB17 03/22/07 0-7 ft	615-SB-18 615SB18 03/22/07 0-7 ft	AI5-101 AI5-101(0-6) 05/10/11 0-0.5 ft	AI5-102 AI5-102(0-2) 05/10/11 0-0.17 ft	AI5-103 AI5-103(0-2) 05/10/11 0-0.17 ft	AI5-104 AI5-104(0-2) 05/10/11 0-0.17 ft	AI5-105 AI5-105(0-2) 05/11/11 0-0.17 ft	AI5-105 DUP-AI5-1(0-2) 05/11/11 0-0.17 ft	AI5-106 AI5-106(0-2) 05/11/11 0-0.17 ft	AI5-106 AI5-106(0-6) 05/11/11 0-0.5 ft	AI5-107 AI5-107(0-2) 05/11/11 0-0.17 ft	AI5-108 AI5-108(0-2) 05/11/11 0-0.17 ft	AI5-109 AI5-109(0-2) 05/10/11 0-0.17 ft	AI5-110 AI5-110(0-2) 05/11/11 0-0.17 ft	SB-08 FSS-SB-08-02 08/01/98 2-3 ft	SB-08 FSS-SB-08-03 08/01/98 8-10 ft	615-SB-01 615-SB01 05/09/06 3.7-3.7 ft
Volatile Organics (mg/Kg)																		
Acetone																0.013	0.012	
Methylene chloride																0.0048 U	0.0047 U	0.00011 B
Vinyl chloride																0.012	0.0047 U	
Semivolatile Organics (mg/Kg)																		
Anthracene																		0.067 J
Benzo(a)anthracene																		0.25 J
Benzo(a)pyrene																		0.22 J
Benzo(b)fluoranthene																		0.31 J
Benzo(ghi)perylene																		0.091 J
Benzo(k)fluoranthene																		0.15 J
Bis(2-Ethylhexyl)phthalate																		
Chrysene																		0.29 J
Fluoranthene																		0.5
Indeno(1,2,3-cd)pyrene																		
Phenanthrene																		0.26 J
Phenol																		0.52
Pyrene																		0.54
Metals (mg/Kg)																		
Aluminum				4100	2160	2930	3740	5360	6050		7520	4570	7660	6070	2990		6180	5580
Antimony				0.24 J	0.42 UJ	0.4 UJ	0.4 UJ	1.2 J	0.74 J		0.44 UJ	1.4 J	0.44 UJ	0.43 J	0.25 J		0.61 BN	0.365 U
Arsenic				**13.3**	2.9	1.7	2.8	3.9	3.8		3	3.1	3.2	5.5	6.5		1.4	3.36
Barium				42.7	49.8	23.5	45.9	55.8	51.5		47.3	47.7	53.4	56.8	53.8		37.5	38.3
Beryllium				0.32 U	0.22 U	0.19 U	0.22 U	0.36 J	0.37 J		0.46	0.31 J	0.48	0.37 U	0.37 J		0.25 B	0.327 J
Cadmium				0.48 J	0.072 J	0.054 J	0.037 J	0.53 J	0.55 J		0.22 J	1.7	0.74	0.47 J	0.21 J			0.325 J
Calcium				11100 J	10600 J	**27200** J	**15800** J	**30500**	**35300**		8170	**16000**	6140	3250 J	4660		1180	8770
Chromium				11.6	7.1	7.6	5.6	18.1	18.9		17.7	29.7	15.4	18.2	7.3		22.7	10.3
Cobalt				4 J	2.7 J	3 J	4.1 J	3.6 J	3.8 J		**13**	4 J	4.7 J	5.7 J	3.4 J		6.6	5.1 J
Copper				38	17.3	11.7	23.7	**90.7** J	**89.2** J		21.6 J	69.4 J	27.3 J	**227**	44.6 J		13.1	29.1
Iron				7720	3870	6670	6180	9240	9160		15600	8850	14000	13600	6140		13700	9680
Lead				81.9 J	21.2 J	53.3 J	22.6 J	366 J	360 J		143 J	**587** J	88 J	350 J	55.3 J		42.2	56.5
Magnesium				1240 J	760 J	**12700** J	1550 J	2420 J	3550 J		2340	1780	2030	2010 J	706		2180 X	**5590**
Manganese				101	48	160	78.7	155 J	162 J		438 J	140 J	227 J	206	56 J		237	209
Nickel				12.2	8.4	14	10.5	13.9	14.3		18.9	22.8	14.2	21.3	12		13.1	21.1
Potassium				401 J	326 J	427 J	486 J	451 J	535 J		1280	387 J	688	836	325 J		1180	640
Selenium				0.63 J	0.73 U	0.7 U	0.69 U	0.65 J	0.64 J		0.77 U	0.69 J	0.78 U	0.83 U	1.9			0.38 U
Silver				0.12 U	0.1 U	0.1 U	0.072 J	0.19 J	0.17 J		0.11 U	0.22 J	0.11 U	0.11 J	0.19 J			**1.35**
Sodium				235 J	**431** J	179 J	**379** J	206 J	201 J		226 J	45.9 J	129 J	**496** J	**286** J		236	**374** J
Thallium				1.2 U	1 U	1 U	0.99 U	1.1 U	1.1 U		1.1 U	1.2 U	1.1 U	1.2 U	1.2 U			0.587 U
Vanadium				19.2	11.1	40.1	20.1	15.1	17.2		22	36.1	20.1	27.2	14.9		17.4	17.6
Zinc				80.2 J	26.6 J	29.9 J	28.6 J	158 J	167 J		120 J	283 J	213 J	**316** J	45.7 J		39.5	62.4
Mercury (mg/Kg)																		
Mercury	**6.6**	**12.2**	**2**					0.28 J	0.348 J	0.178 J							0.48	0.123
Mercury, Inorganic Salts	6.6	12.2	2														0.48	0.123
Methyl mercury								0.000169 J	0.000153 J	0.000059 UJ								
Elemental Mercury								0.0004 U	0.0003 U	0.0003 U								

Table 6-5
Summary of Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	615-SB-01 615-SB01 RE 05/09/06 3.7-3.7 ft	615-SB-02 615-SB02 05/09/06 2-2 ft	615-SB-03 615SB03 05/09/06 3.5-3.5 ft	615-SB-04 615SB04 10/30/06 2.5-2.5 ft	615-SB-05 615SB05 10/30/06 2.7-2.7 ft	615-SB-06 615SB06 10/31/06 5-5 ft	615-SB-10 615SB10 10/31/06 4.8-4.8 ft	615-SB-11 615SB11 10/31/06 4-4 ft	615-SB-15 615SB15 03/22/07 7-7 ft	AI5-101 AI5-101(2-6) 05/10/11 2-6 ft	AI5-101 AI5-101(6-24) 05/10/11 0.5-2 ft	AI5-102 AI5-102(2-6) 05/10/11 2-6 ft	AI5-102 AI5-102(6-24) 05/10/11 0.5-2 ft	AI5-103 AI5-103(2-6) 05/10/11 2-6 ft	AI5-103 AI5-103(6-24) 05/10/11 0.5-2 ft	AI5-104 AI5-104(2-6) 05/10/11 2-6 ft	AI5-104 AI5-104(6-24) 05/10/11 0.5-2 ft	AI5-105 AI5-105(2-6) 05/11/11 2-6 ft
Volatile Organics (mg/Kg)																		
Acetone																		
Methylene chloride																		
Vinyl chloride																		
Semivolatile Organics (mg/Kg)																		
Anthracene	0.065 J																	
Benzo(a)anthracene	0.27 J																	
Benzo(a)pyrene	0.23 J																	
Benzo(b)fluoranthene	0.37																	
Benzo(ghi)perylene	0.1 J																	
Benzo(k)fluoranthene	0.16 J																	
Bis(2-Ethylhexyl)phthalate	0.078 J																	
Chrysene	0.29 J																	
Fluoranthene	0.47																	
Indeno(1,2,3-cd)pyrene	0.066 J																	
Phenanthrene	0.26 J																	
Phenol	0.53																	
Pyrene	0.78																	
Metals (mg/Kg)																		
Aluminum										6850	9430	7740	5700	6530	9580	6260	15200	7290
Antimony										0.43 UJ	0.42 UJ	0.42 UJ	0.43 UJ	0.45 UJ	0.44 UJ	0.44 UJ	0.47 UJ	0.45 UJ
Arsenic										2.5	3.9	1.9	2	2	2.4	2.4	2.9	2
Barium										27.2	31.8	24.1	15.8 J	32.2	84.1	32.5	156	43.6
Beryllium										0.33 U	0.34 U	0.34 U	0.29 U	0.35 U	0.49 U	0.33 U	0.72	0.44 J
Cadmium										0.086 U	0.084 U	0.084 U	0.085 U	0.089 U	0.088 U	0.088 U	0.094 U	0.091 U
Calcium										1280 J	508 J	4960 J	567 J	980 J	4700 J	1260 J	2940 J	1070
Chromium										19.9	18.6	19.1	10.5	14.1	28.9	15.8	**45.2**	20
Cobalt										3.6 J	5.4	11.4	**15.8**	4.4 J	8.5	5.3 J	**13.4**	4.9 J
Copper										13.9	10.4	14.1	7.4	28.8	24.9	12	35.7	15.7 J
Iron										11200	14800	11900	9160	12000	17700	13000	**25200**	13400
Lead										7.5 J	7.6 J	5.5 J	4.1 J	78.3 J	39.6 J	18.8 J	72.8 J	24.7 J
Magnesium										2020 J	2390 J	2340 J	1210 J	1880 J	**5540** J	2200 J	**7280** J	2420
Manganese										103	143	209	253	177	339	190	510	193 J
Nickel										11.3	11.4	19.1	9.8	11.3	25.5	11.9	36.4	14.2
Potassium										587	688	647	507 J	711	**2880**	1030	**5320**	1230
Selenium										0.75 U	0.73 U	0.73 U	0.75 U	0.78 U	0.77 U	0.77 U	0.83 U	0.79 U
Silver										0.11 U	0.1 U	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.12 U	0.11 U
Sodium										70.3 J	**567**	185 J	70.4 J	97.1 J	**488** J	97.1 J	**451** J	155 J
Thallium										1.1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U
Vanadium										17.9	24	22.5	16.5	17.2	30.7	20.6	**44.9**	20.7
Zinc										30.2 J	31.7 J	29 J	19.4 J	92.3 J	53.2 J	38.9 J	116 J	38.3 J
Mercury (mg/Kg)																		
Mercury		1.9	1.6	0.088	1.9	0.77	**2.3**	1	**9.8**									
Mercury, Inorganic Salts		1.9	1.6	0.088	1.9	0.77	2.3	1	9.8									
Methyl mercury																		
Elemental Mercury																		

Table 6-5
Summary of Analytical Results in Soil - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	AI5-105 AI5-105(6-24) 05/11/11 0.5-2 ft	AI5-105 DUP-AI5-2(6-24) 05/11/11 0.5-2 ft	AI5-106 AI5-106(2-6) 05/11/11 2-6 ft	AI5-106 AI5-106(6-24) 05/11/11 0.5-2 ft	AI5-107 AI5-107(2-6) 05/11/11 2-6 ft	AI5-107 AI5-107(6-24) 05/11/11 0.5-2 ft	AI5-108 AI5-108(6-24) 05/11/11 0.5-2 ft	AI5-109 AI5-109(6-24) 05/10/11 0.5-2 ft	AI5-110 AI5-110(6-24) 05/11/11 0.5-2 ft	AI5-108 AI5-108(2-6) 05/11/11 2-6 ft	AI5-109 AI5-109(2-6) 05/10/11 2-6 ft	AI5-110 AI5-110(2-6) 05/11/11 2-6 ft
Volatile Organics (mg/Kg)												
Acetone												
Methylene chloride												
Vinyl chloride												
Semivolatile Organics (mg/Kg)												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(ghi)perylene												
Benzo(k)fluoranthene												
Bis(2-Ethylhexyl)phthalate												
Chrysene												
Fluoranthene												
Indeno(1,2,3-cd)pyrene												
Phenanthrene												
Phenol												
Pyrene												
Metals (mg/Kg)												
Aluminum	8080	8590	7220	9590	8740	7700	7970	8610	9370	9770	8210	3660
Antimony	0.25 J	0.35 J	0.31 J	**1.9** J	**1.1** J	0.44 UJ	0.2 J	0.43 UJ	0.44 UJ	0.25 J	0.41 UJ	0.46 UJ
Arsenic	2.2 J	3.1 J	2.3	3.4	1.6	2.8	3.2	2.7	2.8	3.5	2.3	2
Barium	71.3 J	41.8 J	43.3	50.7	68.3	48.9	39	40.9	46.5	43	36.6	102
Beryllium	0.45	0.49	0.5	0.48	0.53	0.47	0.46	0.4 U	0.51	0.51	0.36 U	0.29 J
Cadmium	0.088 U	0.48 J	0.09 U	0.088 U	0.087 U	0.087 U	0.45 J	0.097 J	0.088 U	0.15 J	0.21 J	0.093 U
Calcium	3350 J	986 J	2570	865	1660	661	1070	1540 J	2070	1900	14900 J	629
Chromium	21.1	18.2	15.7	19.8	24.9	17.8	17.6	18.1	19.9	19.8	12.5	11.4
Cobalt	7.6 J	6.1 J	5 J	5.8	9.3	6.5	6.3	4.7 J	6.8	6.6	3.1 J	5.9
Copper	66.9 J	25.7 J	32.9 J	17.7 J	17.4 J	18.7 J	18.1 J	21.1	19.5 J	24.3 J	13.8	16.3 J
Iron	17200	19000	14000	16500	16900	17300	22100	13900	16900	20100	10200	14800
Lead	106 J	55.4 J	81.6 J	106 J	8.5 J	26.7 J	85.6 J	56 J	22.7 J	60.1 J	35.5 J	5.3 J
Magnesium	4010 J	2260 J	2300	2530	3270	2140	2090	2290 J	2990	2450	2150 J	1170
Manganese	205 J	316 J	278 J	267 J	233 J	421 J	324 J	186	186 J	350 J	129	476 J
Nickel	19.7	16.1	13.5	18.3	25.7	20.3	15.8	14.3	18.7	18.1	10.4	13.6
Potassium	**2290** J	848 J	873	1140	**2260**	1140	805	775	1180	837	431 J	712
Selenium	**0.64** J	0.78 U	0.79 U	0.77 U	0.76 U	0.76 U	0.77 U	0.75 U	**0.68** J	**0.45** J	0.72 U	0.81 U
Silver	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.12 U
Sodium	**373** J	64.2 J	**410** J	207 J	**370** J	**310** J	72.7 J	**435** J	267 J	114 J	**356** J	100 J
Thallium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1 U	1.2 U
Vanadium	28.3 J	21.8 J	17.4	24.3	28.7	23.4	21.5	22.5	25.6	24	16.3	11.5
Zinc	71.3 J	**507** J	61.9 J	126 J	38.1 J	31.5 J	**339** J	58.4 J	41 J	195 J	261 J	24.2 J
Mercury (mg/Kg)												
Mercury	1.72 J			1.26 J								
Mercury, Inorganic Salts												
Methyl mercury	0.000209 J			0.000062 UJ								
Elemental Mercury	0.0003 U			0.0003 U								

Notes
mg/Kg = milligram per kilogram
U = not detected
J = value is estimated
R = value is rejected
N = Spike sample recovery not within control limits
B = Analyte was detected in the method blank
* = Duplicate analysis not within control limit
D = Concentration reported from a secondary dilution
E = Compound exceeded the calibration range of the instrument
X = Defined by the laboratory
P = Value from a Gas Chromatograph (GC) analysis when there is greater than 25% difference between the two GC columns

Bold indicates concentration is above Background
Underline indicates concentration is above the Residential RSL
indicates concentration is above the Industrial RSL
indicates concentration is above the Unrestricted NYSDEC SCO
indicates concentration is above the Residential NYSDEC SCO
indicates concentration is above the Restricted Residential NYSDEC SCO
indicates concentration is above the Commercial NYSDEC SCO
indicates concentration is above the Industrial NYSDEC SCO

NC = no criteria available
blank cells - Indicate analyte was not analyzed for in that sample.
Two duplicate samples were collected for SS-18-01 and SS-24-01.
SS-18-01 and SS-24-01 were the primary samples.

Prepared by / Date: KJC 10/10/11
Checked by / Date: KMW 11/01/11

SECTION 8

Table 8-1
Selection of Exposure Pathways
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Area 1	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
			Area 2	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
			Area 3	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
			Area 4	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
			Area 5	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
			Background	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Trespasser/Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Adolescent	Dermal/Ingestion	Quantitative	
		Subsurface Soil	Area 1	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
			Area 2	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
			Area 3	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
			Area 4	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
			Area5	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
			Background	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
Future	Soil	Surface Soil	Area 1	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 2	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 3	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	

Table 8-1
Selection of Exposure Pathways
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont)	**Soil (cont)**	**Surface Soil (cont)**	Area 4	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 5	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Background	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
		Subsurface Soil	Area 1	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	

Table 8-1
Selection of Exposure Pathways
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont)	**Soil (cont)**	**Subsurface Soil (cont)**	Area 2	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 3	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 4	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
			Area 5	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	

Table 8-1
Selection of Exposure Pathways
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont)	**Soil (cont)**	**Subsurface Soil (cont)**	Background	Outdoor Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Indoor Worker	Adult	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal/Ingestion	Quantitative	
						Inhalation	Quantitative	
				Recreational Receptor	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
Future	**Water**	**Groundwater**	Site	Resident	Adult	Dermal/Ingestion	Quantitative	
					Child	Dermal/Ingestion	Quantitative	
				Construction Worker	Adult	Dermal	Quantitative	

Prepared By/Date: EYM 10/07/11
Checked By/Date: BJR 11/01/11

Table 8-2
Data Summary and Selection of Chemicals of Potential Concern - Surface Soils (0 - 0.5 feet)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Frequency of Detection	Range of Non Detects	Concentration Used for Screening (2)	Background (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value (5)	Potential ARAR/TBC Source	Retain as COPC? (6)	Rationale for Contaminant Deletion or Selection
	Semivolatile Organics													
90-12-0	1-Methylnaphthalene	0.0021 J	0.459	mg/kg	AI4-111	34 / 38	0.0027 - 0.037	0.459		22 c			No	BSL
91-57-6	2-Methylnaphthalene	0.0028 J	0.803	mg/kg	AI4-111	59 / 90	0.0027 - 0.46	0.803	0.01423	31 n			No	BSL
59-50-7	4-Chloro-3-methylphenol	0.0056 J	0.0082 J	mg/kg	B-06	7 / 55	0.00551 - 0.52	0.0082		610 n			No	BSL
106-44-5	4-Methylphenol	0.055 J	0.055 J	mg/kg	SS-29	1 / 55	0.00278 - 0.46	0.055		31 n			No	BSL
83-32-9	Acenaphthene	0.0011 J	2	mg/kg	AI4-111	45 / 93	0.0078 - 0.52	2	0.084	100 ny			No	BSL
208-96-8	Acenaphthylene	0.001	3.3	mg/kg	AI4-106	75 / 95	0.033 - 0.46	3.3	0.02767	100 ny			No	BSL
120-12-7	Anthracene	0.011	4	mg/kg	AI4-111	86 / 97	0.033 - 0.46	4	0.1515	100 ny			No	BSL
56-55-3	Benzo(a)anthracene	0.031 J	7.3	mg/kg	AI4-106	104 / 104		7.3	0.5034	0.15 c			Yes	ASL
50-32-8	Benzo(a)pyrene	0.038 J	9.8	mg/kg	AI4-106	104 / 104		9.8	0.4277	0.015 c			Yes	ASL
205-99-2	Benzo(b)fluoranthene	0.035 J	15	mg/kg	AI4-106	105 / 105		15	0.7393	0.15 c			Yes	ASL
191-24-2	Benzo(ghi)perylene	0.042	9.1	mg/kg	AI4-106	103 / 104	0.033 - 0.033	9.1	0.2324	100 ny			No	BSL
207-08-9	Benzo(k)fluoranthene	0.019 J	2.7	mg/kg	SS-12	73 / 102	0.0018 - 0.21	2.7	0.1655	1 ny			Yes	ASL
117-81-7	Bis(2-Ethylhexyl)phthalate	0.026 J	17 E	mg/kg	SS-20	65 / 65		17	0.61	35 c*			No	BSL
85-68-7	Butylbenzylphthalate	0.012 J	0.3 J	mg/kg	SS-29	32 / 56	0.00209 - 0.44	0.3	0.2359	260 c*			No	BSL
86-74-8	Carbazole	0.01 J	160 J	mg/kg	SS-12	31 / 55	0.033 - 0.46	160	0.06649				Yes	NSL
218-01-9	Chrysene	0.036 J	8.2	mg/kg	AI4-106	104 / 105	0.38 - 0.38	8.2	0.4155	1 ny			Yes	ASL
53-70-3	Dibenz(a,h)anthracene	0.0078	2	mg/kg	AI4-106	65 / 96	0.0184 - 0.66	2	0.03904	0.015 c			Yes	ASL
132-64-9	Dibenzofuran	0.011 J	0.16 J	mg/kg	SS-31	13 / 55	0.00803 - 0.52	0.16		7.8 n			No	BSL
84-74-2	Di-n-butylphthalate	0.028 J	0.35	mg/kg	B-11	21 / 55	0.34 - 0.46	0.35	0.08313	610 n			No	BSL
117-84-0	Di-n-octylphthalate	0.01 J	0.01 J	mg/kg	B-01	1 / 55	0.00125 - 0.52	0.01					No	FOD
206-44-0	Fluoranthene	0.039	16	mg/kg	AI4-106	105 / 105		16	0.7041	100 ny			No	BSL
86-73-7	Fluorene	0.0016 J	1.9	mg/kg	AI4-111	52 / 93	0.018 - 0.52	1.9	0.06418	100 ny			No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.034	7.4	mg/kg	AI4-106	103 / 104	0.033 - 0.033	7.4	0.1824	0.15 c			Yes	ASL
91-20-3	Naphthalene	0.0049 J	1.9	mg/kg	AI4-111	73 / 98	0.00589 - 0.46	1.9	0.01936	3.6 c*			No	BSL
87-86-5	Pentachlorophenol	0.022 J	0.022 J	mg/kg	B-06	1 / 55	0.00552 - 2.6	0.022		0.89 c			No	BSL
85-01-8	Phenanthrene	0.021 J	12	mg/kg	AI4-111	105 / 105		12	0.7072	100 ny			No	BSL
129-00-0	Pyrene	0.04 J	14	mg/kg	AI4-106	105 / 105		14	1.044	100 ny			No	BSL
	Pesticides													
72-54-8	4,4`-DDD	0.02 P	0.071 P	mg/kg	624-SS-53	2 / 2		0.071		2 c			No	BSL
72-55-9	4,4`-DDE	0.022 P	0.044 P	mg/kg	624-SS-53	2 / 2		0.044		1.4 c			No	BSL
50-29-3	4,4`-DDT	0.2	1	mg/kg	624-SS-01	8 / 8		1		1.7 c*			No	BSL
7421-93-4	Endrin aldehyde	0.0082 P	0.0082 P	mg/kg	624-SS-53	1 / 2	0.0043 - 0.0043	0.0082		1.8 n			No	BSL
53494-70-5	Endrin ketone	0.013 P	0.032 P	mg/kg	624-SS-53	2 / 2		0.032		1.8 n			No	BSL
55963-79-6	Gamma-BHC	0.0032	0.0052 P	mg/kg	624-SS-53	2 / 2		0.0052		0.52 c			No	BSL
5103-74-2	Gamma-Chlordane	0.0087 P	0.0087 P	mg/kg	624-SS-53	1 / 2	0.0021 - 0.0021	0.0087		1.6 c			No	BSL
1024-57-3	Heptachlor epoxide	0.016	0.12	mg/kg	624-SS-05	3 / 3		0.12		0.053 c*			Yes	ASL
	Inorganics													
7429-90-5	Aluminum	48	38200	mg/kg	AI3-103	112 / 112		38200	13200	7700 n			Yes	ASL
7440-36-0	Antimony	0.22 J	6.3	mg/kg	B-11	100 / 111	0.12 - 0.47	6.3	1.684	3.1 n			Yes	ASL
7440-38-2	Arsenic	1.7	132	mg/kg	AI3-105	112 / 112		132	10.73	0.39 c*			Yes	ASL
7440-39-3	Barium	23.5	449	mg/kg	B-11	112 / 112		449	113.7	350 ny			Yes	ASL
7440-41-7	Beryllium	0.046 J	2.7	mg/kg	AI3-103	105 / 112	0.0267 - 0.4	2.7	0.62	14 ny			No	BSL
7440-43-9	Cadmium	0.02 B	8.6	mg/kg	AI3-103	104 / 104		8.6	2.5	2.5 ny			Yes	ASL
7440-70-2	Calcium	290	30500	mg/kg	AI5-105	112 / 112		30500	12100				No	E
7440-47-3	Chromium	4.9	136	mg/kg	AI3-103	112 / 112		136	32.76	0.29 c			Yes	ASL
7440-48-4	Cobalt	2.7 J	35.5	mg/kg	SS-42	112 / 112		35.5	9.122	2.3 n			Yes	ASL
7440-50-8	Copper	9.5	11500 J	mg/kg	AI2-108	112 / 112		11500	84.44	270 ny			Yes	ASL
7439-89-6	Iron	3870	62600	mg/kg	AI3-103	112 / 112		62600	23696	5500 n			No	E
7439-92-1	Lead	13.6	2140 J	mg/kg	AI3-103	112 / 112		2140	522.5	40 n			Yes	ASL
7439-95-4	Magnesium	485 X	13100	mg/kg	FLA-48	112 / 112		13100	4802				No	E
7439-96-5	Manganese	46.6 N	1140	mg/kg	AI3-103	112 / 112		1140	626.7	180 n			Yes	ASL

Table 8-2
Data Summary and Selection of Chemicals of Potential Concern - Surface Soils (0 - 0.5 feet)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Frequency of Detection	Range of Non Detects	Concentration Used for Screening (2)	Background (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value (5)	Potential ARAR/TBC Source	Retain as COPC? (6)	Rationale for Contaminant Deletion or Selection
7439-97-6	Mercury	0.08 B	5	mg/kg	SS-38	96 / 97	0.06 - 0.06	5	1.2	0.81 ny			Yes	ASL
HLA0430	Mercury, Inorganic Salts	0.08 B	5	mg/kg	SS-38	76 / 77	0.06 - 0.06	5		2.3 ns			Yes	ASL
22967-92-6	Methyl mercury	0.000169 J	0.011 J	mg/kg	AI2-111	13 / 14	5.9E-05 - 6E-05	0.011		0.78 n			No	BSL
7440-02-0	Nickel	7	78.5	mg/kg	AI3-103	112 / 112		78.5	33.68	140 ny			No	BSL
7440-09-7	Potassium	325 J	3950	mg/kg	AI3-103	112 / 112		3950	1286				No	E
7782-49-2	Selenium	0.18 B	3.2 J	mg/kg	AI3-103	90 / 104	0.69 - 1	3.2	0.439	36 ny			No	BSL
7440-22-4	Silver	0.072 J	2.4	mg/kg	SS-41	26 / 103	0.097 - 0.45	2.4	0.211	36 ny			No	BSL
7440-23-5	Sodium	15.5 J	932 J	mg/kg	AI3-103	109 / 112	31.4 - 31.4	932	250				No	E
7440-28-0	Thallium	0.012 B	0.2 J	mg/kg	B-03	20 / 107	0.12 - 5.9	0.2	0.892	0.078 n			Yes	ASL
7440-62-2	Vanadium	11	154	mg/kg	AI3-103	112 / 112		154	55.95	39 n			Yes	ASL
7440-66-6	Zinc	26.6 J	1370 J	mg/kg	AI3-103	112 / 112		1370	289.4	2200 ny			No	BSL

Notes:

Prepared By/Date: EYM 10/07/11
Checked By/Date: BJR 10/10/11

(1) Minimum or maximum concentration detected in data set. Samples included in data set are identified in Appendix E.
(2) The concentration used for screening is the maximum detected concentration.
(3) Background value is the site specific background upper threshold limit concentration.
(4) Values are the lower of Regional Screening Levels (RSLs) obtained from USEPA June 2011 and NY Residential Soil Cleanup Objective (NYSCO) obtained from NYSDEC and NYSDOH September 2006.
Values used for screening are the residential soil RSLs or NY SCOs for the lesser of cancer risks equal to 1E-06 or non-cancer risks equal to a hazard index of 0.1 or 0.2 respectively.
RSL-for m-cresol used for 4-methylphenol.
RSL for pyrene used for phenanthrene, acenaphthylene, benzo(ghi)perylene.
RSL for endrin used for endrin ketone, endrin aldehyde
RSL for chromium (VI) used for chromium.
RSL for Mercuric chloride used for mercury.
RSL for Vanadium and compounds used for vanadium.
RSL for chlordane used for gamma-chlordane.
n - RSL is based on a non-cancer hazard quotient of 0.1.
c - RSL is based on an excess lifetime cancer risk of 1 in 1 million.
c* - where n RSL < 100X c RSL.
ns - RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
ny - value is NYSCO
(5) There are no Applicable or Relevant and Appropriate Requirements / To Be Considered (ARAR/TBC) for soil.
(6) Analyte is selected as a COPC if the concentration used for screening exceeds the screening toxicity value or if no screening value is available.
ASL - Concentration used for screening is greater than the screening toxicity value; the analyte was selected as a COPC.
BSL - Concentration used for screening is less than the screening toxicity value; the analyte was not selected as a COPC.
NSL - No screening level available; the analyte was selected as a COPC.
FOD - Analyte detected in less than 5% of the samples;the analyte was not selected as a COPC.
E - Compound is an essential nutrient.
mg/kg - milligrams per kilogram.
COPC - Chemical of potential concern.
B - The reported result is attributed to laboratory contamination due to the presence of the chemical in the associated blank.
J - Value is estimated.

Table 8-3
Data Summary and Selection of Chemicals of Potential Concern - Suburface Soils (0.5 - 10 feet)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Frequency of Detection	Range of Non Detects	Concentration Used for Screening (2)	Background (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value (5)	Potential ARAR/TBC Source	Retain as COPC? (6)	Rationale for Contaminant Deletion or
	Volatile Organics													
78-93-3	2-Butanone	0.0037 J	0.01 J	mg/kg	FLA-12	2 / 12	0.0091 - 0.67	0.01		100 ny			No	BSL
67-64-1	Acetone	0.01	0.41 J	mg/kg	FLA-11	12 / 12		0.41		100 ny			No	BSL
71-43-2	Benzene	0.0043 J	0.0043 J	mg/kg	FLA-12	1 / 12	0.0043 - 0.33	0.0043		1.1 c*			No	BSL
100-41-4	Ethyl benzene	0.0026 J	0.0031 J	mg/kg	SB-06	3 / 12	0.0043 - 0.33	0.0031		5.4 c			No	BSL
75-09-2	Methylene chloride	0.00011 B	0.00011 B	mg/kg	615-SB-01	1 / 13	0.0043 - 0.33	0.00011		11 c			No	BSL
108-88-3	Toluene	0.0022 J	0.0022 J	mg/kg	FLA-12	1 / 12	0.0043 - 0.33	0.0022		100 ny			No	BSL
79-01-6	Trichloroethene	0.0014 J	0.0033 J	mg/kg	FLA-12	2 / 12	0.0043 - 0.33	0.0033		2.5 n			No	BSL
75-01-4	Vinyl chloride	0.0021 J	0.012	mg/kg	SB-08	4 / 12	0.0043 - 0.33	0.012		0.06 c			No	BSL
	Semivolatile Organics													
95-50-1	1,2-Dichlorobenzene	0.0061 J	0.0061 J	mg/kg	B-11	1 / 12	0.0037 - 0.066	0.0061		100 ny			No	BSL
90-12-0	1-Methylnaphthalene	0.00086 J	0.065	mg/kg	AI3-111	32 / 38	0.0012 - 0.024	0.065		22 c			No	BSL
91-57-6	2-Methylnaphthalene	0.00088 J	0.14	mg/kg	AI3-106	35 / 48	0.0012 - 0.033	0.14	0.01423	31 n			No	BSL
59-50-7	4-Chloro-3-methylphenol	0.0064 J	0.008 J	mg/kg	B-01	4 / 12	0.0055 - 0.033	0.008		610 n			No	BSL
83-32-9	Acenaphthene	0.0011 J	0.19 J	mg/kg	AI3-111	33 / 50	0.0011 - 0.033	0.19	0.05448	100 ny			No	BSL
208-96-8	Acenaphthylene	0.0025 J	1.5	mg/kg	AI4-106	43 / 51	0.002 - 0.033	1.5	0.02874	100 ny			No	BSL
120-12-7	Anthracene	0.00098 J	0.67 J	mg/kg	AI3-111	46 / 53	0.0012 - 0.033	0.67	0.4015	100 ny			No	BSL
56-55-3	Benzo(a)anthracene	0.0041 J	4.7	mg/kg	AI4-106	50 / 54	0.033 - 0.033	4.7	0.9177	0.15 c			Yes	ASL
50-32-8	Benzo(a)pyrene	0.0036 J	6.4	mg/kg	AI4-106	50 / 54	0.033 - 0.033	6.4	0.72	0.015 c			Yes	ASL
205-99-2	Benzo(b)fluoranthene	0.006 J	8.8	mg/kg	AI4-106	50 / 54	0.066 - 0.66	8.8	0.9443	0.15 c			Yes	ASL
191-24-2	Benzo(ghi)perylene	0.0026 J	5.3	mg/kg	AI4-106	50 / 54	0.033 - 0.033	5.3	0.2015	100 ny			No	BSL
207-08-9	Benzo(k)fluoranthene	0.013 J	0.35 J	mg/kg	SB-03	20 / 54	0.0019 - 0.66	0.35	0.3204	1 ny			No	BSL
117-81-7	Bis(2-Ethylhexyl)phthalate	0.021 J	0.36 J	mg/kg	SB-03	15 / 15		0.36	0.0869	35 c*			No	BSL
85-68-7	Butylbenzylphthalate	0.0086 J	0.031 J	mg/kg	B-02	4 / 12	0.0021 - 0.033	0.031	0.03433	260 c*			No	BSL
86-74-8	Carbazole	0.0075 J	0.065 J	mg/kg	B-11	6 / 12	0.033 - 0.033	0.065	0.06649				Yes	NSL
218-01-9	Chrysene	0.0034 J	4.3	mg/kg	AI4-106	50 / 54	0.033 - 0.033	4.3	0.7812	1 ny			Yes	ASL
53-70-3	Dibenz(a,h)anthracene	0.0036 J	1.2	mg/kg	AI4-106	42 / 51	0.0024 - 0.66	1.2	0.04165	0.015 c			Yes	ASL
132-64-9	Dibenzofuran	0.0084 J	0.03 J	mg/kg	B-11	4 / 12	0.033 - 0.033	0.03		7.8 n			No	BSL
84-74-2	Di-n-butylphthalate	0.032 J	0.36	mg/kg	B-11	12 / 12		0.36	0.01057	610 n			No	BSL
206-44-0	Fluoranthene	0.0044 J	6.6	mg/kg	AI4-106	51 / 54	0.033 - 0.033	6.6	1.462	100 ny			No	BSL
86-73-7	Fluorene	0.0014 J	0.21 J	mg/kg	AI3-111	35 / 50	0.0019 - 0.04	0.21	0.06518	100 ny			No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.0031 J	4.4	mg/kg	AI4-106	49 / 53	0.0119 - 0.033	4.4	0.3446	0.15 c			Yes	ASL
91-20-3	Naphthalene	0.0019 J	0.1 J	mg/kg	AI3-111	38 / 50	0.0012 - 0.033	0.1	0.01936	3.6 c*			No	BSL
85-01-8	Phenanthrene	0.0027 J	1.8 J	mg/kg	AI3-111	50 / 54	0.033 - 0.033	1.8	1.448	100 ny			No	BSL
108-95-2	Phenol	0.52	0.53	mg/kg	615-SB-01	2 / 12	0.033 - 0.033	0.53		100 ny			No	BSL
129-00-0	Pyrene	0.0037 J	6.1	mg/kg	AI4-106	52 / 54	0.033 - 0.033	6.1	2.319	100 ny			No	BSL
	Inorganics													
7429-90-5	Aluminum	3660	21300	mg/kg	B-05	63 / 63		21300	16830	7700 n			Yes	ASL
7440-36-0	Antimony	0.07 J	8.9	mg/kg	B-11	35 / 63	0.365 - 0.5	8.9	0.654	3.1 n			Yes	ASL
7440-38-2	Arsenic	1.2	18.9	mg/kg	AI3-105	63 / 63		18.9	7.599	0.39 c*			Yes	ASL
7440-39-3	Barium	15.8 J	358	mg/kg	B-11	63 / 63		358	160.1	350 ny			Yes	ASL
7440-41-7	Beryllium	0.053 J	1.1	mg/kg	AI3-112	52 / 63	0.0267 - 0.54	1.1	0.749	14 ny			No	BSL
7440-43-9	Cadmium	0.033 J	1.3	mg/kg	B-11	41 / 61	0.084 - 0.099	1.3	0.77	2.5 ny			No	BSL
7440-70-2	Calcium	267 J	14900 J	mg/kg	AI5-109	63 / 63		14900	16223				No	E
7440-47-3	Chromium	10.3	45.2	mg/kg	AI5-104	63 / 63		45.2	29.58	0.29 c*			Yes	ASL

Table 8-3
Data Summary and Selection of Chemicals of Potential Concern - Suburface Soils (0.5 - 10 feet)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Frequency of Detection	Range of Non Detects	Concentration Used for Screening (2)	Background (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value (5)	Potential ARAR/TBC Source	Retain as COPC? (6)	Rationale for Contaminant Deletion or
7440-48-4	Cobalt	1.8 B	15.8	mg/kg	AI5-102	63 / 63		15.8	12.2	2.3 n			Yes	ASL
7440-50-8	Copper	7.4	2470	mg/kg	B-01	63 / 63		2470	67.33	270 ny			Yes	ASL
7439-89-6	Iron	6930	34100	mg/kg	B-11	63 / 63		34100	23254	5500 n			No	E
7439-92-1	Lead	4.1 J	1060	mg/kg	B-11	63 / 63		1060	448.9	40 n			Yes	ASL
7439-95-4	Magnesium	1170	7280 J	mg/kg	AI5-104	63 / 63		7280	4433				No	E
7439-96-5	Manganese	58.9	557	mg/kg	AI2-103	63 / 63		557	586.4	180 n			Yes	ASL
7439-97-6	Mercury	0.021 J	12.2	mg/kg	615-SB-17	45 / 46	0.0077 - 0.0077	12.2	2.26	0.81 ny			Yes	ASL
HLA0430	Mercury, Inorganic Salts	0.021 J	12.2	mg/kg	615-SB-17	25 / 26	0.0077 - 0.0077	12.2		2.3 ns			Yes	ASL
22967-92-6	Methyl mercury	0.000083 J	0.00139 J	mg/kg	AI2-111	12 / 14	6E-05 - 6E-05	0.00139		0.78 n			No	BSL
7440-02-0	Nickel	7.8	36.4	mg/kg	AI5-104	63 / 63		36.4	96.41	140 ny			No	BSL
7440-09-7	Potassium	356 J	5320	mg/kg	AI5-104	63 / 63		5320	2194				No	E
7782-49-2	Selenium	0.094 J	0.91 J	mg/kg	AI2-111	25 / 61	0.38 - 0.87	0.91	0.439	36 ny			No	BSL
7440-22-4	Silver	0.078 J	1.35	mg/kg	615-SB-01	8 / 61	0.093 - 0.45	1.35	0.211	36 ny			No	BSL
7440-23-5	Sodium	19 J	567	mg/kg	AI5-101	56 / 63	31.4 - 72.2	567	277.2				No	E
7440-28-0	Thallium	0.092 J	0.25 J	mg/kg	B-05	12 / 61	0.587 - 1.2	0.25	0.892	0.078 n			Yes	ASL
7440-62-2	Vanadium	11.5	44.9	mg/kg	AI5-104	63 / 63		44.9	37.44	39 n			Yes	ASL
7440-66-6	Zinc	19.4 J	478	mg/kg	B-11	63 / 63		478	308.4	2200 ny			No	BSL

Notes:

Prepared By/Date: EYM 10/07/11
Checked By/Date: BJR 10/10/11

(1) Minimum or maximum concentration detected in data set. Samples included in data set are identified in Appendix E.
(2) The concentration used for screening is the maximum detected concentration.
(3) Background value is the site specific background upper threshold limit concentration.
(4) Values are the lower of Regional Screening Levels (RSLs) obtained from USEPA June 2011 and NY Residential Soil Cleanup Objective (NYSCO) obtained from NYSDEC and NYSDOH September 2006.
Values used for screening are the residential soil RSLs or NY SCOs for the lesser of cancer risks equal to 1E-06 or non-cancer risks equal to a hazard index of 0.1 or 0.2 respectively.
RSL for pyrene used for phenanthrene, acenaphthylene, benzo(ghi)perylene.
RSL for chromium (VI) used for chromium.
RSL for mercuric chloride used for mercury.
RSL for vanadium and compounds used for vanadium.

- n - RSL is based on a non-cancer hazard quotient of 0.1.
- c - RSL is based on an excess lifetime cancer risk of 1 in 1 million.
- c* - where n RSL < 100X c RSL.
- ns - RSL is based on a non-cancer hazard quotient of 0.1; concentration may exceed Csat.
- ny - value is NYSCO

(5) There are no Applicable or Relevant and Appropriate Requirements / To Be Considered (ARAR/TBC) for soil.
(6) Analyte is selected as a COPC if the concentration used for screening exceeds the screening toxicity value or if no screening value is available.

- ASL - Concentration used for screening is greater than the screening toxicity value; the analyte was selected as a COPC.
- BSL - Concentration used for screening is less than the screening toxicity value; the analyte was not selected as a COPC.
- NSL - No screening level available; the analyte was selected as a COPC.
- FOD - Analyte detected in less than 5% of the samples; the analyte was not selected as a COPC.
- E - Compound is an essential nutrient.

mg/kg - milligrams per kilogram.
COPC - Chemical of potential concern.
B - The reported result is attributed to laboratory contamination due to the presence of the chemical in the associated blank.
J - Value is estimated.

Table 8-4
Data Summary and Selection of Chemicals of Potential Concern - Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Frequency of Detection	Range of Non Detects	Concentration Used for Screening (2)	Background (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value (5)	Potential ARAR/TBC Source	Retain as COPC? (6)	Rationale for Contaminant Deletion or Selection
	Volatile Organics													
67-66-3	Chloroform	0.014 J	0.014 J	mg/L	MW-4	2 / 5	0.0015 - 0.0015	0.014		0.00019 c			Yes	ASL
	Semivolatile Organics													
56-55-3	Benzo(a)anthracene	0.00022	0.00022	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00022		0.000029 c			Yes	ASL
50-32-8	Benzo(a)pyrene	0.00018 J	0.00018 J	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00018		2.9E-06 c			Yes	ASL
205-99-2	Benzo(b)fluoranthene	0.000033 J	0.00024	mg/L	MW-5	2 / 5	0.000028 - 0.000029	0.00024		0.000029 c			Yes	ASL
191-24-2	Benzo(ghi)perylene	0.00031	0.00031	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00031		0.11 n			No	BSL
207-08-9	Benzo(k)fluoranthene	0.00028	0.00028	mg/L	MW-5	1 / 5	0.000094 - 0.000096	0.00028		0.00029 c			No	BSL
218-01-9	Chrysene	0.00023	0.00023	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00023		0.0029 c			No	BSL
53-70-3	Dibenz(a,h)anthracene	0.00026	0.00026	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00026		2.9E-06 c			Yes	ASL
206-44-0	Fluoranthene	0.00004 J	0.000044 J	mg/L	MW-4	2 / 5	0.000028 - 0.000029	0.000044		0.15 n			No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.00027	0.00027	mg/L	MW-5	1 / 5	0.000028 - 0.000029	0.00027		0.000029 c			Yes	ASL
129-00-0	Pyrene	0.000037 J	0.000044 J	mg/L	MW-5	2 / 5	0.000028 - 0.000029	0.000044		0.11 n			No	BSL
	Inorganics													
7429-90-5	Aluminum	0.0641 J	0.111 J	mg/L	MW-4	5 / 5		0.111		3.7 n			No	BSL
7440-39-3	Barium	0.0066 J	0.0555 J	mg/L	MW-3	5 / 5		0.0555		0.73 n			No	BSL
7440-70-2	Calcium	12.4	72.1	mg/L	MW-4	5 / 5		72.1					No	E
7440-47-3	Chromium	0.001 J	0.0059	mg/L	MW-3	4 / 5	0.0025 - 0.0025	0.0059		0.000043 c			Yes	ASL
7440-48-4	Cobalt	0.0008 J	0.0008 J	mg/L	MW-4	1 / 5	0.0025 - 0.0025	0.0008		0.0011 n			No	BSL
7440-50-8	Copper	0.0133 J	0.0133 J	mg/L	MW-4	1 / 5	0.005 - 0.005	0.0133		0.15 n			No	BSL
7439-89-6	Iron	0.108 J	0.108 J	mg/L	MW-4	1 / 5	0.04 - 0.04	0.108		2.6 n			No	BSL
7439-92-1	Lead	0.0018 J	0.0018 J	mg/L	MW-4	1 / 5	0.003 - 0.003	0.0018		0.015			No	BSL
7439-95-4	Magnesium	4.08 J	22.4	mg/L	MW-3	5 / 5		22.4					No	E
7439-96-5	Manganese	0.0038 J	0.0199	mg/L	MW-5	3 / 5	0.002 - 0.002	0.0199		0.088 n			No	BSL
7440-02-0	Nickel	0.0041 J	0.0133 J	mg/L	MW-4	3 / 5	0.003 - 0.003	0.0133		0.073 n			No	BSL
7440-09-7	Potassium	0.948 J	3.42 J	mg/L	MW-4	5 / 5		3.42					No	E
7440-23-5	Sodium	7.02	85.6	mg/L	MW-4	5 / 5		85.6					No	E
7440-66-6	Zinc	0.0326	0.0326	mg/L	MW-4	1 / 5	0.012 - 0.012	0.0326		1.1 n			No	BSL
7439-97-6	Mercury	0.000039 J	0.000039 J	mg/L	MW-4	1 / 5	0.000075 - 0.000075	0.000039		0.002 M			No	BSL

Notes:

Prepared By/Date: EYM 10/07/11
Checked By/Date: BJR 10/25/11

(1) Minimum or maximum concentration detected in data set. Samples included in data set are identified in Appendix E.
(2) The concentration used for screening is the maximum detected concentration.
(3) Background not available for groundwater.
(4) Values are the lower of Tap Water Regional Screening Levels (RSLs) obtained from USEPA June 2011 and Maximum Contaminant Level (MCL) obtained from USEPA May 2009.
Values used for screening are the lesser of tap water RSLs for the lesser of cancer risks equal to 1E-06 or non-cancer risks equal to a hazard index of 0.1 or Federal MCL.
RSL for pyrene used for phenanthrene, acenaphthylene, benzo(ghi)perylene.
RSL for Chromium (VI) used for chromium
RSL for Mercuric chloride used for mercury
n - RSL is based on a non-cancer hazard quotient of 0.1
c - RSL is based on an excess lifetime cancer risk of 1 in 1 million
M - Federal MCL
(5) There are no Applicable or Relevant and Appropriate Requirements / To Be Considered (ARAR/TBC) for groundwater.
(6) Analyte is selected as a COPC if the concentration used for screening exceeds the screening value or no screening value is available.
ASL - Concentration used for screening is greater than the screening toxicity value; the analyte was selected as a COPC
BSL - Concentration used for screening is less than the screening toxicity value; the analyte was not selected as a COPC
E - Compound is an essential nutrient; the analyte was not selected as a COPC
mg/L - milligrams per liter
COPC - Chemical of potential concern
J - Value is estimated

Table 8-5
Background Data Summary - Surface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection			Range of Non Detects			Range of Detected Concentrations			Average of All Samples
Semivolatile Organics (mg/kg)										
2-Methylnaphthalene	7	/	15	0.0024	:	0.0029	0.0028	-	0.022	0.0050
4-Methylphenol	1	/	15	0.006	:	0.0074	0.027	-	0.027	0.0049
Acenaphthene	15	/	15				0.0016	-	0.084	0.015
Acenaphthylene	15	/	15				0.0024	-	0.029	0.0091
Acetophenone	2	/	15	0.0056	:	0.0069	0.01	-	0.028	0.0052
Anthracene	15	/	15				0.0036	-	0.16	0.035
Benzo(a)anthracene	15	/	15				0.035	-	0.59	0.16
Benzo(a)pyrene	15	/	15				0.034	-	0.35	0.14
Benzo(b)fluoranthene	15	/	15				0.051	-	0.58	0.24
Benzo(ghi)perylene	15	/	15				0.024	-	0.19	0.084
Benzo(k)fluoranthene	15	/	15				0.015	-	0.12	0.057
Biphenyl	4	/	15	0.0016	:	0.002	0.0016	-	0.0051	0.0015
Bis(2-Chloroethoxy)methane	1	/	15	0.0064	:	0.0078	0.011	-	0.011	0.0040
Bis(2-Ethylhexyl)phthalate	15	/	15				0.046	-	0.51	0.12
Butylbenzylphthalate	13	/	15	0.0047	:	0.0047	0.0092	-	0.22	0.037
Caprolactum	1	/	15	0.0048	:	0.0059	0.0074	-	0.0074	0.0029
Carbazole	12	/	15	0.0048	:	0.0057	0.0056	-	0.1	0.019
Chrysene	15	/	15				0.033	-	0.41	0.13
Dibenz(a,h)anthracene	13	/	15	0.0042	:	0.0047	0.0044	-	0.042	0.017
Dibenzofuran	4	/	15	0.0032	:	0.0039	0.0079	-	0.045	0.0066
Diethylphthalate	5	/	15	0.0032	:	0.0039	0.0037	-	0.0084	0.0032
Di-n-butylphthalate	14	/	15	0.0043	:	0.0043	0.0044	-	0.13	0.019
Di-n-octylphthalate	3	/	15	0.0072	:	0.0088	0.01	-	0.027	0.0064
Fluoranthene	15	/	15				0.06	-	0.7	0.23
Fluorene	15	/	15				0.0016	-	0.099	0.015
Hexachlorobenzene	1	/	15	0.0076	:	0.0093	0.012	-	0.012	0.0047
Indeno(1,2,3-cd)pyrene	15	/	15				0.02	-	0.17	0.067
Naphthalene	12	/	15	0.0008	:	0.00095	0.0016	-	0.029	0.0054
N-Nitrosodiphenylamine	1	/	15	0.0036	:	0.0044	0.016	-	0.016	0.0029
Pentachlorophenol	3	/	15	0.018	:	0.022	0.018	-	0.021	0.012
Phenanthrene	15	/	15				0.032	-	1	0.19
Pyrene	15	/	15				0.079	-	1.1	0.33
Metals (mg/kg)										
Aluminum	15	/	15				3630	-	13200	9586
Antimony	13	/	15	0.24	:	0.25	0.32	-	1.5	0.63
Arsenic	15	/	15				3.4	-	11.5	6.5
Barium	15	/	15				42.6	-	102	72
Beryllium	15	/	15				0.19	-	0.62	0.45
Cadmium	15	/	15				0.086	-	2.5	0.63
Calcium	15	/	15				1140	-	12100	3652
Chromium	15	/	15				14.5	-	31.8	22
Cobalt	15	/	15				3.9	-	8.6	5.8
Copper	15	/	15				22.9	-	84.9	41
Iron	15	/	15				13000	-	25200	17627
Lead	15	/	15				61.9	-	3000	368
Magnesium	15	/	15				1710	-	5900	2719
Manganese	15	/	15				156	-	653	333
Mercury	15	/	15				0.11	-	1.2	0.27
Mercury, Inorganic Salts	15	/	15				0.11	-	1.2	0.27
Nickel	15	/	15				14.2	-	40.4	20
Potassium	15	/	15				441	-	1030	729
Selenium	3	/	15	0.39	:	0.5	0.43	-	0.94	0.30
Silver	3	/	15	0.031	:	0.065	0.16	-	0.4	0.074
Sodium	2	/	15	88.3	:	250	94.4	-	113	69
Thallium	3	/	15	0.48	:	0.61	0.64	-	1.4	0.40
Vanadium	15	/	15				22.1	-	47.5	33
Zinc	15	/	15				64.6	-	692	170

Notes:
mg/kg - milligram per kilogram

Prepared By/Date: EYM 11/01/11
Checked By/Date: BJR 11/02/11

Table 8-6
Background Data Summary - Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Average of All Samples
Semivolatile Organics (mg/kg)				
2-Methylnaphthalene	5 / 15	0.0022 : 0.0025	0.0024 - 0.021	0.0035
Acenaphthene	7 / 15	0.0011 : 0.0013	0.0016 - 0.084	0.011
Acenaphthylene	8 / 15	0.00072 : 0.00084	0.0012 - 0.025	0.0043
Acetophenone	3 / 15	0.005 : 0.006	0.0056 - 0.0088	0.0036
Anthracene	11 / 15	0.0011 : 0.0012	0.0015 - 0.19	0.031
Benzo(a)anthracene	15 / 15		0.0022 - 0.59	0.11
Benzo(a)pyrene	15 / 15		0.0022 - 0.51	0.090
Benzo(b)fluoranthene	15 / 15		0.004 - 0.74	0.13
Benzo(ghi)perylene	12 / 15	0.0045 : 0.0048	0.0074 - 0.27	0.052
Benzo(k)fluoranthene	14 / 15	0.002 : 0.002	0.0022 - 0.12	0.035
Biphenyl	3 / 15	0.0014 : 0.0017	0.0023 - 0.0051	0.0014
Bis(2-Ethylhexyl)phthalate	15 / 15		0.011 - 0.085	0.030
Butylbenzylphthalate	4 / 15	0.0036 : 0.0042	0.0092 - 0.052	0.0080
Carbazole	5 / 15	0.0043 : 0.0051	0.0066 - 0.1	0.015
Chrysene	15 / 15		0.0019 - 0.64	0.099
Dibenz(a,h)anthracene	7 / 15	0.0036 : 0.004	0.0041 - 0.052	0.011
Dibenzofuran	5 / 15	0.0029 : 0.0034	0.0039 - 0.045	0.0067
Diethylphthalate	3 / 15	0.0029 : 0.0034	0.0037 - 0.0046	0.0021
Di-n-butylphthalate	9 / 15	0.0037 : 0.0043	0.0036 - 0.014	0.0045
Fluoranthene	15 / 15		0.0026 - 0.98	0.17
Fluorene	6 / 15	0.00072 : 0.00084	0.0032 - 0.099	0.013
Indeno(1,2,3-cd)pyrene	14 / 15	0.0011 : 0.0011	0.002 - 0.17	0.040
Naphthalene	7 / 15	0.00072 : 0.00084	0.0012 - 0.029	0.0041
N-Nitrosodiphenylamine	1 / 15	0.0032 : 0.0038	0.01 - 0.01	0.0023
Pentachlorophenol	6 / 15	0.016 : 0.019	0.017 - 0.018	0.012
Phenanthrene	15 / 15		0.0015 - 1	0.16
Pyrene	15 / 15		0.0034 - 1.9	0.27
Metals (mg/kg)				
Aluminum	15 / 15		6300 - 15700	10697
Antimony	7 / 15	0.2 : 0.25	0.2 - 1.2	0.24
Arsenic	15 / 15		2.3 - 6.7	4.2
Barium	15 / 15		33.5 - 203	76
Beryllium	15 / 15		0.26 - 0.77	0.45
Cadmium	14 / 15	0.02 : 0.02	0.1 - 0.53	0.24
Calcium	15 / 15		299 - 20300	3370
Chromium	15 / 15		14.9 - 28.6	21
Cobalt	15 / 15		5.2 - 12.2	7.1
Copper	15 / 15		7.8 - 70.3	25
Iron	15 / 15		13500 - 25300	17327
Lead	15 / 15		9.3 - 218	79
Magnesium	15 / 15		1490 - 4160	2482
Manganese	15 / 15		220 - 578	351
Mercury	15 / 15		0.0064 - 0.8	0.21
Mercury, Inorganic Salts	14 / 14		0.0064 - 0.8	0.22
Nickel	15 / 15		13.4 - 83.3	38
Potassium	15 / 15		286 - 2080	905
Selenium	1 / 15	0.36 : 0.46	0.39 - 0.39	0.21
Silver	2 / 15	0.027 : 0.035	0.032 - 0.065	0.020
Sodium	13 / 15	214 : 273	74.4 - 235	122
Thallium	4 / 15	0.44 : 0.53	0.6 - 0.83	0.37
Vanadium	15 / 15		21.4 - 34.9	28
Zinc	15 / 15		24.1 - 460	97

Notes:
mg/kg - milligram per kilogram

Prepared By/Date: EYM 11/01/11
Checked By/Date: BJR 11/02/11

Table 8-7
Exposure Point Concentrations - Surface Soil (0-0.5 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Area 1	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.41	0.49	N [j]	0.79		0.49	mg/kg	UCL - N [j]	(4)
	Benzo(a)pyrene	mg/kg	0.43	0.52	N [j]	0.87		0.52	mg/kg	UCL - N [j]	(4)
	Benzo(b)fluoranthene	mg/kg	0.57	0.69	N [j]	1.1		0.69	mg/kg	UCL - N [j]	(4)
	Benzo(k)fluoranthene	mg/kg	0.22	0.26	N [j]	0.43		0.26	mg/kg	UCL - N [j]	(4)
	Carbazole	mg/kg	0.11	0.10	NP [c]	0.14	J	0.10	mg/kg	UCL - NP [c]	(4)
	Chrysene	mg/kg	0.47	0.56	N [j]	0.88		0.56	mg/kg	UCL - N [j]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.16	0.14	NP [d]	0.18	J	0.14	mg/kg	UCL - NP [d]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.32	0.39	N [j]	0.7		0.39	mg/kg	UCL - N [j]	(4)
	Inorganics										
	Aluminum	mg/kg	6,269	7,339	N [k]	12,700		7,339	mg/kg	UCL - N [k]	(4)
	Antimony	mg/kg	1.7	2.5	G [l]	6.3		2.5	mg/kg	UCL - G [l]	(4)
	Arsenic	mg/kg	6.2	6.9	N [j]	9.5		6.9	mg/kg	UCL - N [j]	(4)
	Barium	mg/kg	206	252	N [j]	449		252	mg/kg	UCL - N [j]	(4)
	Cadmium	mg/kg	1.1	1.3	N [j]	2.4		1.3	mg/kg	UCL - N [j]	(4)
	Chromium	mg/kg	21	23	N [j]	30		23	mg/kg	UCL - N [j]	(4)
	Cobalt	mg/kg	6.0	6.5	N [j]	8.2		6.5	mg/kg	UCL - N [j]	(4)
	Copper	mg/kg	110	156	G [l]	346		156	mg/kg	UCL - G [l]	(4)
	Lead	mg/kg	578	776	G [l]	1,540		578	mg/kg	Avg	(5)
	Manganese	mg/kg	292	337	N [k]	536		337	mg/kg	UCL - N [k]	(4)
	Mercury	mg/kg	0.94	1.2	G [l]	2.4		1.2	mg/kg	UCL - G [l]	(4)
	Thallium	mg/kg	0.11	0.16	NP [c]	0.18	B	0.16	mg/kg	UCL - NP [c]	(4)
	Vanadium	mg/kg	24	26	N [j]	33		26	mg/kg	UCL - N [j]	(4)
Area 2	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.28	0.42	LN [m]	1.6		0.42	mg/kg	UCL - LN [m]	(4)
	Benzo(a)pyrene	mg/kg	0.31	0.43	G [l]	1.6		0.43	mg/kg	UCL - G [l]	(4)
	Benzo(b)fluoranthene	mg/kg	0.44	0.62	G [l]	2.2		0.62	mg/kg	UCL - G [l]	(4)
	Benzo(k)fluoranthene	mg/kg	0.16	0.24	NP [e]	0.92		0.24	mg/kg	UCL - NP [e]	(4)
	Carbazole	mg/kg	0.12	0.070	NP [c]	0.1	J	0.07	mg/kg	UCL - NP [c]	(4)
	Chrysene	mg/kg	0.34	0.69	NP [f]	1.9		0.69	mg/kg	UCL - NP [f]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.12	0.10	NP [c]	0.28	J	0.10	mg/kg	UCL - NP [c]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.25	0.51	NP [f]	1.3		0.51	mg/kg	UCL - NP [f]	(4)
	Pesticides										
	Heptachlor epoxide	mg/kg	0.056		NC [a]	0.12		0.12	mg/kg	Maximum	(3)
	Inorganics										
	Aluminum	mg/kg	6,966	9,021	NP [g]	14,400		9,021	mg/kg	UCL - NP [g]	(4)
	Antimony	mg/kg	0.96	1.9	NP [f]	5.7	J	1.9	mg/kg	UCL - NP [f]	(4)
	Arsenic	mg/kg	5.0	5.6	G [l]	11.7		5.6	mg/kg	UCL - G [l]	(4)
	Barium	mg/kg	104	119	N [k]	295		119	mg/kg	UCL - N [k]	(4)
	Cadmium	mg/kg	0.58	0.70	G [l]	1.9		0.70	mg/kg	UCL - G [l]	(4)
	Chromium	mg/kg	17.6	19.1	N [j]	29.4	X	19.1	mg/kg	UCL - N [j]	(4)
	Cobalt	mg/kg	5.7	6.1	N [j]	9.5		6.1	mg/kg	UCL - N [j]	(4)
	Copper	mg/kg	469	2,318	NP [g]	11,500	J	2,318	mg/kg	UCL - NP [g]	(4)

Table 8-7
Exposure Point Concentrations - Surface Soil (0-0.5 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration EPC	Units	Statistic	Rationale
Area 2 Con't	Lead	mg/kg	279	318	N [j]	494		279	mg/kg	Avg	(5)
	Manganese	mg/kg	314	352	N [j]	617		352	mg/kg	UCL - N [j]	(4)
	Mercury	mg/kg	0.85	1.2	LN [m]	2.7		1.2	mg/kg	UCL - LN [m]	(4)
	Thallium	mg/kg	0.34		NC [b]	0.15	J	0.15	mg/kg	Maximum	(3)
	Vanadium	mg/kg	29	32	G [l]	61.7		32	mg/kg	UCL - G [l]	(4)
Area 3	**Semivolatile Organics**									Maximum	
	Benzo(a)anthracene	mg/kg	0.36	0.46	G [l]	1.5	J	0.46	mg/kg	UCL - G [l]	(4)
	Benzo(a)pyrene	mg/kg	0.39	0.49	G [l]	1.8	J	0.49	mg/kg	UCL - G [l]	(4)
	Benzo(b)fluoranthene	mg/kg	0.60	0.77	G [l]	2.9	J	0.77	mg/kg	UCL - G [l]	(4)
	Benzo(k)fluoranthene	mg/kg	0.13	0.19	NP [c]	0.54		0.19	mg/kg	UCL - NP [c]	(4)
	Carbazole	mg/kg	0.12	0.10	NP [c]	0.17		0.10	mg/kg	UCL - NP [c]	(4)
	Chrysene	mg/kg	0.44	0.56	G [l]	2	J	0.56	mg/kg	UCL - G [l]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.11	0.098	NP [d]	0.18		0.098	mg/kg	UCL - NP [d]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.29	0.36	G [l]	1.2		0.36	mg/kg	UCL - G [l]	(4)
	Inorganics										
	Aluminum	mg/kg	10,362	12,265	N [k]	38,200		12,265	mg/kg	UCL - N [k]	(4)
	Antimony	mg/kg	0.51	0.63	NP [e]	2.1	J	0.63	mg/kg	UCL - NP [e]	(4)
	Arsenic	mg/kg	13.2	32	NP [g]	132		32	mg/kg	UCL - NP [g]	(4)
	Arsenic (6)	mg/kg	9.1	16.6	NP [g]	53.7		16.6	mg/kg	UCL - NP [g]	(4)
	Barium	mg/kg	60	81	N [k]	390		81	mg/kg	UCL - N [k]	(4)
	Cadmium	mg/kg	0.56	0.73	LN [m]	8.6		0.73	mg/kg	UCL - LN [m]	(4)
	Chromium	mg/kg	25	32	N [k]	136		32	mg/kg	UCL - N [k]	(4)
	Cobalt	mg/kg	5.8	7.0	N [k]	23.7	J	7.0	mg/kg	UCL - N [k]	(4)
	Copper	mg/kg	44	80	NP [g]	268		80	mg/kg	UCL - NP [g]	(4)
	Lead	mg/kg	213	512	NP [g]	2,140	J	213	mg/kg	Avg	(5)
	Manganese	mg/kg	274	332	N [k]	1,140		332	mg/kg	UCL - N [k]	(4)
	Mercury	mg/kg	1.0	1.7	LN [m]	5		1.7	mg/kg	UCL - LN [m]	(4)
	Thallium	mg/kg	0.38	0.15	NP [d]	0.2	J	0.15	mg/kg	UCL - NP [d]	(4)
	Vanadium	mg/kg	36	43	N [k]	154		43	mg/kg	UCL - N [k]	(4)
Area 4	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	1.0	2.4	NP [g]	7.3		2.4	mg/kg	UCL - NP [g]	(4)
	Benzo(a)pyrene	mg/kg	1.3	3.0	NP [g]	9.8		3.0	mg/kg	UCL - NP [g]	(4)
	Benzo(b)fluoranthene	mg/kg	1.7	2.7	LN [m]	15		2.7	mg/kg	UCL - LN [m]	(4)
	Benzo(k)fluoranthene	mg/kg	0.44	0.68	NP [e]	2.7		0.68	mg/kg	UCL - NP [e]	(4)
	Carbazole	mg/kg	22	153	NP [i]	160	J	153	mg/kg	UCL - NP [i]	(4)
	Chrysene	mg/kg	1.1	2.4	NP [g]	8.2		2.4	mg/kg	UCL - NP [g]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.29	0.81	NP [h]	2		0.81	mg/kg	UCL - NP [h]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.94	2.2	NP [g]	7.4		2.2	mg/kg	UCL - NP [g]	(4)
	Inorganics										
	Aluminum	mg/kg	8,327	9,363	G [l]	14,500		9,363	mg/kg	UCL - G [l]	(4)
	Antimony	mg/kg	0.49	0.72	NP [f]	1.1		0.72	mg/kg	UCL - NP [f]	(4)
	Arsenic	mg/kg	5.3	6.5	N [k]	19.2		6.5	mg/kg	UCL - N [k]	(4)
	Barium	mg/kg	82	91	N [j]	138		91	mg/kg	UCL - N [j]	(4)

Table 8-7
Exposure Point Concentrations - Surface Soil (0-0.5 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Area 4 Con't	Cadmium	mg/kg	0.36	0.44	G [l]	0.85		0.44	mg/kg	UCL - G [l]	(4)
	Chromium	mg/kg	18.5	19.8	N [j]	28.2	X	19.8	mg/kg	UCL - N [j]	(4)
	Cobalt	mg/kg	5.8	6.3	N [j]	8.2		6.3	mg/kg	UCL - N [j]	(4)
	Copper	mg/kg	28	31	N [j]	50.9	E	31	mg/kg	UCL - N [j]	(4)
	Lead	mg/kg	163	181	N [j]	305		163	mg/kg	Avg	(5)
	Manganese	mg/kg	358	389	N [j]	566		389	mg/kg	UCL - N [j]	(4)
	Mercury	mg/kg	0.28	0.35	NP [e]	0.79		0.35	mg/kg	UCL - NP [e]	(4)
	Thallium	mg/kg	0.11	0.16	NP [d]	0.18	J	0.16	mg/kg	UCL - NP [d]	(4)
	Vanadium	mg/kg	27	29	N [j]	37		29	mg/kg	UCL - N [j]	(4)
Area 5	**Inorganics**										
	Aluminum	mg/kg	4,929	5,946	N [j]	9,380		5,946	mg/kg	UCL - N [j]	(4)
	Antimony	mg/kg	0.47	0.69	NP [d]	1.4	J	0.69	mg/kg	UCL - NP [d]	(4)
	Arsenic	mg/kg	4.4	5.7	G [l]	13.3		5.7	mg/kg	UCL - G [l]	(4)
	Barium	mg/kg	55	62	N [j]	84.8	X	62	mg/kg	UCL - N [j]	(4)
	Cadmium	mg/kg	0.50	0.83	G [l]	1.7		0.83	mg/kg	UCL - G [l]	(4)
	Chromium	mg/kg	13.6	16.7	N [j]	29.7		16.7	mg/kg	UCL - N [j]	(4)
	Cobalt	mg/kg	7.4	16.7	NP [g]	35.5		16.7	mg/kg	UCL - NP [g]	(4)
	Copper	mg/kg	73	120	G [l]	310	E	120	mg/kg	UCL - G [l]	(4)
	Lead	mg/kg	255	447	G [l]	793		255	mg/kg	Avg	(5)
	Manganese	mg/kg	160	218	G [l]	438	J	218	mg/kg	UCL - G [l]	(4)
	Mercury	mg/kg	1.8	5.0	G [l]	4.8	N	4.8	mg/kg	Maximum	(3)
	Thallium	mg/kg	0.41		NC [b]	0.012	B	0.012	mg/kg	Maximum	(3)
	Vanadium	mg/kg	21	25	G [l]	40.1		25	mg/kg	UCL - G [l]	(4)
Background	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.16	0.24	G [l]	0.59		0.24	mg/kg	UCL - G [l]	(4)
	Benzo(a)pyrene	mg/kg	0.14	0.20	G [l]	0.35		0.20	mg/kg	UCL - G [l]	(4)
	Benzo(b)fluoranthene	mg/kg	0.24	0.33	G [l]	0.58		0.33	mg/kg	UCL - G [l]	(4)
	Benzo(k)fluoranthene	mg/kg	0.057	0.073	N [j]	0.12		0.073	mg/kg	UCL - N [j]	(4)
	Carbazole	mg/kg	0.019	0.032	NP [e]	0.1		0.032	mg/kg	UCL - NP [e]	(4)
	Chrysene	mg/kg	0.13	0.19	G [l]	0.41		0.19	mg/kg	UCL - G [l]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.017	0.023	NP [d]	0.042		0.023	mg/kg	UCL - NP [d]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.067	0.087	N [j]	0.17		0.087	mg/kg	UCL - N [j]	(4)
	Inorganics										
	Aluminum	mg/kg	9,586	10,949	N [j]	13,200		10,949	mg/kg	UCL - N [j]	(4)
	Antimony	mg/kg	0.63	0.82	NP [c]	1.5	J	0.82	mg/kg	UCL - NP [c]	(4)
	Arsenic	mg/kg	6.5	7.4	N [j]	11.5		7.4	mg/kg	UCL - N [j]	(4)
	Barium	mg/kg	72	80	N [j]	102		80	mg/kg	UCL - N [j]	(4)
	Cadmium	mg/kg	0.63	0.88	G [l]	2.5		0.88	mg/kg	UCL - G [l]	(4)
	Chromium	mg/kg	22	24	N [j]	31.8		24	mg/kg	UCL - N [j]	(4)
	Cobalt	mg/kg	5.8	6.4	N [j]	8.6		6.4	mg/kg	UCL - N [j]	(4)
	Copper	mg/kg	41	50	G [l]	84.9		50	mg/kg	UCL - G [l]	(4)

Table 8-7
Exposure Point Concentrations - Surface Soil (0-0.5 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Background Con't	Lead	mg/kg	368	1,207	NP [g]	3,000		368	mg/kg	Avg	(5)
	Manganese	mg/kg	333	391	N [j]	653		391	mg/kg	UCL - N [j]	(4)
	Mercury	mg/kg	0.27	0.58	NP [g]	1.2		0.58	mg/kg	UCL - NP [g]	(4)
	Thallium	mg/kg	0.40	1.4	NP [d]	1.4	J	1.4	mg/kg	Maximum	(3)
	Vanadium	mg/kg	33	37	N [j]	47.5		37	mg/kg	UCL - N [j]	(4)

NOTES:

Prepared by / Date: EYM 10/07/11
Checked by / Date: BJR 10/20/2011

(1) Chemicals of potential concern (COPCs) are identified in Table 8-2.
(2) 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Appendix F.
(3) The maximum detected concentration is used as the EPC because it is lower than the calculated 95% UCL, or no 95% UCL is calculated.
(4) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.
(5) The average concentration is used as the EPC consistant with USEPA Guidance
(6) An alternate arsenic EPC was calculated by removing the arsenic result from sample AI3-105(0-2) of 132 mg/kg.

NC - Not Calculated
- [a] Dataset too small to calculate UCL
- [b] Only one distinct data value was detected

NP - Non-Parametric distribution
- [c] 95% KM (t) UCL
- [d] 95% KM (Percentile Bootstrap) UCL
- [e] 95% KM (BCA) UCL
- [f] 95% KM (Chebyshev) UCL
- [g] 95% Chebyshev (Mean, Sd) UCL
- [h] 97.5% KM (Chebyshev) UCL
- [i] 99% KM (Chebyshev) UCL

N - Normal distribution
- [j] 95% Student's-t UCL
- [k] 95% Modified-t UCL

G - Gamma Distribution
- [l] 95% Approximate Gamma UCL

LN - Log Normal Distribution
- [m] 95% H-UCL

mg/kg = milligrams per kilogram
Avg = Average
EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
J = Value is estimated.
B = Reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrumental Detection Limit (IDL)
E = Reported value is estimated due to an interference
N = Spiked sample recovery was not within normal limits

Table 8-8
Exposure Point Concentrations - Subsurface Soil (0.5 - 10 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Area 1	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.37		NC [a]	0.56		0.56	mg/kg	Maximum	(3)
	Benzo(a)pyrene	mg/kg	0.32		NC [a]	0.57		0.57	mg/kg	Maximum	(3)
	Benzo(b)fluoranthene	mg/kg	0.39		NC [a]	0.49		0.49	mg/kg	Maximum	(3)
	Carbazole	mg/kg	0.04		NC [a]	0.065	J	0.07	mg/kg	Maximum	(3)
	Chrysene	mg/kg	0.29		NC [a]	0.43		0.43	mg/kg	Maximum	(3)
	Dibenz(a,h)anthracene	mg/kg	0.24		NC [b]	0.068	J	0.07	mg/kg	Maximum	(3)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.25		NC [a]	0.46	J	0.46	mg/kg	Maximum	(3)
	Inorganics									Maximum	
	Aluminum	mg/kg	13,235		NC [a]	17,500		17,500	mg/kg	Maximum	(3)
	Antimony	mg/kg	4.5		NC [a]	8.9		8.9	mg/kg	Maximum	(3)
	Arsenic	mg/kg	6.1		NC [a]	8.3		8.3	mg/kg	Maximum	(3)
	Barium	mg/kg	207		NC [a]	358		358	mg/kg	Maximum	(3)
	Chromium	mg/kg	28		NC [a]	32		32	mg/kg	Maximum	(3)
	Cobalt	mg/kg	9.8		NC [a]	9.9		9.9	mg/kg	Maximum	(3)
	Copper	mg/kg	143		NC [a]	271		271	mg/kg	Maximum	(3)
	Lead	mg/kg	543		NC [a]	1,060		543	mg/kg	Avg	(5)
	Manganese	mg/kg	323		NC [a]	349		349	mg/kg	Maximum	(3)
	Mercury	mg/kg	0.55		NC [a]	1		1	mg/kg	Maximum	(3)
	Thallium	mg/kg	0.13		NC [a]	0.13	J	0.13	mg/kg	Maximum	(3)
	Vanadium	mg/kg	30		NC [a]	31	J	31	mg/kg	Maximum	(3)
Area 2	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.066	0.15	NP [c]	0.24		0.15	mg/kg	UCL - NP [c]	(4)
	Benzo(a)pyrene	mg/kg	0.081	0.19	NP [c]	0.31		0.19	mg/kg	UCL - NP [c]	(4)
	Benzo(b)fluoranthene	mg/kg	0.11	0.26	NP [c]	0.45		0.26	mg/kg	UCL - NP [c]	(4)
	Chrysene	mg/kg	0.078	0.17	NP [c]	0.29		0.17	mg/kg	UCL - NP [c]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.043	0.028	NP [d]	0.06		0.028	mg/kg	UCL - NP [d]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.058	0.084	NP [d]	0.19		0.084	mg/kg	UCL - NP [d]	(4)
	Inorganics										
	Aluminum	mg/kg	9,575	10,278	N [h]	12,600		10,278	mg/kg	UCL - N [h]	(4)
	Antimony	mg/kg	0.34	0.48	NP [d]	0.86	J	0.48	mg/kg	UCL - NP [d]	(4)
	Arsenic	mg/kg	3.3	3.8	N [h]	5.5		3.8	mg/kg	UCL - N [h]	(4)
	Barium	mg/kg	75	81	N [h]	102		81	mg/kg	UCL - N [h]	(4)
	Chromium	mg/kg	19.0	21	N [h]	26		21	mg/kg	UCL - N [h]	(4)
	Cobalt	mg/kg	6.4	6.8	N [h]	7.6		6.8	mg/kg	UCL - N [h]	(4)
	Copper	mg/kg	30	41	G [j]	75.1	J	41	mg/kg	UCL - G [j]	(4)
	Lead	mg/kg	86	120	N [h]	225	J	86	mg/kg	Avg	(5)
	Manganese	mg/kg	409	458	N [h]	557		458	mg/kg	UCL - N [h]	(4)
	Mercury	mg/kg	0.36	0.69	G [j]	1.76	J	0.69	mg/kg	UCL - G [j]	(4)
	Thallium	mg/kg	0.52		NC [b]	0.1	J	0.10	mg/kg	Maximum	(3)
	Vanadium	mg/kg	23	25	N [h]	30.6		25	mg/kg	UCL - N [h]	(4)

Table 8-8
Exposure Point Concentrations - Subsurface Soil (0.5 - 10 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Area 3	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.23	0.59	NP [c]	1.4	J	0.59	mg/kg	UCL - NP [c]	(4)
	Benzo(a)pyrene	mg/kg	0.23	0.59	NP [c]	1.4	J	0.59	mg/kg	UCL - NP [c]	(4)
	Benzo(b)fluoranthene	mg/kg	0.38	0.92	NP [c]	2.2	J	0.92	mg/kg	UCL - NP [c]	(4)
	Carbazole	mg/kg	0.02		NC [a]	0.04		0.04	mg/kg	Maximum	(3)
	Chrysene	mg/kg	0.22	0.56	NP [c]	1.3	J	0.56	mg/kg	UCL - NP [c]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.092	0.14	NP [c]	0.23		0.14	mg/kg	UCL - NP [c]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.17	0.41	NP [c]	0.89		0.41	mg/kg	UCL - NP [c]	(4)
	Inorganics										
	Aluminum	mg/kg	10,292	11,248	N [h]	14,900		11,248	mg/kg	UCL - N [h]	(4)
	Antimony	mg/kg	0.33	0.44	NP [f]	1.2	J	0.44	mg/kg	UCL - NP [f]	(4)
	Arsenic	mg/kg	6.4	8.4	G [j]	18.9		8.4	mg/kg	UCL - G [j]	(4)
	Barium	mg/kg	55	62	N [h]	105		62	mg/kg	UCL - N [h]	(4)
	Chromium	mg/kg	19.2	21	N [h]	26.2		21	mg/kg	UCL - N [h]	(4)
	Cobalt	mg/kg	5.9	6.4	N [h]	7.7		6.4	mg/kg	UCL - N [h]	(4)
	Copper	mg/kg	157	688	NP [e]	2,470		688	mg/kg	UCL - NP [e]	(4)
	Lead	mg/kg	96	124	N [h]	265	J	96	mg/kg	Avg	(5)
	Manganese	mg/kg	268	300	N [h]	463		300	mg/kg	UCL - N [h]	(4)
	Mercury	mg/kg	0.55	1.8	NP [c]	2.7		1.8	mg/kg	UCL - NP [c]	(4)
	Thallium	mg/kg	0.45	0.16	NP [d]	0.19	J	0.16	mg/kg	UCL - NP [d]	(4)
	Vanadium	mg/kg	26	28	N [h]	36.7		28	mg/kg	UCL - N [h]	(4)
Area 4	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.47	0.87	G [j]	4.7		0.87	mg/kg	UCL - G [j]	(4)
	Benzo(a)pyrene	mg/kg	0.56	2.0	NP [e]	6.4		2.0	mg/kg	UCL - NP [e]	(4)
	Benzo(b)fluoranthene	mg/kg	0.84	2.9	NP [e]	8.8		2.9	mg/kg	UCL - NP [e]	(4)
	Carbazole	mg/kg	0.021		NC [a]	0.028	J	0.028	mg/kg	Maximum	(3)
	Chrysene	mg/kg	0.56	1.7	NP [e]	4.3		1.7	mg/kg	UCL - NP [e]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.13	0.39	NP [c]	1.2		0.39	mg/kg	UCL - NP [c]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.40	1.4	NP [e]	4.4		1.4	mg/kg	UCL - NP [e]	(4)
	Inorganics										
	Aluminum	mg/kg	13,662	17,797	N [h]	21,300		17,797	mg/kg	UCL - N [h]	(4)
	Antimony	mg/kg	0.50	0.84	NP [d]	1.2	N	0.84	mg/kg	UCL - NP [d]	(4)
	Arsenic	mg/kg	3.6	4.4	N [h]	4.9		4.4	mg/kg	UCL - N [h]	(4)
	Barium	mg/kg	84	101	N [h]	120		101	mg/kg	UCL - N [h]	(4)
	Chromium	mg/kg	24	29	N [h]	33		29	mg/kg	UCL - N [h]	(4)
	Cobalt	mg/kg	8.6	11	N [h]	12		11	mg/kg	UCL - N [h]	(4)
	Copper	mg/kg	26	31	N [h]	35.4		31	mg/kg	UCL - N [h]	(4)
	Lead	mg/kg	118	211	N [h]	298		118	mg/kg	Avg	(5)
	Manganese	mg/kg	440	473	N [h]	485		473	mg/kg	UCL - N [h]	(4)
	Mercury	mg/kg	0.20	0.44	G [j]	0.86		0.44	mg/kg	UCL - G [j]	(4)
	Thallium	mg/kg	0.25	0.24	NP [d]	0.25	J	0.24	mg/kg	UCL - NP [d]	(4)
	Vanadium	mg/kg	29	35	N [h]	40	J	35	mg/kg	UCL - N [h]	(4)

Table 8-8
Exposure Point Concentrations - Subsurface Soil (0.5 - 10 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	95% UCL (2) (Calculation)		Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
								EPC	Units	Statistic	Rationale
Area 5	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.26		NC [a]	0.27	J	0.27	mg/kg	Maximum	(3)
	Benzo(a)pyrene	mg/kg	0.23		NC [a]	0.23	J	0.23	mg/kg	Maximum	(3)
	Benzo(b)fluoranthene	mg/kg	0.34		NC [a]	0.37		0.37	mg/kg	Maximum	(3)
	Chrysene	mg/kg	0.29		NC [a]	0.29	J	0.29	mg/kg	Maximum	(3)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.07		NC [b]	0.066	J	0.066	mg/kg	Maximum	(3)
	Inorganics										
	Aluminum	mg/kg	7,966	8,838	G [j]	15,200		8,838	mg/kg	UCL - G [j]	(4)
	Antimony	mg/kg	0.36	0.54	NP [d]	1.9	J	0.54	mg/kg	UCL - NP [d]	(4)
	Arsenic	mg/kg	2.5	2.8	N [h]	3.9		2.8	mg/kg	UCL - N [h]	(4)
	Barium	mg/kg	51	63	LN [l]	156		63	mg/kg	UCL - LN [l]	(4)
	Chromium	mg/kg	19.3	22	G [j]	45.2		22	mg/kg	UCL - G [j]	(4)
	Cobalt	mg/kg	6.9	8.1	G [j]	15.8		8.1	mg/kg	UCL - G [j]	(4)
	Copper	mg/kg	21	26	G [j]	66.9	J	26	mg/kg	UCL - G [j]	(4)
	Lead	mg/kg	43	62	G [j]	106	J	43	mg/kg	Avg	(5)
	Manganese	mg/kg	255	298	G [j]	510		298	mg/kg	UCL - G [j]	(4)
	Mercury	mg/kg	2.9	5.3	G [j]	12.2		5.3	mg/kg	UCL - G [j]	(4)
	Vanadium	mg/kg	22	25	G [j]	44.9		25	mg/kg	UCL - G [j]	(4)
Background	**Semivolatile Organics**										
	Benzo(a)anthracene	mg/kg	0.11	0.59	NP [g]	0.59		0.59	mg/kg	UCL - NP [g]	(4)
	Benzo(a)pyrene	mg/kg	0.090	0.19	G [j]	0.51		0.19	mg/kg	UCL - G [j]	(4)
	Benzo(b)fluoranthene	mg/kg	0.13	0.71	NP [g]	0.74		0.71	mg/kg	UCL - NP [g]	(4)
	Carbazole	mg/kg	0.015	0.036	NP [f]	0.1		0.036	mg/kg	UCL - NP [f]	(4)
	Chrysene	mg/kg	0.099	0.24	G [k]	0.64		0.24	mg/kg	UCL - G [k]	(4)
	Dibenz(a,h)anthracene	mg/kg	0.011	0.021	NP [f]	0.052		0.021	mg/kg	UCL - NP [f]	(4)
	Indeno(1,2,3-cd)pyrene	mg/kg	0.040	0.11	NP [c]	0.17		0.11	mg/kg	UCL - NP [c]	(4)
	Inorganics										
	Aluminum	mg/kg	10,697	11,809	N [h]	15,700		11,809	mg/kg	UCL - N [h]	(4)
	Antimony	mg/kg	0.24	0.41	NP [f]	1.2	J	0.41	mg/kg	UCL - NP [f]	(4)
	Arsenic	mg/kg	4.2	4.8	N [h]	6.7		4.8	mg/kg	UCL - N [h]	(4)
	Barium	mg/kg	76	94	G [j]	203		94	mg/kg	UCL - G [j]	(4)
	Chromium	mg/kg	21	23	N [h]	28.6		23	mg/kg	UCL - N [h]	(4)
	Cobalt	mg/kg	7.1	8.1	N [i]	12.2		8.1	mg/kg	UCL - N [i]	(4)
	Copper	mg/kg	25	33	G [j]	70.3		33.4	mg/kg	UCL - G [j]	(4)
	Lead	mg/kg	79	110	N [h]	218		79	mg/kg	Avg	(5)
	Manganese	mg/kg	351	402	G [j]	578		402	mg/kg	UCL - G [j]	(4)
	Mercury	mg/kg	0.21	0.40	G [j]	0.8		0.40	mg/kg	UCL - G [j]	(4)
	Thallium	mg/kg	0.37	0.80	NP [f]	0.83	J	0.80	mg/kg	UCL - NP [f]	(4)
	Vanadium	mg/kg	28	30	N [h]	34.9		30	mg/kg	UCL - N [h]	(4)

Table 8-8
Exposure Point Concentrations - Subsurface Soil (0.5 - 10 ft)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Prepared By/Date: EYM 10/7/2011
Checked By/Date: BJR 10/21/2011

NOTES:
(1) Chemicals of potential concern (COPCs) are identified in Table 8-3
(2) 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Appendix F
(3) The maximum detected concentration is used as the EPC because it is lower than the calculated 95% UCL, or no 95% UCL is calculated
(4) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.
(5) The average concentration is used as the EPC consistant with USEPA Guidance

NC - Not Calculated
- [a] Dataset too small to calculate UCL
- [b] Only one distinct data value was detected

NP - Non-Parametric distribution
- [c] 95% KM (Chebyshev) UCL
- [d] 95% KM (t) UCL
- [e] 95% Chebyshev (Mean, Sd) UCL
- [f] 95% KM (Percentile Bootstrap) UCL
- [g] 99% Chebyshev (Mean, Sd) UCL

N - Normal distribution
- [h] 95% Student's-t UCL
- [i] 95% Modified-t UCL

G - Gamma Distribution
- [j] 95% Approximate Gamma UCL
- [k] 95% Adjusted Gamma UCL

LN - Log Normal Distribution
- [l] 95% H-UCL

mg/kg = milligrams per kilogram
Avg = Average
EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
J = Value is estimated.
N = Spiked sample recovery was not within normal limits

Table 8-9
Exposure Point Concentrations - Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Chemical of Potential Concern (1)	Units	Arithmetic Mean	Maximum Detected Concentration (Qualifier)		Exposure Point Concentration			
						EPC	Units	Statistic	Rationale
Groundwater	**Volatile Organics**								
	Chloroform	mg/L	0.0061	0.014	J	0.014	mg/L	Maximum	(2)
	Semivolatile Organics								
	Benzo(a)anthracene	mg/L	0.000055	0.00022		0.00022	mg/L	Maximum	(2)
	Benzo(a)pyrene	mg/L	0.000047	0.00018	J	0.00018	mg/L	Maximum	(2)
	Benzo(b)fluoranthene	mg/L	0.000063	0.00024		0.00024	mg/L	Maximum	(2)
	Dibenz(a,h)anthracene	mg/L	0.000063	0.00026		0.00026	mg/L	Maximum	(2)
	Indeno(1,2,3-cd)pyrene	mg/L	0.000065	0.00027		0.00027	mg/L	Maximum	(2)
	Inorganics								
	Chromium	mg/L	0.0028	0.0059		0.0059	mg/L	Maximum	(2)

Notes:

(1) Chemicals of potential concern (COPCs) are identified in Table 8-4.

(2) The maximum detected concentration is used as the EPC.

Prepared by / Date: EYM 10/19/11

Checked by / Date: BJR 10/25/11

EPC = Exposure Point Concentration

UCL = Upper Confidence Limit on the arithmetic mean

J = Value is estimated.

mg/kg = milligrams per kilogram

Table 8-10
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Current Land Use Surface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Current Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Ingestion	Outdoor Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
			Area 3, Area 4,	IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	36	day/yr	Assumption	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Trespasser	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 16 - 30)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1994	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	40 [a]	day/yr	Assumption	
				ED	Exposure Duration	14	yr	USEPA, 1994	
				BW	Body Weight	70	kg	USEPA, 1994	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	5110	day	USEPA, 1989 / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Trespasser	Older child/adolescent	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 6 - 16)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 1994	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	40 [a]	day/yr	Assumption	
				ED	Exposure Duration	10	yr	USEPA, 1994	
				BW	Body Weight	44 [b]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3650	day	USEPA, 1989 / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
Dermal	Outdoor Worker	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
			Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm²-event	USEPA, 2002b	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3300	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	USEPA, 2002b	CS x AF x ABSd x CF
				EF	Exposure Frequency	36	day/yr	Assumption	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		

Table 8-10
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Current Land Use Surface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Current Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Dermal	Trespasser	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
(cont)		(ages 16 - 30)	Area 3, Area 4,	AF	Adherence Factor	0.07	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	4849 [c]	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	40 [a]	day/yr	Assumption	
				ED	Exposure Duration	14	yr	USEPA, 1994	
				BW	Body Weight	70	kg	USEPA, 1994	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	5110	day	USEPA, 1989 / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
	Trespasser	Older child/adolescent	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
		(ages 6 - 16)	Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3306 [d]	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	40 [a]	day/yr	Assumption	
				ED	Exposure Duration	10	yr	USEPA, 1994	
				BW	Body Weight	44 [b]	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3650	day	USEPA, 1989 / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		

USEPA, 1989. “Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)”; Office of Emergency and Remedial Response; EPA-540/1-89/002 (interim final); Washington, D.C., December.

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USEPA, 1997. "Exposure Factors Handbook, Volume 1"; Office of Research and Development; EPA-600/P-95/002Fa; Washington, D.C.; August.

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USEPA, 2002b. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." OSWER 9355.4-24. December.

USEPA, 2004. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

USEPA, 2011. "Exposure Factors Handbook: 2011 Edition" EPA/600/R-090/052F. September.

[a] - Assumes trespassing occurs 2 times per week from April to August.

[b] - Body weight are mean concentrations from Table 8-1. Recommended Values for Body Weight.

[c] - Average of 50th percentile body surface area (hands, forearms, lower leges, and face) for adult males and females.

[d] - Average of 50th percentile body surface areas (hands, forearms, lower legs, and face) for males and females ages 6 to 16.

NA - Not Applicable
kg - kilograms
cm^2 - square centimeters
m^3 - cubic meters

mg - milligrams
yr - year
ug - micrograms

hr - hour
UCL - upper confidence limit

Prepared by / Date: BJR 8/30/11
Checked by / Date: EYM 10/18/11

Table 8-11
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Current Land Use Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Current Land Use
Medium: Soil
Exposure Medium: Subsurface Soil (0.5 - 10 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Ingestion	Outdoor Worker	Adult	Area 1, Area 2, Area 3, Area 4, Area 5	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)= CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002b	
				FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	36	day/yr	Assumption	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
Dermal	Outdoor Worker	Adult	Area 1, Area 2, Area 3, Area 4, Area 5	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) = DAevent x SA x EF x ED x EV x 1/BW x 1/AT
				AF	Adherence Factor	0.2	mg/cm²-event	USEPA, 2002b	
				AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3300	cm^2	USEPA, 2004	Where DAevent = CS x AF x ABSd x CF
				EV	Event Day	1	event/day	USEPA, 2002b	
				EF	Exposure Frequency	36	day/yr	Assumption	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		

USEPA, 2002a. "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. December
USEPA, 2002b. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." OSWER 9355.4-24. December.
USEPA, 2004. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

NA - Not Applicable
kg - kilograms
cm^2 - square centimeters
UCL - upper confidence limit
mg - milligrams
yr - year
ug - micrograms

Prepared by / Date: BJR 8/30/11
Checked by / Date: EYM 10/18/11

Table 8-12
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Surface and Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs) and Subsurface Soil (0.5 - 10 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Ingestion	Outdoor Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
			Area 3, Area 4,	IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	225	day/yr	USEPA, 2002b	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Indoor Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
			Area 3, Area 4,	IR-S	Ingestion Rate of Soil	50	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	250	day/yr	USEPA, 2002b	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Construction Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
			Area 3, Area 4,	IR-S	Ingestion Rate of Soil	330	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	250	day/yr	USEPA, 2002b	
				ED	Exposure Duration	1	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	365	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Resident	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 7 - 31)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	350	day/yr	USEPA, 2002b	
				ED	Exposure Duration	24	yr	USEPA, 2002b	
				BW	Body Weight	65 [a]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Resident	Child	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 1 - 7)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	350	day/yr	USEPA, 2002b	
				ED	Exposure Duration	6	yr	USEPA, 2002b	
				BW	Body Weight	15	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		

Table 8-12
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Surface and Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs) and Subsurface Soil (0.5 - 10 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Ingestion	Recreational	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 7 - 31)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	52	day/yr	USEPA, 2002b	
				ED	Exposure Duration	24	yr	USEPA, 2002b	
				BW	Body Weight	65 [a]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
	Recreational	Child	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 1 - 7)	Area 3, Area 4,	IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 2002b	CS-c x IR-S x FI x EF x ED x CF1 x 1/BW x 1/AT
			Area 5	FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	52	day/yr	USEPA, 2002b	
				ED	Exposure Duration	6	yr	USEPA, 2002b	
				BW	Body Weight	15	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 2002b / equal to ED	
				CF1	Conversion Factor	1.0.E-06	kg/mg		
Dermal	Outdoor Worker	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
			Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm^2-event	USEPA, 2002b	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3300	cm^2	USEPA, 2002b	Where DAevent =
				EV	Event Day	1	event/day	USEPA, 2002b	CS x AF x ABSd x CF
				EF	Exposure Frequency	225	day/yr	USEPA, 2002b	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
	Indoor Worker	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
			Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm^2-event	USEPA, 2002b	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3300	cm^2	USEPA, 2002b	Where DAevent =
				EV	Event Day	1	event/day	USEPA, 2002b	CS x AF x ABSd x CF
				EF	Exposure Frequency	250	day/yr	USEPA, 2002b	
				ED	Exposure Duration	25	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		

Table 8-12
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Surface and Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs) and Subsurface Soil (0.5 - 10 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Dermal	Construction Worker	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
			Area 3, Area 4,	AF	Adherence Factor	0.3	mg/cm²-event	USEPA, 2002b	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	3300	cm^2	USEPA, 2002b	Where DAevent =
				EV	Event Day	1	event/day	USEPA, 2002b	CS x AF x ABSd x CF
				EF	Exposure Frequency	250	day/yr	USEPA, 2002b	
				ED	Exposure Duration	1	yr	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	365	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
	Resident	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
		(ages 7 - 31)	Area 3, Area 4,	AF	Adherence Factor	0.07	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	5091 [b]	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	350	day/yr	USEPA, 2004	
				ED	Exposure Duration	24	yr	USEPA, 2002b	
				BW	Body Weight	65 [a]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
	Resident	Child	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
		(ages 1 - 7)	Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	2800	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	350	day/yr	USEPA, 2004	
				ED	Exposure Duration	6	yr	USEPA, 2002b	
				BW	Body Weight	15	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		

Table 8-12
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Surface and Subsurface Soil
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Soil
Exposure Medium: Surface Soil (0 - 0.5 ft bgs) and Subsurface Soil (0.5 - 10 ft bgs)

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Dermal	Recreational	Adult	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
		(ages 7 - 31)	Area 3, Area 4,	AF	Adherence Factor	0.07	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	5091 [b]	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	52	day/yr	USEPA, 2004	
				ED	Exposure Duration	24	yr	USEPA, 2002b	
				BW	Body Weight	65 [a]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
	Recreational	Child	Area 1, Area 2,	CS	Chemical Concentration In Soil	95% UCL	mg/kg	USEPA, 2002a	INTAKE-DERMAL (mg/kg-day) =
		(ages 1 - 7)	Area 3, Area 4,	AF	Adherence Factor	0.2	mg/cm²-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
			Area 5	AbF	Absorption Factor	chemical-specific	unitless	USEPA, 2004	
				SA	Skin Surface Area Available For Contact	2800	cm^2	USEPA, 2004	Where DAevent =
				EV	Event Day	1	event/day	Assumption	CS x AF x ABSd x CF
				EF	Exposure Frequency	52	day/yr	USEPA, 2004	
				ED	Exposure Duration	6	yr	USEPA, 2002b	
				BW	Body Weight	15	kg	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 2002b / equal to ED	
				CF	Conversion Factor	1.0E-06	kg/mg		
Dust Inhalation	Outdoor Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INHALATION (ug/m³) =
			Area 3, Area 4,	CAair	Concentration in Air	calculated	ug/m^3	Modeled from soil	CAair x ED x EF x ET x 1/AT x 1/24 hr
			Area 5	EFo	Exposure Frequency	225	day/yr	USEPA, 2002b	CAair =
				ED	Exposure Duration	25	yr	USEPA, 2002b	CS-c x 1/PEF x 1000 ug/mg
				ET	Exposure Time	8	hr	Assumption	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	9125	day	USEPA, 2002b / equal to ED	
				PEF	Particulate Emission Factor	TBC	m^3/kg		
	Construction Worker	Adult	Area 1, Area 2,	CS-c	Chemical Concentration in Soil	95% UCL	mg/kg	USEPA, 2002a	CHEMICAL INTAKE-INHALATION (ug/m³) =
			Area 3, Area 4,	CAair	Concentration in Air	calculated	ug/m^3	Modeled from soil	CAair x ED x EF x ET x 1/AT x 1/24 hr
			Area 5	EFo	Exposure Frequency	250	day/yr	USEPA, 2004	CAair =
				ED	Exposure Duration	1	yr	USEPA, 2004	CS-c x 1/PEF x 1000 ug/mg
				ET	Exposure Time	8	hr	Assumption	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 2002b	
				AT-N	Averaging Time (Non-Cancer)	365	day	USEPA, 2002b / equal to ED	
				PEF	Particulate Emission Factor	TBC	m^3/kg		

USEPA, 2002a. "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. December
USEPA, 2002b. "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites." OSWER 9355.4-24. December.
USEPA, 2004. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.
USEPA, 2011. "Exposure Factors Handbook: 2011 Edition" EPA/600/R-090/052F. September.

[a] - Body weight are mean concentrations from Table 8-1. Recommended Values for Body Weight.
[b] - Assumes head, hands, forearms, and lower legs are exposed.

NA - Not Applicable
kg - kilograms
cm^2 - square centimeters
mg - milligrams
yr - year
ug - micrograms
hr - hour
UCL - upper confidence limit
m^3 - cubic meters

Prepared by / Date: BJR 8/30/11
Checked by / Date: EYM 10/18/11

Table 8-13
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Ingestion	Resident	Adult	Site	CW-c	Chemical Concentration in Water	Maximum	mg/l	USEPA, 1994	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 7 - 31)		IR-W	Ingestion Rate of Water	2	l/day	USEPA, 2011	CW-c x IR-W x FI x EF x ED x 1/BW x 1/AT
				FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	350	day/yr	USEPA, 2004	
				ED	Exposure Duration	24	yr	USEPA, 2004	
				BW	Body Weight	65 [a]	kg	USEPA, 2011	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 1989 / equal to ED	
		Child	Site	CW-c	Chemical Concentration in Water	Maximum	mg/l	USEPA, 1994	CHEMICAL INTAKE-INGESTION (mg/kg-day)=
		(ages 1 - 7)		IR-W	Ingestion Rate of Water	1	l/day	USEPA, 2011	CW-c x IR-W x FI x EF x ED x 1/BW x 1/AT
				FI	Fraction Ingested	1	unitless	Assumption	
				EF	Exposure Frequency	350	day/yr	USEPA, 2004	
				ED	Exposure Duration	6	yr	USEPA, 2004	
				BW	Body Weight	15	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 1989 / equal to ED	
Dermal	Resident	Adult	Site	CW	Chemical Concentration in Water	Maximum	mg/l	USEPA, 1994	INTAKE-DERMAL (mg/kg-day)=
		(ages 7 - 31)		DAevent	Permeability Constant Per Event	chemical-specific	mg/cm^2-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	18000	cm^2	USEPA, 2004	DAevent = CW x CF x PCevent
				tevent	Exposure Time	0.58	hr/event	USEPA, 2004	where:
				EF	Exposure Frequency	350	day/yr	USEPA, 2004	PCevent is tevent multiplied by chemical-specific parameters
				ED	Exposure Duration	24	yr	USEPA, 2004	B, t*, Tevent, and Kp, using the algorithm that is appropriate
				EV	Event Frequency	1	event/day	USEPA, 2004	for the relationship between tevent and t*, per USEPA (2004)
				BW	Body Weight	65 [a]	kg	USEPA, 2011	and as described in the risk assessment text.
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	Calculations are documented in the risk calculations appendix.
				AT-N	Averaging Time (Non-Cancer)	8760	day	USEPA, 1989 / equal to ED	
				CF	Conversion Factor	0.001	l/cm^3		
		Child	Site	CW	Chemical Concentration in Water	Maximum	mg/l	USEPA, 1994	INTAKE-DERMAL (mg/kg-day)=
		(ages 1 - 7)		DAevent	Permeability Constant Per Event	chemical-specific	mg/cm^2-event	USEPA, 2004	DAevent x SA x EF x ED x EV x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	6600	cm^2	USEPA, 2004	DAevent = CW x CF x PCevent
				tevent	Exposure Time	1.0	hr/event	USEPA, 2004	where:
				EF	Exposure Frequency	350	day/yr	USEPA, 2000	PCevent is tevent multiplied by chemical-specific parameters
				ED	Exposure Duration	6	yr	USEPA, 2004	B, t*, Tevent, and Kp, using the algorithm that is appropriate
				EV	Event Frequency	1	event/day	USEPA, 2004	for the relationship between tevent and t*, per USEPA (2004)
				BW	Body Weight	15	kg	USEPA, 2004	and as described in the risk assessment text.
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	Calculations are documented in the risk calculations appendix.
				AT-N	Averaging Time (Non-Cancer)	2190	day	USEPA, 1989 / equal to ED	
				CF	Conversion Factor	0.001	l/cm^3		

Table 8-13
Values Used For Daily Intake Calculations
Reasonable Maximum Exposure - Future Land Use Groundwater
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Scenario Timeframe: Future Land Use
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Points	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation / Model Name
Dermal	Construction Worker	Adult	Site	CW	Chemical Concentration in Water	Maximum	mg/l	USEPA, 2002	INTAKE-DERMAL (mg/kg-day)=
				PCevent	Permeability Constant Per Event	chemical-specific	cm/event	USEPA, 2001	CW x SA x PCevent x EV x EF x ED x ADAF x CF x 1/BW x 1/AT
				SA	Skin Surface Area Available For Contact	2300 [b]	cm^2	USEPA, 2004	PCevent = PC x ET; calculated in PCevent table
				ET	Exposure Time	1	hr/day	Assumption	
				EV	Event Day	1	event/day	Assumption	
				EF	Exposure Frequency	30	day/yr	Assumption	
				ED	Exposure Duration	1	yr	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	day	USEPA, 1989	
				AT-N	Averaging Time (Noncancer)	365	day	USEPA, 1989	
				CF	Conversion Factor	0.001	l/cm^3		

USEPA, 1989. “Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)”; Office of Emergency and Remedial Response; EPA-540/1-89/002 (interim final); Washington, D.C., December.

USEPA, 1994. “Risk Updates No. 2”; USEPA Region I, Waste Management Division; August. Values from "Attachment 2" to Risk Updates No. 2.

USEPA, 2001. “Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part E)”; Office of Solid Waste and Emergency Response; EPA-540/R-99/005 (interim final); Washington, D.C.

USEPA, 2002. "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. December

USEPA, 2004. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

USEPA, 2011. "Exposure Factors Handbook: 2011 Edition" EPA/600/R-090/052F. September.

[a] - Body weight are mean concentrations from Table 8-1. Recommended Values for Body Weight.
[b] - Assumes construction worker's hands and forearms would be exposed to groundwater.

mg - milligrams
cm^2 - square centimeters
cm^3 - cubic centimeters
l - liter
yr - year
hr - hour
kg - kilograms
UCL - upper confidence limit

Prepared by / Date: BJR 3/15/11
Checked by / Date: EYM 10/18/11

Table 8-14
Calculation of Total Particulate Emission Factor - Sources Other than Unpaved Roads
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Equations:

$$PEF = Q/C_{SR} \times (1/F_D) \times [(T \times A_R)/(556 \times ((W/3)^{0.4}) \times ((365-p)/365) \times \sum VKT)]$$

$$Q/C_{sr} = A \times \exp[(\ln A_c - B)^2/C]$$

PARAMETER / DEFINITIONS	UNITS	VALUES
PEF'_{sc} / Subchronic particulate emission factor for construction activities other than traffic on unpaved roads	m³/kg	8.62E+06 calculated
Q/C_{sr} / Inverse of the ratio of the 1-hr geometric mean air concentration to the emission flux along a straight road bisecting a squre site.	g/m²-s per kg/m³	**22.5** Calculated
A / Constant		12.9351 USEPA, 2002
B / Constant		5.7383 USEPA, 2002
C / Constant		71.7711 USEPA, 2002
A_c / Areal extent of site with surface soil contamination	m²	2,306 Smallest Exposure Area
F_D / Dispersion correction factor	unitless	0.19 $F_D = 0.1852 + 5.3537/tc + -9.6318/tc^2$
tc / Duration of construction	hr	2000 8 hr/day for 250 days
T / Total time over which construction occurs	s	7,200,000 8 hr/day for 250 days
A_R / Surface area of contaminated road segment	m²	293 $L_R \times W_R \times 0.0929$ ft^2/m^2
L_R / Length of contaminated road segment	ft	158 Square root of A_c
W_R / Width of contaminated road segment	ft	20 USEPA, 2002
W / Mean vehicle weight	tons	10 Calculated - see below
p / Number of days per year with at least 0.01 inches of precipitation	unitless	130 USEPA, 2002
VKT / Sum of kilometers travelled by all vehicles during time of construction	Km	51 Calculated - see below

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

Notes:

Units for A, B, and C constants are not presented in USEPA (2002).

Calculation of W and VKT parameter values

Vehicle		Number per day		Weight (tons)	Km travelled per vehicle on-site per day
Car/pickup truck		5		2	0.1
Dump truck (loaded)		2		30	0.1
	W =	10	tons		
	VKT =	50.5	Km over 250 days		

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Table 8-15
Cancer Toxicity Data - Oral/Dermal
Final Remedial Investigation Report
Queens, New York

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units		Source	Date Verified
VOLATILES								
Chloroform	3.1E-02	$(mg/kg/day)^{-1}$	100%	3.1E-02	$(mg/kg/day)^{-1}$	B2 [a]	CALEPA	October-11
SEMIVOLATILES								
Benzo(a)anthracene [b], [c]	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
Benzo(a)pyrene [c]	7.3E+00	$(mg/kg/day)^{-1}$	89%	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	October-11
Benzo(b)fluoranthene [b], [c]	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
Benzo(g,h,i)perylene	NA			NA		D	IRIS	October-11
Benzo(k)fluoranthene [b], [c]	7.3E-02	$(mg/kg/day)^{-1}$	89%	7.3E-02	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
Carbazole	2.0E-02	$(mg/kg/day)^{-1}$	100%	2.0E-02	$(mg/kg/day)^{-1}$	B2	HEAST	October-11
Chrysene [b], [c]	7.3E-03	$(mg/kg/day)^{-1}$	89%	7.3E-03	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
Dibenzo(a,h)anthracene [b], [c]	7.3E+00	$(mg/kg/day)^{-1}$	89%	7.3E+00	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
Indeno(1,2,3-cd)pyrene [b], [c]	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	October-11
PESTICIDES/PCBs								
Heptachlor Epoxide	9.1E+00	$(mg/kg/day)^{-1}$	100%	9.1E+00	$(mg/kg/day)^{-1}$	B2	IRIS	October-11
INORGANICS/METALS								
Aluminum	ND			ND		Inadequate evidence	PPRTV	October-11
Antimony	ND			ND		ND	IRIS	October-11
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	95%	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	October-11
Barium	NA			NA		D	IRIS	October-11
Cadmium	ND			ND		ND	IRIS	October-11
Chromium VI	5.0E-01	$(mg/kg/day)^{-1}$	2.5%	1.3E-02		Inadequate evidence	NJ DEP	October-11
Cobalt	ND			ND			PPRTV	October-11
Copper	NA			NA		D	IRIS	October-11
Lead	ND			ND		B2	IRIS	October-11
Manganese	ND			ND		D	IRIS	October-11
Mercury	NA			NA		D	IRIS	October-11
Thallium	ND			ND		Inadequate evidence	IRIS	October-11
Vanadium	ND			ND		ND		October-11

Table 8-15
Cancer Toxicity Data - Oral/Dermal
Final Remedial Investigation Report
Queens, New York

Prepared by/ Date: EYM 10/12/11
Checked by/ Date: BJR 11/02/11

Notes:

In accordance with OSWER 9285.7-53, slope factors are identified from the following heirarchy of sources:

Tier 1:

IRIS = Integrated Risk Information System: Obtained from: http://www.epa.gov/IRIS/

Tier 2:

PPRTV = Preliminary Peer-Reviewed Toxicity Value: Obtained from: http://hhpprtv.ornl.gov/

Tier 3:

HEAST= Health Effects Assessment Summary Tables Obtained from: USEPA Solid Waste and Emergency Response, FY 1997 Update. EPA-540-R-97-036. July 1997.

MRL = Minimum Risk Level (ATSDR: chronic MRLs):

CalEPA = California Environmental Protection Agency Toxicity Criteria Database Obtained from: http://www.oehha.ca.gov/risk/chemicalDB/

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: Obtained from Region III RSL Table November 2010.

PPRTV SL = Preliminary Peer-Reviewed Toxicity Value Screening Level Obtained from: http://hhpprtv.ornl.gov/

(1) Values obtained from RAGS Volume 1 (Part E, Supplemental Guidance for Dermal Risk Assessment, Final) (EPA, 2004)
Per this guidance, a value of 100% is used for analytes without published values.

(2) Adjusted Dermal SF = Oral SF / Oral to Dermal Adjustment Factor. Per RAGS Part E (USEPA, 2004), adjustments are only performed for chemicals that have an oral absorption efficiency of less than 50%.

[a] - The RfD for chloroform is protective for cancer risk.

[b] - Slope Factor for Benzo(a)Pyrene used for other carcinogenic PAHs, adjusted by Relative Potency Factors of 1.0 [benzo(a)pyrene,dibenz(a,h)anthracene]; 0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-c,d)pyrene]; 0.01 [benzo(k)fluoranthene]; 0.001 [chrysene].

[c] - Slope factors are developed in accordance with the EPA Memorandum: "Implementation of the Cancer Guidelines and Accompanying Supplemental Guidance - Science Policy Council Cancer Guidelines Implementation Workgroup Communication II: Performing Risk Assessments that include Carcinogens Described in the Supplemental Guidance as having a Mutagenic Mode of Action (June 14, 2006)

Weight of Evidence:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen

kg = kilogram
mg = milligram
NA = not listed in hierarchy sources
ND = no data available

Table 8-16
Cancer Toxicity Data - Inhalation
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units		Source	Date Verified
VOLATILES							
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.1E-02	$(mg/kg/day)^{-1}$	B2	IRIS	October-11
SEMIVOLATILES							
Benzo(a)anthracene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Benzo(a)pyrene	1.1E-03	$(ug/m^3)^{-1}$	3.9E+00	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Benzo(b)fluoranthene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Benzo(g,h,i)perylene	NA		NA		D	IRIS	October-11
Benzo(k)fluoranthene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Carbazole	ND		ND		Inadequate data	PPRTV	October-11
Chrysene	1.10E-05	$(ug/m^3)^{-1}$	3.9E-02	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Dibenzo(a,h)anthracene	1.2E-03	$(ug/m^3)^{-1}$	4.1E+00	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
Indeno(1,2,3-cd)pyrene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	October-11
PESTICIDES/PCBs							
Heptachlor Epoxide	2.6E-03	$(ug/m^3)^{-1}$	9.1E+00	$(mg/kg/day)^{-1}$	B2	IRIS	October-11
INORGANICS/METALS							
Aluminum	ND		ND		Inadequate data	PPRTV	October-11
Antimony	ND		ND		Inadequate data	IRIS	October-11
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A	IRIS	October-11
Barium	NA		NA		D	IRIS	October-11
Cadmium	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/day)^{-1}$	B1	IRIS	October-11
Chromium VI	1.2E-02	$(ug/m^3)^{-1}$	4.3E+01	$(mg/kg/day)^{-1}$	A	IRIS	October-11
Cobalt	9.0E-03	$(ug/m^3)^{-1}$	3.2E+01	$(mg/kg/day)^{-1}$	Likely carcinogenic in humans	PPRTV	October-11
Copper	NA		NA		D	IRIS	October-11
Lead	ND		ND		B2	IRIS	October-11
Manganese	ND		ND		D	IRIS	October-11
Mercury	NA		NA		C	IRIS	October-11
Thallium	ND		ND		Inadequate evidence	IRIS	October-11
Vanadium	ND		ND		ND		October-11

Table 8-16
Cancer Toxicity Data - Inhalation
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Notes:

Prepared by/ Date: EYM 10/12/11
Checked by/ Date: BJR 11/02/11

In accordance with OSWER 9285.7-53, unit risk values are identified from the following heirarchy of sources:

Tier 1:
IRIS = Integrated Risk Information System: Obtained from: http://www.epa.gov/IRIS/
Tier 2:
PPRTV = Preliminary Peer-Reviewed Toxicity Value: Obtained from: http://hhpprtv.ornl.gov/
Tier 3:
HEAST= Health Effects Assessment Summary Tables Obtained from: USEPA Solid Waste and Emergency Response, FY 1997 Update. EPA-540-R-97-036. July 1997
MRL = Minimum Risk Level (ATSDR: chronic MRLs):
CalEPA = California Environmental Protection Agency Toxicity Criteria Database Obtained from: http://www.oehha.ca.gov/risk/chemicalDB/
In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:
NCEA = National Center for Environmental Assessment: Obtained from Region III RSL Table November 2010.
PPRTV SL = Preliminary Peer-Reviewed Toxicity Value Screening Level Obtained from: http://hhpprtv.ornl.gov/

(1) - Inhalation cancer dose-response values are typically published as unit risk values. Unit risk values may be converted to slope factors using the following equation (HEAST, 1997):

Adjustment = 70 kg [adult body weight] * 1000 ug/mg [conversion factor] / 20 m3/day [inhalation rate] and Inhalation Slope Factor = Unit Risk * Adjustment

For slope factors obtained from NCEA (published in USEPA Region III RBC Table), it is assumed that the value has been converted from a Unit Risk value. Therefore, the slope factor is converted back to a unit risk value as follows: 20 m3/day / 70 kg * 1000 ug/mg

PAHs, adjusted by Relative Potency Factors of 1.0 [benzo(a)pyrene, dibenz(a,h)anthracene]; 0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-c,d)pyrene]; 0.01 [benzo(k)fluoranthene]; 0.001 [chrysen

Weight of Evidence:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen

mg = milligram
ug = microgram
kg = kilogram
m^3 = cubic meter
NA = not listed in hierarchy sources
ND = no data available

Table 8-17
Non-Cancer Toxicity Data - Oral/Dermal
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption	Adjusted Dermal RfD (2)		Primary Target Organ or System / Critical Effect	Combined	RfD: Target Organ(s)	
		Value	Units	Efficiency for Dermal (1)	Value	Units		Uncertainty/Modifying Factors	Source	Date Verified
VOLATILES										
Chloroform	chronic	1.0E-02	mg/kg/day	100%	1.0E-02	mg/kg/day	Liver; fatty cyst formation in liver	100/1	IRIS	October-11
	subchronic	1.0E-01	mg/kg/day	100%	1.0E-01	mg/kg/day	Hepatic	100	MRL	October-11
SEMIVOLATILES										
Benzo(a)anthracene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
Benzo(a)pyrene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
Benzo(b)fluoranthene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
Benzo(g,h,i)perylene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	October-11
Benzo(k)fluoranthene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
Carbazole	chronic	ND			ND				PPRTV	October-11
	subchronic	ND			ND				PPRTV	October-11
Chrysene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	October-11
Dibenzo(a,h)anthracene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
Indeno(1,2,3-cd)pyrene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (1)	October-11
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (1)	October-11
PESTICIDES/PCBs										
Heptachlor Epoxide	chronic	1.3E-05	mg/kg/day	100%	1.3E-05	mg/kg/day	Liver; increased liver weight	1,000/1	IRIS	October-11
	subchronic	1.3E-05	mg/kg/day	100%	1.3E-05	mg/kg/day	Liver; increased liver weight	1,000/1	HEAST97	October-11
INORGANICS/METALS										
Aluminum	chronic	1.0E+00	mg/kg/day	100%	1.0E+00	mg/kg/day	LOAEL / CNS	100	PPRTV	October-11
	subchronic	1.0E+00	mg/kg/day	100%	1.0E+00	mg/kg/day	CNS	30	MRL	October-11
Antimony	chronic	4.0E-04	mg/kg/day	15%	6.0E-05	mg/kg/day	Reduced lifespan; hematological; blood glucose and cholesterol	1,000/1	IRIS	October-11
	subchronic	4.0E-04	mg/kg/day	15%	6.0E-05	mg/kg/day	Reduced lifespan; hematological; blood glucose and cholesterol		PPRTV	October-11
Arsenic	chronic	3.0E-04	mg/kg/day	95%	3.0E-04	mg/kg/day	Skin; keratosis, hyperpigmentation and vascular complications	3/1	IRIS	October-11
	subchronic	3.0E-04	mg/kg/day	95%	3.0E-04	mg/kg/day	Skin; keratosis and hyperpigmentation	3/1	HEAST	October-11
Barium	chronic	2.0E-01	mg/kg/day	7%	1.4E-02	mg/kg/day	Kidney; nephropathy	300	IRIS	October-11
	subchronic	2.0E-01	mg/kg/day	7%	1.4E-02	mg/kg/day	Renal	100	MRL	October-11
Cadmium (food)	chronic	1.0E-03	mg/kg/day	2.5%	2.5E-05	mg/kg/day	Kidney; proteinuria	10/1	IRIS	October-11
	subchronic	5.0E-04	mg/kg/day	2.5%	1.3E-05	mg/kg/day	Musculoskeletal effects	100	MRL	October-11
Cadmium (water)	chronic	5.0E-04	mg/kg/day	5%	2.5E-05	mg/kg/day	Kidney; proteinuria	10/1	IRIS	October-11
	subchronic	5.0E-04	mg/kg/day	5%	2.5E-05	mg/kg/day	Kidney; proteinuria	10/1	Chronic	October-11
Chromium VI	chronic	3.0E-03	mg/kg/day	2.5%	7.5E-05	mg/kg/day	No effects reported	300/3	IRIS	October-11
	subchronic	2.0E-02	mg/kg/day	2.5%	5.0E-04	mg/kg/day	No effects reported	100/1	HEAST	October-11
Cobalt	chronic	3.0E-04	mg/kg/day	100%	3.0E-04	mg/kg/day	LOAEL / Thyroid	3,000	PPRTV	October-11
	subchronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	LOAEL / Thyroid	300	PPRTV	October-11
Copper	chronic	4.0E-02	mg/kg/day	100%	4.0E-02	mg/kg/day			HEAST	October-11
	subchronic	1.0E-02	mg/kg/day	100%	1.0E-02	mg/kg/day	Gastrointestinal system	3	MRL	October-11
Lead	chronic	ND			ND				IRIS	October-11
	subchronic	ND			ND				chronic	October-11
Manganese (soil)	chronic	4.7E-02	mg/kg/day	4%	1.9E-03	mg/kg/day	CNS; Impairment of neurobehavioral function	3/1	IRIS	October-11
	subchronic	4.7E-02	mg/kg/day	4%	1.9E-03	mg/kg/day	CNS; Impairment of neurobehavioral function	3/1	chronic	October-11
Mercury	chronic	3.0E-04	mg/kg/day	7%	2.1E-05	mg/kg/day	Immune system; autoimmune effects	1,000/1	IRIS	October-11
	subchronic	2.0E-03	mg/kg/day	7%	1.4E-04	mg/kg/day	Renal	100	MRL	October-11
Thallium	chronic	1.0E-05	mg/kg/day	100%	1.0E-05	mg/kg/day	No effects observed	3,000	PPRTV SL	October-11
	subchronic	5.0E-05	mg/kg/day	100%	5.0E-05	mg/kg/day	No effects observed	300/1	PPRTV SL	October-11
Vanadium	chronic	5.0E-03	mg/kg/day	2.6%	1.3E-04	mg/kg/day	Kidney	100/1	NCEC	October-11
	subchronic	1.0E-02	mg/kg/day	2.6%	2.6E-04	mg/kg/day	Hematological	10/1	MRL	October-11

Table 8-17
Non-Cancer Toxicity Data - Oral/Dermal
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Prepared by/ Date: EYM 10/12/11
Checked by/ Date: BJR 11/02/11

Notes:

In accordance with OSWER 9285.7-53, chronic RfDs are identified from the following heirarchy of sources:

Tier 1:

IRIS = Integrated Risk Information System: Obtained from: http://www.epa.gov/IRIS/

Tier 2:

PPRTV = Preliminary Peer-Reviewed Toxicity Value: Obtained from: http://hhpprtv.ornl.gov/

Tier 3:

HEAST= Health Effects Assessment Summary Tables Obtained from: USEPA Solid Waste and Emergency Response, FY 1997 Update. EPA-540-R-97-036. July 1997.

MRL = Minimum Risk Level (ATSDR: chronic MRLs):

CalEPA = California Environmental Protection Agency Toxicity Criteria Database Obtained from: http://www.oehha.ca.gov/risk/chemicalDB/

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: Obtained from Region III RSL Table June 2011.

PPRTV SL = Preliminary Peer-Reviewed Toxicity Value Screening Level Obtained from: http://hhpprtv.ornl.gov/

Subchronic RfDs are obtained from:
- PPRTV: provisional value
- ATSDR: Intermitent MRLs
- HEAST: subchronic RfDs
- Equal to chronic RfDs when no PPRTV, ATSDR or HEAST value is available

mg = milligram
kg = kilogram
NA = not listed in hierarchy sources
ND = no data available
chronic = the chronic value is used as the subchronic RfD

(1) Values obtained from RAGS Volume 1 (Part E, Supplemental Guidance for Dermal Risk Assessment, Final) (EPA, 2004)
Per this guidance, a value of 100% is used for analytes without published values.

(2) Adjusted Dermal RfD = Oral RfD x Oral to Dermal Adjustment Factor. Per RAGS Part E (USEPA, 2004), adjustments are only performed for chemicals that have an oral absorption efficiency of less than 50%.

Per USEPA Region I "Risk Updates, No. 5", (August, 1999), Non-carcinogenic PAHs without published RfDs should be evaluated using the published RfD for a structurally similar PAH.
Surrogate (1) - Value for pyrene used as a surrogate

For manganese in non-drinking water media: As recommended by USEPA Region I Risk Update, a non-dietary RfD is obtained by subtracting typical dietary intake of manganese (5 mg/day) from critical dose (10 mg/day). A modifying factor of 1 is then applied, per USEPA Region 1.

Vanadium - RfD for vanadium is the RfD for Vanadium pentoxide of 9E-3, adjusted for the amount of vanadium in vanadium pentoxide (56%), per USEPA Region I.

Table 8-18
Non-Cancer Toxicity Data - Inhalation
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1) Value	Inhalation RfC (1) Units	Extrapolated RfD (1) Value	Extrapolated RfD (1) Units	Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s) Source	RfC: Target Organ(s) Date Verified
VOLATILES									
Chloroform	chronic	9.8E-02	mg/m3	2.8E-02	mg/kg/day	Hepatic	100	MRL	October-11
	subchronic	2.4E-01	mg/m3	6.9E-02	mg/kg/day	Hepatic	300	MRL	October-11
SEMIVOLATILES									
Benzo(a)anthracene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Benzo(a)pyrene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Benzo(b)fluoranthene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Benzo(g,h,i)perylene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND					October-11
Benzo(k)fluoranthene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Carbazole	chronic	ND		ND				PPRTV	October-11
	subchronic	ND		ND				PPRTV	October-11
Chrysene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND					October-11
Dibenzo(a,h)anthracene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Indeno(1,2,3-cd)pyrene	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
PESTICIDES/PCBs									
Heptachlor Epoxide	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND					October-11
INORGANICS/METALS									
Aluminum	chronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	LOAEL / CNS	300	PPRTV	October-11
	subchronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	LOAEL / CNS	300	chronic	October-11
Antimony	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND					October-11
Arsenic	chronic	1.5E-05	mg/m3	4.3E-06	mg/kg/day	Developmental; cardiovascular; CNS		CalEPA	October-11
	subchronic	1.5E-05	mg/m3	4.3E-06	mg/kg/day	Developmental; cardiovascular; CNS		chronic	October-11
Barium	chronic	5.0E-04	mg/m3	1.4E-04	mg/kg/day	Developmental; fetotoxicity	1,000	HEAST97	October-11
	subchronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	Developmental; fetotoxicity	100	HEAST97	October-11
Cadmium	chronic	2.0E-05	mg/m3	5.7E-06	mg/kg/day	Renal	9	RSL	October-11
	subchronic	2.0E-05	mg/m3	5.7E-06	mg/kg/day	Kidney; respiratory system		Chronic	October-11
Cadmium	chronic	2.0E-05	mg/m3	5.7E-06	mg/kg/day	Kidney; respiratory system		RSL	October-11
	subchronic	2.0E-05	mg/m3	5.7E-06	mg/kg/day	Kidney; respiratory system		Chronic	October-11
Chromium VI	chronic	1.0E-04	mg/m3	2.9E-05	mg/kg/day	Lung; enzyme alterations	300/1	IRIS	October-11
	subchronic	5.0E-06	mg/m3	1.4E-06	mg/kg/day	Respiratory system	100	MRL	October-11
Cobalt	chronic	6.0E-06	mg/m3	1.7E-06	mg/kg/day	Respiratory tract / Lung / NOAEL	300	PPRTV	October-11
	subchronic	2.0E-05	mg/m3	5.7E-06	mg/kg/day	Respiratory tract / Lung / NOAEL	100	PPRTV	October-11
Copper	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND					October-11
Lead	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Manganese	chronic	5.0E-05	mg/m3	1.4E-05	mg/kg/day	CNS; impairment of neurobehavioral function	1,000/1	IRIS	October-11
	subchronic	5.0E-05	mg/m3	1.4E-05	mg/kg/day	CNS; impairment of neurobehavioral function	1,000/1	chronic	October-11
Mercury	chronic	3.0E-04	mg/m3	8.6E-05	mg/kg/day	CNS; tremors, memory; autonomic dysfunction	30/1	IRIS	October-11
	subchronic	3.0E-04	mg/m3	8.6E-05	mg/kg/day	CNS; neurotoxicity	30/1	HEAST97	October-11
Thallium	chronic	ND		ND				IRIS	October-11
	subchronic	ND		ND				chronic	October-11
Vanadium	chronic	1.0E-04	mg/m3	2.9E-05	mg/kg/day	Respiratory	30	MRL	October-11
	subchronic	1.0E-04	mg/m3	2.9E-05	mg/kg/day	Respiratory	30	Chronic	October-11

Table 8-18
Non-Cancer Toxicity Data - Inhalation
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Prepared by/ Date: EYM 10/12/11
Checked by/ Date: BJR 11/02/11

Notes:

In accordance with OSWER 9285.7-53, chronic RfCs are identified from the following heirarchy of sources:

Tier 1:

IRIS = Integrated Risk Information System: Obtained from: http://www.epa.gov/IRIS/

Tier 2:

PPRTV = Preliminary Peer-Reviewed Toxicity Value: Obtained from: http://hhpprtv.ornl.gov/

Tier 3:

HEAST= Health Effects Assessment Summary Tables Obtained from: USEPA Solid Waste and Emergency Response, FY 1997 Update. EPA-540-R-97-036. July 1997.

MRL = Minimum Risk Level (ATSDR: chronic MRLs):

CalEPA = California Environmental Protection Agency Toxicity Criteria Database Obtained from: http://www.oehha.ca.gov/risk/chemicalDB/

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: Obtained from Region III RSL Table November 2010.

PPRTV SL = Preliminary Peer-Reviewed Toxicity Value Screening Level Obtained from: http://hhpprtv.ornl.gov/

Subchronic RfCs are obtained from:
- PPRTV: provisional value
- ATSDR: Intermitent MRLs
- HEAST: subchronic RfDs
- Equal to chronic RfDs when no PPRTV, ATSDR or HEAST value is available

kg = kilogram
ug - microgram
m^3 - cubic meter
NA = not listed in hierarchy sources
ND = no data available
chronic = the chronic value is used as the subchronic RfD

(1) - Inhalation non-cancer dose-response values are typically published as RfC values. RfC values may be converted to RfDs using the following equation (HEAST, 1997):
RfD (mg/kg-d) = RfC (mg/m^3) x 20 m^3/d / 70 kg, unless otherwise indicated

For RfDs obtained from NCEA (published in USEPA Region III RBC Table), it is assumed that the value has been converted from a RfC value. Therefore, the RfD is converted back to a RfC value as follows: RfC (mg/m^3) = RfD (mg/kg/day) x 70 kg / 20 m^3/day

Value for chromium VI particulates: value for chromium VI as dissolved chromium VI aerosols or chromic acid mists is 5E-6 mg/m3

There is a National Ambient Air Quality Standard for lead of 1.5 µg/m3 averaged over three months

Table 8-19
Risk Summary Table - Current Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 1				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	2.E-06	0.05
		Dermal Contact	6.E-07	0.001
	Adult Trespasser	Incidental Ingestion	5.E-07	0.02
		Dermal Contact	1.E-07	0.0004
		Total Surface Soil Risk:	**3.E-06**	**0.05**
Surface Soil	Outdoor Worker	Incidental Ingestion	8.E-07	0.01
		Dermal Contact	4.E-07	0.0007
		Total Surface Soil Risk:	**1.E-06**	**0.02**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	9.E-07	0.02
		Dermal Contact	4.E-07	0.0008
		Total Subsurface Soil Risk:	**1.E-06**	**0.02**
Area 2				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	2.E-06	0.08
		Dermal Contact	5.E-07	0.001
	Adult Trespasser	Incidental Ingestion	5.E-07	0.03
		Dermal Contact	1.E-07	0.0003
		Total Surface Soil Risk:	**3.E-06**	**0.08**
Surface Soil	Outdoor Worker	Incidental Ingestion	7.E-07	0.02
		Dermal Contact	3.E-07	0.0006
		Total Surface Soil Risk:	**1.E-06**	**0.02**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	4.E-07	0.01
		Dermal Contact	1.E-07	0.0004
		Total Subsurface Soil Risk:	**5.E-07**	**0.01**
Area 3				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	5.E-06	0.1
		Dermal Contact	8.E-07	0.005
	Adult Trespasser	Incidental Ingestion	2.E-06	0.03
		Dermal Contact	2.E-07	0.002
		Total Surface Soil Risk:	**7.E-06**	**0.10**
Surface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	0.03
		Dermal Contact	7.E-07	0.003
		Total Surface Soil Risk:	**3.E-06**	**0.03**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	1.E-06	0.02
		Dermal Contact	4.E-07	0.0008
		Total Subsurface Soil Risk:	**1.E-06**	**0.02**

Table 8-19
Risk Summary Table - Current Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 4				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	8.E-06	0.05
		Dermal Contact	3.E-06	0.001
	Adult Trespasser	Incidental Ingestion	1.E-06	0.01
		Dermal Contact	5.E-07	0.0004
		Total Surface Soil Risk:	**1.E-05**	**0.05**
Surface Soil	Outdoor Worker	Incidental Ingestion	2.E-06	0.01
		Dermal Contact	2.E-06	0.0007
		Total Surface Soil Risk:	**4.E-06**	**0.01**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	1.E-06	0.02
		Dermal Contact	1.E-06	0.0004
		Total Subsurface Soil Risk:	**2.E-06**	**0.02**
Area 5				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	6.E-07	0.06
		Dermal Contact	6.E-08	0.001
	Adult Trespasser	Incidental Ingestion	3.E-07	0.02
		Dermal Contact	3.E-08	0.0003
		Total Surface Soil Risk:	**1.E-06**	**0.06**
Surface Soil	Outdoor Worker	Incidental Ingestion	4.E-07	0.02
		Dermal Contact	9.E-08	0.0006
		Total Surface Soil Risk:	**5.E-07**	**0.02**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	3.E-07	0.01
		Dermal Contact	1.E-07	0.0003
		Total Subsurface Soil Risk:	**5.E-07**	**0.01**
Background				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	1.E-06	0.1
		Dermal Contact	3.E-07	0.001
	Adult Trespasser	Incidental Ingestion	4.E-07	0.04
		Dermal Contact	6.E-08	0.0004
		Total Receptor Surface Soil Risk:	**2.E-06**	**0.1**
Surface Soil	Outdoor Worker	Incidental Ingestion	4.E-06	0.2
		Dermal Contact	1.E-06	0.005
		Total Receptor Surface Soil Risk:	**5.E-06**	**0.2**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	0.1
		Dermal Contact	1.E-06	0.003
		Total Receptor Surface Soil Risk:	**4.E-06**	**0.1**

Prepared By/Date: EYM 10/21/2011
Checked By/Date: BJR 11/01/2011

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 1				
Surface Soil	Child Resident	Incidental Ingestion	4.E-05	1
		Dermal Contact	1.E-05	0.03
	Adult Resident	Incidental Ingestion	1.E-05	0.2
		Dermal Contact	3.E-06	0.004
		Total Surface Soil Risk:	**6.E-05**	**1**
Subsurface Soil	Child Resident	Incidental Ingestion	4.E-05	2
		Dermal Contact	1.E-05	0.03
	Adult Resident	Incidental Ingestion	1.E-05	0.2
		Dermal Contact	3.E-06	0.004
		Total Subsurface Soil Risk:	**7.E-05**	**2**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	6.E-06	0.2
		Dermal Contact	2.E-06	0.004
	Adult Rrecreational Recepto	Incidental Ingestion	2.E-06	0.02
		Dermal Contact	4.E-07	0.0006
		Total Surface Soil Risk:	**9.E-06**	**0.2**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	6.E-06	0.3
		Dermal Contact	2.E-06	0.004
	Adult Rrecreational Recepto	Incidental Ingestion	2.E-06	0.03
		Dermal Contact	5.E-07	0.0007
		Total Subsurface Soil Risk:	**1.E-05**	**0.3**
Surface Soil	Indoor Worker	Incidental Ingestion	3.E-06	0.05
		Dermal Contact	3.E-06	0.005
		Total Surface Soil Risk:	**5.E-06**	**0.06**
Subsurface Soil	Indoor Worker	Incidental Ingestion	3.E-06	0.07
		Dermal Contact	3.E-06	0.005
		Total Subsurface Soil Risk:	**6.E-06**	**0.08**
Surface Soil	Outdoor Worker	Incidental Ingestion	5.E-06	0.09
		Dermal Contact	2.E-06	0.004
		Dust Inhalation	2.E-08	0.002
		Total Surface Soil Risk:	**7.E-06**	**0.1**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	6.E-06	0.1
		Dermal Contact	2.E-06	0.005
		Dust Inhalation	3.E-08	0.002
		Total Subsurface Soil Risk:	**8.E-06**	**0.1**
Surface Soil	Construction Worker	Incidental Ingestion	8.E-07	0.2
		Dermal Contact	2.E-07	0.008
		Dust Inhalation	3.E-07	0.7
		Total Surface Soil Risk:	**1.E-06**	**0.9**
Subsurface Soil	Construction Worker	Incidental Ingestion	8.E-07	0.4
		Dermal Contact	2.E-07	0.008
		Dust Inhalation	3.E-07	0.9
		Total Subsurface Soil Risk:	**1.E-06**	**1**

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 2				
Surface Soil	Child Resident	Incidental Ingestion	3.E-05	2
		Dermal Contact	9.E-06	0.02
	Adult Resident	Incidental Ingestion	9.E-06	0.2
		Dermal Contact	3.E-06	0.003
		Total Surface Soil Risk:	**5.E-05**	**2**
Subsurface Soil	Child Resident	Incidental Ingestion	2.E-05	1
		Dermal Contact	4.E-06	0.01
	Adult Resident	Incidental Ingestion	5.E-06	0.1
		Dermal Contact	1.E-06	0.002
		Total Subsurface Soil Risk:	**2.E-05**	**1**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	5.E-06	0.3
		Dermal Contact	1.E-06	0.003
	Adult Rrecreational Recepto	Incidental Ingestion	1.E-06	0.04
		Dermal Contact	4.E-07	0.0005
		Total Surface Soil Risk:	**8.E-06**	**0.3**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	2.E-06	0.2
		Dermal Contact	6.E-07	0.002
	Adult Rrecreational Recepto	Incidental Ingestion	7.E-07	0.02
		Dermal Contact	2.E-07	0.0003
		Total Subsurface Soil Risk:	**4.E-06**	**0.2**
Surface Soil	Indoor Worker	Incidental Ingestion	3.E-06	0.08
		Dermal Contact	2.E-06	0.004
		Total Surface Soil Risk:	**5.E-06**	**0.08**
Subsurface Soil	Indoor Worker	Incidental Ingestion	1.E-06	0.04
		Dermal Contact	1.E-06	0.002
		Total Subsurface Soil Risk:	**2.E-06**	**0.04**
Surface Soil	Outdoor Worker	Incidental Ingestion	5.E-06	0.1
		Dermal Contact	2.E-06	0.004
		Dust Inhalation	2.E-08	0.002
		Total Surface Soil Risk:	**6.E-06**	**0.1**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	2.E-06	0.07
		Dermal Contact	9.E-07	0.002
		Dust Inhalation	2.E-08	0.002
		Total Subsurface Soil Risk:	**3.E-06**	**0.08**
Surface Soil	Construction Worker	Incidental Ingestion	7.E-07	0.9
		Dermal Contact	1.E-07	0.006
		Dust Inhalation	2.E-07	0.7
		Total Surface Soil Risk:	**1.E-06**	**2**
Subsurface Soil	Construction Worker	Incidental Ingestion	4.E-07	0.2
		Dermal Contact	6.E-08	0.004
		Dust Inhalation	2.E-07	0.8
		Total Subsurface Soil Risk:	**6.E-07**	**0.9**

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 3				
Surface Soil	Child Resident	Incidental Ingestion	8.E-05	3
		Dermal Contact	1.E-05	0.1
	Adult Resident	Incidental Ingestion	3.E-05	0.3
		Dermal Contact	5.E-06	0.02
		Total Surface Soil Risk:	**1.E-04**	**3**
Subsurface Soil	Child Resident	Incidental Ingestion	4.E-05	2
		Dermal Contact	1.E-05	0.03
	Adult Resident	Incidental Ingestion	1.E-05	0.2
		Dermal Contact	3.E-06	0.005
		Total Subsurface Soil Risk:	**7.E-05**	**2**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	1.E-05	0.4
		Dermal Contact	2.E-06	0.02
	Adult Rrecreational Recepto	Incidental Ingestion	4.E-06	0.04
		Dermal Contact	7.E-07	0.003
		Total Surface Soil Risk:	**2.E-05**	**0.4**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	7.E-06	0.2
		Dermal Contact	2.E-06	0.005
	Adult Rrecreational Recepto	Incidental Ingestion	2.E-06	0.03
		Dermal Contact	5.E-07	0.0007
		Total Subsurface Soil Risk:	**1.E-05**	**0.2**
Surface Soil	Indoor Worker	Incidental Ingestion	9.E-06	0.1
		Dermal Contact	5.E-06	0.02
		Total Surface Soil Risk:	**1.E-05**	**0.1**
Subsurface Soil	Indoor Worker	Incidental Ingestion	3.E-06	0.06
		Dermal Contact	3.E-06	0.006
		Total Subsurface Soil Risk:	**6.E-06**	**0.06**
Surface Soil	Outdoor Worker	Incidental Ingestion	2.E-05	0.2
		Dermal Contact	5.E-06	0.02
		Dust Inhalation	3.E-08	0.002
		Total Surface Soil Risk:	**2.E-05**	**0.2**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	6.E-06	0.1
		Dermal Contact	3.E-06	0.005
		Dust Inhalation	2.E-08	0.002
		Total Subsurface Soil Risk:	**9.E-06**	**0.1**
Surface Soil	Construction Worker	Incidental Ingestion	2.E-06	0.5
		Dermal Contact	3.E-07	0.03
		Dust Inhalation	4.E-07	0.9
		Total Surface Soil Risk:	**3.E-06**	**1**
Subsurface Soil	Construction Worker	Incidental Ingestion	9.E-07	0.4
		Dermal Contact	2.E-07	0.008
		Dust Inhalation	2.E-07	0.6
		Total Subsurface Soil Risk:	**1.E-06**	**1**

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 3 - Alternate Approach				
Surface Soil	Child Resident	Incidental Ingestion	5.E-05	2
		Dermal Contact	1.E-05	0.06
	Adult Resident	Incidental Ingestion	2.E-05	0.2
		Dermal Contact	4.E-06	0.009
		Total Surface Soil Risk:	**8.E-05**	**2**
Area 4				
Surface Soil	Child Resident	Incidental Ingestion	2.E-04	1
		Dermal Contact	6.E-05	0.03
	Adult Resident	Incidental Ingestion	4.E-05	0.1
		Dermal Contact	1.E-05	0.004
		Total Surface Soil Risk:	**3.E-04**	**1**
Subsurface Soil	Child Resident	Incidental Ingestion	1.E-04	2
		Dermal Contact	4.E-05	0.02
	Adult Resident	Incidental Ingestion	2.E-05	0.2
		Dermal Contact	9.E-06	0.003
		Total Subsurface Soil Risk:	**2.E-04**	**2**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	2.E-05	0.2
		Dermal Contact	9.E-06	0.004
	Adult Rrecreational Recepto	Incidental Ingestion	5.E-06	0.02
		Dermal Contact	2.E-06	0.0006
		Total Surface Soil Risk:	**4.E-05**	**0.2**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	2.E-05	0.2
		Dermal Contact	5.E-06	0.003
	Adult Rrecreational Recepto	Incidental Ingestion	3.E-06	0.03
		Dermal Contact	1.E-06	0.0004
		Total Subsurface Soil Risk:	**3.E-05**	**0.2**
Surface Soil	Indoor Worker	Incidental Ingestion	8.E-06	0.05
		Dermal Contact	1.E-05	0.005
		Total Surface Soil Risk:	**2.E-05**	**0.05**
Subsurface Soil	Indoor Worker	Incidental Ingestion	5.E-06	0.06
		Dermal Contact	7.E-06	0.003
		Total Subsurface Soil Risk:	**1.E-05**	**0.06**
Surface Soil	Outdoor Worker	Incidental Ingestion	1.E-05	0.08
		Dermal Contact	1.E-05	0.004
		Dust Inhalation	2.E-08	0.002
		Total Surface Soil Risk:	**2.E-05**	**0.09**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	9.E-06	0.1
		Dermal Contact	6.E-06	0.003
		Dust Inhalation	3.E-08	0.002
		Total Subsurface Soil Risk:	**1.E-05**	**0.1**
Surface Soil	Construction Worker	Incidental Ingestion	2.E-06	0.2
		Dermal Contact	7.E-07	0.007
		Dust Inhalation	2.E-07	0.7
		Total Surface Soil Risk:	**3.E-06**	**0.9**
Subsurface Soil	Construction Worker	Incidental Ingestion	1.E-06	0.2
		Dermal Contact	4.E-07	0.004
		Dust Inhalation	3.E-07	1
		Total Subsurface Soil Risk:	**2.E-06**	**1**

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 5				
Surface Soil	Child Resident	Incidental Ingestion	9.E-06	2
		Dermal Contact	8.E-07	0.02
	Adult Resident	Incidental Ingestion	4.E-06	0.2
		Dermal Contact	5.E-07	0.003
		Total Surface Soil Risk:	**2.E-05**	**2**
Subsurface Soil	Child Resident	Incidental Ingestion	1.E-05	1
		Dermal Contact	4.E-06	0.01
	Adult Resident	Incidental Ingestion	4.E-06	0.1
		Dermal Contact	1.E-06	0.001
		Total Subsurface Soil Risk:	**2.E-05**	**1**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	1.E-06	0.2
		Dermal Contact	1.E-07	0.003
	Adult Rrecreational Recepto	Incidental Ingestion	6.E-07	0.03
		Dermal Contact	7.E-08	0.0005
		Total Surface Soil Risk:	**2.E-06**	**0.2**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	2.E-06	0.2
		Dermal Contact	7.E-07	0.001
	Adult Rrecreational Recepto	Incidental Ingestion	6.E-07	0.02
		Dermal Contact	2.E-07	0.0002
		Total Subsurface Soil Risk:	**4.E-06**	**0.2**
Surface Soil	Indoor Worker	Incidental Ingestion	2.E-06	0.06
		Dermal Contact	6.E-07	0.004
		Total Surface Soil Risk:	**2.E-06**	**0.06**
Subsurface Soil	Indoor Worker	Incidental Ingestion	1.E-06	0.04
		Dermal Contact	9.E-07	0.002
		Total Subsurface Soil Risk:	**2.E-06**	**0.04**
Surface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	0.1
		Dermal Contact	5.E-07	0.004
		Dust Inhalation	2.E-08	0.001
		Total Surface Soil Risk:	**3.E-06**	**0.1**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	2.E-06	0.07
		Dermal Contact	9.E-07	0.002
		Dust Inhalation	2.E-08	0.001
		Total Subsurface Soil Risk:	**3.E-06**	**0.08**
Surface Soil	Construction Worker	Incidental Ingestion	4.E-07	0.2
		Dermal Contact	4.E-08	0.006
		Dust Inhalation	3.E-07	0.5
		Total Surface Soil Risk:	**7.E-07**	**0.7**
Subsurface Soil	Construction Worker	Incidental Ingestion	3.E-07	0.1
		Dermal Contact	6.E-08	0.003
		Dust Inhalation	2.E-07	0.6
		Total Subsurface Soil Risk:	**6.E-07**	**0.7**

Table 8-20
Risk Summary Table - Future Land Use
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Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Site				
Groundwater	Construction Worker	Dermal Contact	6.E-07	0.0001
		Total Groundwater Risk:	**6.E-07**	**0.0001**
Groundwater	Child Resident	Ingestion	9.E-05	0.2
		Dermal Contact	2.E-03	0.1
	Adult Resident	Ingestion	7.E-05	0.1
		Dermal Contact	2.E-03	0.05
		Total Groundwater Risk:	**4.E-03**	**0.3**
Background				
Surface Soil	Child Resident	Incidental Ingestion	2.E-05	3
		Dermal Contact	5.E-06	0.03
	Adult Resident	Incidental Ingestion	7.E-06	0.3
		Dermal Contact	1.E-06	0.004
		Total Surface Soil Risk:	**4.E-05**	**3**
Subsurface Soil	Child Resident	Incidental Ingestion	2.E-05	2
		Dermal Contact	5.E-06	0.02
	Adult Resident	Incidental Ingestion	6.E-06	0.2
		Dermal Contact	1.E-06	0.003
		Total Subsurface Soil Risk:	**3.E-05**	**2**
Surface Soil	Child Recreational Receptor	Incidental Ingestion	3.E-06	0.4
		Dermal Contact	7.E-07	0.004
	Adult Rrecreational Recepto	Incidental Ingestion	1.E-06	0.05
		Dermal Contact	2.E-07	0.0006
		Total Surface Soil Risk:	**5.E-06**	**0.4**
Subsurface Soil	Child Recreational Receptor	Incidental Ingestion	3.E-06	0.3
		Dermal Contact	8.E-07	0.003
	Adult Rrecreational Recepto	Incidental Ingestion	9.E-07	0.04
		Dermal Contact	2.E-07	0.0004
		Total Subsurface Soil Risk:	**5.E-06**	**0.3**
Surface Soil	Indoor Worker	Incidental Ingestion	2.E-06	0.1
		Dermal Contact	1.E-06	0.005
		Total Surface Soil Risk:	**4.E-06**	**0.1**
Subsurface Soil	Indoor Worker	Incidental Ingestion	2.E-06	0.08
		Dermal Contact	1.E-06	0.003
		Total Subsurface Soil Risk:	**3.E-06**	**0.08**
Surface Soil	Outdoor Worker	Incidental Ingestion	4.E-06	0.2
		Dermal Contact	1.E-06	0.005
		Dust Inhalation	2.E-08	0.002
		Total Surface Soil Risk:	**5.E-06**	**0.2**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	0.1
		Dermal Contact	1.E-06	0.003
		Dust Inhalation	2.E-08	0.002
		Total Subsurface Soil Risk:	**4.E-06**	**0.1**
Surface Soil	Construction Worker	Incidental Ingestion	6.E-07	0.3
		Dermal Contact	8.E-08	0.01
		Dust Inhalation	3.E-07	0.8
		Total Surface Soil Risk:	**9.E-07**	**1**
Subsurface Soil	Construction Worker	Incidental Ingestion	5.E-07	0.2
		Dermal Contact	8.E-08	0.005
		Dust Inhalation	2.E-07	0.8
		Total Subsurface Soil Risk:	**8.E-07**	**1**

Table 8-21
Child Lead Model Summary
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Surface Soil			Subsurface Soil		
Exposure Point	**EPC (mg/kg)**	**PbB_{child} (ug/dL)**	**$P(PbB_{child} > PbB_t)$**	**EPC (mg/kg)**	**PbB_{child} (ug/dL)**	**$P(PbB_{child} > PbB_t)$**
Area 1	578	5.9	**13.2%**	543	5.6	**11.1%**
Area 2	279	3.4	1.1%	86	1.6	0.006%
Area 3	213	2.8	0.36%	96	1.7	0.01%
Area 4	163	2.4	0.11%	118	2.0	0.025%
Area 5	255	3.2	0.78%	43	1.2	0.000%
Background	368	4.2	3.2%	79	1.6	0.004%

Notes:
mg/kg = milligram per kilogram
ug/dL = microgram per deciliter
EPC = Exposure point concentration
PbB = Blood lead level
P(PbBchild > PbBt) = the probability that child PbB > target PbB, assuming lognormal distributions

Prepared By/Date: EYM 10/24/11
Checked By/Date: BJR 11/01/11

Bold = the probability percantage of PbB concentration greater than 10 ug/dL
is above the 5% acceptable risk margin

Table 8-22
Adult Lead Model Summary
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Point	Surface Soil					Subsurface Soil				
	EPC (mg/kg)	PbB_{adult} (1) (ug/dL)	PbB_{adult} (2) (ug/dL)	$P(PbB_{fetal} > PbB_t)$ (1)	$P(PbB_{fetal} > PbB_t)$ (2)	EPC (mg/kg)	PbB_{adult} (1) (ug/dL)	PbB_{adult} (2) (ug/dL)	$P(PbB_{fetal} > PbB_t)$ (1)	$P(PbB_{fetal} > PbB_t)$ (2)
Area 1	578	1.8	2.3	0.11%	1.8%	543	1.8	2.3	0.092%	1.6%
Area 2	279	1.4	1.9	0.021%	0.87%	86	1.1	1.6	0.0048%	0.48%
Area 3	213	1.3	1.8	0.014%	0.72%	96	1.1	1.6	0.0053%	0.49%
Area 4	163	1.2	1.7	0.0093%	0.62%	118	1.2	1.7	0.0064%	0.53%
Area 5	255	1.4	1.9	0.018%	0.81%	43	1.1	1.6	0.0032%	0.41%
Background	368	1.5	2.0	0.037%	1.1%	79	1.1	1.6	0.0046%	0.47%

Notes:
(1) GSDi and PbBo from Analysis of NHANES 1999-2004
(2) GSDi and PbBo from Analysis of NHANES III (Phases 1&2)

Prepared By/Date: EYM 10/24/11
Checked By/Date: BJR 11/01/11

mg/kg = milligram per kilogram
ug/dL = microgram per deciliter
EPC = Exposure point concentration
GSDi = Geometric standard deviation
PbB = blood lead level
P(PbBfetal > PbBt) = The probability that fetal PbB > target PbB, assuming lognormal distribution

Table 8-23
Incremental Risk Summary Table - Current Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 1				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	8.E-07	B
		Dermal Contact	4.E-07	B
	Adult Trespasser	Incidental Ingestion	1.E-07	B
		Dermal Contact	5.E-08	B
		Total Surface Soil Risk:	**1.E-06**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Area 2				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	5.E-07	B
		Dermal Contact	3.E-07	B
	Adult Trespasser	Incidental Ingestion	4.E-08	B
		Dermal Contact	3.E-08	B
		Total Surface Soil Risk:	**9.E-07**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:		
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Area 3				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	3.E-06	B
		Dermal Contact	6.E-07	0.004
	Adult Trespasser	Incidental Ingestion	1.E-06	B
		Dermal Contact	2.E-07	0.0013
		Total Surface Soil Risk:	**5.E-06**	**0.004**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**

Table 8-23
Incremental Risk Summary Table - Current Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 4				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	7.E-06	B
		Dermal Contact	3.E-06	B
	Adult Trespasser	Incidental Ingestion	1.E-06	B
		Dermal Contact	5.E-07	B
		Total Surface Soil Risk:	**1.E-05**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	4.E-07	B
		Total Surface Soil Risk:	**4.E-07**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Area 5				
Surface Soil	Adolescent Trespasser	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Trespasser	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**

Notes:
B - Consistent with background

Prepared By/Date: EYM 10/24/11
Checked By/Date: BJR 11/02/11

Table 8-24
Incremental Risk Summary Table - Future Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 1				
Surface Soil	Child Resident	Incidental Ingestion	2.E-05	B
		Dermal Contact	6.E-06	B
	Adult Resident	Incidental Ingestion	3.E-06	B
		Dermal Contact	2.E-06	B
		Total Surface Soil Risk:	**3.E-05**	**B**
Subsurface Soil	Child Resident	Incidental Ingestion	2.E-05	B
		Dermal Contact	5.E-06	0.01
	Adult Resident	Incidental Ingestion	5.E-06	B
		Dermal Contact	2.E-06	0.002
		Total Subsurface Soil Risk:	**3.E-05**	**0.01**
Surface Soil	Child Recreational Receptoı	Incidental Ingestion	3.E-06	B
		Dermal Contact	9.E-07	B
	Adult Rrecreational Receptc	Incidental Ingestion	5.E-07	B
		Dermal Contact	2.E-07	B
		Total Surface Soil Risk:	**4.E-06**	**B**
Subsurface Soil	Child Recreational Receptoı	Incidental Ingestion	3.E-06	B
		Dermal Contact	8.E-07	0.002
	Adult Rrecreational Receptc	Incidental Ingestion	8.E-07	B
		Dermal Contact	2.E-07	0.0003
		Total Subsurface Soil Risk:	**5.E-06**	**0.002**
Surface Soil	Indoor Worker	Incidental Ingestion	6.E-07	B
		Dermal Contact	1.E-06	B
		Total Surface Soil Risk:	**2.E-06**	**B**
Subsurface Soil	Indoor Worker	Incidental Ingestion	1.E-06	B
		Dermal Contact	1.E-06	0.002
		Total Subsurface Soil Risk:	**3.E-06**	**0.002**
Surface Soil	Outdoor Worker	Incidental Ingestion	1.E-06	B
		Dermal Contact	1.E-06	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**2.E-06**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	B
		Dermal Contact	1.E-06	0.002
		Dust Inhalation	8.E-09	0.0002
		Total Subsurface Soil Risk:	**4.E-06**	**0.002**
Surface Soil	Construction Worker	Incidental Ingestion	2.E-07	B
		Dermal Contact	7.E-08	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**2.E-07**	**B**
Subsurface Soil	Construction Worker	Incidental Ingestion	4.E-07	0.2
		Dermal Contact	8.E-08	0.003
		Dust Inhalation	1.E-07	0.1
		Total Subsurface Soil Risk:	**6.E-07**	**0.3**

Table 8-24
Incremental Risk Summary Table - Future Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 2				
Surface Soil	Child Resident	Incidental Ingestion	1.E-05	B
		Dermal Contact	4.E-06	B
	Adult Resident	Incidental Ingestion	2.E-06	B
		Dermal Contact	1.E-06	B
		Total Surface Soil Risk:	**2.E-05**	**B**
Subsurface Soil	Child Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Child Recreational Receptoı	Incidental Ingestion	2.E-06	B
		Dermal Contact	6.E-07	B
	Adult Rrecreational Receptc	Incidental Ingestion	3.E-07	B
		Dermal Contact	2.E-07	B
		Total Surface Soil Risk:	**3.E-06**	**B**
Subsurface Soil	Child Recreational Receptoı	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Rrecreational Receptc	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Indoor Worker	Incidental Ingestion	2.E-07	B
		Dermal Contact	7.E-07	B
		Total Surface Soil Risk:	**1.E-06**	**B**
Subsurface Soil	Indoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	4.E-07	B
		Dermal Contact	6.E-07	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**1.E-06**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	B	0.00007
		Total Subsurface Soil Risk:	**B**	**0.00007**
Surface Soil	Construction Worker	Incidental Ingestion	7.E-08	0.7
		Dermal Contact	4.E-08	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**1.E-07**	**0.7**
Subsurface Soil	Construction Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	B	0.01
		Total Subsurface Soil Risk:	**B**	**0.01**

Table 8-24
Incremental Risk Summary Table - Future Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 3				
Surface Soil	Child Resident	Incidental Ingestion	6.E-05	B
		Dermal Contact	9.E-06	0.09
	Adult Resident	Incidental Ingestion	2.E-05	B
		Dermal Contact	3.E-06	0.01
		Total Surface Soil Risk:	**9.E-05**	**0.09**
Subsurface Soil	Child Resident	Incidental Ingestion	3.E-05	B
		Dermal Contact	7.E-06	0.01
	Adult Resident	Incidental Ingestion	6.E-06	B
		Dermal Contact	2.E-06	0.002
		Total Subsurface Soil Risk:	**4.E-05**	**0.01**
Surface Soil	Child Recreational Receptoı	Incidental Ingestion	8.E-06	B
		Dermal Contact	1.E-06	0.01
	Adult Rrecreational Receptc	Incidental Ingestion	3.E-06	B
		Dermal Contact	5.E-07	0.002
		Total Surface Soil Risk:	**1.E-05**	**0.01**
Subsurface Soil	Child Recreational Receptoı	Incidental Ingestion	4.E-06	B
		Dermal Contact	1.E-06	0.002
	Adult Rrecreational Receptc	Incidental Ingestion	1.E-06	B
		Dermal Contact	3.E-07	0.0003
		Total Subsurface Soil Risk:	**6.E-06**	**0.002**
Surface Soil	Indoor Worker	Incidental Ingestion	7.E-06	B
		Dermal Contact	4.E-06	0.02
		Total Surface Soil Risk:	**1.E-05**	**0.02**
Subsurface Soil	Indoor Worker	Incidental Ingestion	2.E-06	B
		Dermal Contact	2.E-06	0.002
		Total Subsurface Soil Risk:	**3.E-06**	**0.002**
Surface Soil	Outdoor Worker	Incidental Ingestion	1.E-05	B
		Dermal Contact	3.E-06	0.01
		Dust Inhalation	1.E-08	0.0002
		Total Surface Soil Risk:	**2.E-05**	**0.01**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	3.E-06	B
		Dermal Contact	1.E-06	0.002
		Dust Inhalation	B	B
		Total Subsurface Soil Risk:	**5.E-06**	**0.002**
Surface Soil	Construction Worker	Incidental Ingestion	2.E-06	0.2
		Dermal Contact	2.E-07	0.02
		Dust Inhalation	1.E-07	0.1
		Total Surface Soil Risk:	**2.E-06**	**0.3**
Subsurface Soil	Construction Worker	Incidental Ingestion	4.E-07	0.2
		Dermal Contact	1.E-07	0.004
		Dust Inhalation	B	B
		Total Subsurface Soil Risk:	**5.E-07**	**0.2**

Table 8-24
Incremental Risk Summary Table - Future Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 4				
Surface Soil	Child Resident	Incidental Ingestion	1.E-04	B
		Dermal Contact	5.E-05	B
	Adult Resident	Incidental Ingestion	3.E-05	B
		Dermal Contact	1.E-05	B
		Total Surface Soil Risk:	**2.E-04**	**B**
Subsurface Soil	Child Resident	Incidental Ingestion	8.E-05	B
		Dermal Contact	3.E-05	B
	Adult Resident	Incidental Ingestion	2.E-05	B
		Dermal Contact	8.E-06	B
		Total Subsurface Soil Risk:	**1.E-04**	**B**
Surface Soil	Child Recreational Receptoı	Incidental Ingestion	2.E-05	B
		Dermal Contact	8.E-06	B
	Adult Rrecreational Receptc	Incidental Ingestion	4.E-06	B
		Dermal Contact	2.E-06	B
		Total Surface Soil Risk:	**4.E-05**	**B**
Subsurface Soil	Child Recreational Receptoı	Incidental Ingestion	1.E-05	B
		Dermal Contact	5.E-06	B
	Adult Rrecreational Receptc	Incidental Ingestion	2.E-06	B
		Dermal Contact	1.E-06	B
		Total Subsurface Soil Risk:	**2.E-05**	**B**
Surface Soil	Indoor Worker	Incidental Ingestion	6.E-06	B
		Dermal Contact	1.E-05	B
		Total Surface Soil Risk:	**2.E-05**	**B**
Subsurface Soil	Indoor Worker	Incidental Ingestion	3.E-06	B
		Dermal Contact	6.E-06	B
		Total Subsurface Soil Risk:	**9.E-06**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	1.E-05	B
		Dermal Contact	9.E-06	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**2.E-05**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	6.E-06	B
		Dermal Contact	5.E-06	B
		Dust Inhalation	6.E-09	0.0005
		Total Subsurface Soil Risk:	**1.E-05**	**0.0005**
Surface Soil	Construction Worker	Incidental Ingestion	2.E-06	B
		Dermal Contact	6.E-07	B
		Dust Inhalation	B	B
		Total Surface Soil Risk:	**2.E-06**	**B**
Subsurface Soil	Construction Worker	Incidental Ingestion	8.E-07	B
		Dermal Contact	3.E-07	B
		Dust Inhalation	7.E-08	0.2
		Total Subsurface Soil Risk:	**1.E-06**	**0.2**

Table 8-24
Incremental Risk Summary Table - Future Land Use
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area / Medium	Receptor	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Area 5				
Surface Soil	Child Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Child Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Resident	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Child Recreational Receptoı	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Rrecreational Receptc	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Child Recreational Receptoı	Incidental Ingestion	B	B
		Dermal Contact	B	B
	Adult Rrecreational Receptc	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Indoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Surface Soil Risk:	**B**	**B**
Subsurface Soil	Indoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	1.E-10	B
		Total Surface Soil Risk:	**1.E-10**	**B**
Subsurface Soil	Outdoor Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	B	B
		Total Subsurface Soil Risk:	**B**	**B**
Surface Soil	Construction Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	1.E-09	B
		Total Surface Soil Risk:	**1.E-09**	**B**
Subsurface Soil	Construction Worker	Incidental Ingestion	B	B
		Dermal Contact	B	B
		Dust Inhalation	B	B
		Total Subsurface Soil Risk:	**B**	**B**

Notes:
B - Consistent with background

Prepared By/Date: EYM 10/26/11
Checked By/Date: BJR 11/02/11

SECTION 9

Table 9-1
Surface Soil Samples Used in the SLERA by Exposure Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Sample Location	Sample ID	Date	Depth BGS (ft)
Area 1	B-10	Ad2004-SS-10-DP	6/21/2004	1 - 2
	B-10	Ad2004-SS-10-SH	6/21/2004	0 - 1
	B-11	Ad2004-SS-11-DP	6/21/2004	1 - 2
	B-11	Ad2004-SS-11-SH	6/21/2004	0 - 1
	B-11	Ad2004-SS-B11-DP	8/26/2004	1 - 2
	B-11	Ad2004-SS-B11-SH	8/26/2004	0 - 1
	FLA-09	FLA-SB-09-01	8/1/1998	0 - 0.5
	FLA-10	FLA-SB-10-01	8/1/1998	0 - 0.5
	FLA-11	FLA-SB-11-01	8/1/1998	0 - 0.5
	FLA-12	FLA-SB-12-01	8/1/1998	0 - 0.5
	FLA-13	FLA-SB-13-01	8/1/1998	0 - 0.5
	FLA-46	FLA-SS-46-01	7/1/2000	0 - 0.17
	FLA-47	FLA-SS-47-01	7/1/2000	0 - 0.17
	FLA-48	FLA-SS-48-01	7/1/2000	0 - 0.17
	FLA-48	FSS-SS-48-22	7/1/2000	0 - 0.17
	FLA-49	FLA-SS-49-01	7/1/2000	0 - 0.17
	FLA-50	FLA-SS-50-01	7/1/2000	0 - 0.17
	FLA-51	FLA-SS-51-01	7/1/2000	0 - 0.17
	FLA-52	FLA-SS-52-01	7/1/2000	0 - 0.17
Area 2	624-SS-02	624-SS-02-01	8/26/1998	0 - 0.5
	624-SS-03	624-SS-03-01	8/26/1998	0 - 0.5
	624-SS-04	624-SS-04-01	8/26/1998	0 - 0.5
	624-SS-05	624-SS-05-01	8/26/1998	0 - 0.5
	624-SS-06	624-SS-06-01	8/26/1998	0 - 0.5
	624-SS-53	624-SS-53-01	7/22/2000	0 - 0.17
	624-SS-54	624-SS-54-01	7/22/2000	0 - 0.17
	AI2-101	AI2-101(0-2)"	5/13/2011	0 - 0.17
	AI2-101	AI2-101(6-24)"	5/13/2011	0.5 - 2
	AI2-102	AI2-102(0-2)"	5/13/2011	0 - 0.17
	AI2-102	AI2-102(6-24)"	5/13/2011	0.5 - 2
	AI2-103	AI2-103(0-2)"	5/13/2011	0 - 0.17
	AI2-103	AI2-103(6-24)"	5/13/2011	0.5 - 2
	AI2-104	AI2-104(0-2)"	5/13/2011	0 - 0.17
	AI2-104	AI2-104(6-24)"	5/13/2011	0.5 - 2
	AI2-105	AI2-105(0-2)"	5/13/2011	0 - 0.17
	AI2-105	AI2-105(6-24)"	5/13/2011	0.5 - 2
	AI2-106	AI2-106(0-2)"	5/13/2011	0 - 0.17
	AI2-106	AI2-106(6-24)"	5/13/2011	0.5 - 2
	AI2-107	AI2-107(0-2)	5/11/2011	0 - 0.17
	AI2-107	AI2-107(6-24)	5/11/2011	0.5 - 2
	AI2-108	AI2-108(0-2)	5/12/2011	0 - 0.17
	AI2-108	AI2-108(6-24)	5/12/2011	0.5 - 2
	AI2-109	AI2-109(0-2)	5/11/2011	0 - 0.17
	AI2-109	AI2-109(6-24)	5/11/2011	0.5 - 2
	AI2-110	AI2-110(0-2)	5/12/2011	0 - 0.17
	AI2-110	AI2-110(6-24)	5/12/2011	0.5 - 2
	AI2-111	AI2-111(0-2)	5/11/2011	0 - 0.17
	AI2-111	AI2-111(6-24)	5/11/2011	0.5 - 2

Table 9-1
Surface Soil Samples Used in the SLERA by Exposure Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Sample Location	Sample ID	Date	Depth BGS (ft)
Area 2	AI2-112	AI2-112(0-2)	5/11/2011	0 - 0.17
	AI2-112	AI2-112(6-24)	5/11/2011	0.5 - 2
	B-09	Ad2004-SS-9-DP	6/21/2004	1 - 2
	B-09	Ad2004-SS-9-SH	6/21/2004	0 - 1
	SB-04	FSS-SB-04-01	8/1/1998	0 - 0.5
	SB-05	FSS-SB-05-01	8/1/1998	0 - 0.5
	SS-18	FSS-SS-18-01	7/1/2000	0 - 0.17
	SS-19	FSS-SS-19-01	7/1/2000	0 - 0.17
	SS-20	FSS-SS-20-01	7/1/2000	0 - 0.17
	SS-21	FSS-SS-21-01	7/1/2000	0 - 0.17
	SS-22	FSS-SS-22-01	7/1/2000	0 - 0.17
	SS-23	FSS-SS-23-01	7/1/2000	0 - 0.17
	SS-24	FSS-SS-24-01	7/1/2000	0 - 0.17
	SS-25	FSS-SS-25-01	7/1/2000	0 - 0.17
	SS-26	FSS-SS-26-01	7/1/2000	0 - 0.17
	SS-27	FSS-SS-27-01	7/1/2000	0 - 0.17
	SS-28	FSS-SS-28-01	7/1/2000	0 - 0.17
	SS-29	FSS-SS-29-01	7/1/2000	0 - 0.17
Area 3	AI3-101	AI3-101(0-2)	5/10/2011	0 - 0.17
	AI3-101	AI3-101(6-24)	5/10/2011	0.5 - 2
	AI3-102	AI3-102(0-2)	5/10/2011	0 - 0.17
	AI3-102	AI3-102(6-24)	5/10/2011	0.5 - 2
	AI3-103	AI3-103(0-2)	5/10/2011	0 - 0.17
	AI3-103	AI3-103(6-24)	5/10/2011	0.5 - 2
	AI3-104	AI3-104(0-2)	5/10/2011	0 - 0.17
	AI3-104	AI3-104(6-24)	5/10/2011	0.5 - 2
	AI3-105	AI3-105(0-2)	5/10/2011	0 - 0.17
	AI3-105	AI3-105(6-24)	5/10/2011	0.5 - 2
	AI3-106	AI3-106(0-2)	5/11/2011	0 - 0.17
	AI3-106	AI3-106(6-24)	5/11/2011	0.5 - 2
	AI3-107	AI3-107(0-2)	5/11/2011	0 - 0.17
	AI3-107	AI3-107(6-24)	5/11/2011	0.5 - 2
	AI3-108	AI3-108(0-2)	5/10/2011	0 - 0.17
	AI3-108	AI3-108(6-24)	5/10/2011	0.5 - 2
	AI3-109	AI3-109(0-2)	5/10/2011	0 - 0.17
	AI3-109	AI3-109(6-24)	5/10/2011	0.5 - 2
	AI3-110	AI3-110(0-2)	5/11/2011	0 - 0.17
	AI3-110	AI3-110(6-24)	5/11/2011	0.5 - 2
	AI3-111	AI3-111(0-2)	5/10/2011	0 - 0.17
	AI3-111	AI3-111(6-24)	5/10/2011	0.5 - 2
	AI3-112	AI3-112(0-2)	5/10/2011	0 - 0.17
	AI3-112	AI3-112(6-12)	5/10/2011	0.5 - 1
	AI3-112	AI3-112(6-24)	5/10/2011	0.5 - 2
	B-01	Ad2004-SS-1-DP	6/21/2004	1 - 2
	B-01	Ad2004-SS-1-SH	6/21/2004	0 - 1
	B-02	Ad2004-SS-2-DP	6/21/2004	1 - 2
	B-02	Ad2004-SS-2-SH	6/21/2004	0 - 1
	B-03	Ad2004-SS-3-DP	6/21/2004	1 - 2

Table 9-1
Surface Soil Samples Used in the SLERA by Exposure Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Sample Location	Sample ID	Date	Depth BGS (ft)
Area 3	B-03	Ad2004-SS-3-SH	6/21/2004	0 - 1
	B-04	Ad2004-SS-4-DP	6/21/2004	1 - 2
	B-04	Ad2004-SS-4-SH	6/21/2004	0 - 1
	SB-06	FSS-SB-06-01	8/1/1998	0 - 0.5
	SB-07	FSS-SB-07-01	8/1/1998	0 - 0.5
	SS-30	FSS-SS-30-01	7/1/2000	0 - 0.17
	SS-31	FSS-SS-31-01	7/1/2000	0 - 0.17
	SS-32	FSS-SS-32-01	7/1/2000	0 - 0.17
	SS-33	FSS-SS-33-01	7/1/2000	0 - 0.17
	SS-34	FSS-SS-34-01	7/1/2000	0 - 0.17
	SS-35	FSS-SS-35-01	7/1/2000	0 - 0.17
	SS-36	FSS-SS-36-01	7/1/2000	0 - 0.17
	SS-37	FSS-SS-37-01	7/1/2000	0 - 0.17
	SS-38	FSS-SS-38-01	7/1/2000	0 - 0.17
	SS-39	FSS-SS-39-01	7/1/2000	0 - 0.17
	SS-40	FSS-SS-40-01	7/1/2000	0 - 0.17
	SS-45	FSS-SS-45-01	7/1/2000	0 - 0.17
Area 4	AI4-101	AI4-101(0-2)	5/10/2011	0 - 0.17
	AI4-101	AI4-101(6-24)	5/10/2011	0.5 - 2
	AI4-102	AI4-102(0-2)	5/12/2011	0 - 0.17
	AI4-102	AI4-102(6-24)	5/12/2011	0.5 - 2
	AI4-103	AI4-103(0-2)	5/12/2011	0 - 0.17
	AI4-103	AI4-103(6-24)	5/12/2011	0.5 - 2
	AI4-104	AI4-104(0-2)	5/12/2011	0 - 0.17
	AI4-104	AI4-104(6-24)	5/12/2011	0.5 - 2
	AI4-105	AI4-105(0-2)	5/11/2011	0 - 0.17
	AI4-105	AI4-105(6-24)	5/11/2011	0.5 - 2
	AI4-106	AI4-106(0-2)	5/11/2011	0 - 0.17
	AI4-106	AI4-106(6-24)	5/11/2011	0.5 - 2
	AI4-107	AI4-107(0-2)	5/12/2011	0 - 0.17
	AI4-107	AI4-107(6-24)	5/12/2011	0.5 - 2
	AI4-108	AI4-108(0-2)	5/12/2011	0 - 0.17
	AI4-108	AI4-108(6-24)	5/12/2011	0.5 - 2
	AI4-109	AI4-109(0-2)	5/12/2011	0 - 0.17
	AI4-109	AI4-109(6-24)	5/12/2011	0.5 - 2
	AI4-110	AI4-110(0-2)	5/12/2011	0 - 0.17
	AI4-110	AI4-110(6-24)	5/12/2011	0.5 - 2
	AI4-111	AI4-111(0-2)	5/12/2011	0 - 0.17
	AI4-111	AI4-111(6-24)	5/12/2011	0.5 - 2
	AI4-112	AI4-112(0-2)	5/11/2011	0 - 0.17
	AI4-112	AI4-112(6-24)	5/11/2011	0.5 - 2
	AI4-113	AI4-113(0-2)	5/12/2011	0 - 0.17
	AI4-113	AI4-113(6-24)	5/12/2011	0.5 - 2
	AI4-114	AI4-114(0-2)	5/12/2011	0 - 0.17
	AI4-114	AI4-114(6-24)	5/12/2011	0.5 - 2
	AI4-115	AI4-115(0-2)	5/11/2011	0 - 0.17
	AI4-115	AI4-115(6-24)	5/11/2011	0.5 - 2

Table 9-1
Surface Soil Samples Used in the SLERA by Exposure Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Sample Location	Sample ID	Date	Depth BGS (ft)
Area 4	B-05	Ad2004-SS-5-DP	6/21/2004	1 - 2
	B-05	Ad2004-SS-5-SH	6/21/2004	0 - 1
	B-06	Ad2004-SS-6-DP	6/21/2004	1 - 2
	B-06	Ad2004-SS-6-SH	6/21/2004	0 - 1
	B-07	Ad2004-SS-7-DP	6/21/2004	1 - 2
	B-07	Ad2004-SS-7-SH	6/21/2004	0 - 1
	B-08	Ad2004-SS-8-DP	6/21/2004	1 - 2
	B-08	Ad2004-SS-8-SH	6/21/2004	0 - 1
	SB-01	FSS-SB-01-01	8/1/1998	0 - 0.5
	SB-02	FSS-SB-02-01	8/1/1998	0 - 0.5
	SB-03	FSS-SB-03-01	8/1/1998	0 - 0.5
	SS-01	FSS-SS-01-01	7/1/2000	0 - 0.17
	SS-02	FSS-SS-02-01	7/1/2000	0 - 0.17
	SS-03	FSS-SS-03-01	7/1/2000	0 - 0.17
	SS-04	FSS-SS-04-01	7/1/2000	0 - 0.17
	SS-05	FSS-SS-05-01	7/1/2000	0 - 0.17
	SS-06	FSS-SS-06-01	7/1/2000	0 - 0.17
	SS-07	FSS-SS-07-01	7/1/2000	0 - 0.17
	SS-08	FSS-SS-08-01	7/1/2000	0 - 0.17
	SS-09	FSS-SS-09-01	7/1/2000	0 - 0.17
	SS-10	FSS-SS-10-01	7/1/2000	0 - 0.17
	SS-11	FSS-SS-11-01	7/1/2000	0 - 0.17
	SS-12	FSS-SS-12-01	7/1/2000	0 - 0.17
	SS-13	FSS-SS-13-01	7/1/2000	0 - 0.17
	SS-14	FSS-SS-14-01	7/1/2000	0 - 0.17
	SS-15	FSS-SS-15-01	7/1/2000	0 - 0.17
	SS-16	FSS-SS-16-01	7/1/2000	0 - 0.17
	SS-17	FSS-SS-17-01	7/1/2000	0 - 0.17
Area 5	AI5-101	AI5-101(0-6)	5/10/2011	0 - 0.5
	AI5-101	AI5-101(6-24)	5/10/2011	0.5 - 2
	AI5-102	AI5-102(0-2)	5/10/2011	0 - 0.17
	AI5-102	AI5-102(6-24)	5/10/2011	0.5 - 2
	AI5-103	AI5-103(0-2)	5/10/2011	0 - 0.17
	AI5-103	AI5-103(6-24)	5/10/2011	0.5 - 2
	AI5-104	AI5-104(0-2)	5/10/2011	0 - 0.17
	AI5-104	AI5-104(2-6)	5/10/2011	0.17 - 0.5
	AI5-104	AI5-104(6-24)	5/10/2011	0.5 - 2
	AI5-105	AI5-105(0-2)	5/11/2011	0 - 0.17
	AI5-105	AI5-105(6-24)	5/11/2011	0.5 - 2
	AI5-106	AI5-106(0-2)	5/11/2011	0 - 0.17
	AI5-106	AI5-106(0-6)	5/11/2011	0 - 0.5
	AI5-106	AI5-106(6-24)	5/11/2011	0.5 - 2
	AI5-107	AI5-107(0-2)	5/11/2011	0 - 0.17
	AI5-107	AI5-107(6-24)	5/11/2011	0.5 - 2
	AI5-108	AI5-108(0-2)	5/11/2011	0 - 0.17
	AI5-108	AI5-108(6-24)	5/11/2011	0.5 - 2
	AI5-109	AI5-109(0-2)	5/10/2011	0 - 0.17

Table 9-1
Surface Soil Samples Used in the SLERA by Exposure Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

	Sample Location	Sample ID	Date	Depth BGS (ft)
Area 5	AI5-109	AI5-109(6-24)	5/10/2011	0.5 - 2
	AI5-110	AI5-110(0-2)	5/11/2011	0 - 0.17
	AI5-110	AI5-110(6-24)	5/11/2011	0.5 - 2
	SB-08	FSS-SB-08-01	8/1/1998	0 - 0.5
	SS-41	FSS-SS-41-01	7/1/2000	0 - 0.17
	SS-42	FSS-SS-42-01	7/1/2000	0 - 0.17
	SS-43	FSS-SS-43-01	7/1/2000	0 - 0.17
	SS-44	FSS-SS-44-01	7/1/2000	0 - 0.17
Background	BKG-01	BKG-SD-01	9/16/2008	1.5 - 2
	BKG-01	BKG-SH-01	9/16/2008	0 - 0.25
	BKG-02	BKG-SD-02	9/16/2008	1.5 - 2
	BKG-02	BKG-SH-02	9/16/2008	0 - 0.25
	BKG-03	BKG-SD-03	9/16/2008	1.5 - 2
	BKG-03	BKG-SH-03	9/16/2008	0 - 0.25
	BKG-04	BKG-SD-04	9/16/2008	1.5 - 2
	BKG-04	BKG-SH-04	9/16/2008	0 - 0.25
	BKG-05	BKG-SD-05	9/16/2008	1.5 - 2
	BKG-05	BKG-SH-05	9/16/2008	0 - 0.25
	BKG-06	BKG-SD-06	9/16/2008	1.5 - 2
	BKG-06	BKG-SH-06	9/16/2008	0 - 0.25
	BKG-07	BKG-SD-07	9/16/2008	1.5 - 2
	BKG-07	BKG-SH-07	9/16/2008	0 - 0.25
	BKG-08	BKG-SD-08	9/16/2008	1.5 - 2
	BKG-08	BKG-SH-08	9/16/2008	0 - 0.25
	BKG-09	BKG-SD-09	9/16/2008	1.5 - 2
	BKG-09	BKG-SH-09	9/16/2008	0 - 0.25
	BKG-10	BKG-SD-10	9/16/2008	1.5 - 2
	BKG-10	BKG-SH-10	9/16/2008	0 - 0.25
	BKG-11	BKG-SD-11	9/16/2008	1.5 - 2
	BKG-11	BKG-SH-11	9/16/2008	0 - 0.25
	BKG-12	BKG-SD-12	9/16/2008	1.5 - 2
	BKG-12	BKG-SH-12	9/16/2008	0 - 0.25
	BKG-13	BKG-SD-13	9/16/2008	1.5 - 2
	BKG-13	BKG-SH-13	9/16/2008	0 - 0.25
	BKG-14	BKG-SD-14	9/16/2008	1.5 - 2
	BKG-14	BKG-SH-14	9/16/2008	0 - 0.25
	BKG-15	BKG-SD-15	9/16/2008	1.5 - 2
	BKG-15	BKG-SH-15	9/16/2008	0 - 0.25

Prepared By: SFR 10/28/2011
Checked by: EYM 11/2/2011

Notes:
BGS - Below Ground Surface
SLERA - Screening Level Ecological Risk Assessment

Table 9-2
Soil Screening Benchmark Values
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Selected Benchmark	
	Screening	Source[a]
SVOCs (mg/kg)		
1,1'-Biphenyl	60	ORNL - Plants
1,2-Dichlorobenzene	2.96	Region 5
1-Methylnaphthalene	NA	NA
2,4,5-Trichlorophenol	0.000000199	Region 5
2,4-Dichlorophenol	87.5	Region 5
2,4-Dinitrophenol	20	ORNL - Plants
2,6-Dinitrotoluene	0.0328	Region 5
2-Chlorophenol	0.243	Region 5
2-Methylnaphthalene	3.24	Region 5
2-Methylphenol	40.4	Region 5
2-Nitroaniline	74.1	Region 5
2-Nitrophenol	1.6	Region 5
3,3`-Dichlorobenzidine	0.646	Region 5
3-Nitroaniline	3.16	Region 5
4-Chloro-3-methylphenol	7.95	Region 5
4-Chloroaniline	1.1	Region 5
4-Methylphenol	163	Region 5
4-Nitrophenol	7	ORNL - Invertebrates
Acenaphthene	20	Region 4
Acenaphthylene	682	Region 5
Acetophenone	300	Region 5
Anthracene	0.1	Region 4
Benzo(a)anthracene	5.21	Region 5
Benzo(a)pyrene	0.1	Region 4
Benzo(b)fluoranthene	59.8	Region 5
Benzo(ghi)perylene	119	Region 5
Benzo(k)fluoranthene	148	Region 5
Bis(2-chloroethoxy)methane	0.302	Region 5
Bis(2-Ethylhexyl)phthalate	0.925	Region 5
Butylbenzylphthalate	0.239	Region 5
Caprolactam	NA	NA
Carbazole	NA	NA
Chrysene	4.73	Region 5
Dibenz(a,h)anthracene	18.4	Region 5
Dibenzofuran	NA	NA
Diethylphthalate	100	ORNL - Plants
Dimethylphthalate	200	ORNL - Invertebrates
Di-n-butylphthalate	200	ORNL - Plants
Di-n-octylphthalate	709	Region 5
Fluoranthene	0.1	Region 4
Fluorene	30	ORNL - Invertebrates
Hexachlorobenzene	0.0025	Region 4
Indeno(1,2,3-cd)pyrene	109	Region 5

Table 9-2
Soil Screening Benchmark Values
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Selected Benchmark	
	Screening	Source[a]
SVOCs (mg/kg)		
Isophorone	139	Region 5
Naphthalene	0.0994	Region 5
Nitrobenzene	40	ORNL - Invertebrates
N-Nitrosodiphenylamine	20	ORNL - Invertebrates
o-Dichlorobenzene	2.96	Region 5
p-Chloro-M-Cresol	7.95	Region 5
Pentachlorobenzene	20	ORNL - Invertebrates
Pentachlorophenol	2.1	Eco-SSL - Birds
Phenanthrene	0.1	Region 4
Phenol	30	ORNL - Invertebrates
Pyrene	0.1	Region 4
Pesticides (mg/kg)		
4,4`-DDD	0.0025	Region 4
4,4`-DDE	0.0025	Region 4
4,4`-DDT	0.021	Eco-SSL - Mammals
Aldrin	0.00332	Region 5
Alpha-BHC	0.0025	Region 4
Alpha-Chlordane	NA	NA
Beta-BHC	0.00398	Region 5
Delta-BHC	9.94	Region 5
Dieldrin	0.0049	Eco-SSL - Mammals
Endosulfan I	0.119	Region 5
Endosulfan II	0.119	Region 5
Endosulfan sulfate	0.0358	Region 5
Endrin	0.001	Region 4
Endrin aldehyde	NA	NA
Endrin ketone	NA	NA
Gamma-BHC/Lindane	0.00005	Region 4
gamma-Chlordane	NA	NA
Heptachlor	0.00598	Region 5
Heptachlor epoxide	0.152	Region 5
Methoxychlor	0.0199	Region 5
Toxaphene	0.119	Region 5
Metals (mg/kg)		
Aluminum	50	ORNL - Plants
Antimony	0.27	Eco-SSL - Mammals
Arsenic	18	Eco-SSL - Plants
Barium	330	Eco-SSL - Invertebrates
Beryllium	21	Eco-SSL - Mammals
Cadmium	0.36	Eco-SSL - Mammals
Calcium[b]	EN	EN
Chromium	26	Eco-SSL - Birds
Cobalt	13	Eco-SSL - Plants

Table 9-2
Soil Screening Benchmark Values
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Selected Benchmark	
	Screening	Source[a]
Metals (mg/kg)		
Copper	28	Eco-SSL - Birds
Elemental Mercury	0.1	ORNL - Invertebrates
Iron	200	Region 4
Lead	11	Eco-SSL - Birds
Magnesium[b]	EN	EN
Manganese	220	ECO-SSL- Plants
Mercury	0.1	ORNL - Invertebrates
Methyl mercury	0.00158	Region 5
Nickel	38	Eco-SSL - Plants
Potassium [b]	EN	EN
Selenium	0.52	Eco-SSL - Plants
Silver	4.2	Eco-SSL - Birds
Sodium [b]	EN	EN
Thallium	1	ORNL - Plants
Vanadium	7.8	Eco-SSL - Birds
Zinc	46	Eco-SSL - Birds

Prepared by: SFR 8/3/2011
Checked by: EYM 10/5/2011

Notes:

[a] Screening benchmark sources are listed in order of preference:

[1] The lowest values (for plants, soil invertebrates, mammals or birds) from the following source were used:

Eco-SSL - (Plants, Invertebrates, Mammals or Birds) - USEPA, 2005. *Guidance for Developing Ecological Soil* Screening Levels. OSWER Directive 9285.7-55, November 2003, Revised February 2005.

[2] Lacking an Eco-SSL value, a screening benchmark was selected from the lowest value presented in the following sources:

ORNL - Plants - Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten. 1997. *Toxicological Benchmarks* for *Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National* Laboratory, Oak Ridge, TN.

ORNL - Invertebrates - Efroymson, R.A., M.E., Will, and G.W. Suter II. 1997. *Toxicological Benchmarks for* Contaminants of *Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes:* 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

[3] Lacking an Eco-SSL or ORNL value, a benchmark was selected from the lowest value presented in the following sources:

Region 4 - Friday, G. P. 1998. *Ecological Screening Values for Surface Water, Sediment, and Soil.* Westinghouse Savannah River Company, Savannah River Technology Center, (WSRC-TR-98-00110), Aiken, SC 29808. Cited in: USEPA 2001. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* . November 30, 2001 update.

Region 5 - USEPA. 2003. *USEPA, Region 5, RCRA Ecological Screening Levels* . August 22, 2003.

[b] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

EN - Essential Nutrient

mg/kg - milligrams per kilogram

NA - Not Available

SVOC - Semivolatile Organic Compound

Table 9-3
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 1
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)															
1,2-Dichlorobenzene	1	/	14	0.00402	:	0.44	0.0061	-	0.0061	B-11	0.12	2.96	0	No	BSL
2,4,5-Trichlorophenol	0	/	11	0.033	:	2.2					0.75	0.000000199	0	No	ND
2,4-Dichlorophenol	0	/	11	0.033	:	0.44					0.15	87.5	0	No	ND
2,4-Dinitrophenol	0	/	11	0.033	:	2.2					0.75	20	0	No	ND
2,6-Dinitrotoluene	0	/	11	0.033	:	0.44					0.15	0.0328	0	No	ND
2-Chlorophenol	0	/	11	0.033	:	0.44					0.15	0.243	0	No	ND
2-Methylnaphthalene	7	/	12	0.033	:	0.44	0.042	-	0.088	FLA-50	0.076	3.24	0	No	BSL
2-Methylphenol	0	/	11	0.033	:	0.44					0.15	40.4	0	No	ND
2-Nitroaniline	0	/	11	0.033	:	2.2					0.75	74.1	0	No	ND
2-Nitrophenol	0	/	11	0.033	:	0.44					0.15	1.6	0	No	ND
3,3`-Dichlorobenzidine	0	/	11	0.35	:	2					0.42	0.646	0	No	ND
3-Nitroaniline	0	/	11	0.033	:	2.2					0.75	3.16	0	No	ND
4-Chloro-3-methylphenol	5	/	14	0.033	:	0.44	0.0064	-	0.0079	B-11	0.12	7.95	0	No	BSL
4-Chloroaniline	0	/	11	0.17	:	0.44					0.17	1.1	0	No	ND
4-Methylphenol	0	/	14	0.00278	:	0.44					0.12	163	0	No	ND
4-Nitrophenol	0	/	11	0.066	:	2.2					0.76	7	0	No	ND
Acenaphthene	6	/	14	0.033	:	0.44	0.029	-	0.13	FLA-48	0.12	20	0	No	BSL
Acenaphthylene	10	/	14	0.033	:	0.43	0.014	-	0.053	FLA-47	0.070	682	0	No	BSL
Anthracene	16	/	17	0.033	:	0.033	0.012	-	0.24	FLA-48	0.12	0.1	11	Yes	ASL
Benzo(a)anthracene	18	/	19	0.033	:	0.033	0.089	-	0.79	FLA-48	0.40	5.21	0	No	BSL
Benzo(a)pyrene	18	/	19	0.033	:	0.033	0.14	-	0.87	FLA-48	0.42	0.1	18	Yes	ASL
Benzo(b)fluoranthene	18	/	19	0.66	:	0.66	0.073	-	1.1	FLA-48	0.54	59.8	0	No	BSL
Benzo(ghi)perylene	18	/	19	0.033	:	0.033	0.069	-	0.63	FLA-48	0.29	119	0	No	BSL
Benzo(k)fluoranthene	18	/	19	0.66	:	0.66	0.068	-	0.43	FLA-48	0.23	148	0	No	BSL
Bis(2-Ethylhexyl)phthalate	17	/	17				0.038	-	1.8	FLA-51	0.26	0.925	1	Yes	ASL
Butylbenzylphthalate	5	/	14	0.00209	:	0.44	0.023	-	0.078	B-11	0.11	0.239	0	No	BSL
Carbazole	9	/	14	0.033	:	0.43	0.038	-	0.14	FLA-48	0.093	NA	-	Yes	NSL
Chrysene	18	/	19	0.033	:	0.033	0.12	-	0.88	FLA-48	0.44	4.73	0	No	BSL
Dibenz(a,h)anthracene	8	/	17	0.0184	:	0.66	0.055	-	0.18	FLA-48	0.17	18.4	0	No	BSL
Dibenzofuran	6	/	14	0.033	:	0.44	0.011	-	0.049	FLA-48	0.10	NA	-	Yes	NSL
Diethylphthalate	0	/	11	0.033	:	0.44					0.15	100	0	No	ND
Dimethylphthalate	0	/	11	0.033	:	0.44					0.15	200	0	No	ND

Table 9-3
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 1
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)															
Di-n-butylphthalate	8	/	14	0.35	:	0.44	0.043	-	0.36	B-11	0.22	200	0	No	BSL
Di-n-octylphthalate	0	/	14	0.00125	:	0.44					0.12	709	0	No	ND
Fluoranthene	18	/	19	0.033	:	0.033	0.16	-	1.2	FLA-48	0.65	0.1	18	Yes	ASL
Fluorene	8	/	14	0.033	:	0.43	0.026	-	0.092	FLA-48	0.092	30	0	No	BSL
Hexachlorobenzene	0	/	11	0.033	:	0.44					0.15	0.0025	0	No	ND
Indeno(1,2,3-cd)pyrene	18	/	19	0.0119	:	0.0119	0.086	-	0.7	FLA-48	0.31	109	0	No	BSL
Isophorone	0	/	11	0.033	:	0.44					0.15	139	0	No	ND
Naphthalene	15	/	18	0.033	:	0.35	0.0099	-	0.16	FLA-13 / FLA-48	0.086	0.0994	8	Yes	ASL
Nitrobenzene	0	/	11	0.033	:	0.44					0.15	40	0	No	ND
Pentachlorophenol	0	/	14	0.00602	:	2.2					0.59	2.1	0	No	ND
Phenanthrene	18	/	19	0.033	:	0.033	0.056	-	1	FLA-48	0.42	0.1	17	Yes	ASL
Phenol	0	/	11	0.033	:	0.44					0.15	30	0	No	ND
Pyrene	18	/	19	0.033	:	0.033	0.16	-	1.5	FLA-48	0.73	0.1	18	Yes	ASL
Metals (mg/kg)															
Aluminum	17	/	17				4,400	-	17,500	B-10	7,089	50	17	Yes	ASL
Antimony	17	/	17				0.19	-	8.9	B-11	2.1	0.27	16	Yes	ASL
Arsenic	17	/	17				2.8	-	9.5	FLA-48	6.2	18	0	No	BSL
Barium	17	/	17				56	-	449	B-11	206	330	2	Yes	ASL
Beryllium	15	/	17	0.0267	:	0.0267	0.095	-	0.54	FLA-49	0.30	21	0	No	BSL
Cadmium	16	/	16				0.06	-	2.4	B-11	1.0	0.36	14	Yes	ASL
Calcium [d]	17	/	17				1,310	-	22,700	FLA-48	8,706	EN	-	No	EN
Chromium	17	/	17				11.7	-	32	B-11	22	26	5	Yes	ASL
Cobalt	17	/	17				3.7	-	9.9	B-10	6.4	13	0	No	BSL
Copper	17	/	17				15	-	346	B-11	114	28	16	Yes	ASL
Iron	17	/	17				10,600	-	34,300	FLA-11	22,882	200	17	Yes	ASL
Lead	17	/	17				26	-	1540	B-10	574	11	17	Yes	ASL
Magnesium [d]	17	/	17				1,970	-	13,100	FLA-48	3,992	EN	-	No	EN
Manganese	17	/	17				212	-	536	B-10	296	220	15	Yes	ASL
Mercury	17	/	17				0.097	-	2.4	B-10	0.89	0.1	16	Yes	ASL
Nickel	17	/	17				12.8	-	26	B-11	19.5	38	0	No	BSL
Potassium [d]	17	/	17				716	-	1,700	FLA-12	1,103	EN	-	No	EN
Selenium	14	/	14				0.14	-	1.1	FLA-51	0.57	0.52	9	Yes	ASL
Silver	8	/	16	0.19	:	0.362	0.18	-	0.66	B-11	0.27	4.2	0	No	BSL
Sodium [d]	16	/	17	31.4	:	31.4	80	-	214	FLA-11	151	EN	-	No	EN
Thallium	8	/	16	0.17	:	0.2	0.11	-	0.18	FLA-12	0.12	1	0	No	BSL

Table 9-3
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 1
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Engineer School, Fort Totten
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Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Metals (mg/kg)									
Vanadium	17 / 17		18.4 - 33	FLA-12	24	7.8	17	Yes	ASL
Zinc	17 / 17		50 - 564	B-11	349	46	17	Yes	ASL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	5 / 5		37,300 - 73,900	FLA-09	55,680				

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmark selection is shown in Table 9-2.
[c] Chemical is identified as a Chemical of Potential Ecological Concern (COPECs) and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.
ASL - Above Screening Level
BSL - Below Screening Level
ND - Not Detected
NSL - No Screening Level
EN - Essential Nutrient
[d] Calcium, magnesium, potassium, and sodium are considered essential nutrients, therefore assessment is unnecessary.
[e] Total organic carbon is displayed for reference only.
bgs - below ground surface
mg/kg - milligrams per kilogram
NA - Not available
SVOCs - Semivolatile Organic Compounds

Table 9-4
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 2
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
1,2-Dichlorobenzene	0 / 14	0.033 : 0.52			0.18	2.96	0	No	ND
1-Methylnaphthalene	17 / 24	0.0012 : 0.037	0.001 - 0.024	AI2-107	0.0069	NA	-	Yes	NSL
2,4,5-Trichlorophenol	0 / 14	0.033 : 2.6			0.87	0.000000199	0	No	ND
2,4-Dichlorophenol	0 / 14	0.033 : 0.52			0.18	87.5	0	No	ND
2,4-Dinitrophenol	0 / 14	0.033 : 2.6			0.88	20	0	No	ND
2,6-Dinitrotoluene	0 / 14	0.033 : 0.52			0.18	0.0328	0	No	ND
2-Chlorophenol	0 / 14	0.033 : 0.52			0.18	0.243	0	No	ND
2-Methylnaphthalene	22 / 39	0.0012 : 0.46	0.0016 - 0.11	AI2-111	0.054	3.24	0	No	BSL
2-Methylphenol	0 / 14	0.033 : 0.52			0.18	40.4	0	No	ND
2-Nitroaniline	0 / 14	0.033 : 2.6			0.88	74.1	0	No	ND
2-Nitrophenol	0 / 14	0.033 : 0.52			0.18	1.6	0	No	ND
3,3`-Dichlorobenzidine	0 / 14	0.34 : 2			0.32	0.646	0	No	ND
3-Nitroaniline	0 / 14	0.033 : 2.6			0.88	3.16	0	No	ND
4-Chloro-3-methylphenol	0 / 14	0.033 : 0.52			0.18	7.95	0	No	ND
4-Chloroaniline	0 / 14	0.17 : 0.52			0.19	1.1	0	No	ND
4-Methylphenol	1 / 14	0.033 : 0.46	0.055 - 0.055	SS-29	0.16	163	0	No	BSL
4-Nitrophenol	0 / 14	0.066 : 2.6			0.88	7	0	No	ND
Acenaphthene	17 / 38	0.0011 : 0.52	0.0011 - 0.035	AI2-111	0.071	20	0	No	BSL
Acenaphthylene	25 / 39	0.002 : 0.46	0.0025 - 0.41	SS-29	0.085	682	0	No	BSL
Anthracene	30 / 39	0.0012 : 0.46	0.00098 - 0.24	SB-05	0.073	0.1	2	Yes	ASL
Benzo(a)anthracene	39 / 40	0.033 : 0.033	0.0041 - 1.6	SS-29	0.21	5.21	0	No	BSL
Benzo(a)pyrene	39 / 40	0.033 : 0.033	0.0036 - 1.6	SB-05	0.24	0.1	27	Yes	ASL
Benzo(b)fluoranthene	39 / 40	0.066 : 0.066	0.006 - 2.2	SB-05 / SS-29	0.33	59.8	0	No	BSL
Benzo(ghi)perylene	38 / 40	0.033 : 0.033	0.0026 - 1.2	SB-05	0.19	119	0	No	BSL
Benzo(k)fluoranthene	26 / 39	0.0018 : 0.066	0.013 - 0.92	SB-05	0.11	148	0	No	BSL
Bis(2-Ethylhexyl)phthalate	16 / 16		0.021 - 17	SS-20	1.8	0.925	12	Yes	ASL
Butylbenzylphthalate	11 / 15	0.033 : 0.4	0.012 - 0.3	SS-29	0.10	0.239	1	Yes	ASL
Carbazole	6 / 14	0.033 : 0.46	0.034 - 0.1	SS-29	0.11	NA	-	Yes	NSL
Chrysene	38 / 40	0.033 : 0.38	0.0034 - 1.9	SB-05	0.26	4.73	0	No	BSL
Dibenz(a,h)anthracene	24 / 38	0.0024 : 0.66	0.0036 - 0.28	SS-29	0.096	18.4	0	No	BSL
Dibenzofuran	0 / 14	0.033 : 0.52			0.18	NA	-	No	ND
Diethylphthalate	0 / 14	0.033 : 0.52			0.18	100	0	No	ND

Table 9-4
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 2
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Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
Dimethylphthalate	0 / 14	0.033 : 0.52			0.18	200	0	No	ND
Di-n-butylphthalate	4 / 14	0.34 : 0.46	0.064 - 0.34	B-09	0.20	200	0	No	BSL
Di-n-octylphthalate	0 / 14	0.033 : 0.52			0.18	709	0	No	ND
Fluoranthene	39 / 40	0.033 : 0.033	0.0044 - 2	SB-05	0.36	0.1	27	Yes	ASL
Fluorene	16 / 38	0.0019 : 0.52	0.0016 - 0.027	AI2-111	0.072	30	0	No	BSL
Hexachlorobenzene	0 / 14	0.033 : 0.52			0.18	0.0025	0	No	ND
Indeno(1,2,3-cd)pyrene	38 / 40	0.033 : 0.033	0.0031 - 1.3	SB-05	0.19	109	0	No	BSL
Isophorone	0 / 14	0.033 : 0.52			0.17	139	0	No	ND
Naphthalene	23 / 39	0.0012 : 0.46	0.0021 - 0.19	SS-29	0.060	0.0994	2	Yes	ASL
Nitrobenzene	0 / 14	0.033 : 0.52			0.18	40	0	No	ND
Pentachlorophenol	0 / 14	0.033 : 2.6			0.88	2.1	0	No	ND
Phenanthrene	39 / 40	0.033 : 0.033	0.0027 - 1	SB-05	0.17	0.1	23	Yes	ASL
Phenol	0 / 14	0.033 : 0.52			0.18	30	0	No	ND
Pyrene	40 / 40		0.0037 - 2.9	SB-05	0.38	0.1	30	Yes	ASL
Pesticides (mg/kg)									
4,4`-DDD	2 / 2		0.02 - 0.071	624-SS-53	0.046	0.0025	2	Yes	ASL
4,4`-DDE	2 / 2		0.022 - 0.044	624-SS-53	0.033	0.0025	2	Yes	ASL
4,4`-DDT	8 / 8		0.2 - 1	624-SS-02	0.64	0.021	8	Yes	ASL
Aldrin	0 / 2	0.0021 : 0.0027			0.0012	0.00332	0	No	ND
Alpha-BHC	0 / 2	0.0021 : 0.0027			0.0012	0.0025	0	No	ND
Alpha-Chlordane	0 / 2	0.0021 : 0.0027			0.0012	NA	-	No	ND
Beta-BHC	0 / 2	0.0021 : 0.0027			0.0012	0.00398	0	No	ND
Delta-BHC	0 / 2	0.0021 : 0.0027			0.0012	9.94	0	No	ND
Dieldrin	0 / 2	0.0043 : 0.0055			0.0025	0.0049	0	No	ND
Endosulfan I	0 / 2	0.0021 : 0.0027			0.0012	0.119	0	No	ND
Endosulfan II	0 / 2	0.0043 : 0.0055			0.0025	0.119	0	No	ND
Endosulfan sulfate	0 / 2	0.0043 : 0.0055			0.0025	0.0358	0	No	ND
Endrin	0 / 2	0.0043 : 0.0055			0.0025	0.001	0	No	ND
Endrin aldehyde	0 / 2	0.0043 : 0.0043	0.0082 - 0.0082	624-SS-53	0.0052	NA	-	No	NSL
Endrin ketone	2 / 2		0.013 - 0.032	624-SS-53	0.023	NA	-	Yes	NSL
Gamma-BHC	2 / 2		0.0032 - 0.0052	624-SS-53	0.0042	0.00005	2	Yes	ASL
Gamma-Chlordane	1 / 2	0.0021 : 0.0021	0.0087 - 0.0087	624-SS-53	0.0049	NA	-	Yes	NSL

Table 9-4
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 2
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Engineer School, Fort Totten
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Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Pesticides (mg/kg)															
Heptachlor	0	/	2	0.0021	:	0.0027					0.0012	0.00598	0	No	ND
Heptachlor epoxide	3	/	3				0.016	-	0.12	624-SS-05	0.056	0.152	0	No	BSL
Methoxychlor	0	/	2	0.021	:	0.027					0.012	0.0199	0	No	ND
Toxaphene	0	/	2	0.21	:	0.27					0.12	0.119	0	No	ND
Metals (mg/kg)															
Aluminum	40	/	40				48	-	14,400	B-09	7,814	50	39	Yes	ASL
Antimony	32	/	39	0.37	:	0.48	0.2	-	5.7	AI2-108	0.76	0.27	31	Yes	ASL
Arsenic	40	/	40				2.1	-	11.7	AI2-108	4.5	18	0	No	BSL
Barium	40	/	40				52.3	-	295	SB-04	94	330	0	No	BSL
Beryllium	40	/	40				0.17	-	0.89	AI2-109	0.48	21	0	No	BSL
Cadmium	37	/	39	0.095	:	0.096	0.033	-	1.9	AI2-107	0.43	0.36	22	Yes	ASL
Calcium [d]	40	/	40				837	-	14,600	AI2-107	4,290	EN	-	No	EN
Chromium	40	/	40				9.8	-	29.4	SB-04	18.0	26	2	Yes	ASL
Cobalt	40	/	40				3.7	-	9.5	AI2-101	6.0	13	0	No	BSL
Copper	40	/	40				9.6	-	11,500	AI2-108	326	28	30	Yes	ASL
Elemental Mercury	0	/	8	0.0003	:	0.0004					0.00019	0.1	0	No	ND
Iron	40	/	40				10,000	-	19,400	AI2-101	14,380	200	40	Yes	ASL
Lead	40	/	40				11	-	494	SB-04	216	11	39	Yes	ASL
Magnesium [d]	40	/	40				916	-	7,000	SB-05	2,769	EN	-	No	EN
Manganese	40	/	40				84.8	-	617	B-09	345	220	36	Yes	ASL
Mercury	36	/	36				0.028	-	2.7	SS-23	0.70	0.1	33	Yes	ASL
Methyl mercury	7	/	8	0.000063	:	0.000063	0.000083	-	0.011	AI2-111	0.0031	0.00158	4	Yes	ASL
Nickel	40	/	40				12.5	-	23.1	AI2-101	17.5	38	0	No	BSL
Potassium [d]	40	/	40				403	-	1230	SS-25	759	EN	-	No	EN
Selenium	27	/	40	0.65	:	0.99	0.19	-	1.5	AI2-108	0.54	0.52	13	Yes	ASL
Silver	11	/	38	0.093	:	0.362	0.085	-	0.45	AI2-102	0.12	4.2	0	No	BSL
Sodium [d]	38	/	40	31.4	:	72.2	38	-	383	AI2-101	134	EN	-	No	EN
Thallium	2	/	38	0.14	:	1.5	0.1	-	0.15	B-09	0.41	1	0	No	BSL
Vanadium	40	/	40				17.7	-	61.7	AI2-101	27	7.8	40	Yes	ASL
Zinc	40	/	40				29	-	301	AI2-101	139	46	37	Yes	ASL

Table 9-4
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 2
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Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	2 / 2		44,100 - 57,900	SB-05	51,000				

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmark selection is shown in Table 9-2.
[c] Chemical is identified as a Chemical of Potential Ecological Concern (COPECs) and retained for further evaluation
if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.
ASL - Above Screening Level
BSL - Below Screening Level
ND - Not Detected
NSL - No Screening Level
EN - Essential Nutrient
[d] Calcium, magnesium, potassium, and sodium are considered essential nutrients, therefore assessment is unnecessary.
[e] Total organic carbon is displayed for reference only.
bgs - below ground surface
mg/kg - milligrams per kilogram
NA - Not available
SVOCs - Semivolatile Organic Compounds

Table 9-5
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
1,2-Dichlorobenzene	0 / 20	0.033 : 0.39			0.12	2.96	0	No	ND
1-Methylnaphthalene	22 / 24	0.0013 : 0.024	0.001 - 0.18	AI3-103	0.018	NA	-	Yes	NSL
2,4,5-Trichlorophenol	0 / 20	0.033 : 1.9			0.56	0.000000199	0	No	ND
2,4-Dichlorophenol	0 / 20	0.033 : 0.39			0.12	87.5	0	No	ND
2,4-Dinitrophenol	0 / 20	0.033 : 1.9			0.56	20	0	No	ND
2,6-Dinitrotoluene	0 / 20	0.033 : 0.39			0.12	0.0328	0	No	ND
2-Chlorophenol	0 / 20	0.033 : 0.39			0.12	0.243	0	No	ND
2-Methylnaphthalene	32 / 44	0.033 : 0.39	0.00088 - 0.22	AI3-103	0.050	3.24	0	No	BSL
2-Methylphenol	0 / 20	0.033 : 0.39			0.12	40.4	0	No	ND
2-Nitroaniline	0 / 20	0.033 : 1.9			0.56	74.1	0	No	ND
2-Nitrophenol	0 / 20	0.033 : 0.39			0.12	1.6	0	No	ND
3,3`-Dichlorobenzidine	0 / 20	0.35 : 2			0.51	0.646	0	No	ND
3-Nitroaniline	0 / 20	0.033 : 1.9			0.56	3.16	0	No	ND
4-Chloro-3-methylphenol	4 / 20	0.033 : 0.39	0.0056 - 0.008	B-01	0.12	7.95	0	No	BSL
4-Chloroaniline	0 / 20	0.17 : 0.39			0.15	1.1	0	No	ND
4-Methylphenol	0 / 20	0.033 : 0.39			0.12	163	0	No	ND
4-Nitrophenol	0 / 20	0.066 : 1.9			0.57	7	0	No	ND
Acenaphthene	25 / 44	0.0013 : 0.39	0.0017 - 0.19	AI3-111	0.063	20	0	No	BSL
Acenaphthylene	38 / 45	0.033 : 0.39	0.001 - 0.56	AI3-111	0.083	682	0	No	BSL
Anthracene	41 / 44	0.033 : 0.38	0.0022 - 0.67	AI3-111	0.087	0.1	11	Yes	ASL
Benzo(a)anthracene	44 / 46	0.033 : 0.033	0.0071 - 1.5	AI3-103	0.31	5.21	0	No	BSL
Benzo(a)pyrene	44 / 46	0.033 : 0.033	0.011 - 1.8	AI3-103	0.33	0.1	38	Yes	ASL
Benzo(b)fluoranthene	44 / 46	0.66 : 0.66	0.019 - 2.9	AI3-103	0.52	59.8	0	No	BSL
Benzo(ghi)perylene	44 / 46	0.033 : 0.033	0.0089 - 1.6	AI3-103	0.24	119	0	No	BSL
Benzo(k)fluoranthene	20 / 46	0.0019 : 0.66	0.049 - 0.54	SS-39	0.11	148	0	No	BSL
Bis(2-Ethylhexyl)phthalate	22 / 22		0.028 - 0.87	SS-39	0.23	0.925	0	No	BSL
Butylbenzylphthalate	13 / 20	0.033 : 0.39	0.015 - 0.15	SS-36	0.083	0.239	0	No	BSL
Carbazole	11 / 20	0.033 : 0.39	0.0075 - 0.17	SS-31	0.10	NA	-	Yes	NSL
Chrysene	44 / 46	0.033 : 0.033	0.011 - 2	AI3-103	0.36	4.73	0	No	BSL
Dibenz(a,h)anthracene	33 / 44	0.0026 : 0.66	0.0084 - 0.23	AI3-111	0.10	18.4	0	No	BSL
Dibenzofuran	3 / 20	0.033 : 0.39	0.016 - 0.16	SS-31	0.12	NA	-	Yes	NSL
Diethylphthalate	0 / 20	0.033 : 0.39			0.12	100	0	No	ND
Dimethylphthalate	0 / 20	0.033 : 0.39			0.12	200	0	No	ND

Table 9-5
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 3
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Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
Di-n-butylphthalate	10 / 20	0.35 : 0.39	0.028 - 0.091	B-02	0.12	200	0	No	BSL
Di-n-octylphthalate	1 / 20	0.033 : 0.39	0.01 - 0.01	B-01	0.12	709	0	No	BSL
Fluoranthene	45 / 46	0.033 : 0.033	0.014 - 3.3	AI3-103	0.60	0.1	42	Yes	ASL
Fluorene	27 / 44	0.0022 : 0.39	0.0023 - 0.21	AI3-111	0.062	30	0	No	BSL
Hexachlorobenzene	0 / 20	0.033 : 0.39			0.12	0.0025	0	No	ND
Indeno(1,2,3-cd)pyrene	44 / 46	0.033 : 0.033	0.0085 - 1.2	AI3-103	0.24	109	0	No	BSL
Isophorone	0 / 20	0.033 : 0.39			0.12	139	0	No	ND
Naphthalene	33 / 44	0.0013 : 0.39	0.0022 - 0.21	AI3-103	0.039	0.0994	4	Yes	ASL
Nitrobenzene	0 / 20	0.033 : 0.39			0.12	40	0	No	ND
Pentachlorophenol	0 / 20	0.033 : 1.9			0.56	2.1	0	No	ND
Phenanthrene	44 / 46	0.033 : 0.033	0.0059 - 1.9	AI3-103	0.33	0.1	31	Yes	ASL
Phenol	0 / 20	0.033 : 0.39			0.12	30	0	No	ND
Pyrene	45 / 46	0.033 : 0.033	0.011 - 3.1	AI3-103	0.55	0.1	39	Yes	ASL
Metals (mg/kg)									
Aluminum	46 / 46		6,070 - 38,200	AI3-103	10,611	50	46	Yes	ASL
Antimony	37 / 46	0.24 : 0.5	0.07 - 2.1	AI3-103	0.42	0.27	31	Yes	ASL
Arsenic	46 / 46		2.1 - 132	AI3-105	11.0	18	4	Yes	ASL
Barium	46 / 46		25 - 390	AI3-103	59	330	1	Yes	ASL
Beryllium	46 / 46		0.046 - 2.7	AI3-103	0.53	21	0	No	BSL
Cadmium	42 / 46	0.02 : 0.11	0.02 - 8.6	AI3-103	0.41	0.36	9	Yes	ASL
Calcium [d]	46 / 46		267 - 15,000	AI3-103	1,895	EN	-	No	EN
Chromium	46 / 46		15 - 136	AI3-103	23	26	3	Yes	ASL
Cobalt	46 / 46		2.9 - 23.7	AI3-103	5.9	13	1	Yes	ASL
Copper	46 / 46		9.8 - 2,470	B-01	91	28	31	Yes	ASL
Elemental Mercury	0 / 8	0.0002 : 0.0004			0.00015	NA	0	No	ND
Iron	46 / 46		12,200 - 62,600	AI3-103	16,389	200	46	Yes	ASL
Lead	46 / 46		8.6 - 2,140	AI3-103	174	11	46	Yes	ASL
Magnesium [d]	46 / 46		1,650 - 9,140	AI3-103	2,609	EN	-	No	EN
Manganese	46 / 46		151 - 1,140	AI3-103	278	220	35	Yes	ASL
Mercury	29 / 30	0.0077 : 0.0077	0.08 - 5	SS-38	0.89	0.1	28	Yes	ASL
Methyl mercury	8 / 8		0.000179 - 0.00226	AI3-111	0.00096	0.00158	2	Yes	ASL
Nickel	46 / 46		9.7 - 78.5	AI3-103	17.4	38	1	Yes	ASL
Potassium [d]	46 / 46		325 - 3,950	AI3-103	829	EN	-	No	EN
Selenium	34 / 45	0.76 : 1	0.094 - 3.2	AI3-103	0.61	0.52	17	Yes	ASL
Silver	5 / 44	0.097 : 0.362	0.078 - 0.83	AI3-103	0.12	4.2	0	No	BSL

Table 9-5
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 3
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Metals (mg/kg)									
Sodium [d]	40 / 46	31.4 : 66.3	15.5 - 932	AI3-103	111	EN	-	No	EN
Thallium	10 / 46	0.24 : 0.5	0.092 - 0.2	B-03	0.41	1	0	No	BSL
Vanadium	46 / 46		18.5 - 154	AI3-103	33	7.8	46	Yes	ASL
Zinc	46 / 46		40 - 1,370	AI3-103	122	46	39	Yes	ASL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	1 / 1		19,200 - 19,200	SB-06	19,200				

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmark selection is shown in Table 9-2.
[c] Chemical is identified as a Chemical of Potential Ecological Concern (COPECs) and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.
ASL - Above Screening Level
BSL - Below Screening Level
ND - Not Detected
NSL - No Screening Level
EN - Essential Nutrient
[d] Calcium, magnesium, potassium, and sodium are considered essential nutrients, therefore assessment is unnecessary.
[e] Total organic carbon is displayed for reference only.
bgs - below ground surface
mg/kg - milligrams per kilogram
NA - Not available
SVOCs - Semivolatile Organic Compounds

Table 9-6
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
1,2-Dichlorobenzene	0 / 19	0.00369 : 0.4			0.11	2.96	0	No	ND
1-Methylnaphthalene	27 / 28	0.0174 : 0.0174	0.00086 - 0.459	AI4-111	0.029	NA	-	Yes	NSL
2,4,5-Trichlorophenol	0 / 15	0.033 : 2			0.70	0.000000199	0	No	ND
2,4-Dichlorophenol	0 / 15	0.033 : 0.4			0.14	87.5	0	No	ND
2,4-Dinitrophenol	0 / 15	0.033 : 2			0.70	20	0	No	ND
2,6-Dinitrotoluene	0 / 15	0.033 : 0.4			0.14	0.0328	0	No	ND
2-Chlorophenol	0 / 15	0.033 : 0.4			0.14	0.243	0	No	ND
2-Methylnaphthalene	33 / 43	0.0174 : 0.39	0.0014 - 0.803	AI4-111	0.080	3.24	0	No	BSL
2-Methylphenol	0 / 15	0.033 : 0.4			0.14	40.4	0	No	ND
2-Nitroaniline	0 / 15	0.033 : 2			0.70	74.1	0	No	ND
2-Nitrophenol	0 / 15	0.033 : 0.4			0.14	1.6	0	No	ND
3,3`-Dichlorobenzidine	0 / 17	0.37 : 2			0.48	0.646	0	No	ND
3-Nitroaniline	0 / 15	0.033 : 2			0.70	3.16	0	No	ND
4-Chloro-3-methylphenol	2 / 19	0.00551 : 0.4	0.0059 - 0.0082	B-06	0.12	7.95	0	No	BSL
4-Chloroaniline	0 / 17	0.17 : 0.4			0.15	1.1	0	No	ND
4-Methylphenol	0 / 19	0.00537 : 0.4			0.11	163	0	No	ND
4-Nitrophenol	0 / 17	0.066 : 2			0.63	7	0	No	ND
Acenaphthene	30 / 47	0.0011 : 0.4	0.0019 - 2	AI4-111	0.099	20	0	No	BSL
Acenaphthylene	44 / 47	0.033 : 0.38	0.008 - 3.3	AI4-106	0.26	682	0	No	BSL
Anthracene	42 / 47	0.033 : 0.39	0.0057 - 4	AI4-111	0.21	0.1	14	Yes	ASL
Benzo(a)anthracene	49 / 49		0.028 - 7.3	AI4-106	0.82	5.21	2	Yes	ASL
Benzo(a)pyrene	49 / 49		0.041 - 9.8	AI4-106	1.0	0.1	41	Yes	ASL
Benzo(b)fluoranthene	50 / 50		0.036 - 15	AI4-106	1.4	59.8	0	No	BSL
Benzo(ghi)perylene	49 / 49		0.033 - 9.1	AI4-106	0.81	119	0	No	BSL
Benzo(k)fluoranthene	25 / 48	0.0018 : 0.076	0.029 - 2.7	SS-12	0.29	148	0	No	BSL
Bis(2-Ethylhexyl)phthalate	22 / 22		0.026 - 0.58	SB-01	0.13	0.925	0	No	BSL
Butylbenzylphthalate	7 / 19	0.00756 : 0.39	0.0086 - 0.068	SS-15	0.094	0.239	0	No	BSL
Carbazole	11 / 19	0.033 : 0.39	0.01 - 160	SS-12	17.7	NA	-	Yes	NSL
Chrysene	50 / 50		0.033 - 8.2	AI4-106	0.88	4.73	1	Yes	ASL
Dibenz(a,h)anthracene	41 / 47	0.37 : 0.66	0.01 - 2	AI4-106	0.23	18.4	0	No	BSL
Dibenzofuran	8 / 19	0.00803 : 0.39	0.0084 - 0.11	SS-12	0.086	NA	-	Yes	NSL
Diethylphthalate	0 / 15	0.033 : 0.4			0.14	100	0	No	ND
Dimethylphthalate	0 / 15	0.033 : 0.4			0.14	200	0	No	ND
Di-n-butylphthalate	11 / 19	0.37 : 0.4	0.032 - 0.23	B-07	0.14	200	0	No	BSL
Di-n-octylphthalate	0 / 19	0.00691 : 0.4			0.11	709	0	No	ND
Fluoranthene	50 / 50		0.04 - 16	AI4-106	1.4	0.1	45	Yes	ASL

Table 9-6
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
SVOCs (mg/kg)									
Fluorene	36 / 47	0.033 : 0.4	0.0014 - 1.9	AI4-111	0.094	30	0	No	BSL
Hexachlorobenzene	0 / 15	0.033 : 0.4			0.14	0.0025	0	No	ND
Indeno(1,2,3-cd)pyrene	49 / 49		0.024 - 7.4	AI4-106	0.74	109	0	No	BSL
Isophorone	0 / 15	0.033 : 0.4			0.14	139	0	No	ND
Naphthalene	40 / 47	0.033 : 0.39	0.0019 - 1.9	AI4-111	0.095	0.0994	7	Yes	ASL
Nitrobenzene	0 / 15	0.033 : 0.4			0.14	40	0	No	ND
Pentachlorophenol	1 / 19	0.00552 : 2	0.022 - 0.022	B-06	0.56	2.1	0	No	BSL
Phenanthrene	50 / 50		0.012 - 12	AI4-111	0.60	0.1	31	Yes	ASL
Phenol	0 / 15	0.033 : 0.4			0.14	30	0	No	ND
Pyrene	50 / 50		0.038 - 14	AI4-106	1.5	0.1	45	Yes	ASL
Metals (mg/kg)									
Aluminum	30 / 30		4,900 - 21,300	B-05	9,389	50	30	Yes	ASL
Antimony	28 / 30	0.12 : 0.37	0.15 - 1.1	B-07	0.46	0.27	22	Yes	ASL
Arsenic	30 / 30		2.4 - 19.2	SS-13	5.0	18	1	Yes	ASL
Barium	30 / 30		42.9 - 138	B-08	82	330	0	No	BSL
Beryllium	28 / 30	0.4 : 0.54	0.053 - 0.53	SB-01	0.25	21	0	No	BSL
Cadmium	28 / 28		0.047 - 0.85	SS-14	0.32	0.36	11	Yes	ASL
Calcium [d]	30 / 30		983 - 6,900	AI4-101	2,626	EN	-	No	EN
Chromium	30 / 30		12.7 - 33	B-05	19.6	26	3	Yes	ASL
Cobalt	30 / 30		3.3 - 12	B-05	6.4	13	0	No	BSL
Copper	30 / 30		14.5 - 50.9	SS-03	27	28	14	Yes	ASL
Elemental Mercury	0 / 8	0.0002 : 0.0004			0.00016	0.1	0	No	ND
Iron	30 / 30		10,700 - 30,800	B-05	16,437	200	30	Yes	ASL
Lead	30 / 30		14 - 305	B-08	153	11	30	Yes	ASL
Magnesium [d]	30 / 30		1460 - 5,670	B-05	2,762	EN	-	No	EN
Manganese	30 / 30		207 - 566	B-07	373	220	29	Yes	ASL
Mercury	35 / 36	0.06 : 0.06	0.021 - 0.79	B-07	0.24	0.1	26	Yes	ASL
Methyl mercury	8 / 8		0.00031 - 0.000708	AI4-105	0.00047	0.00158	0	No	BSL
Nickel	30 / 30		11.4 - 24	B-05	16.6	38	0	No	BSL
Potassium [d]	30 / 30		724 - 3,330	B-05	1,178	EN	-	No	EN
Selenium	25 / 27	0.65 : 0.81	0.19 - 0.82	SS-16	0.53	0.52	13	Yes	ASL
Silver	0 / 27	0.093 : 0.45			0.13	4.2	0	No	ND
Sodium [d]	29 / 30	31.4 : 31.4	32 - 404	B-05	147	EN	-	No	EN
Thallium	10 / 29	0.12 : 1.2	0.12 - 0.25	B-05	0.14	1	0	No	BSL
Vanadium	30 / 30		19.2 - 40	B-05	28	7.8	30	Yes	ASL
Zinc	30 / 30		44 - 200	B-08	117	46	29	Yes	ASL

Table 9-6
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 4
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	3 / 3		23,600 - 32,000	SB-02	27,700				

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.

[b] Screening benchmark selection is shown in Table 9-2.

[c] Chemical is identified as a Chemical of Potential Ecological Concern (COPECs) and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

ASL - Above Screening Level
BSL - Below Screening Level
ND - Not Detected
NSL - No Screening Level
EN - Essential Nutrient

[d] Calcium, magnesium, potassium, and sodium are considered essential nutrients, therefore assessment is unnecessary.

[e] Total organic carbon is displayed for reference only.

bgs - below ground surface
mg/kg - milligrams per kilogram
NA - Not available
SVOCs - Semivolatile Organic Compounds

Table 9-7
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Number of Detections Exceeding Benchmark	Retain for Further Evaluation? [c]	Rationale [c]
Metals (mg/kg)									
Aluminum	26 / 26		2,160 - 15,200	AI5-104	6,593	50	26	Yes	ASL
Antimony	12 / 26	0.21 : 0.47	0.2 - 1.9	AI5-106	0.43	0.27	12	Yes	ASL
Arsenic	26 / 26		1.7 - 13.3	AI5-101	3.7	18	0	No	BSL
Barium	26 / 26		15.8 - 156	AI5-104	55	330	0	No	BSL
Beryllium	16 / 26	0.19 : 0.49	0.19 - 0.72	AI5-104	0.31	21	0	No	BSL
Cadmium	16 / 25	0.084 : 0.094	0.037 - 1.7	AI5-107	0.32	0.36	8	Yes	ASL
Calcium [d]	26 / 26		508 - 30,500	AI5-105	6,357	EN	-	No	EN
Chromium	26 / 26		4.9 - 45.2	AI5-104	16.8	26	3	Yes	ASL
Cobalt	26 / 26		2.7 - 35.5	SS-42	7.6	13	2	Yes	ASL
Copper	26 / 26		7.4 - 310	SS-41	52	28	11	Yes	ASL
Elemental Mercury	0 / 4	0.0003 : 0.0004			0.00016	0.1	0	No	ND
Iron	26 / 26		3,870 - 25,200	AI5-104	12,682	200	26	Yes	ASL
Lead	26 / 26		4.1 - 793	SS-42	168	11	23	Yes	ASL
Magnesium [d]	26 / 26		485 - 12,700	AI5-103	2,678	EN	-	No	EN
Manganese	26 / 26		46.6 - 510	AI5-104	208	220	9	Yes	ASL
Mercury	9 / 9		0.178 - 4.8	SS-44	1.7	0.1	9	Yes	ASL
Methyl mercury	2 / 4	0.000059 : 0.000062	0.000169 - 0.000209	AI5-105	0.00011	0.00158	0	No	BSL
Nickel	26 / 26		7 - 36.4	AI5-104	15.8	38	0	No	BSL
Potassium [d]	26 / 26		325 - 5,320	AI5-104	1,042	EN	-	No	EN
Selenium	10 / 25	0.69 : 0.83	0.47 - 1.9	AI5-110	0.56	0.52	8	Yes	ASL
Silver	7 / 25	0.1 : 0.13	0.072 - 2.4	SS-41	0.22	4.2	0	No	BSL
Sodium [d]	26 / 26		45.9 - 567	AI5-101	267	EN	-	No	EN
Thallium	1 / 25	0.12 : 1.2	0.012 - 0.012	SS-42	0.47	1	0	No	BSL
Vanadium	26 / 26		11 - 44.9	AI5-104	23	7.8	26	Yes	ASL
Zinc	26 / 26		19.4 - 339	AI5-108	113	46	16	Yes	ASL

Table 9-7
Selection of COPEC - Surface Soil (0-2 ft bgs) - Area 5
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmark selection is shown in Table 9-2.
[c] Chemical is identified as a Chemical of Potential Ecological Concern (COPECs) and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.
ASL - Above Screening Level
BSL - Below Screening Level
ND - Not Detected
EN - Essential Nutrient
[d] Calcium, magnesium, potassium, and sodium are considered essential nutrients, therefore assessment is unnecessary.
bgs - below ground surface
mg/kg - milligrams per kilogram

Table 9-8
Background Soil Analyte Concentrations - Surface Soil (0-2 ft bgs)
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Average (arithmetic mean) [a]
SVOCs (mg/kg)										
2,4,5-Trichlorophenol	0	/	30	0.0083	:	0.011				0.0048
2,4,6-Trichlorophenol	0	/	30	0.012	:	0.017				0.0070
2,4-Dichlorophenol	0	/	30	0.014	:	0.019				0.0079
2,4-Dimethylphenol	0	/	30	0.009	:	0.012				0.0052
2,4-Dinitrophenol	0	/	30	0.032	:	0.043				0.018
2,4-Dinitrotoluene	0	/	30	0.0068	:	0.0093				0.0039
2,6-Dinitrotoluene	0	/	30	0.0065	:	0.0088				0.0037
2-Chloronaphthalene	0	/	30	0.0018	:	0.0024				0.0010
2-Chlorophenol	0	/	30	0.0094	:	0.013				0.0054
2-Methylnaphthalene	12	/	30	0.0022	:	0.0029	0.0024	-	0.022	0.0043
2-Methylphenol	0	/	30	0.01	:	0.014				0.0060
2-Nitroaniline	0	/	30	0.0058	:	0.0078				0.0033
2-Nitrophenol	0	/	30	0.014	:	0.02				0.0083
3,3`-Dichlorobenzidine	0	/	30	0.0054	:	0.0074				0.0031
3-Nitroaniline	0	/	30	0.0072	:	0.0098				0.0042
4,6-Dinitro-2-methylphenol	0	/	30	0.022	:	0.03				0.013
4-Bromophenyl phenyl ether	0	/	30	0.0032	:	0.0044				0.0019
4-Chloro-3-methylphenol	0	/	30	0.017	:	0.024				0.0099
4-Chloroaniline	0	/	30	0.0036	:	0.0049				0.0021
4-Chlorophenyl phenyl ether	0	/	30	0.0011	:	0.0015				0.00062
4-Methylphenol	1	/	30	0.0054	:	0.0074	0.027	-	0.027	0.0039
4-Nitroaniline	0	/	30	0.0072	:	0.038				0.0047
4-Nitrophenol	0	/	30	0.019	:	0.026				0.011
Acenaphthene	22	/	30	0.0011	:	0.0013	0.0016	-	0.084	0.013
Acenaphthylene	23	/	30	0.00072	:	0.00084	0.0012	-	0.029	0.0067
Acetophenone	5	/	30	0.005	:	0.0069	0.0056	-	0.028	0.0044
Anthracene	26	/	30	0.0011	:	0.0012	0.0015	-	0.19	0.033
Atrazine	0	/	30	0.0022	:	0.0029				0.0012
Benzaldehyde	0	/	30	0.0029	:	0.0039				0.0017
Benzo(a)anthracene	30	/	30				0.0022	-	0.59	0.13
Benzo(a)pyrene	30	/	30				0.0022	-	0.51	0.12
Benzo(b)fluoranthene	30	/	30				0.004	-	0.74	0.18

Table 9-8
Background Soil Analyte Concentrations - Surface Soil (0-2 ft bgs)
Final Remedial Investigation Report
Engineer School, Fort Totten
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Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Average (arithmetic mean) [a]
SVOCs (mg/kg)										
Benzo(ghi)perylene	27	/	30	0.0045	:	0.0048	0.0074	-	0.27	0.068
Benzo(k)fluoranthene	29	/	30	0.002	:	0.002	0.0022	-	0.12	0.046
Biphenyl	7	/	30	0.0014	:	0.002	0.0016	-	0.0051	0.0015
Bis(2-Chloroethoxy)methane	1	/	30	0.0058	:	0.0078	0.011	-	0.011	0.0036
Bis(2-Chloroethyl)ether	0	/	30	0.0025	:	0.0034				0.0015
Bis(2-Chloroisopropyl)ether	0	/	30	0.005	:	0.0069				0.0029
Bis(2-Ethylhexyl)phthalate	30	/	30				0.011	-	0.51	0.077
Butylbenzylphthalate	17	/	30	0.0036	:	0.0047	0.0092	-	0.22	0.022
Caprolactum	1	/	30	0.0043	:	0.0059	0.0074	-	0.0074	0.0026
Carbazole	17	/	30	0.0043	:	0.0057	0.0056	-	0.1	0.017
Chrysene	30	/	30				0.0019	-	0.64	0.12
Dibenz(a,h)anthracene	20	/	30	0.0036	:	0.0047	0.0041	-	0.052	0.014
Dibenzofuran	9	/	30	0.0029	:	0.0039	0.0039	-	0.045	0.0067
Diethylphthalate	8	/	30	0.0029	:	0.0039	0.0037	-	0.0084	0.0027
Dimethylphthalate	0	/	30	0.0025	:	0.0034				0.0015
Di-n-butylphthalate	23	/	30	0.0037	:	0.0043	0.0036	-	0.13	0.012
Di-n-octylphthalate	3	/	30	0.0065	:	0.0088	0.01	-	0.027	0.0050
Fluoranthene	30	/	30				0.0026	-	0.98	0.20
Fluorene	21	/	30	0.00072	:	0.00084	0.0016	-	0.099	0.014
Hexachlorobenzene	1	/	30	0.0068	:	0.0093	0.012	-	0.012	0.0042
Hexachlorobutadiene	0	/	30	0.0022	:	0.0029				0.0012
Hexachlorocyclopentadiene	0	/	30	0.0058	:	0.0078				0.0033
Hexachloroethane	0	/	30	0.0047	:	0.0064				0.0027
Indeno(1,2,3-cd)pyrene	29	/	30	0.0011	:	0.0011	0.002	-	0.17	0.053
Isophorone	0	/	30	0.0043	:	0.0059				0.0025
Naphthalene	19	/	30	0.00072	:	0.00095	0.0012	-	0.029	0.0047
Nitrobenzene	0	/	30	0.0061	:	0.0083				0.0035
N-Nitrosodi-n-propylamine	0	/	30	0.0036	:	0.0049				0.0021
N-Nitrosodiphenylamine	2	/	30	0.0032	:	0.0044	0.01	-	0.016	0.0026
Pentachlorophenol	9	/	30	0.016	:	0.022	0.017	-	0.021	0.012
Phenanthrene	30	/	30				0.0015	-	1	0.18
Phenol	0	/	30	0.009	:	0.012				0.0052
Pyrene	30	/	30				0.0034	-	1.9	0.30

Table 9-8
Background Soil Analyte Concentrations - Surface Soil (0-2 ft bgs)
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Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Average (arithmetic mean) [a]
Metals (mg/kg)										
Aluminum	30	/	30				3,630	-	15,700	10,142
Antimony	20	/	30	0.2	:	0.25	0.2	-	1.5	0.43
Arsenic	30	/	30				2.3	-	11.5	5.4
Barium	30	/	30				33.5	-	203	74
Beryllium	30	/	30				0.19	-	0.77	0.45
Cadmium	29	/	30	0.02	:	0.02	0.086	-	2.5	0.44
Calcium	30	/	30				299	-	20,300	3,511
Chromium	30	/	30				14.5	-	31.8	21
Cobalt	30	/	30				3.9	-	12.2	6.5
Copper	30	/	30				7.8	-	84.9	33
Iron	30	/	30				13,000	-	25,300	17,477
Lead	30	/	30				9.3	-	3,000	223
Magnesium	30	/	30				1,490	-	5,900	2,600
Manganese	30	/	30				156	-	653	342
Mercury	30	/	30				0.0064	-	1.2	0.24
Nickel	30	/	30				13.4	-	83.3	29
Potassium	30	/	30				286	-	2,080	817
Selenium	4	/	30	0.36	:	0.5	0.39	-	0.94	0.26
Silver	5	/	30	0.027	:	0.065	0.032	-	0.4	0.047
Sodium	15	/	30	88.3	:	273	74.4	-	235	95
Thallium	7	/	30	0.44	:	0.61	0.6	-	1.4	0.38
Vanadium	30	/	30				21.4	-	47.5	30
Zinc	30	/	30				24.1	-	692	134

Prepared by: SFR 10/10/2011
Checked by: KJC 10/14/2011

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
bgs - below ground surface
mg/kg - milligrams per kilogram
SVOCs - Semivolatile Organic Compounds

Table 9-9
Comparison of Maximum Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection			Maximum Concentration in Exposure Area [b]	Maximum Concentration in Background [c]	Benchmark [d]	Maximum Hazard Quotients [e]		Maximum Incremental Risk HQ [f]
								Exposure Area	Background	
Area 1	**SVOCs (mg/kg)**									
	Anthracene	16	/	17	0.24	0.19	0.1	**2.4**	**1.9**	B
	Benzo(a)pyrene	18	/	19	0.87	0.51	0.1	**8.7**	**5.1**	**3.6**
	Bis(2-Ethylhexyl)phthalate	17	/	17	1.8	0.51	0.925	**1.9**	0.55	**1.4**
	Carbazole	9	/	14	0.14	0.1	NA	NC	NC	NC
	Dibenzofuran	6	/	14	0.049	0.045	NA	NC	NC	NC
	Fluoranthene	18	/	19	1.2	0.98	0.1	**12**	**10**	**2.2**
	Naphthalene	15	/	18	0.16	0.029	0.0994	**1.6**	0.29	**1.3**
	Phenanthrene	18	/	19	1	1	0.1	**10**	**10**	B
	Pyrene	18	/	19	1.5	1.9	0.1	**15**	**19**	B
	Metals (mg/kg)									
	Aluminum	17	/	17	17,500	15,700	50	**350**	**314**	**36**
	Antimony	17	/	17	8.9	1.5	0.27	**33**	**5.6**	**27**
	Barium	17	/	17	449	203	330	**1.4**	0.62	B
	Cadmium	16	/	16	2.4	2.5	0.36	**6.7**	**6.9**	B
	Chromium	17	/	17	32	31.8	26	**1.2**	**1.2**	B
	Copper	17	/	17	346	84.9	28	**12**	**3.0**	**9.3**
	Iron	17	/	17	34,300	25,300	200	**172**	**127**	**45**
	Lead	17	/	17	1,540	3,000	11	**140**	**273**	B
	Manganese	17	/	17	536	653	220	**2.4**	**3.0**	B
	Mercury	17	/	17	2.4	1.2	0.1	**24**	**12**	**12**
	Selenium	14	/	14	1.1	0.94	0.52	**2.1**	**1.8**	B
	Vanadium	17	/	17	33	47.5	7.8	**4.2**	**6.1**	B
	Zinc	17	/	17	564	692	46	**12**	**15**	B

Table 9-9
Comparison of Maximum Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection			Maximum Concentration in Exposure Area [b]	Maximum Concentration in Background [c]	Benchmark [d]	Maximum Hazard Quotients [e]		Maximum Incremental Risk HQ [f]
								Exposure Area	Background	
Area 2	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	17	/	24	0.024	NA	NA	NC	NC	NC
	Anthracene	30	/	39	0.24	0.19	0.1	**2.4**	**1.9**	B
	Benzo(a)pyrene	39	/	40	1.6	0.51	0.1	**16**	**5.1**	**11**
	Bis(2-Ethylhexyl)phthalate	16	/	16	17	0.51	0.925	**18**	0.55	**18**
	Butylbenzylphthalate	11	/	15	0.3	0.22	0.239	**1.3**	0.92	B
	Fluoranthene	39	/	40	2	0.98	0.1	**20**	**9.8**	**10**
	Naphthalene	23	/	39	0.19	0.029	0.0994	**1.9**	0.29	**1.6**
	Phenanthrene	39	/	40	1	1	0.1	**10**	**10**	B
	Pyrene	40	/	40	2.9	1.9	0.1	**29**	**19**	**10**
	Pesticides (mg/kg)									
	4,4`-DDD	2	/	2	0.071	NA	0.0025	**28**	NC	NC
	4,4`-DDE	2	/	2	0.044	NA	0.0025	**18**	NC	NC
	4,4`-DDT	8	/	8	1	NA	0.021	**48**	NC	NC
	Endrin ketone	2	/	2	0.032	NA	NA	NC	NC	NC
	Gamma-BHC	2	/	2	0.0052	NA	0.00005	**104**	NC	NC
	Gamma-Chlordane	1	/	2	0.0087	NA	NA	NC	NC	NC
	Metals (mg/kg)									
	Aluminum	40	/	40	14,400	15,700	50	**288**	**314**	B
	Antimony	32	/	39	5.7	1.5	0.27	**21**	**5.6**	**16**
	Cadmium	37	/	39	1.9	2.5	0.36	**5.3**	**6.9**	B
	Chromium	40	/	40	29.4	31.8	26	**1.1**	**1.2**	B
	Copper	40	/	40	11,500	84.9	28	**411**	**3.0**	**408**
	Iron	40	/	40	19,400	25,300	200	**97**	**127**	B
	Lead	40	/	40	494	3,000	11	**45**	**273**	B
	Manganese	40	/	40	617	653	220	**2.8**	**3.0**	B
	Mercury	36	/	36	2.7	1.2	0.1	**27**	**12**	**15**
	Methyl mercury	7	/	8	0.011	NA	0.00158	**7.0**	NC	NC
	Selenium	27	/	40	1.5	0.94	0.52	**2.9**	**1.8**	**1.1**
	Vanadium	40	/	40	61.7	47.5	7.8	**7.9**	**6.1**	**1.8**
	Zinc	40	/	40	301	692	46	**6.5**	**15**	B

Table 9-9
Comparison of Maximum Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection			Maximum Concentration in Exposure Area [b]	Maximum Concentration in Background [c]	Benchmark [d]	Maximum Hazard Quotients [e]		Maximum Incremental Risk HQ [f]
								Exposure Area	Background	
Area 3	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	22	/	24	0.18	NA	NA	NC	NC	NC
	Anthracene	41	/	44	0.67	0.19	0.1	**6.7**	**1.9**	**4.8**
	Benzo(a)pyrene	44	/	46	1.8	0.51	0.1	**18**	**5.1**	**13**
	Carbazole	11	/	20	0.17	0.1	NA	NC	NC	NC
	Dibenzofuran	3	/	20	0.16	0.045	NA	NC	NC	NC
	Fluoranthene	45	/	46	3.3	0.98	0.1	**33**	**9.8**	**23**
	Naphthalene	33	/	44	0.21	0.029	0.0994	**2.1**	0.29	**1.8**
	Phenanthrene	44	/	46	1.9	1	0.1	**19**	**10**	**9.0**
	Pyrene	45	/	46	3.1	1.9	0.1	**31**	**19**	**12**
	Metals (mg/kg)									
	Aluminum	46	/	46	38,200	15,700	50	**764**	**314**	**450**
	Antimony	37	/	46	2.1	1.5	0.27	**7.8**	**5.6**	**2.2**
	Arsenic	46	/	46	132	11.5	18	**7.3**	0.64	**6.7**
	Barium	46	/	46	390	203	330	**1.2**	0.62	B
	Cadmium	42	/	46	8.6	2.5	0.36	**24**	**6.9**	**17**
	Chromium	46	/	46	136	31.8	26	**5.2**	**1.2**	**4.0**
	Cobalt	46	/	46	23.7	12.2	13	**1.8**	0.94	B
	Copper	46	/	46	2,470	84.9	28	**88**	**3.0**	**85**
	Iron	46	/	46	62,600	25,300	200	**313**	**127**	**187**
	Lead	46	/	46	2,140	3,000	11	**195**	**273**	B
	Manganese	46	/	46	1,140	653	220	**5.2**	**3.0**	**2.2**
	Mercury	29	/	30	5	1.2	0.1	**50**	**12**	**38**
	Methyl mercury	8	/	8	0.00226	NA	0.00158	**1.4**	NC	NC
	Nickel	46	/	46	78.5	83.3	38	**2.1**	**2.2**	B
	Selenium	34	/	45	3.2	0.94	0.52	**6.2**	**1.8**	**4.3**
	Vanadium	46	/	46	154	47.5	7.8	**20**	**6.1**	**14**
	Zinc	46	/	46	1,370	692	46	**30**	**15**	**15**

Table 9-9
Comparison of Maximum Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection			Maximum Concentration in Exposure Area [b]	Maximum Concentration in Background [c]	Benchmark [d]	Maximum Hazard Quotients [e]		Maximum Incremental Risk HQ [f]
								Exposure Area	Background	
Area 4	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	27	/	28	0.459	NA	NA	NC	NC	NC
	Anthracene	42	/	47	4	0.19	0.1	**40**	**1.9**	**38**
	Benzo(a)anthracene	49	/	49	7.3	0.59	5.21	**1.4**	0.11	**1.3**
	Benzo(a)pyrene	49	/	49	9.8	0.51	0.1	**98**	**5.1**	**93**
	Carbazole	11	/	19	160	0.1	NA	NC	NC	NC
	Chrysene	50	/	50	8.2	0.64	4.73	**1.7**	0.14	**1.6**
	Dibenzofuran	8	/	19	0.11	0.045	NA	NC	NC	NC
	Fluoranthene	50	/	50	16	0.98	0.1	**160**	**9.8**	**150**
	Naphthalene	40	/	47	1.9	0.029	0.0994	**19**	0.29	**19**
	Phenanthrene	50	/	50	12	1	0.1	**120**	**10**	**110**
	Pyrene	50	/	50	14	1.9	0.1	**140**	**19**	**121**
	Metals (mg/kg)									
	Aluminum	30	/	30	21,300	15,700	50	**426**	**314**	**112**
	Antimony	28	/	30	1.1	1.5	0.27	**4.1**	**5.6**	B
	Arsenic	30	/	30	19.2	11.5	18	**1.1**	0.64	B
	Cadmium	28	/	28	0.85	2.5	0.36	**2.4**	**6.9**	B
	Chromium	30	/	30	33	31.8	26	**1.3**	**1.2**	B
	Copper	30	/	30	50.9	84.9	28	**1.8**	**3.0**	B
	Iron	30	/	30	30,800	25,300	200	**154**	**127**	**28**
	Lead	30	/	30	305	3,000	11	**28**	**273**	B
	Manganese	30	/	30	566	653	220	**2.6**	**3.0**	B
	Mercury	35	/	36	0.79	1.2	0.1	**7.9**	**12**	B
	Selenium	25	/	27	0.82	0.94	0.52	**1.6**	**1.8**	B
	Vanadium	30	/	30	40	47.5	7.8	**5.1**	**6.1**	B
	Zinc	30	/	30	200	692	46	**4.3**	**15**	B

Table 9-9
Comparison of Maximum Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection	Maximum Concentration in Exposure Area [b]	Maximum Concentration in Background [c]	Benchmark [d]	Maximum Hazard Quotients [e]		Maximum Incremental Risk HQ [f]
						Exposure Area	Background	
Area 5	**Metals (mg/kg)**							
	Aluminum	26 / 26	15,200	15,700	50	**304**	**314**	B
	Antimony	12 / 26	2	1.5	0.27	**7.0**	**5.6**	**1.5**
	Cadmium	16 / 25	2	2.5	0.36	**4.7**	**6.9**	B
	Chromium	26 / 26	45	31.8	26	**1.7**	**1.2**	B
	Cobalt	26 / 26	36	12.2	13	**2.7**	0.94	**1.8**
	Copper	26 / 26	310	84.9	28	**11**	**3.0**	**8.0**
	Iron	26 / 26	25,200	25,300	200	**126**	**127**	B
	Lead	26 / 26	793	3,000	11	**72**	**273**	B
	Manganese	26 / 26	510	653	220	**2.3**	**3.0**	B
	Mercury	9 / 9	4.8	1.2	0.1	**48**	**12**	**36**
	Selenium	10 / 25	2	0.94	0.52	**3.7**	**1.8**	**1.8**
	Vanadium	26 / 26	45	47.5	7.8	**5.8**	**6.1**	B
	Zinc	26 / 26	339	692	46	**7.4**	**15**	B

Prepared by: SFR 10/11/2011
Checked by: KJC 10/14/2011

Notes:

[a] Chemicals of Potential Ecological Concern (COPEC) are identified in Tables 9-3 through 9-7.
[b] Maximum concentrations in exposure areas are presented in Tables 9-3 through 9-7.
[c] Maximum concentrations in background are presented in Table 9-8.
[d] Benchmarks are soil screening benchmarks presented in Table 9-2.
[e] Hazard quotients are calculated by dividing maximum concentrations by selected benchmarks.
[f] The incremental risk is calculated by subtracting the background hazard quotient from the exposure area hazard quotient.
B - Incremental Risk is ≤1 and therefore incremental risk above background is negligible
bgs - below ground surface
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
NA - Not available
NC - Not calculated; no benchmark available and/or no background concentration available.
Bolded values indicate HQs > 1

Table 9-10
Comparison of Average Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection	Average Concentration in Exposure Area [b]	Average Concentration in Background [c]	Benchmark [d]	Average Hazard Quotients [e] Exposure Area	Average Hazard Quotients [e] Background	Average Incremental Risk HQ [f]
Area 1	**SVOCs (mg/kg)**							
	Anthracene	16 / 17	0.12	0.033	0.1	**1.2**	0.33	B
	Benzo(a)pyrene	18 / 19	0.42	0.12	0.1	**4.2**	**1.2**	**3.0**
	Bis(2-Ethylhexyl)phthalate	17 / 17	0.26	0.077	0.925	0.28	0.08	B
	Carbazole	9 / 14	0.093	0.017	NA	NC	NC	NC
	Dibenzofuran	6 / 14	0.10	0.0067	NA	NC	NC	NC
	Fluoranthene	18 / 19	0.65	0.20	0.1	**6.5**	**2.0**	**4.5**
	Naphthalene	15 / 18	0.086	0.0047	0.0994	0.87	0.05	B
	Phenanthrene	18 / 19	0.42	0.18	0.1	**4.2**	**1.8**	**2.5**
	Pyrene	18 / 19	0.73	0.30	0.1	**7.3**	**3.0**	**4.3**
	Metals (mg/kg)							
	Aluminum	17 / 17	7,089	10,142	50	**142**	**203**	B
	Antimony	17 / 17	2.1	0.43	0.27	**7.6**	**1.6**	**6.0**
	Barium	17 / 17	206	74	330	0.62	0.22	B
	Cadmium	16 / 16	1.0	0.44	0.36	**2.9**	**1.2**	**1.7**
	Chromium	17 / 17	22	21	26	0.84	0.81	B
	Copper	17 / 17	114	33	28	**4.1**	**1.2**	**2.9**
	Iron	17 / 17	22,882	17,477	200	**114**	**87**	**27**
	Lead	17 / 17	574	223	11	**52**	**20**	**32**
	Manganese	17 / 17	296	342	220	**1.3**	**1.6**	B
	Mercury	17 / 17	0.89	0.24	0.1	**8.9**	**2.4**	**6.5**
	Selenium	14 / 14	0.57	0.26	0.52	**1.1**	0.50	B
	Vanadium	17 / 17	24	30	7.8	**3.1**	**3.9**	B
	Zinc	17 / 17	349	134	46	**7.6**	**2.9**	**4.7**

Table 9-10

Comparison of Average Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
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Exposure Area	COPEC [a]	Frequency of Detection			Average Concentration in Exposure Area [b]	Average Concentration in Background [c]	Benchmark [d]	Average Hazard Quotients [e]		Average Incremental Risk HQ [f]
								Exposure Area	Background	
Area 2	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	17	/	24	0.0069	NA	NA	NC	NC	NC
	Anthracene	30	/	39	0.073	0.033	0.1	0.73	0.33	B
	Benzo(a)pyrene	39	/	40	0.24	0.12	0.1	**2.4**	**1.2**	**1.2**
	Bis(2-Ethylhexyl)phthalate	16	/	16	1.8	0.077	0.925	**2.0**	0.08	**1.9**
	Butylbenzylphthalate	11	/	15	0.10	0.022	0.239	0.44	0.09	B
	Fluoranthene	39	/	40	0.36	0.20	0.1	**3.6**	**2.0**	**1.6**
	Naphthalene	23	/	39	0.060	0.0047	0.0994	0.61	0.05	B
	Phenanthrene	39	/	40	0.17	0.18	0.1	**1.7**	**1.8**	B
	Pyrene	40	/	40	0.38	0.30	0.1	**3.8**	**3.0**	B
	Pesticides (mg/kg)									
	4,4`-DDD	2	/	2	0.046	NA	0.0025	**18**	NC	NC
	4,4`-DDE	2	/	2	0.033	NA	0.0025	**13**	NC	NC
	4,4`-DDT	8	/	8	0.64	NA	0.021	**31**	NC	NC
	Endrin ketone	2	/	2	0.023	NA	NA	NC	NC	NC
	Gamma-BHC	2	/	2	0.0042	NA	0.00005	**84**	NC	NC
	Gamma-Chlordane	1	/	2	0.0049	NA	NA	NC	NC	NC
	Metals (mg/kg)									
	Aluminum	40	/	40	7,814	10,142	50	**156**	**203**	B
	Antimony	32	/	39	0.76	0.43	0.27	**2.8**	**1.6**	**1.2**
	Cadmium	37	/	39	0.43	0.44	0.36	**1.2**	**1.2**	B
	Chromium	40	/	40	18.0	21	26	0.69	0.81	B
	Copper	40	/	40	326	33	28	**12**	**1.2**	**10**
	Iron	40	/	40	14,380	17,477	200	**72**	**87**	B
	Lead	40	/	40	216	223	11	**20**	**20**	B
	Manganese	40	/	40	345	342	220	**1.6**	**1.6**	B
	Mercury	36	/	36	0.00019	0.24	0.1	0.00	**2.4**	B
	Methyl mercury	7	/	8	0.0031	NA	0.00158	**2.0**	NC	NC
	Selenium	27	/	40	0.54	0.26	0.52	1.0	0.50	B
	Vanadium	40	/	40	27	30	7.8	**3.5**	**3.9**	B
	Zinc	40	/	40	139	134	46	**3.0**	**2.9**	B

Table 9-10

Comparison of Average Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area	COPEC [a]	Frequency of Detection			Average Concentration in Exposure Area [b]	Average Concentration in Background [c]	Benchmark [d]	Average Hazard Quotients [e]		Average Incremental Risk HQ [f]
								Exposure Area	Background	
Area 3	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	22	/	24	0.018	NA	NA	NC	NC	NC
	Anthracene	41	/	44	0.087	0.033	0.1	0.87	0.33	B
	Benzo(a)pyrene	44	/	46	0.33	0.12	0.1	**3.3**	**1.2**	**2.2**
	Carbazole	11	/	20	0.10	0.017	NA	NC	NC	NC
	Dibenzofuran	3	/	20	0.12	0.0067	NA	NC	NC	NC
	Fluoranthene	45	/	46	0.60	0.20	0.1	**6.0**	**2.0**	**4.0**
	Naphthalene	33	/	44	0.039	0.0047	0.0994	0.39	0.05	B
	Phenanthrene	44	/	46	0.33	0.18	0.1	**3.3**	**1.8**	**1.5**
	Pyrene	45	/	46	0.55	0.30	0.1	**5.5**	**3.0**	**2.5**
	Metals (mg/kg)									
	Aluminum	46	/	46	10,611	10,142	50	**212**	**203**	**9.4**
	Antimony	37	/	46	0.42	0.43	0.27	**1.5**	**1.6**	B
	Arsenic	46	/	46	11.0	5.4	18	0.61	0.30	B
	Barium	46	/	46	59	74	330	0.18	0.22	B
	Cadmium	42	/	46	0.41	0.44	0.36	**1.1**	**1.2**	B
	Chromium	46	/	46	23	21	26	0.89	0.81	B
	Cobalt	46	/	46	5.9	6.5	13	0.45	0.50	B
	Copper	46	/	46	91	33.26	28	**3.3**	**1.2**	**2.1**
	Iron	46	/	46	16,389	17,477	200	**82**	**87**	B
	Lead	46	/	46	174	223	11	**16**	**20**	B
	Manganese	46	/	46	278	342	220	**1.3**	**1.6**	B
	Mercury	29	/	30	0.89	0.24	0.1	**8.9**	**2.4**	**6.5**
	Methyl mercury	8	/	8	0.00096	NA	0.00158	0.61	NC	NC
	Nickel	46	/	46	17.4	29	38	0.46	0.77	B
	Selenium	34	/	45	0.61	0.26	0.52	**1.2**	0.50	B
	Vanadium	46	/	46	33	30	7.8	**4.2**	**3.9**	B
	Zinc	46	/	46	122	134	46	**2.6**	**2.9**	B

Table 9-10
Comparison of Average Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
Final Remedial Investigation Report
Engineer School, Fort Totten
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Exposure Area	COPEC [a]	Frequency of Detection			Average Concentration in Exposure Area [b]	Average Concentration in Background [c]	Benchmark [d]	Average Hazard Quotients [e]		Average Incremental Risk HQ [f]
								Exposure Area	Background	
Area 4	**SVOCs (mg/kg)**									
	1-Methylnaphthalene	27	/	28	0.029	NA	NA	NC	NC	NC
	Anthracene	42	/	47	0.21	0.033	0.1	**2.1**	0.33	**1.8**
	Benzo(a)anthracene	49	/	49	0.82	0.13	5.21	0.16	0.03	B
	Benzo(a)pyrene	49	/	49	1.0	0.12	0.1	**10**	**1.2**	**9.2**
	Carbazole	11	/	19	17.7	0.017	NA	NC	NC	NC
	Chrysene	50	/	50	0.88	0.12	4.73	0.19	0.02	B
	Dibenzofuran	8	/	19	0.086	0.0067	NA	NC	NC	NC
	Fluoranthene	50	/	50	1.4	0.20	0.1	**14**	**2.0**	**12**
	Naphthalene	40	/	47	0.095	0.0047	0.0994	1.0	0.05	B
	Phenanthrene	50	/	50	0.60	0.18	0.1	**6.0**	**1.8**	**4.2**
	Pyrene	50	/	50	1.5	0.30	0.1	**15**	**3.0**	**12**
	Metals (mg/kg)									
	Aluminum	30	/	30	9,389	10,142	50	**188**	**203**	B
	Antimony	28	/	30	0.46	0.43	0.27	**1.7**	**1.6**	B
	Arsenic	30	/	30	5.0	5.4	18	0.28	0.30	B
	Cadmium	28	/	28	0.32	0.44	0.36	0.89	**1.2**	B
	Chromium	30	/	30	19.6	21	26	0.75	0.81	B
	Copper	30	/	30	27	33	28	0.98	**1.2**	B
	Iron	30	/	30	16,437	17,477	200	**82**	**87**	B
	Lead	30	/	30	153	223	11	**14**	**20**	B
	Manganese	30	/	30	373	342	220	**1.7**	**1.6**	B
	Mercury	35	/	36	0.00016	0.24	0.1	0.00	**2.4**	B
	Selenium	25	/	27	0.53	0.26	0.52	1.0	0.50	B
	Vanadium	30	/	30	28	30	7.8	**3.6**	**3.9**	B
	Zinc	30	/	30	117	134	46	**2.5**	**2.9**	B

Table 9-10

Comparison of Average Site Surface Soil (0-2ft bgs)
Concentrations to Screening Benchmarks and Background Soil Concentrations
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Exposure Area	COPEC [a]	Frequency of Detection	Average Concentration in Exposure Area [b]	Average Concentration in Background [c]	Benchmark [d]	Average Hazard Quotients [e]		Average Incremental Risk HQ [f]
						Exposure Area	Background	
Area 5	**Metals (mg/kg)**							
	Aluminum	26 / 26	6,593	10,142	50	**132**	**203**	B
	Antimony	12 / 26	0.43	0.43	0.27	**1.6**	**1.6**	B
	Cadmium	16 / 25	0.32	0.44	0.36	0.88	**1.2**	B
	Chromium	26 / 26	16.8	21	26	0.65	0.81	B
	Cobalt	26 / 26	7.6	6.5	13	0.58	0.50	B
	Copper	26 / 26	52	33	28	**1.9**	**1.2**	B
	Iron	26 / 26	12,682	17,477	200	**63**	**87**	B
	Lead	26 / 26	168	223	11	**15**	**20**	B
	Manganese	26 / 26	208	342	220	0.95	**1.6**	B
	Mercury	9 / 9	1.7	0.24	0.1	**17**	**2.4**	**15**
	Selenium	10 / 25	0.56	0.26	0.52	**1.1**	0.50	B
	Vanadium	26 / 26	23	30	7.8	**2.9**	**3.9**	B
	Zinc	26 / 26	113	134	46	**2.4**	**2.9**	B

Prepared by: SFR 10/11/2011
Checked by: KJC 10/14/2011

Notes:

[a] Chemicals of Potential Ecological Concern (COPEC) are identified in Tables 9-3 through 9-7.
[b] Average concentrations in exposure areas are presented in Tables 9-3 through 9-7.
[c] Average concentrations in background are presented in Table 9-8.
[d] Benchmarks are soil screening benchmarks presented in Table 9-2.
[e] Hazard quotients are calculated by dividing average concentrations by selected benchmarks.
[f] The incremental risk is calculated by subtracting the background hazard quotient from the exposure area hazard quotient.
B - Incremental Risk is ≤1 and therefore incremental risk above background is negligible
bgs - below ground surface
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
NA - Not available
NC - Not calculated; no benchmark available and/or no background concentration available.
Bolded values indicate HQs > 1

SECTION 10

Table 10-1
Summary of Conclusions and Recommendations by Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

Area	Risk Assessment Conclusions	Nature and Extent Conclusions	Recommendation
1	• Current and future land use receptors: cancer risks and non-cancer HI within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI value of 1. • Modeled blood lead levels exceed allowable USEPA level of 10 µg/dL for the Future Child Resident. Adult blood levels are below 10 µg/dL.	• They Army placed soil that originated from elsewhere at Ft. Totten in a low area within Area 1 to eliminate periods of standing water. The soil was excavated from the vicinity of Buildings 118, 119, and 121 (former vehicle maintenance shops) and included a portion of those buildings' parking lots. • PAH concentrations are generally consistent with background. • Lead concentrations consistently exceed background in the southeastern and southwestern portions of the area. • Other metals concentrations are generally consistent with or below background.	Proceed with Feasibility Study (FS) to address exposure to future resident from lead in soil.
2	• Current and future land use receptors: cancer risks and non-cancer HI within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI value of 1. • Modeled blood lead levels are below allowable USEPA level of 10 µg/dL for the Future Child and Adult Resident.	• PAH and metals concentrations are generally consistent with background.	FS not required. Proceed with a No Action Proposed Plan based on acceptable risk for unrestricted use.
3	• Current and future land use receptors: cancer risks are below the acceptable range (10^{-6} to 10^{-4}). • Future resident: HI for surface soil exceeds 1. HI is driven by an anomalous arsenic concentration likely related to a pressure-treated deck and is not representative of overall Area 3 concentrations. When this data point is removed from the risk calculations, the HI falls below 1. • Modeled blood lead levels are below allowable USEPA level of 10 µg/dL for the Future Child and Adult Resident. • A qualitative risk evaluation of 2012 soil sampling results confirms the conclusion of the 2011 BHHRA; mercury in surface and subsurface soil within Area 3 is not a human health concern for all receptors evaluated.	• PAH concentrations are generally consistent with background. • Most of the metals concentrations are generally consistent with or below background. • Elevated mercury detections in historic samples were not reproduced during the November 2012 sampling.	FS not required. Proceed with a No Action Proposed Plan based on removing the anomalous arsenic data point, resulting in acceptable risk for unrestricted use.

Table 10-1
Summary of Conclusions and Recommendations by Area
Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, New York

4	• Current land use receptors: cancer risks and non-cancer HI within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI value of 1. • Future resident: cancer risk above acceptable range (3×10^{-4} for surface soil and 2×10^{-4} subsurface soil). Cancer risk driven by PAHs, especially benzo(a)pyrene. • Incremental (above background) cancer risk for future resident is 2×10^{-4} and 1×10^{-4} for surface soil and subsurface soil, respectively. • Modeled blood lead levels below allowable USEPA level of 10 µg/dL for the Future Child and Adult Resident.	• The sporadic distribution of PAHs, and the presence of coal, coal ash, and asphalt observed at locations with elevated PAHs, indicates that the elevated PAH concentrations are attributable to urban fill.	FS not required. Risk from PAHs is attributable to urban fill. Proceed with a No Action Proposed Plan.
5	• Current and future land use receptors: cancer risks and non-cancer HI within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer screening HI and/or the target organ-based segregated HI value of 1. • Modeled blood lead levels below allowable USEPA level of 10 µg/dL for the Future Child and Adult Resident.	• The majority of the mercury-contaminated soil was excavated and disposed of during a series of removal actions conducted in 2006 and 2007. Underground structures (utilities and cesspools) prevented a complete removal at that time. These structures still exist today and will limit or prevent access to the remaining impacted soils. • May 2011 soil borings and sampling indicate that elevated mercury is limited to the immediate vicinity of the former excavations.	FS not required. Proceed with a No Action Proposed Plan based on acceptable risk for unrestricted use.
Site-Wide Groundwater	• Cancer risks and non-cancer hazard indices (HIs) for the hypothetical Future Construction Worker dermal contact exposure with site-wide shallow groundwater (the most likely scenario under which human contact with groundwater would occur) are within or below the acceptable risk range (10^{-6} to 10^{-4}) and below the threshold non-cancer HI value of 1. • The cancer risk estimate for the Future Resident (potable groundwater use (4×10^{-3})) is above the acceptable risk range. The risk driver is dibenz(a,h)anthracene. The non-cancer HI estimates for the Future Resident (potable groundwater use) are below 1. • A qualitative risk evaluation of 2012 groundwater sampling results indicates risk from exposure to groundwater is not of concern.	• Municipal water is available at the Site, no current or foreseeable use of groundwater has been identified, and potential salt water intrusion would preclude future use of the groundwater for potable or non-potable purposes. • Groundwater samples were collected in November 2012 from MW-4R and MW-5. Dibenz(a,h)anthracene (the previous risk driver for groundwater) was not detected and the concentrations of the two detected compounds (detected in only one unfiltered sample) were well below the corresponding USEPA Tapwater RSLs.	FS not required. Proceed with a No Action Proposed Plan because 2012 qualitative risk evaluation indicates no risk and there is no current or potential future exposure.

Figures

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 1-1 Site Locus Map rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 01/03/2013 DRAWN BY: MRF CHK'D BY: KT APP'D BY: LJP	NOTES AND SOURCES:	SITE LOCUS MAP Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 1-1 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 1-2 Site Plan rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KT APP'D BY: LJP	NOTES AND SOURCES:	SITE PLAN Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 1-2 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

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Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, NY

NOTES AND SOURCES:

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 01/03/2013

DRAWN BY: MRF

CHK'D BY: KT

APP'D BY: LJP

BACKGROUND SAMPLING LOCATIONS

FIGURE 1-3

J:\01 Projects\10404 - Balt HTRW\03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 1-3 Background Sampling Locations rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KAT APP'D BY: LJP	NOTES AND SOURCES: 1. November 2012 soil sample locations are shown on Figure 4-4.	Pre SRI2 and SRI2 Sample Locations Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 2-1 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 2-1 Pre-SRI2 and SRI2 Sample Locations rev1.mxd

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-1 Monitoring Well Locations rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KAT APP'D BY: LJP	NOTES AND SOURCES:	MONITORING WELL LOCATIONS Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 4-1 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-2 May 2011 Soil Sample Locations - Area 2 rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KT APP'D BY: LJP	NOTES AND SOURCES:	MAY 2011 SOIL SAMPLING LOCATIONS AREA 2 Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 4-2 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

PROJECT NO: 10404-03	
PREPARED FOR: USACE	
DATE: 03/31/2014	
DRAWN BY: MRF	
CHK'D BY: KT	
APP'D BY: LJP	

NOTES AND SOURCES:

MAY 2011 SOIL SAMPLING LOCATIONS AREA 3

Final Remedial Investigation Report
Engineer School, Fort Totten
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FIGURE 4-3

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J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-3 May 2011 Soil Sample Locations - Area 3 rev1.mxd

PROJECT NO: 10404-03	NOTES AND SOURCES:	NOVEMBER 2012 SOIL SAMPLING LOCATIONS AREA 3	FIGURE 4-4
PREPARED FOR: USACE			
DATE: 03/31/2014		Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988
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CHK'D BY: KAT			
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J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-4 Nov 2012 Soil Sample Locations - Area 3 rev1.mxd

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-5 May 2011 Soil Sample Locations - Area 4 rev1.mxd

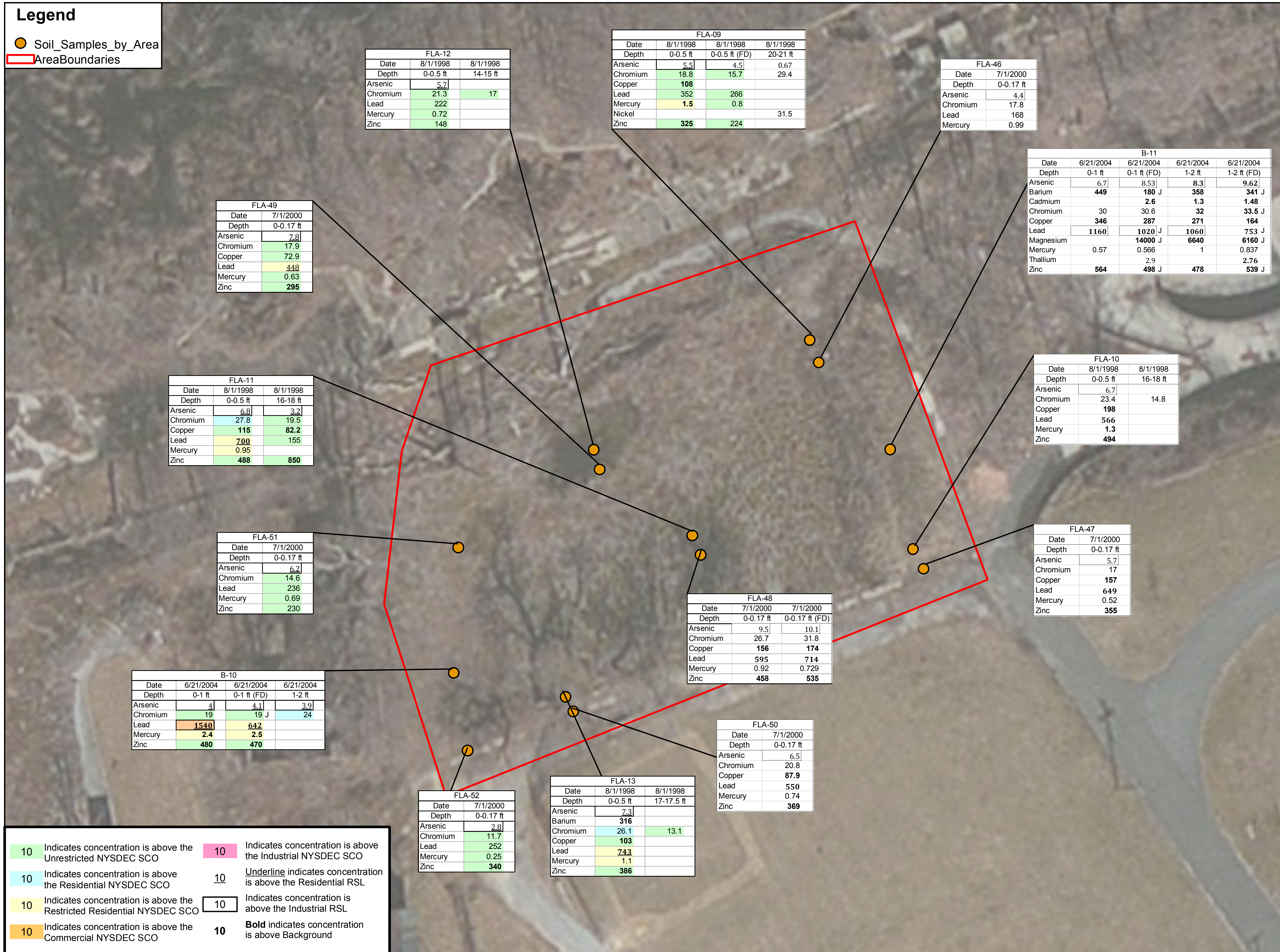
PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KT APP'D BY: LJP	NOTES AND SOURCES:	MAY 2011 SOIL SAMPLING LOCATIONS AREA 4 Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 4-5 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988

PROJECT NO: 10404-03	NOTES AND SOURCES:	MAY 2011 SOIL SAMPLING LOCATIONS AREA 5	FIGURE 4-6
PREPARED FOR: USACE		Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988
DATE: 01/03/2013			
DRAWN BY: MRF			
CHK'D BY: KT			
APP'D BY: LJP			

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 4-6 May 2011 Soil Sample Locations - Area 5 rev1.mxd

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 5-1 Groundwater Contour Map - May 9, 2011 rev1.mxd

PROJECT NO: 10404-03 PREPARED FOR: USACE DATE: 03/31/2014 DRAWN BY: MRF CHK'D BY: KT APP'D BY: LJP	NOTES AND SOURCES:	GROUNDWATER CONTOUR MAP MAY 9, 2011 Final Remedial Investigation Report Engineer School, Fort Totten Queens, NY	FIGURE 5-1 Watermark 175 Cabot Street • Lowell • MA • 01854 Ph. 978-452-9696 Fax 978-453-9988



FLA-12		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	14-15 ft
Arsenic	5.7	
Chromium	21.3	17
Lead	222	
Mercury	0.72	
Zinc	148	

FLA-09			
Date	8/1/1998	8/1/1998	8/1/1998
Depth	0-0.5 ft	0-0.5 ft (FD)	20-21 ft
Arsenic	5.5	4.5	0.67
Chromium	18.8	15.7	29.4
Copper	**108**		
Lead	352	266	
Mercury	**1.5**	0.8	
Nickel			31.5
Zinc	**325**	224	

FLA-46	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.4
Chromium	17.8
Lead	168
Mercury	0.99

B-11				
Date	6/21/2004	6/21/2004	6/21/2004	6/21/2004
Depth	0-1 ft	0-1 ft (FD)	1-2 ft	1-2 ft (FD)
Arsenic	6.7	8.53	**8.3**	**9.62**
Barium	**449**	**180** J	**358**	**341** J
Cadmium		**2.6**	**1.3**	**1.48**
Chromium	30	30.6	**32**	**33.5** J
Copper	**346**	**287**	**271**	**164**
Lead	**1160**	**1020** J	**1060**	**753** J
Magnesium		**14000** J	**6640**	**6160** J
Mercury	0.57	0.566	1	0.837
Thallium		2.9		**2.76**
Zinc	**564**	**498** J	**478**	**539** J

FLA-49	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	7.8
Chromium	17.9
Copper	72.9
Lead	448
Mercury	0.63
Zinc	**295**

FLA-11		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	16-18 ft
Arsenic	6.8	3.2
Chromium	27.8	19.5
Copper	**115**	**82.2**
Lead	**700**	155
Mercury	0.95	
Zinc	**488**	**850**

FLA-10		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	16-18 ft
Arsenic	6.7	
Chromium	23.4	14.8
Copper	**198**	
Lead	**566**	
Mercury	**1.3**	
Zinc	**494**	

FLA-51	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	6.2
Chromium	14.6
Lead	236
Mercury	0.69
Zinc	230

FLA-47	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.7
Chromium	17
Copper	**157**
Lead	**649**
Mercury	0.52
Zinc	**355**

FLA-48		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Arsenic	9.5	10.1
Chromium	26.7	31.8
Copper	**156**	**174**
Lead	**595**	**714**
Mercury	0.92	0.729
Zinc	**458**	**535**

B-10			
Date	6/21/2004	6/21/2004	6/21/2004
Depth	0-1 ft	0-1 ft (FD)	1-2 ft
Arsenic	4	4.1	3.9
Chromium	19	19 J	24
Lead	**1540**	**642**	
Mercury	**2.4**	**2.5**	
Zinc	**480**	**470**	

FLA-50	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	6.5
Chromium	20.8
Copper	**87.9**
Lead	**550**
Mercury	0.74
Zinc	**369**

FLA-13		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	17-17.5 ft
Arsenic	7.3	
Barium	**316**	
Chromium	26.1	13.1
Copper	**103**	
Lead	**743**	
Mercury	1.1	
Zinc	**386**	

FLA-52	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	2.8
Chromium	11.7
Lead	252
Mercury	0.25
Zinc	**340**

10	Indicates concentration is above the Unrestricted NYSDEC SCO	10	Indicates concentration is above the Industrial NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO	10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Restricted Residential NYSDEC SCO	10	Indicates concentration is above the Industrial RSL
10	Indicates concentration is above the Commercial NYSDEC SCO	**10**	**Bold** indicates concentration is above Background

J:\01 Projects\10404 - Balt HTRW\03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-1 Area 1 - Nature and Extent - Metals rev1.mxd

N

0 20 40 80 Feet

Scale: 1" = 40'

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Final Remedial Investigation Report
Engineer School, Fort Totten
Queens, NY

NOTES AND SOURCES:.

1. Only data which are above an NYSDEC SCO or RSL are shown.
2. J - Reported concentration is estimated.

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 01/03/2013

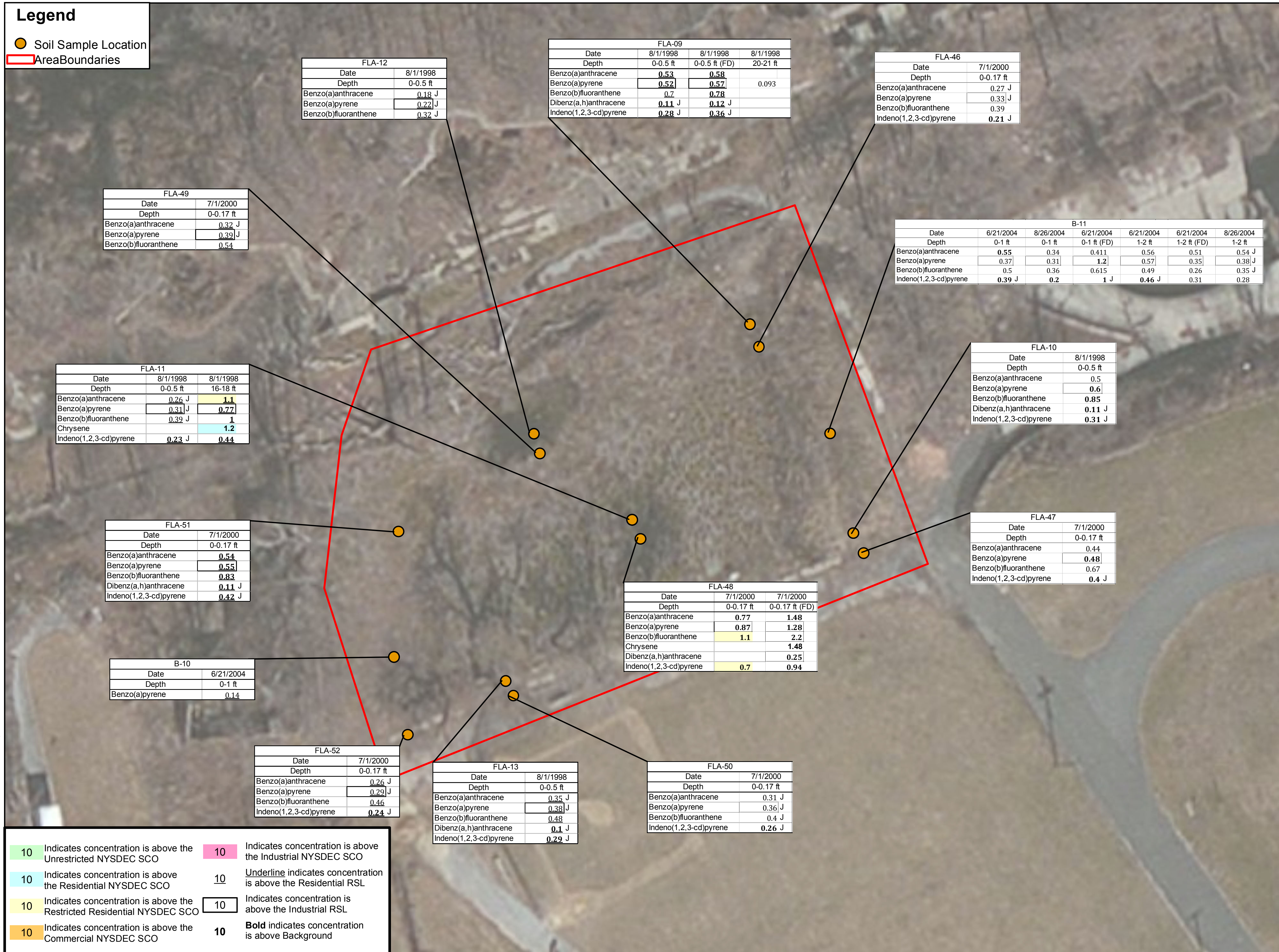
DRAWN BY: MRF

CHK'D BY: KT

APP'D BY: LJP

AREA 1
NATURE AND EXTENTS
METALS

FIGURE 6-1



FLA-12	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)anthracene	0.18 J
Benzo(a)pyrene	0.22 J
Benzo(b)fluoranthene	0.32 J

FLA-09			
Date	8/1/1998	8/1/1998	8/1/1998
Depth	0-0.5 ft	0-0.5 ft (FD)	20-21 ft
Benzo(a)anthracene	0.53	0.58	
Benzo(a)pyrene	0.52	0.57	0.093
Benzo(b)fluoranthene	0.7	0.78	
Dibenz(a,h)anthracene	0.11 J	0.12 J	
Indeno(1,2,3-cd)pyrene	0.28 J	0.36 J	

FLA-46	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.27 J
Benzo(a)pyrene	0.33 J
Benzo(b)fluoranthene	0.39
Indeno(1,2,3-cd)pyrene	0.21 J

FLA-49	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.32 J
Benzo(a)pyrene	0.39 J
Benzo(b)fluoranthene	0.54

B-11						
Date	6/21/2004	8/26/2004	6/21/2004	6/21/2004	6/21/2004	8/26/2004
Depth	0-1 ft	0-1 ft	0-1 ft (FD)	1-2 ft	1-2 ft (FD)	1-2 ft
Benzo(a)anthracene	0.55	0.34	0.411	0.56	0.51	0.54 J
Benzo(a)pyrene	0.37	0.31	1.2	0.57	0.35	0.38 J
Benzo(b)fluoranthene	0.5	0.36	0.615	0.49	0.26	0.35 J
Indeno(1,2,3-cd)pyrene	0.39 J	0.2	1 J	0.46 J	0.31	0.28

FLA-10	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)anthracene	0.5
Benzo(a)pyrene	0.6
Benzo(b)fluoranthene	0.85
Dibenz(a,h)anthracene	0.11 J
Indeno(1,2,3-cd)pyrene	0.31 J

FLA-11		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	16-18 ft
Benzo(a)anthracene	0.26 J	1.1
Benzo(a)pyrene	0.31 J	0.77
Benzo(b)fluoranthene	0.39 J	1
Chrysene		1.2
Indeno(1,2,3-cd)pyrene	0.23 J	0.44

FLA-51	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.54
Benzo(a)pyrene	0.55
Benzo(b)fluoranthene	0.83
Dibenz(a,h)anthracene	0.11 J
Indeno(1,2,3-cd)pyrene	0.42 J

FLA-47	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.44
Benzo(a)pyrene	0.48
Benzo(b)fluoranthene	0.67
Indeno(1,2,3-cd)pyrene	0.4 J

FLA-48		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Benzo(a)anthracene	0.77	1.48
Benzo(a)pyrene	0.87	1.28
Benzo(b)fluoranthene	1.1	2.2
Chrysene		1.48
Dibenz(a,h)anthracene		0.25
Indeno(1,2,3-cd)pyrene	0.7	0.94

B-10	
Date	6/21/2004
Depth	0-1 ft
Benzo(a)pyrene	0.14

FLA-52	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.26 J
Benzo(a)pyrene	0.29 J
Benzo(b)fluoranthene	0.46
Indeno(1,2,3-cd)pyrene	0.24 J

FLA-13	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)anthracene	0.35 J
Benzo(a)pyrene	0.38 J
Benzo(b)fluoranthene	0.48
Dibenz(a,h)anthracene	0.1 J
Indeno(1,2,3-cd)pyrene	0.29 J

FLA-50	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.31 J
Benzo(a)pyrene	0.36 J
Benzo(b)fluoranthene	0.4 J
Indeno(1,2,3-cd)pyrene	0.26 J

10	Indicates concentration is above the Unrestricted NYSDEC SCO	10	Indicates concentration is above the Industrial NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO	10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Restricted Residential NYSDEC SCO	10	Indicates concentration is above the Industrial RSL
10	Indicates concentration is above the Commercial NYSDEC SCO	**10**	**Bold** indicates concentration is above Background

J:\01 Projects\10404 - Balt HTRW\03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-2 Area 1 - Nature and Extent - PAHs rev1.mxd

N

0 20 40 80 Feet

Scale: 1" = 40'

Watermark
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NOTES AND SOURCES:.

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2. J - Reported concentration is estimated.

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 01/03/2013

DRAWN BY: MRF

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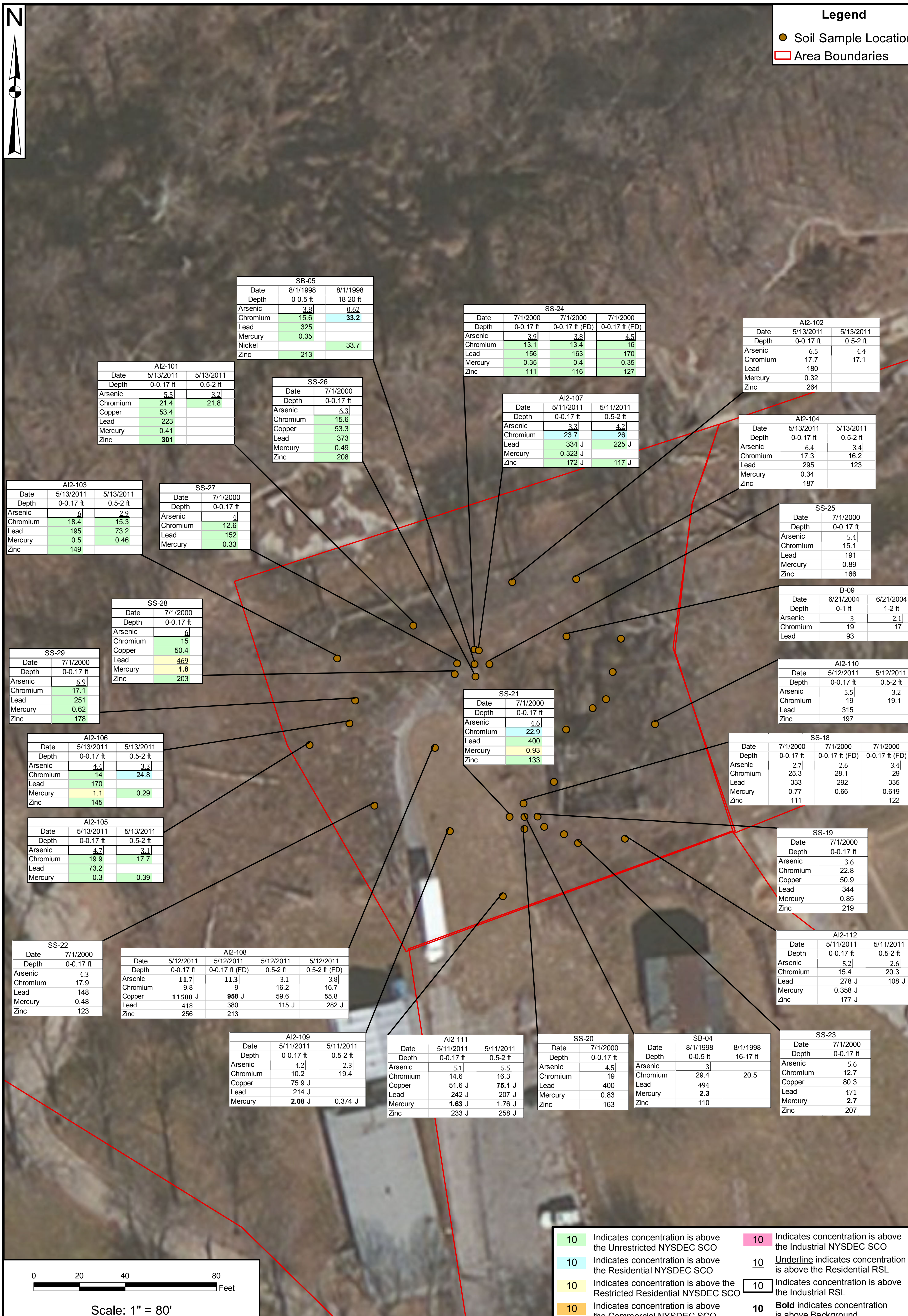
APP'D BY: LJP

AREA 1
NATURE AND EXTENTS
PAHs

FIGURE 6-2



SB-05		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	18-20 ft
Arsenic	3.8	0.62
Chromium	15.6	**33.2**
Lead	325	
Mercury	0.35	
Nickel		33.7
Zinc	213	

AI2-101		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	5.5	3.2
Chromium	21.4	21.8
Copper	53.4	
Lead	223	
Mercury	0.41	
Zinc	**301**	

SS-26	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	6.3
Chromium	15.6
Copper	53.3
Lead	373
Mercury	0.49
Zinc	208

SS-24			
Date	7/1/2000	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)	0-0.17 ft (FD)
Arsenic	3.9	3.8	4.5
Chromium	13.1	13.4	16
Lead	156	163	170
Mercury	0.35	0.4	0.35
Zinc	111	116	127

AI2-102		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	6.5	4.4
Chromium	17.7	17.1
Lead	180	
Mercury	0.32	
Zinc	264	

AI2-107		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	3.3	4.2
Chromium	23.7	26
Lead	334 J	225 J
Mercury	0.323 J	
Zinc	172 J	117 J

AI2-104		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	6.4	3.4
Chromium	17.3	16.2
Lead	295	123
Mercury	0.34	
Zinc	187	

AI2-103		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	6	2.9
Chromium	18.4	15.3
Lead	195	73.2
Mercury	0.5	0.46
Zinc	149	

SS-27	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4
Chromium	12.6
Lead	152
Mercury	0.33

SS-25	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.4
Chromium	15.1
Lead	191
Mercury	0.89
Zinc	166

B-09		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Arsenic	3	2.1
Chromium	19	17
Lead	93	

SS-28	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	6
Chromium	15
Copper	50.4
Lead	469
Mercury	**1.8**
Zinc	203

SS-29	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	6.9
Chromium	17.1
Lead	251
Mercury	0.62
Zinc	178

AI2-110		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	5.5	3.2
Chromium	19	19.1
Lead	315	
Zinc	197	

SS-21	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.6
Chromium	22.9
Lead	400
Mercury	0.93
Zinc	133

AI2-106		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	4.4	3.3
Chromium	14	24.8
Lead	170	
Mercury	1.1	0.29
Zinc	145	

SS-18			
Date	7/1/2000	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)	0-0.17 ft (FD)
Arsenic	2.7	2.6	3.4
Chromium	25.3	28.1	29
Lead	333	292	335
Mercury	0.77	0.66	0.619
Zinc	111		122

AI2-105		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	4.7	3.1
Chromium	19.9	17.7
Lead	73.2	
Mercury	0.3	0.39

SS-19	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.6
Chromium	22.8
Copper	50.9
Lead	344
Mercury	0.85
Zinc	219

AI2-112		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	5.2	2.6
Chromium	15.4	20.3
Lead	278 J	108 J
Mercury	0.358 J	
Zinc	177 J	

SS-22	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.3
Chromium	17.9
Lead	148
Mercury	0.48
Zinc	123

AI2-108				
Date	5/12/2011	5/12/2011	5/12/2011	5/12/2011
Depth	0-0.17 ft	0-0.17 ft (FD)	0.5-2 ft	0.5-2 ft (FD)
Arsenic	**11.7**	**11.3**	3.1	3.8
Chromium	9.8	9	16.2	16.7
Copper	**11500** J	**958** J	59.6	55.8
Lead	418	380	115 J	282 J
Zinc	256	213		

AI2-109		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	4.2	2.3
Chromium	10.2	19.4
Copper	75.9 J	
Lead	214 J	
Mercury	**2.08** J	0.374 J

AI2-111		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	5.1	5.5
Chromium	14.6	16.3
Copper	51.6 J	**75.1** J
Lead	242 J	207 J
Mercury	**1.63** J	1.76 J
Zinc	233 J	258 J

SS-20	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.5
Chromium	19
Lead	400
Mercury	0.83
Zinc	163

SB-04		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	16-17 ft
Arsenic	3	
Chromium	29.4	20.5
Lead	494	
Mercury	**2.3**	
Zinc	110	

SS-23	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.6
Chromium	12.7
Copper	80.3
Lead	471
Mercury	**2.7**
Zinc	207

10	Indicates concentration is above the Unrestricted NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO
10	Indicates concentration is above the Restricted Residential NYSDEC SCO
10	Indicates concentration is above the Commercial NYSDEC SCO
10	Indicates concentration is above the Industrial NYSDEC SCO
10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Industrial RSL
10	**Bold** indicates concentration is above Background

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-3 Area 2 - Nature and Extent - Metals rev1.mxd

PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 03/31/2014
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 2 - NATURE AND EXTENT - METALS

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FIGURE 6-3

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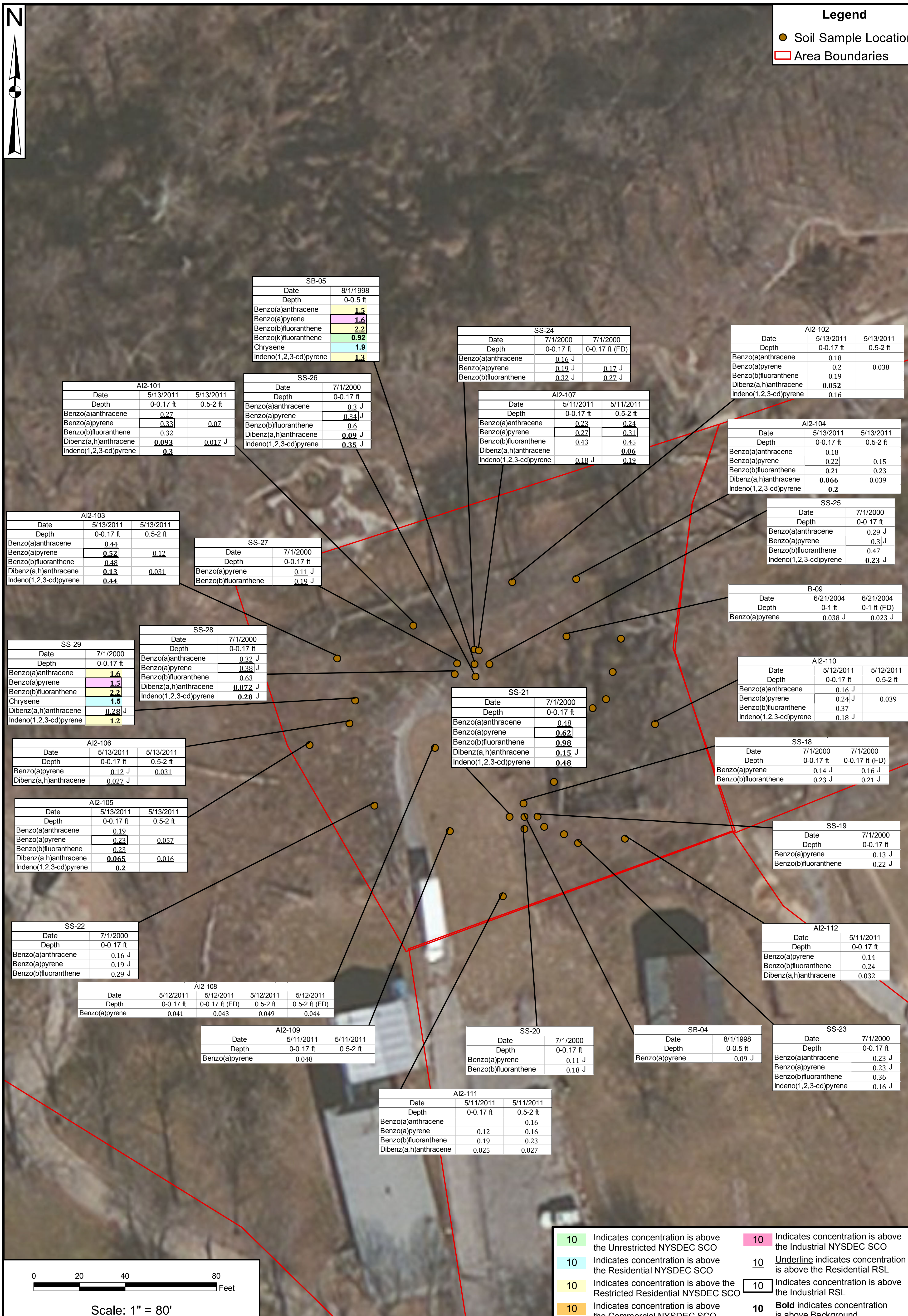

SB-05	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)anthracene	1.5
Benzo(a)pyrene	1.6
Benzo(b)fluoranthene	2.2
Benzo(k)fluoranthene	0.92
Chrysene	1.9
Indeno(1,2,3-cd)pyrene	1.3

SS-24		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Benzo(a)anthracene	0.16 J	
Benzo(a)pyrene	0.19 J	0.17 J
Benzo(b)fluoranthene	0.32 J	0.27 J

AI2-102		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.18	
Benzo(a)pyrene	0.2	0.038
Benzo(b)fluoranthene	0.19	
Dibenz(a,h)anthracene	0.052	
Indeno(1,2,3-cd)pyrene	0.16	

AI2-101		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.27	
Benzo(a)pyrene	0.33	0.07
Benzo(b)fluoranthene	0.32	
Dibenz(a,h)anthracene	0.093	0.017 J
Indeno(1,2,3-cd)pyrene	0.3	

SS-26	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.3 J
Benzo(a)pyrene	0.34 J
Benzo(b)fluoranthene	0.6
Dibenz(a,h)anthracene	0.09 J
Indeno(1,2,3-cd)pyrene	0.35 J

AI2-107		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.23	0.24
Benzo(a)pyrene	0.27	0.31
Benzo(b)fluoranthene	0.43	0.45
Dibenz(a,h)anthracene		0.06
Indeno(1,2,3-cd)pyrene	0.18 J	0.19

AI2-104		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.18	
Benzo(a)pyrene	0.22	0.15
Benzo(b)fluoranthene	0.21	0.23
Dibenz(a,h)anthracene	0.066	0.039
Indeno(1,2,3-cd)pyrene	0.2	

SS-25	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.29 J
Benzo(a)pyrene	0.3 J
Benzo(b)fluoranthene	0.47
Indeno(1,2,3-cd)pyrene	0.23 J

AI2-103		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.44	
Benzo(a)pyrene	0.52	0.12
Benzo(b)fluoranthene	0.48	
Dibenz(a,h)anthracene	0.13	0.031
Indeno(1,2,3-cd)pyrene	0.44	

SS-27	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.11 J
Benzo(b)fluoranthene	0.19 J

B-09		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	0-1 ft (FD)
Benzo(a)pyrene	0.038 J	0.023 J

SS-28	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.32 J
Benzo(a)pyrene	0.38 J
Benzo(b)fluoranthene	0.63
Dibenz(a,h)anthracene	0.072 J
Indeno(1,2,3-cd)pyrene	0.28 J

SS-29	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	1.6
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	2.2
Chrysene	1.5
Dibenz(a,h)anthracene	0.28 J
Indeno(1,2,3-cd)pyrene	1.2

AI2-110		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.16 J	
Benzo(a)pyrene	0.24 J	0.039
Benzo(b)fluoranthene	0.37	
Indeno(1,2,3-cd)pyrene	0.18 J	

SS-21	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.48
Benzo(a)pyrene	0.62
Benzo(b)fluoranthene	0.98
Dibenz(a,h)anthracene	0.15 J
Indeno(1,2,3-cd)pyrene	0.48

AI2-106		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.12 J	0.031
Dibenz(a,h)anthracene	0.027 J	

SS-18		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Benzo(a)pyrene	0.14 J	0.16 J
Benzo(b)fluoranthene	0.23 J	0.21 J

AI2-105		
Date	5/13/2011	5/13/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.19	
Benzo(a)pyrene	0.23	0.057
Benzo(b)fluoranthene	0.23	
Dibenz(a,h)anthracene	0.065	0.016
Indeno(1,2,3-cd)pyrene	0.2	

SS-19	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.13 J
Benzo(b)fluoranthene	0.22 J

SS-22	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.16 J
Benzo(a)pyrene	0.19 J
Benzo(b)fluoranthene	0.29 J

AI2-112	
Date	5/11/2011
Depth	0-0.17 ft
Benzo(a)pyrene	0.14
Benzo(b)fluoranthene	0.24
Dibenz(a,h)anthracene	0.032

AI2-108				
Date	5/12/2011	5/12/2011	5/12/2011	5/12/2011
Depth	0-0.17 ft	0-0.17 ft (FD)	0.5-2 ft	0.5-2 ft (FD)
Benzo(a)pyrene	0.041	0.043	0.049	0.044

AI2-109		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.048	

SS-20	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.11 J
Benzo(b)fluoranthene	0.18 J

SB-04	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)pyrene	0.09 J

SS-23	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.23 J
Benzo(a)pyrene	0.23 J
Benzo(b)fluoranthene	0.36
Indeno(1,2,3-cd)pyrene	0.16 J

AI2-111		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene		0.16
Benzo(a)pyrene	0.12	0.16
Benzo(b)fluoranthene	0.19	0.23
Dibenz(a,h)anthracene	0.025	0.027

PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 03/31/2014
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 2 - NATURE AND EXTENT - PAHs

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FIGURE 6-4

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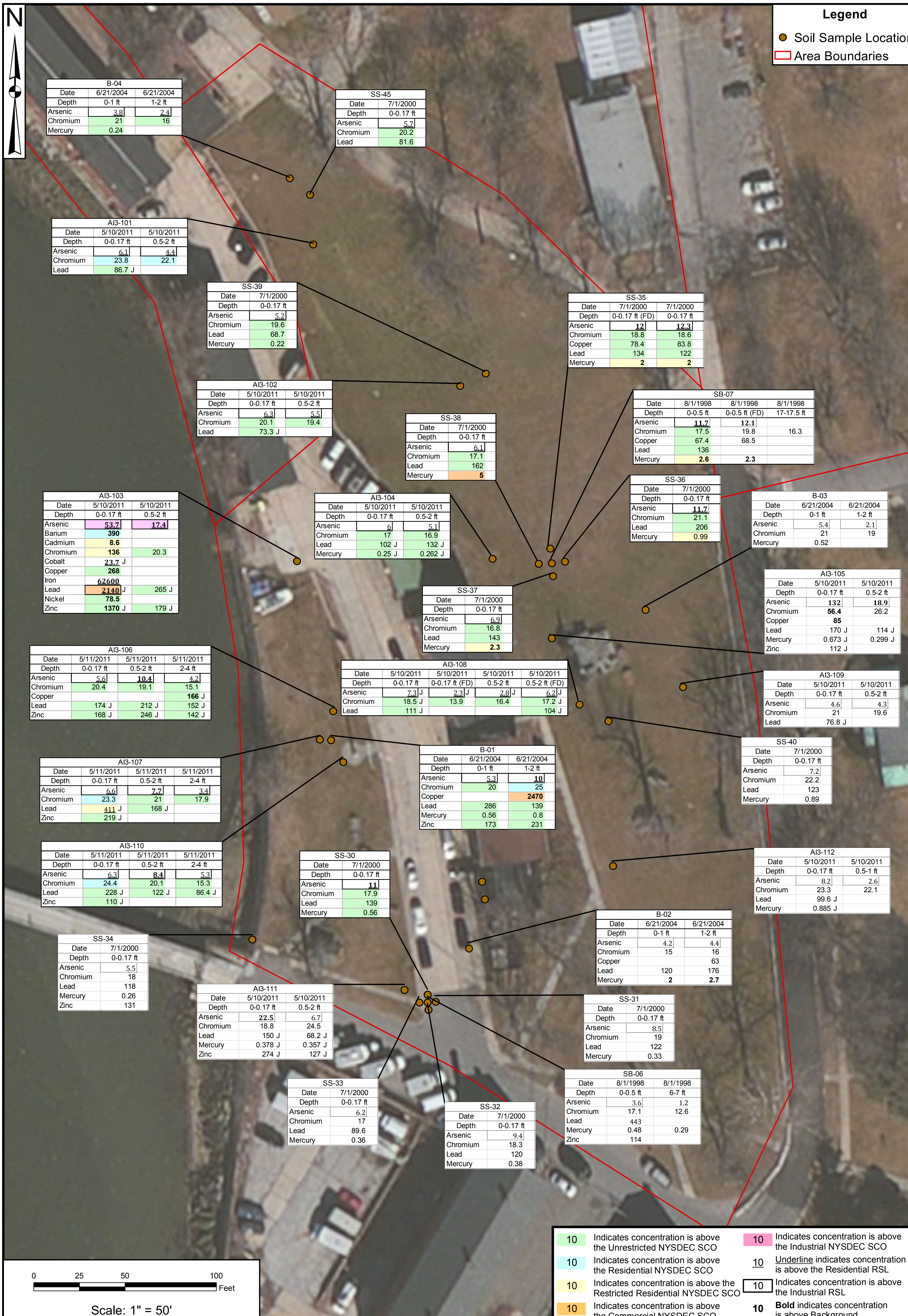
J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-4 Area 2 - Nature and Extent - PAHs rev1.mxd



J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-5 Area 3 - Nature and Extent - Metals (Pre-2012) rev1.mxd

PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 03/31/2014
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 3 - NATURE AND EXTENT - METALS (Pre-2012)

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FIGURE 6-5

Watermark
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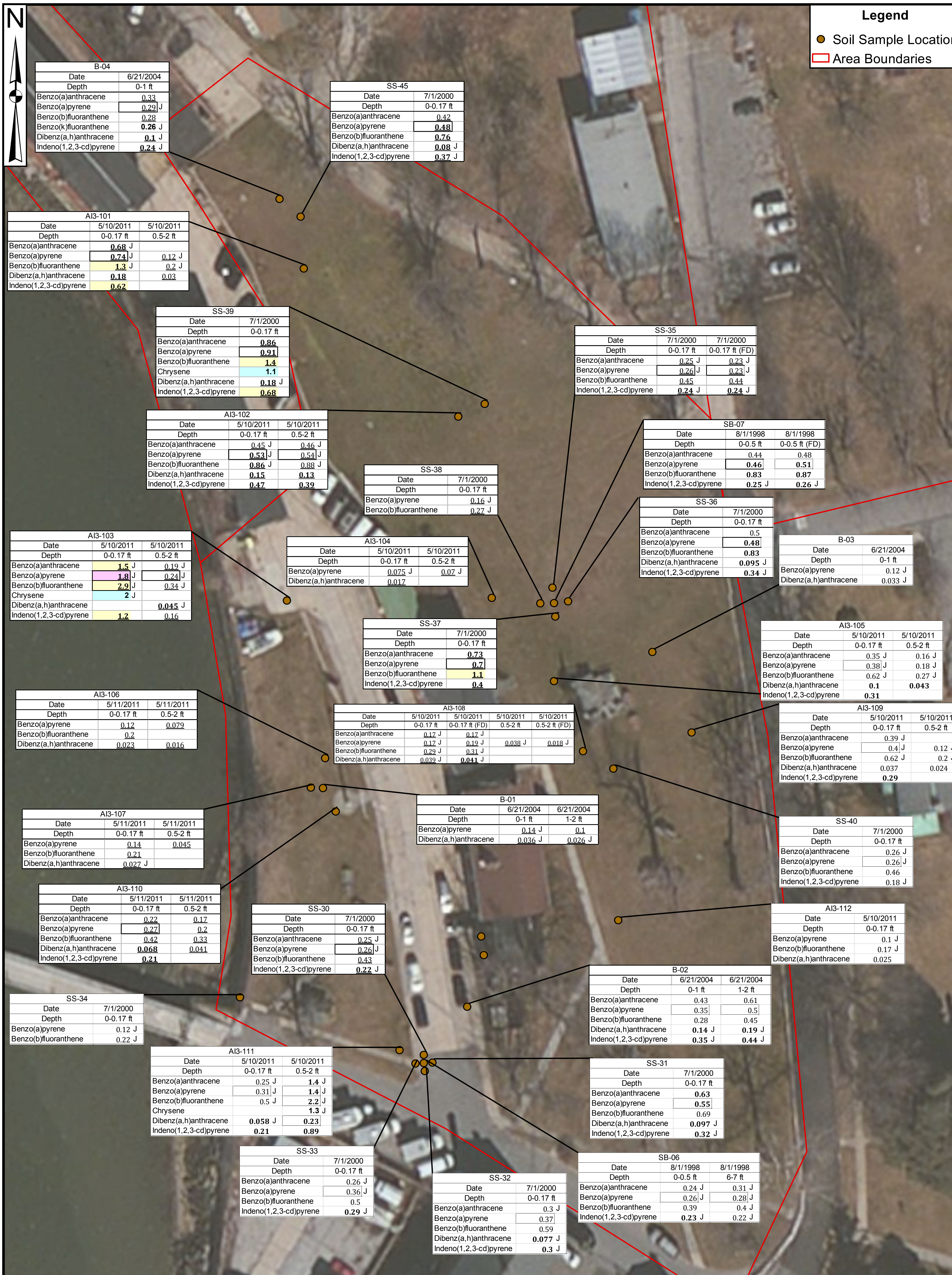

B-04	
Date	6/21/2004
Depth	0-1 ft
Benzo(a)anthracene	0.33
Benzo(a)pyrene	0.29 J
Benzo(b)fluoranthene	0.28
Benzo(k)fluoranthene	0.26 J
Dibenz(a,h)anthracene	0.1 J
Indeno(1,2,3-cd)pyrene	0.24 J

SS-45	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.42
Benzo(a)pyrene	0.48
Benzo(b)fluoranthene	0.76
Dibenz(a,h)anthracene	0.08 J
Indeno(1,2,3-cd)pyrene	0.37 J

AI3-101		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.68 J	
Benzo(a)pyrene	0.74 J	0.12 J
Benzo(b)fluoranthene	1.3 J	0.2 J
Dibenz(a,h)anthracene	0.18	0.03
Indeno(1,2,3-cd)pyrene	0.62	

SS-39	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.86
Benzo(a)pyrene	0.91
Benzo(b)fluoranthene	1.4
Chrysene	1.1
Dibenz(a,h)anthracene	0.18 J
Indeno(1,2,3-cd)pyrene	0.68

SS-35		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Benzo(a)anthracene	0.25 J	0.23 J
Benzo(a)pyrene	0.26 J	0.23 J
Benzo(b)fluoranthene	0.45	0.44
Indeno(1,2,3-cd)pyrene	0.24 J	0.24 J

AI3-102		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.45 J	0.46 J
Benzo(a)pyrene	0.53 J	0.54 J
Benzo(b)fluoranthene	0.86 J	0.88 J
Dibenz(a,h)anthracene	0.15	0.13
Indeno(1,2,3-cd)pyrene	0.47	0.39

SB-07		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	0-0.5 ft (FD)
Benzo(a)anthracene	0.44	0.48
Benzo(a)pyrene	0.46	0.51
Benzo(b)fluoranthene	0.83	0.87
Indeno(1,2,3-cd)pyrene	0.25 J	0.26 J

SS-38	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.16 J
Benzo(b)fluoranthene	0.27 J

SS-36	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.5
Benzo(a)pyrene	0.48
Benzo(b)fluoranthene	0.83
Dibenz(a,h)anthracene	0.095 J
Indeno(1,2,3-cd)pyrene	0.34 J

AI3-103		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	1.5 J	0.19 J
Benzo(a)pyrene	1.8 J	0.24 J
Benzo(b)fluoranthene	2.9 J	0.34 J
Chrysene	2 J	
Dibenz(a,h)anthracene		0.045 J
Indeno(1,2,3-cd)pyrene	1.2	0.16

AI3-104		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.075 J	0.07 J
Dibenz(a,h)anthracene	0.017	

B-03	
Date	6/21/2004
Depth	0-1 ft
Benzo(a)pyrene	0.12 J
Dibenz(a,h)anthracene	0.033 J

SS-37	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.73
Benzo(a)pyrene	0.7
Benzo(b)fluoranthene	1.1
Indeno(1,2,3-cd)pyrene	0.4

AI3-105		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.35 J	0.16 J
Benzo(a)pyrene	0.38 J	0.18 J
Benzo(b)fluoranthene	0.62 J	0.27 J
Dibenz(a,h)anthracene	0.1	0.043
Indeno(1,2,3-cd)pyrene	0.31	

AI3-106		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.12	0.079
Benzo(b)fluoranthene	0.2	
Dibenz(a,h)anthracene	0.023	0.016

AI3-108				
Date	5/10/2011	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.17 ft	0-0.17 ft (FD)	0.5-2 ft	0.5-2 ft (FD)
Benzo(a)anthracene	0.17 J	0.17 J		
Benzo(a)pyrene	0.17 J	0.19 J	0.038 J	0.018 J
Benzo(b)fluoranthene	0.29 J	0.31 J		
Dibenz(a,h)anthracene	0.039 J	0.041 J		

AI3-109		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.39 J	
Benzo(a)pyrene	0.4 J	0.12 J
Benzo(b)fluoranthene	0.62 J	0.2 J
Dibenz(a,h)anthracene	0.037	0.024
Indeno(1,2,3-cd)pyrene	0.29	

AI3-107		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.14	0.045
Benzo(b)fluoranthene	0.21	
Dibenz(a,h)anthracene	0.027 J	

B-01		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Benzo(a)pyrene	0.14 J	0.1
Dibenz(a,h)anthracene	0.036 J	0.026 J

SS-40	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.26 J
Benzo(a)pyrene	0.26 J
Benzo(b)fluoranthene	0.46
Indeno(1,2,3-cd)pyrene	0.18 J

AI3-110		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.22	0.17
Benzo(a)pyrene	0.27	0.2
Benzo(b)fluoranthene	0.42	0.33
Dibenz(a,h)anthracene	0.068	0.041
Indeno(1,2,3-cd)pyrene	0.21	

SS-30	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.25 J
Benzo(a)pyrene	0.26 J
Benzo(b)fluoranthene	0.43
Indeno(1,2,3-cd)pyrene	0.22 J

AI3-112	
Date	5/10/2011
Depth	0-0.17 ft
Benzo(a)pyrene	0.1 J
Benzo(b)fluoranthene	0.17 J
Dibenz(a,h)anthracene	0.025

B-02		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Benzo(a)anthracene	0.43	0.61
Benzo(a)pyrene	0.35	0.5
Benzo(b)fluoranthene	0.28	0.45
Dibenz(a,h)anthracene	0.14 J	0.19 J
Indeno(1,2,3-cd)pyrene	0.35 J	0.44 J

SS-34	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.12 J
Benzo(b)fluoranthene	0.22 J

AI3-111		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.25 J	1.4 J
Benzo(a)pyrene	0.31 J	1.4 J
Benzo(b)fluoranthene	0.5 J	2.2 J
Chrysene		1.3 J
Dibenz(a,h)anthracene	0.058 J	0.23
Indeno(1,2,3-cd)pyrene	0.21	0.89

SS-31	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.63
Benzo(a)pyrene	0.55
Benzo(b)fluoranthene	0.69
Dibenz(a,h)anthracene	0.097 J
Indeno(1,2,3-cd)pyrene	0.32 J

SS-33	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.26 J
Benzo(a)pyrene	0.36 J
Benzo(b)fluoranthene	0.5
Indeno(1,2,3-cd)pyrene	0.29 J

SB-06		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	6-7 ft
Benzo(a)anthracene	0.24 J	0.31 J
Benzo(a)pyrene	0.26 J	0.28 J
Benzo(b)fluoranthene	0.39	0.4 J
Indeno(1,2,3-cd)pyrene	0.23 J	0.22 J

SS-32	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.3 J
Benzo(a)pyrene	0.37
Benzo(b)fluoranthene	0.59
Dibenz(a,h)anthracene	0.077 J
Indeno(1,2,3-cd)pyrene	0.3 J

10 Indicates concentration is above the Unrestricted NYSDEC SCO

10 Indicates concentration is above the Residential NYSDEC SCO

10 Indicates concentration is above the Restricted Residential NYSDEC SCO

10 Indicates concentration is above the Commercial NYSDEC SCO

10 Indicates concentration is above the Industrial NYSDEC SCO

10 Underline indicates concentration is above the Residential RSL

10 Indicates concentration is above the Industrial RSL

10 **Bold** indicates concentration is above Background

0 25 50 100 Feet

Scale: 1" = 50'

J:\01 Projects\10404 - Balt HTRW\03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-6 Area 3 - Nature and Extent - PAHs rev1.mxd

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 03/31/2014

DRAWN BY: MRF

CHK'D BY: KT

APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 3 - NATURE AND EXTENT - PAHs

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FIGURE 6-6

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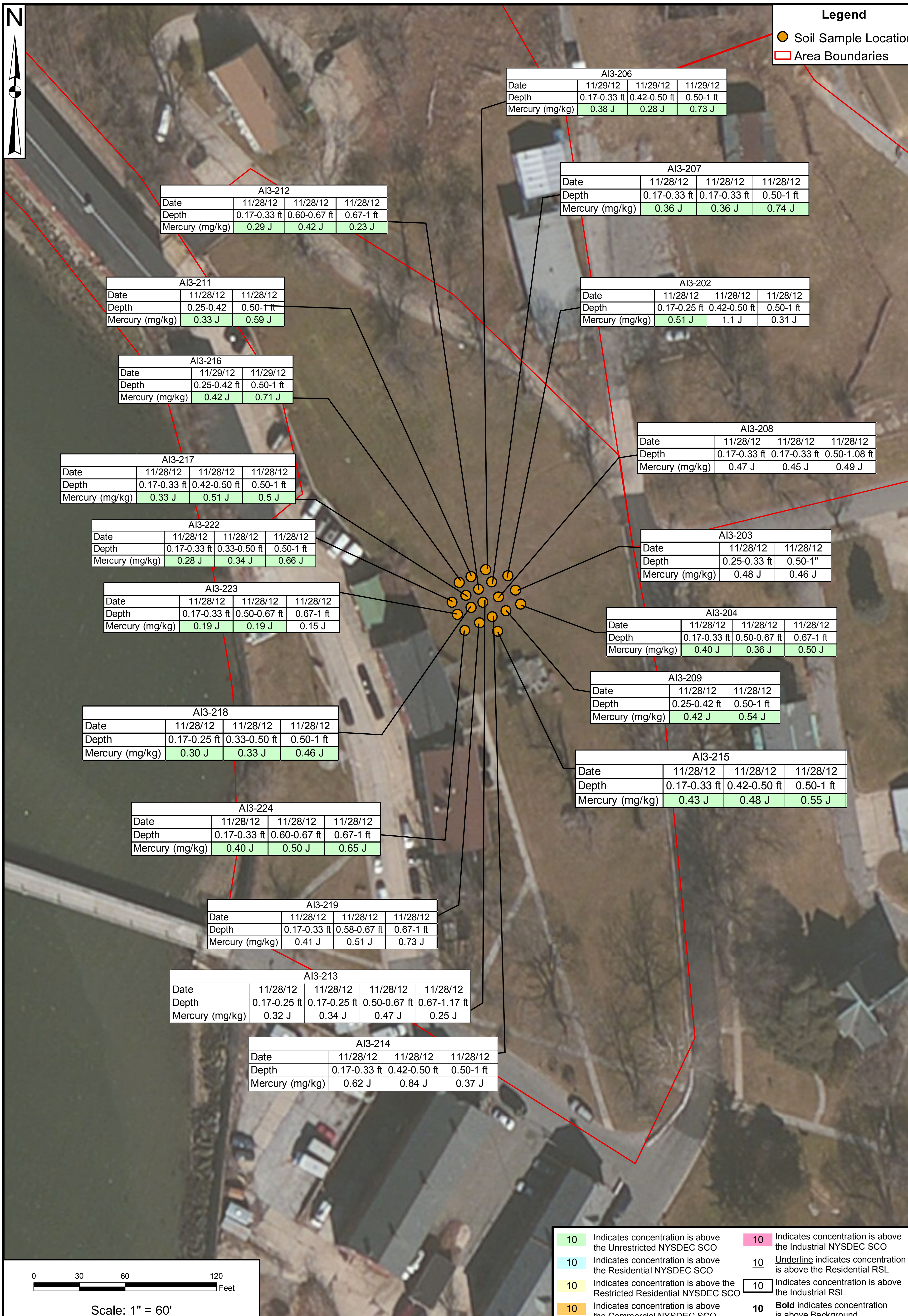

AI3-206			
Date	11/29/12	11/29/12	11/29/12
Depth	0.17-0.33 ft	0.42-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.38 J	0.28 J	0.73 J

AI3-207			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.17-0.33 ft	0.50-1 ft
Mercury (mg/kg)	0.36 J	0.36 J	0.74 J

AI3-212			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.60-0.67 ft	0.67-1 ft
Mercury (mg/kg)	0.29 J	0.42 J	0.23 J

AI3-211		
Date	11/28/12	11/28/12
Depth	0.25-0.42	0.50-1 ft
Mercury (mg/kg)	0.33 J	0.59 J

AI3-202			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.25 ft	0.42-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.51 J	1.1 J	0.31 J

AI3-216		
Date	11/29/12	11/29/12
Depth	0.25-0.42 ft	0.50-1 ft
Mercury (mg/kg)	0.42 J	0.71 J

AI3-208			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.17-0.33 ft	0.50-1.08 ft
Mercury (mg/kg)	0.47 J	0.45 J	0.49 J

AI3-217			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.42-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.33 J	0.51 J	0.5 J

AI3-222			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.33-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.28 J	0.34 J	0.66 J

AI3-203		
Date	11/28/12	11/28/12
Depth	0.25-0.33 ft	0.50-1"
Mercury (mg/kg)	0.48 J	0.46 J

AI3-223			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.50-0.67 ft	0.67-1 ft
Mercury (mg/kg)	0.19 J	0.19 J	0.15 J

AI3-204			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.50-0.67 ft	0.67-1 ft
Mercury (mg/kg)	0.40 J	0.36 J	0.50 J

AI3-209		
Date	11/28/12	11/28/12
Depth	0.25-0.42 ft	0.50-1 ft
Mercury (mg/kg)	0.42 J	0.54 J

AI3-218			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.25 ft	0.33-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.30 J	0.33 J	0.46 J

AI3-215			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.42-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.43 J	0.48 J	0.55 J

AI3-224			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.60-0.67 ft	0.67-1 ft
Mercury (mg/kg)	0.40 J	0.50 J	0.65 J

AI3-219			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.58-0.67 ft	0.67-1 ft
Mercury (mg/kg)	0.41 J	0.51 J	0.73 J

AI3-213				
Date	11/28/12	11/28/12	11/28/12	11/28/12
Depth	0.17-0.25 ft	0.17-0.25 ft	0.50-0.67 ft	0.67-1.17 ft
Mercury (mg/kg)	0.32 J	0.34 J	0.47 J	0.25 J

AI3-214			
Date	11/28/12	11/28/12	11/28/12
Depth	0.17-0.33 ft	0.42-0.50 ft	0.50-1 ft
Mercury (mg/kg)	0.62 J	0.84 J	0.37 J

10	Indicates concentration is above the Unrestricted NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO
10	Indicates concentration is above the Restricted Residential NYSDEC SCO
10	Indicates concentration is above the Commercial NYSDEC SCO
10	Indicates concentration is above the Industrial NYSDEC SCO
10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Industrial RSL
10	**Bold** indicates concentration is above Background

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-7 Area 3 - Nature and Extent - 2012 Mercury Sampling Results rev1.mxd

PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 03/31/2014
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.
2. J - Reported concentration estimated.

AREA 3 - NATURE AND EXTENT - MERCURY (2012)

FIGURE 6-7

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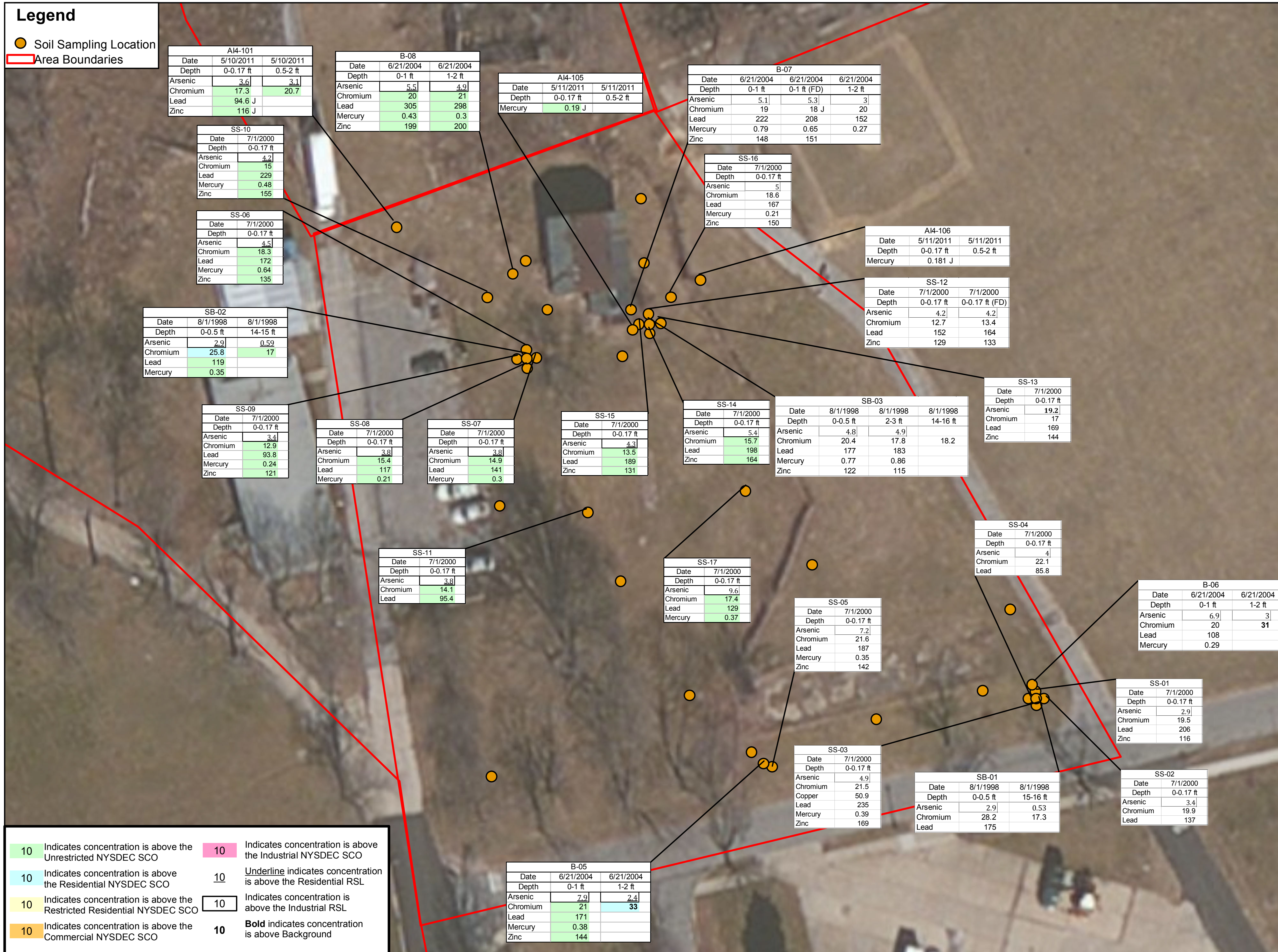

Legend

Soil Sampling Location

Area Boundaries

AI4-101		
Date	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft
Arsenic	3.6	3.1
Chromium	17.3	20.7
Lead	94.6 J	
Zinc	116 J	

B-08		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Arsenic	5.5	4.9
Chromium	20	21
Lead	305	298
Mercury	0.43	0.3
Zinc	199	200

AI4-105		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Mercury	0.19 J	

B-07			
Date	6/21/2004	6/21/2004	6/21/2004
Depth	0-1 ft	0-1 ft (FD)	1-2 ft
Arsenic	5.1	5.3	3
Chromium	19	18 J	20
Lead	222	208	152
Mercury	0.79	0.65	0.27
Zinc	148	151	

SS-10	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.2
Chromium	15
Lead	229
Mercury	0.48
Zinc	155

SS-16	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5
Chromium	18.6
Lead	167
Mercury	0.21
Zinc	150

SS-06	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.5
Chromium	18.3
Lead	172
Mercury	0.64
Zinc	135

AI4-106		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Mercury	0.181 J	

SS-12		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Arsenic	4.2	4.2
Chromium	12.7	13.4
Lead	152	164
Zinc	129	133

SB-02		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	14-15 ft
Arsenic	2.9	0.59
Chromium	25.8	17
Lead	119	
Mercury	0.35	

SS-13	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	**19.2**
Chromium	17
Lead	169
Zinc	144

SS-09	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.4
Chromium	12.9
Lead	93.8
Mercury	0.24
Zinc	121

SS-08	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.8
Chromium	15.4
Lead	117
Mercury	0.21

SS-07	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.8
Chromium	14.9
Lead	141
Mercury	0.3

SS-15	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.3
Chromium	13.5
Lead	189
Zinc	131

SS-14	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.4
Chromium	15.7
Lead	198
Zinc	164

SB-03			
Date	8/1/1998	8/1/1998	8/1/1998
Depth	0-0.5 ft	2-3 ft	14-16 ft
Arsenic	4.8	4.9	
Chromium	20.4	17.8	18.2
Lead	177	183	
Mercury	0.77	0.86	
Zinc	122	115	

SS-04	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4
Chromium	22.1
Lead	85.8

SS-11	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.8
Chromium	14.1
Lead	95.4

SS-17	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	9.6
Chromium	17.4
Lead	129
Mercury	0.37

B-06		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Arsenic	6.9	3
Chromium	20	**31**
Lead	108	
Mercury	0.29	

SS-05	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	7.2
Chromium	21.6
Lead	187
Mercury	0.35
Zinc	142

SS-01	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	2.9
Chromium	19.5
Lead	206
Zinc	116

SS-03	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.9
Chromium	21.5
Copper	50.9
Lead	235
Mercury	0.39
Zinc	169

SB-01		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	15-16 ft
Arsenic	2.9	0.53
Chromium	28.2	17.3
Lead	175	

SS-02	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.4
Chromium	19.9
Lead	137

B-05		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Arsenic	7.9	2.4
Chromium	21	33
Lead	171	
Mercury	0.38	
Zinc	144	

10	Indicates concentration is above the Unrestricted NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO
10	Indicates concentration is above the Restricted Residential NYSDEC SCO
10	Indicates concentration is above the Commercial NYSDEC SCO
10	Indicates concentration is above the Industrial NYSDEC SCO
10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Industrial RSL
10	**Bold** indicates concentration is above Background

N

0 20 40 80 Feet

Scale: 1" = 40'

Watermark

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Final Remedial Investigation Report
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Queens, NY

NOTES AND SOURCES:.

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration is estimated.

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 03/31/2014

DRAWN BY: MRF

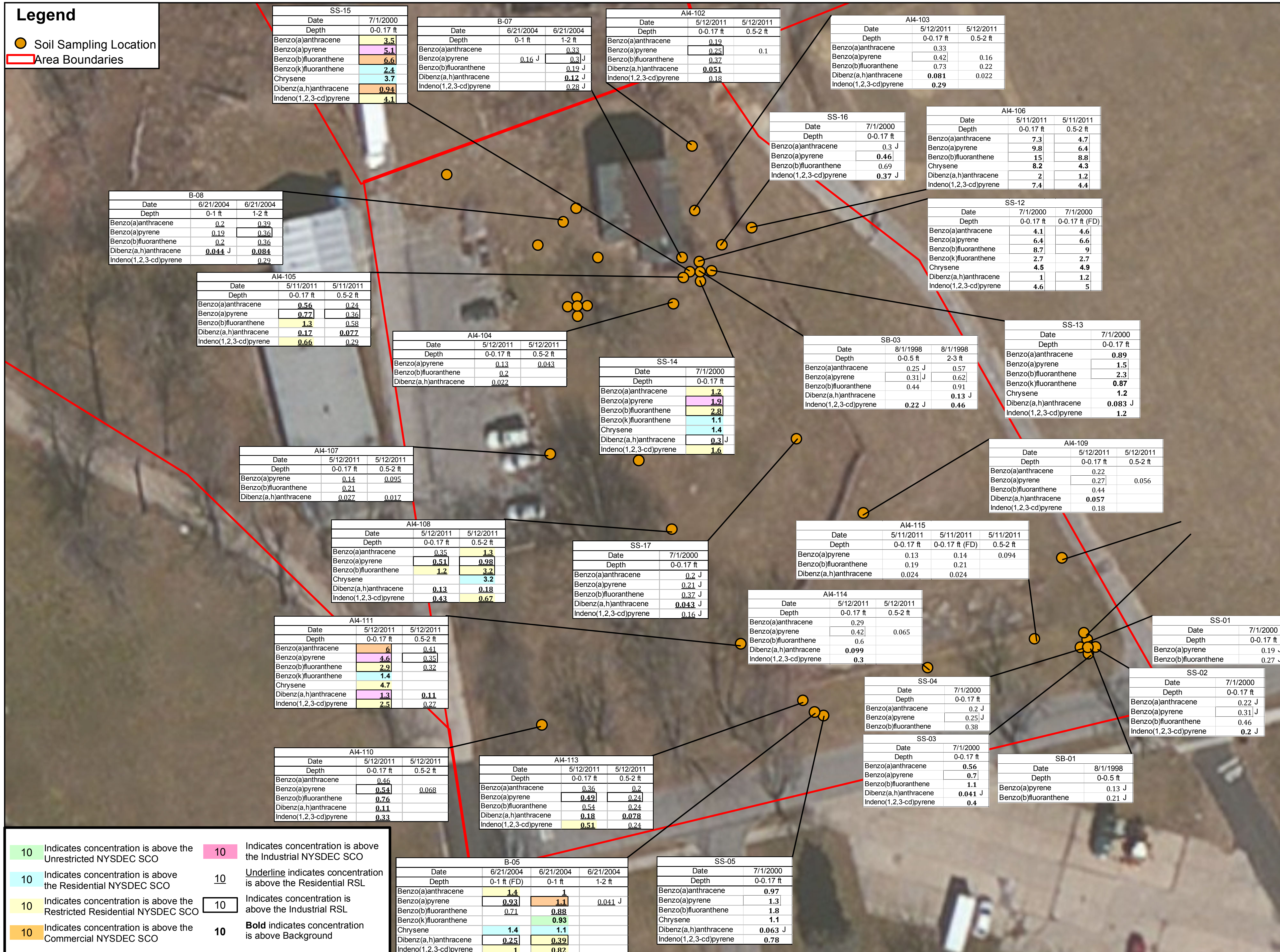
CHK'D BY: KT

APP'D BY: LJP

AREA 4
NATURE AND EXTENTS
METALS

FIGURE 6-8

J:\01 Projects\10404 - Balt HTRW\03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-8 Area 4 - Nature and Extent - Metals rev1.mxd



Legend

Soil Sampling Location

Area Boundaries

SS-15	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	3.5
Benzo(a)pyrene	5.1
Benzo(b)fluoranthene	6.6
Benzo(k)fluoranthene	2.4
Chrysene	3.7
Dibenz(a,h)anthracene	0.94
Indeno(1,2,3-cd)pyrene	4.1

B-07		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Benzo(a)anthracene		0.33
Benzo(a)pyrene	0.16 J	0.3 J
Benzo(b)fluoranthene		0.19 J
Dibenz(a,h)anthracene		0.12 J
Indeno(1,2,3-cd)pyrene		0.28 J

AI4-102		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.19	
Benzo(a)pyrene	0.25	0.1
Benzo(b)fluoranthene	0.37	
Dibenz(a,h)anthracene	0.051	
Indeno(1,2,3-cd)pyrene	0.18	

AI4-103		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.33	
Benzo(a)pyrene	0.42	0.16
Benzo(b)fluoranthene	0.73	0.22
Dibenz(a,h)anthracene	0.081	0.022
Indeno(1,2,3-cd)pyrene	0.29	

SS-16	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.3 J
Benzo(a)pyrene	0.46
Benzo(b)fluoranthene	0.69
Indeno(1,2,3-cd)pyrene	0.37 J

AI4-106		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	7.3	4.7
Benzo(a)pyrene	9.8	6.4
Benzo(b)fluoranthene	15	8.8
Chrysene	8.2	4.3
Dibenz(a,h)anthracene	2	1.2
Indeno(1,2,3-cd)pyrene	7.4	4.4

B-08		
Date	6/21/2004	6/21/2004
Depth	0-1 ft	1-2 ft
Benzo(a)anthracene	0.2	0.39
Benzo(a)pyrene	0.19	0.36
Benzo(b)fluoranthene	0.2	0.36
Dibenz(a,h)anthracene	0.044 J	0.084
Indeno(1,2,3-cd)pyrene		0.29

SS-12		
Date	7/1/2000	7/1/2000
Depth	0-0.17 ft	0-0.17 ft (FD)
Benzo(a)anthracene	4.1	4.6
Benzo(a)pyrene	6.4	6.6
Benzo(b)fluoranthene	8.7	9
Benzo(k)fluoranthene	2.7	2.7
Chrysene	4.5	4.9
Dibenz(a,h)anthracene	1	1.2
Indeno(1,2,3-cd)pyrene	4.6	5

AI4-105		
Date	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.56	0.24
Benzo(a)pyrene	0.77	0.36
Benzo(b)fluoranthene	1.3	0.58
Dibenz(a,h)anthracene	0.17	0.077
Indeno(1,2,3-cd)pyrene	0.66	0.29

SS-13	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.89
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	2.3
Benzo(k)fluoranthene	0.87
Chrysene	1.2
Dibenz(a,h)anthracene	0.083 J
Indeno(1,2,3-cd)pyrene	1.2

AI4-104		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.13	0.043
Benzo(b)fluoranthene	0.2	
Dibenz(a,h)anthracene	0.022	

SB-03		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	2-3 ft
Benzo(a)anthracene	0.25 J	0.57
Benzo(a)pyrene	0.31 J	0.62
Benzo(b)fluoranthene	0.44	0.91
Dibenz(a,h)anthracene		0.13 J
Indeno(1,2,3-cd)pyrene	0.22 J	0.46

SS-14	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	1.2
Benzo(a)pyrene	1.9
Benzo(b)fluoranthene	2.8
Benzo(k)fluoranthene	1.1
Chrysene	1.4
Dibenz(a,h)anthracene	0.3 J
Indeno(1,2,3-cd)pyrene	1.6

AI4-107		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)pyrene	0.14	0.095
Benzo(b)fluoranthene	0.21	
Dibenz(a,h)anthracene	0.027	0.017

AI4-109		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.22	
Benzo(a)pyrene	0.27	0.056
Benzo(b)fluoranthene	0.44	
Dibenz(a,h)anthracene	0.057	
Indeno(1,2,3-cd)pyrene	0.18	

AI4-108		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.35	1.3
Benzo(a)pyrene	0.51	0.98
Benzo(b)fluoranthene	1.2	3.2
Chrysene		3.2
Dibenz(a,h)anthracene	0.13	0.18
Indeno(1,2,3-cd)pyrene	0.43	0.67

AI4-115			
Date	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.17 ft	0-0.17 ft (FD)	0.5-2 ft
Benzo(a)pyrene	0.13	0.14	0.094
Benzo(b)fluoranthene	0.19	0.21	
Dibenz(a,h)anthracene	0.024	0.024	

SS-17	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.2 J
Benzo(a)pyrene	0.21 J
Benzo(b)fluoranthene	0.37 J
Dibenz(a,h)anthracene	0.043 J
Indeno(1,2,3-cd)pyrene	0.16 J

AI4-114		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.29	
Benzo(a)pyrene	0.42	0.065
Benzo(b)fluoranthene	0.6	
Dibenz(a,h)anthracene	0.099	
Indeno(1,2,3-cd)pyrene	0.3	

SS-01	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)pyrene	0.19 J
Benzo(b)fluoranthene	0.27 J

AI4-111		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	6	0.41
Benzo(a)pyrene	4.6	0.35
Benzo(b)fluoranthene	2.9	0.32
Benzo(k)fluoranthene	1.4	
Chrysene	4.7	
Dibenz(a,h)anthracene	1.3	0.11
Indeno(1,2,3-cd)pyrene	2.5	0.27

SS-04	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.2 J
Benzo(a)pyrene	0.25 J
Benzo(b)fluoranthene	0.38

SS-02	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.22 J
Benzo(a)pyrene	0.31 J
Benzo(b)fluoranthene	0.46
Indeno(1,2,3-cd)pyrene	0.2 J

SS-03	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.56
Benzo(a)pyrene	0.7
Benzo(b)fluoranthene	1.1
Dibenz(a,h)anthracene	0.041 J
Indeno(1,2,3-cd)pyrene	0.4

SB-01	
Date	8/1/1998
Depth	0-0.5 ft
Benzo(a)pyrene	0.13 J
Benzo(b)fluoranthene	0.21 J

AI4-110		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.46	
Benzo(a)pyrene	0.54	0.068
Benzo(b)fluoranthene	0.76	
Dibenz(a,h)anthracene	0.11	
Indeno(1,2,3-cd)pyrene	0.33	

AI4-113		
Date	5/12/2011	5/12/2011
Depth	0-0.17 ft	0.5-2 ft
Benzo(a)anthracene	0.36	0.2
Benzo(a)pyrene	0.49	0.24
Benzo(b)fluoranthene	0.54	0.24
Dibenz(a,h)anthracene	0.18	0.078
Indeno(1,2,3-cd)pyrene	0.51	0.24

B-05			
Date	6/21/2004	6/21/2004	6/21/2004
Depth	0-1 ft (FD)	0-1 ft	1-2 ft
Benzo(a)anthracene	1.4	1	
Benzo(a)pyrene	0.93	1.1	0.041 J
Benzo(b)fluoranthene	0.71	0.88	
Benzo(k)fluoranthene		0.93	
Chrysene	1.4	1.1	
Dibenz(a,h)anthracene	0.25	0.39	
Indeno(1,2,3-cd)pyrene	1	0.82	

SS-05	
Date	7/1/2000
Depth	0-0.17 ft
Benzo(a)anthracene	0.97
Benzo(a)pyrene	1.3
Benzo(b)fluoranthene	1.8
Chrysene	1.1
Dibenz(a,h)anthracene	0.063 J
Indeno(1,2,3-cd)pyrene	0.78

10	Indicates concentration is above the Unrestricted NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO
10	Indicates concentration is above the Restricted Residential NYSDEC SCO
10	Indicates concentration is above the Commercial NYSDEC SCO
10	Indicates concentration is above the Industrial NYSDEC SCO
10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Industrial RSL
10	**Bold** indicates concentration is above Background

J:\01 Projects\10404 - Balt HTRW03 - Fort Totten\11.0 Drawings\GIS\Supplemental RI #2\rev1\Figure 6-9 Area 4 - Nature and Extent - PAHs rev1.mxd

N

0 20 40 80 Feet

Scale: 1" = 40'

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NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration is estimated.

PROJECT NO: 10404-03

PREPARED FOR: USACE

DATE: 03/31/2014

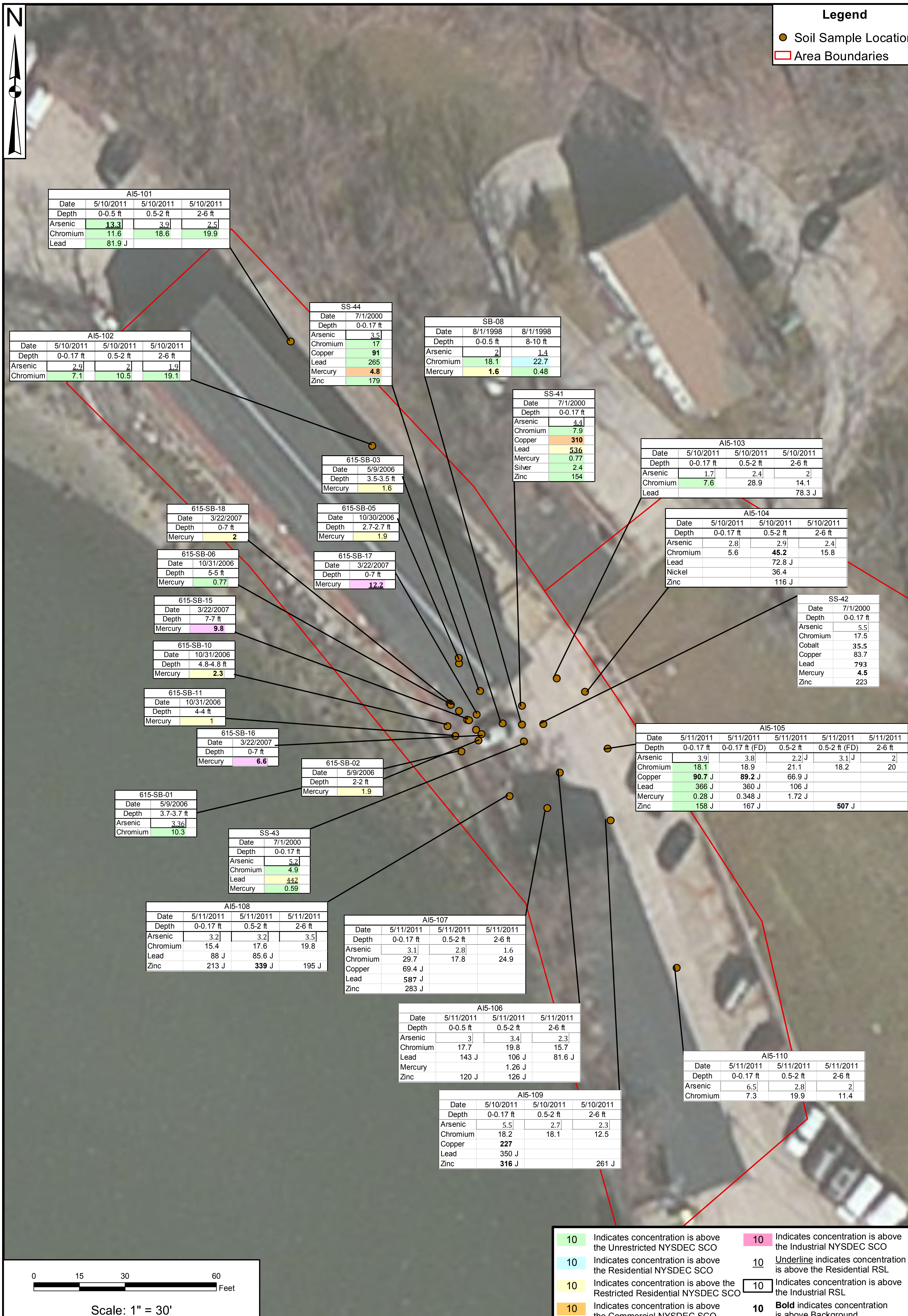
DRAWN BY: MRF

CHK'D BY: KT

APP'D BY: LJP

AREA 4
NATURE and EXTENT
PAHs

FIGURE 6-9



AI5-101			
Date	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.5 ft	0.5-2 ft	2-6 ft
Arsenic	**13.3**	3.9	2.5
Chromium	11.6	18.6	19.9
Lead	81.9 J		

AI5-102			
Date	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	2.9	2	1.9
Chromium	7.1	10.5	19.1

SS-44	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	3.5
Chromium	17
Copper	**91**
Lead	265
Mercury	**4.8**
Zinc	179

SB-08		
Date	8/1/1998	8/1/1998
Depth	0-0.5 ft	8-10 ft
Arsenic	2	1.4
Chromium	18.1	22.7
Mercury	**1.6**	0.48

SS-41	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	4.4
Chromium	7.9
Copper	**310**
Lead	**536**
Mercury	0.77
Silver	2.4
Zinc	154

AI5-103			
Date	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	1.7	2.4	2
Chromium	7.6	28.9	14.1
Lead			78.3 J

615-SB-03	
Date	5/9/2006
Depth	3.5-3.5 ft
Mercury	1.6

615-SB-18	
Date	3/22/2007
Depth	0-7 ft
Mercury	**2**

615-SB-05	
Date	10/30/2006
Depth	2.7-2.7 ft
Mercury	1.9

AI5-104			
Date	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	2.8	2.9	2.4
Chromium	5.6	**45.2**	15.8
Lead		72.8 J	
Nickel		36.4	
Zinc		116 J	

615-SB-06	
Date	10/31/2006
Depth	5-5 ft
Mercury	0.77

615-SB-17	
Date	3/22/2007
Depth	0-7 ft
Mercury	**12.2**

615-SB-15	
Date	3/22/2007
Depth	7-7 ft
Mercury	**9.8**

SS-42	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.5
Chromium	17.5
Cobalt	**35.5**
Copper	83.7
Lead	**793**
Mercury	**4.5**
Zinc	223

615-SB-10	
Date	10/31/2006
Depth	4.8-4.8 ft
Mercury	**2.3**

615-SB-11	
Date	10/31/2006
Depth	4-4 ft
Mercury	1

AI5-105					
Date	5/11/2011	5/11/2011	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.17 ft	0-0.17 ft (FD)	0.5-2 ft	0.5-2 ft (FD)	2-6 ft
Arsenic	3.9	3.8	2.2 J	3.1 J	2
Chromium	18.1	18.9	21.1	18.2	20
Copper	**90.7** J	**89.2** J	66.9 J		
Lead	366 J	360 J	106 J		
Mercury	0.28 J	0.348 J	1.72 J		
Zinc	158 J	167 J		**507** J	

615-SB-16	
Date	3/22/2007
Depth	0-7 ft
Mercury	**6.6**

615-SB-02	
Date	5/9/2006
Depth	2-2 ft
Mercury	1.9

615-SB-01	
Date	5/9/2006
Depth	3.7-3.7 ft
Arsenic	3.36
Chromium	10.3

SS-43	
Date	7/1/2000
Depth	0-0.17 ft
Arsenic	5.2
Chromium	4.9
Lead	442
Mercury	0.59

AI5-108			
Date	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	3.2	3.2	3.5
Chromium	15.4	17.6	19.8
Lead	88 J	85.6 J	
Zinc	213 J	**339** J	195 J

AI5-107			
Date	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	3.1	2.8	1.6
Chromium	29.7	17.8	24.9
Copper	69.4 J		
Lead	**587** J		
Zinc	283 J		

AI5-106			
Date	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.5 ft	0.5-2 ft	2-6 ft
Arsenic	3	3.4	2.3
Chromium	17.7	19.8	15.7
Lead	143 J	106 J	81.6 J
Mercury		1.26 J	
Zinc	120 J	126 J	

AI5-110			
Date	5/11/2011	5/11/2011	5/11/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	6.5	2.8	2
Chromium	7.3	19.9	11.4

AI5-109			
Date	5/10/2011	5/10/2011	5/10/2011
Depth	0-0.17 ft	0.5-2 ft	2-6 ft
Arsenic	5.5	2.7	2.3
Chromium	18.2	18.1	12.5
Copper	**227**		
Lead	350 J		
Zinc	**316** J		261 J

10	Indicates concentration is above the Unrestricted NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO
10	Indicates concentration is above the Restricted Residential NYSDEC SCO
10	Indicates concentration is above the Commercial NYSDEC SCO
10	Indicates concentration is above the Industrial NYSDEC SCO
10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Industrial RSL
10	**Bold** indicates concentration is above Background

PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 01/03/2013
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 5 - NATURE AND EXTENT - METALS

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FIGURE 6-10

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615-SB-01		
Date	5/9/2006	
Depth	3.7-3.7 ft	
Benzo(a)anthracene	0.25	J
Benzo(a)pyrene	0.22	J
Benzo(b)fluoranthene	0.31	J

10	Indicates concentration is above the Unrestricted NYSDEC SCO	10	Indicates concentration is above the Industrial NYSDEC SCO
10	Indicates concentration is above the Residential NYSDEC SCO	10	Underline indicates concentration is above the Residential RSL
10	Indicates concentration is above the Restricted Residential NYSDEC SCO	10	Indicates concentration is above the Industrial RSL
10	Indicates concentration is above the Commercial NYSDEC SCO	**10**	**Bold** indicates concentration is above Background

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PROJECT NO: 10404-03
PREPARED FOR: USACE
DATE: 01/03/2013
DRAWN BY: MRF
CHK'D BY: KT
APP'D BY: LJP

NOTES AND SOURCES:

1. Only data which are above an NYSDEC SCO or RSL are shown.

2. J - Reported concentration estimated.

AREA 5 - NATURE AND EXTENT PAHs

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FIGURE 6-11

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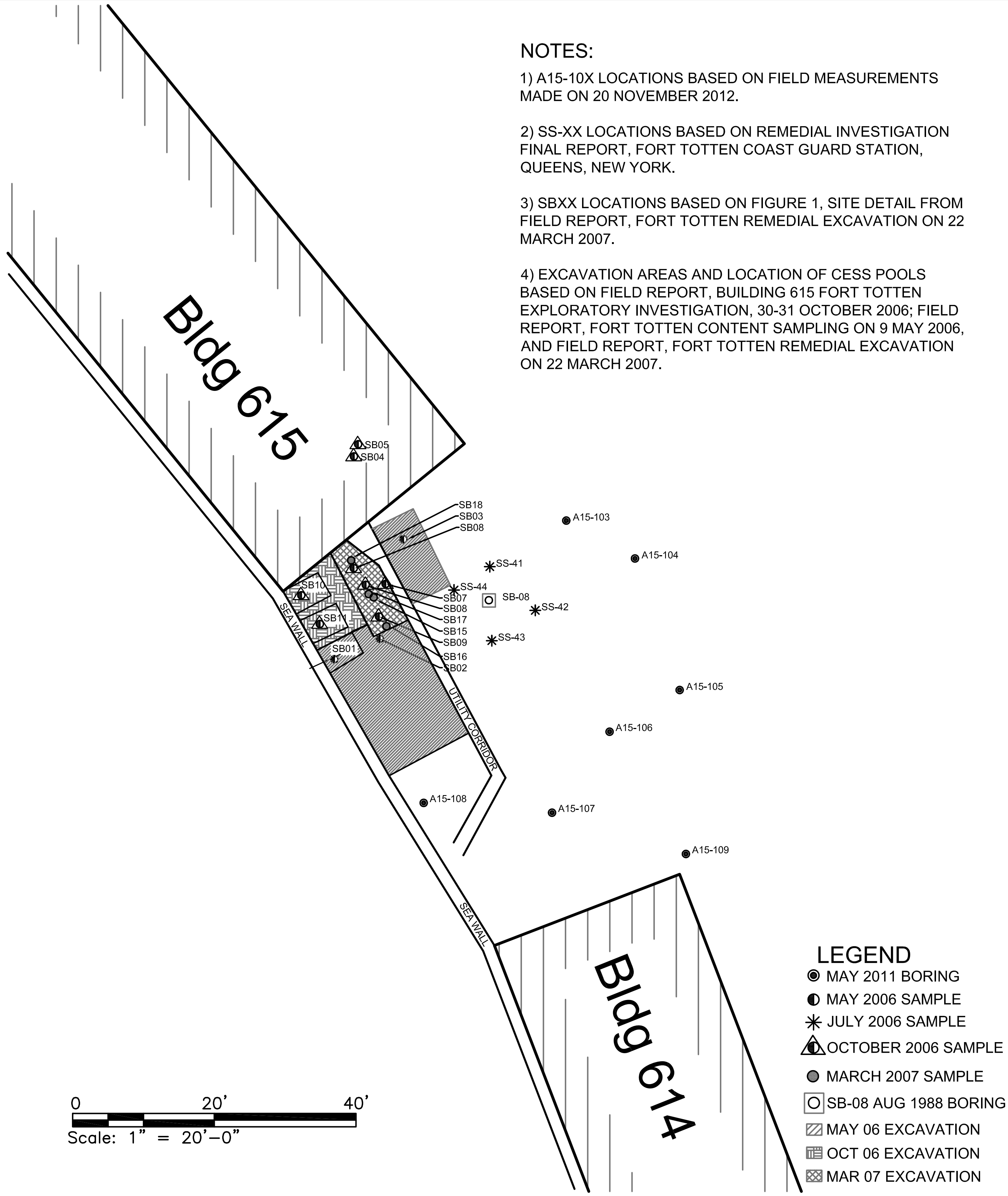
NOTES:

1) A15-10X LOCATIONS BASED ON FIELD MEASUREMENTS MADE ON 20 NOVEMBER 2012.

2) SS-XX LOCATIONS BASED ON REMEDIAL INVESTIGATION FINAL REPORT, FORT TOTTEN COAST GUARD STATION, QUEENS, NEW YORK.

3) SBXX LOCATIONS BASED ON FIGURE 1, SITE DETAIL FROM FIELD REPORT, FORT TOTTEN REMEDIAL EXCAVATION ON 22 MARCH 2007.

4) EXCAVATION AREAS AND LOCATION OF CESS POOLS BASED ON FIELD REPORT, BUILDING 615 FORT TOTTEN EXPLORATORY INVESTIGATION, 30-31 OCTOBER 2006; FIELD REPORT, FORT TOTTEN CONTENT SAMPLING ON 9 MAY 2006, AND FIELD REPORT, FORT TOTTEN REMEDIAL EXCAVATION ON 22 MARCH 2007.



PROJECT NO:	10404-03
PREPARED FOR :	USACE
DATE :	02/06/2013
DRAWN BY:	MGR
CHK'D BY:	LJP
APP'D BY:	LJP

NOTES AND SOURCES:

AREA 5 EXCAVATIONS AND SOIL SAMPLE LOCATIONS

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FIGURE 6-12

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APPENDICES

(All Appendices are Located on the Enclosed CD)