FEASIBILITY STUDY

Wastewater Treatment Plant
at the Former Lake Ontario Ordnance Works Site
Niagara County, New York

Prepared for:

U.S. Army Corps of Engineers
Baltimore District

Contract No.: W912DR-06-D-0002
Delivery Order: 0009
FUDS Project No.: C02NY0025

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June 2014

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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) and EA Engineering, Science, and Technology, Inc. (EA) total quality management system. As such, a senior technical review, as defined in the Quality Control Plan (QCP) for this project, has been conducted. This included review of the overall design addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers (USACE) regulatory constraints under the current Defense Environmental Restoration Program for Formerly Used Defense Site (DERP-FUDS) No. C02NY0025 project, within which this work has been completed. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

[redacted] 16 May 2014

[redacted], NYS Professional Engineer (PE), No. [redacted] Date
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Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's total quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project as defined in the QCP for this project, has been conducted. This included review of assumptions (methods, procedures, and material used in analyses), alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product accomplishes the stated project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

[redacted] 20 May 2014

[redacted] RT) Date
Independent Technical Reviewer

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	asbestos containing material
AEC	U.S. Atomic Energy Commission
AFP	Air Force Plant
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
atm L mol^{-1}	atmosphere liters per mole (units for Henry's Law constant)
bgs	below ground surface
BNI	Bechtel National, Inc.
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
COC	constituent of concern
COPC	chemical of potential concern
CWM	Chemical Waste Management, LLC
CY	cubic yard(s)
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOE	U.S. Department of Energy
EA	EA Engineering, Science, and Technology, Inc.
ECL	Environmental Conservation Law
ERDA	Energy Research and Development Administration
ERT	ERT, Inc.
EU	exposure unit
FS	feasibility study
ft	foot (feet)
ft^3	cubic feet
FUDS	Formerly Used Defense Sites
FUSRAP	Formerly Utilized Sites Remedial Action Program

LIST OF ACRONYMS AND ABBREVIATIONS

gal	gallon
HHRA	human health risk assessment
HI	hazard index
IC	institutional control
in	inch(es)
IPPP	Interim Production Pilot Plant
IRA	interim removal action
ITRC	The Interstate Technology and Regulatory Council
K_H	air to water distribution ratio (Henry's Law constant)
LARW	low-activity radioactive waste
LOOW	Lake Ontario Ordnance Works
LTM	long-term monitoring
LUC	Land-use control
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NA	not applicable
NCP	National Contingency Plan
NFSS	Niagara Falls Storage Site
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYSATF	New York State Assembly Task Force on Toxic Substances
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OEA	Office of Economic Adjustment
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon

LIST OF ACRONYMS AND ABBREVIATIONS

PCB	polychlorinated biphenyl
pCi/L	picocurie per liter
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remedial goal
QCP	Quality Control Plan
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SCO	Soil Cleanup Objective
SLERA	screening level ecological risk assessment
SVOC	semi-volatile organic compound
TBC	to-be-considered
TCLP	Toxicity Characteristic Leaching Procedure
TNT	trinitrotoluene
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
USACE	U.S. Army Corps of Engineers
UE	unrestricted exposure
USC	United States Code
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
UU	unlimited use
VOC	volatile organic compound
VP	Vicinity Property
WWTP	wastewater treatment plant

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EXECUTIVE SUMMARY

This feasibility study (FS) was prepared to evaluate remedial alternatives to address identified contaminants that pose potential risk to human receptors at the Department of Defense Wastewater Treatment Plant (WWTP) site on the former Lake Ontario Ordnance Works (LOOW) in Niagara County, New York. This FS is part of ongoing investigation and remediation activities at the former LOOW that are being conducted under the Defense Environmental Restoration Program [for] Formerly Used Defense Sites (DERP-FUDS).

The FS evaluates remedial technologies for chemical constituents of concern (COCs) identified in site media to ensure that the potential remedial alternatives will protect human health, welfare, and the environment. This document also presents additional groundwater and radionuclides data that was not included in a previous remedial investigation (RI) report for the site.

The former WWTP is situated within 14 acres of land owned by the Town of Lewiston, New York. The site is located between the Niagara Falls Storage Site to the south, Chemical Waste Management, LLC, to the north and east, and a National Grid easement to the west. A New York State Department of Health order prohibits use of the property for schools, hospitals or permanent occupancy. The site is not currently being used. Based on current zoning, use restrictions, and surrounding land use, the reasonable future land use of the property was identified as industrial. A construction worker was identified as the receptor with reasonable maximum exposure for the identified future land use.

Sludge/sediment and water samples collected from WWTP structures and underground pipes during previous RI and deconstruction activities were analyzed for chemical and radiological constituents. Pipe scale samples collected during previous deconstruction activities were also analyzed for radiological constituents. Polychlorinated biphenyls (PCBs) were identified in the sludge/sediment at concentrations that may cause risk to future construction workers at the site. This FS further evaluates and updates the exposure assumptions used based on latest available U.S. Environmental Protection Agency (USEPA) risk assessment guidance, and as a result, Aroclor 1254 and total PCBs are identified as COCs. The estimated volume of contaminated sludge/sediment at the site is 214 cubic yards (CY), which are located in a former acid neutralization building and dilution sump/weir.

Total chromium, lead, and mercury were also detected at concentrations that suggest excavated sludge/sediment might be classified as hazardous waste. Low levels of radionuclides were detected in the sludge/sediment and pipe scale. Elevated COC concentrations and low-level radionuclides were not identified in the water; however, not all structures were sampled due to accessibility limitations. Asbestos containing material was removed from a former WWTP structure during deconstruction and might be present in the remaining structures.

Remediation of radiological contamination at the site was performed by the U.S. Department of Energy (DOE) under the Formerly Utilized Sites Remedial Action Program (FUSRAP). Contaminated soils were removed and the property was closed in the 1980's. In March 2010, the DOE reviewed the previous remedial actions at the site and concluded that all FUSRAP materials were remediated to meet DOE guidelines for unrestricted use.

The remedial action objective (RAO) for the site is to prevent direct contact with COCs in the sludge/sediment that may cause an unacceptable risk. A preliminary remediation goal (PRG) was established for PCBs in the sludge/sediment that contributed to unacceptable risk (**Appendix**

C). A PRG for total PCBs was identified based on applicable or relevant and appropriate requirements (ARARs) and is presented in **Table ES-1.**

Table ES-1. Human Health PRG for Potentially Exposed Construction Workers

COC	Maximum Detected Concentration (mg/kg)	Target Organ	
Aroclor 1254	60	Skin, Eyes	
COC	**Maximum Detected Concentration (mg/kg)**	**Target Organ**	**ARAR-based PRG (mg/kg)**
Total PCBs	65	Skin, eyes	25[a]

Legend:
ARAR – Applicable or Relevant and Appropriate Requirements
HI - Hazard Index
mg/kg – milligrams per kilograms
NA - not applicable
PRG - Preliminary Remediation Goal
The Target Organ identification applies to non-cancer health effects (with corresponding Hazard Indices) only
a Cleanup level for bulk PCB remediation waste in low occupancy areas (40 CFR Part 761.61(a)(4)(i)(B))

Four remedial alternatives were selected for detailed analysis using criteria provided by the USEPA:

- *Alternative 1: No Action* – This alternative is required under *40 CFR 300: National Oil and Hazardous Substances Pollution Contingency Plan* for the FS process (USEPA, 1994). This alternative would not implement any active remedial actions, controls, or monitoring of potential risk. No public awareness or education/training would be initiated regarding potential risks associated with the contaminated sludge/sediment. Existing land-use controls (LUCs) are not considered and existing access restrictions would not be maintained.
- *Alternative 2: Capping* – This alternative would consolidate the contaminated sludge/sediment in one of the WWTP structures followed by placement of a concrete cap over the structure. LUCs/institutional controls (ICs), long-term monitoring, five-year reviews, and site close-out activities would be required.
- *Alternative 4: Removal of Sludge/Sediment with Off-site Disposal* – This alternative would remove contaminated sludge/sediment from the WWTP structures. Contaminated materials would be placed in an off-site permitted treatment, storage, and disposal facility (TSDF). Water within the structures would be pumped, treated if necessary, and discharged. The site would be restored to a condition that allows for unlimited use (UU) and unrestricted exposure (UE).
- *Alternative 6: In Situ Solidification* - This alternative would solidify contaminated sludge/sediment in one of the WWTP structures using a cementitious reagent. Water

within the structure would be pumped, treated if necessary, and discharged. Flowable fill would be placed over the solidified sludge/sediment. LUC/ICs, long-term monitoring, five-year reviews, and site close-out activities would be required.

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1.0 INTRODUCTION

ERT, Inc. (ERT) was contracted by the U.S. Army Corps of Engineers (USACE) to conduct a feasibility study (FS) for identified constituents of concern (COCs) that represent a potential risk to human receptors at the Department of Defense (DoD) Wastewater Treatment Plant (WWTP) site (hereafter "site") on the former Lake Ontario Ordnance Works (LOOW) in Niagara County, New York (**Figure 1-1** and **Figure 1-2**). The FS was completed under contract number W912DR-06-D-0002, delivery order number 0009, dated 25 June 2008, which was issued for an ongoing project under the Defense Environmental Restoration Program [for] Formerly Used Defense Sites (DERP-FUDS) (USACE, 2008a). This FS was prepared in accordance with the U.S. Environmental Protection Agency (USEPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

1.1 Statutory Authority

Environmental restoration activities at FUDS such as LOOW were initiated under the Defense Appropriations Act in 1983. In 1984, execution of this program was delegated by the DoD to USACE through the headquarters of the Army. In October 1986, the Superfund Amendments and Reauthorization Act (SARA) was signed into law and Section 211 of SARA established the DERP. Legislation authorized the Secretary of Defense to carry out response actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for releases of hazardous substances from active defense sites and FUDS if the releases occurred while the facility was under DoD jurisdiction and from vessels owned or operated by the DoD.

Three overarching goals are provided in the DERP legislation:

1. The identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants.
2. Correction of other environmental damage due to DoD use of a property (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment.
3. Demolition and removal of unsafe buildings and structures, including buildings and structures from DoD sites formerly used by or under the jurisdiction of the Secretary of the Army that meet certain eligibility criteria.

Pursuant to DoD Instruction 4715.7, *Management Guidance for the Defense Environmental Restoration Program* (DoD, 2001), the Secretary of the Army is designated as the DoD Executive Agent for the FUDS program and has delegated the responsibility for program management and execution to USACE.

The FUDS program addresses real property that meets two criteria (USACE, 2004):

1. Properties that were formerly owned by, leased by, possessed by or otherwise under the jurisdiction of the Secretary of Defense, or governmental entities that are the legal predecessors of the DoD, and those properties where accountability rested with the DoD but where the activities at the property were conducted by contractors.
2. Properties that were transferred from DoD control prior to 17 October 1986.

These criteria must be met before the property is eligible for inclusion into DERP-FUDS. The real property being addressed at LOOW was owned by the DoD from 1942 until the mid-1940s.

1.2 Purpose and Scope

This FS evaluates remedial alternatives for COCs identified at the LOOW WWTP (hereafter 'site') during remedial investigation (RI) activities that pose risk to potentially exposed human receptors. This FS documents background information and historical data, establishes preliminary remediation goals (PRGs) and remedial action objectives (RAOs), identifies and evaluates remediation technologies, and assembles and evaluates remedial action alternatives.

Also presented is groundwater data that was collected subsequent to a Phase IV RI and the results of radiological analyses performed on sludge/sediment, soil, water, and WWTP structure samples. **Appendix A** provides analytical data summaries for the groundwater (chemical COCs), sludge/sediment and soil (radionuclides), WWTP water (radionuclides), and WWTP structure (radionuclides) samples.

1.3 LOOW Background Information

In 1942, the War Department obtained a 7,500 acre parcel of land in northwestern Niagara County, New York, for the construction of a trinitrotoluene (TNT) production facility designated as the Lake Ontario Ordnance Works (**Figure 1-2**). Production operations, production support, and storage facilities occupied 2,500 acres of the eastern portion of LOOW. The remaining 5,000 acres were left undeveloped to serve as a buffer zone for the TNT production facility and to allow for the possible expansion of TNT production. Expansion of the facility never occurred, and in 1943, after nine months of operation, LOOW was decommissioned due to excess TNT production at other War Department facilities. The eastern 2,500 acres, which comprised the TNT production area, was subsequently used by other DoD agencies including the Air Force and Navy (Air Force Plant 38 [AFP-38], AFP-68, and a Navy Interim Production Pilot Plant [IPPP]) for high-efficiency boron fuels. The U.S. Army subsequently used a portion of this acreage for the construction of a Nike Missile Base.

In the mid-1940s, 1,500 acres of the southern portion of LOOW were transferred to the USACE Manhattan Engineer District, which later gave rise to the U. S. Atomic Energy Commission (AEC). In 1974, the AEC was replaced by the Energy Research and Development Administration (ERDA) and the U.S. Nuclear Regulatory Commission (NRC). In 1977, ERDA became the U.S. Department of Energy (DOE). While under operation by the Manhattan Engineer District, radioactive materials were stored on portions of the southern 1,500 acres of LOOW, which was called the Lake Ontario Storage Area. Between the 1950s and 1980s, radioactive materials housed in this area were consolidated and transferred to the current 191-acre Niagara Falls Storage Site (NFSS). During consolidation, the area surrounding the NFSS, formerly used by AEC and its predecessor, was designated as "Vicinity Properties" (VPs) to facilitate the DOE environmental cleanup and closure. The NFSS and the VPs that remain open are currently being addressed under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The former WWTP Site was designated VP X and is located north and adjacent to the northwestern corner of NFSS. VP X was closed by DOE in 1991 (Bechtel National, Inc. [BNI], 1992). The DOE reviewed radiological conditions at VP X in 2010 in response to stakeholder concerns. The review concluded that VP X remains protective under the current

land-use restrictions (DOE, 2010). USACE does not have the authority to re-evaluate the property under FUSRAP.

1.3.1 Site Description

The site lies within 14 acres of unused land owned by the Town of Lewiston, New York (**Figure 1-2**). The WWTP structures occupied approximately 4 acres of the property (**Figure 1-3**). The site is located between the NFSS to the south, Chemical Waste Management, LLC (CWM) to the north and east, and a National Grid easement to the west. Currently, there are no industrial, commercial, or residential uses of the property.

Prior to the Town of Lewiston acquiring the property, a 'Commissioner's Orders' was prepared by the New York State Department of Health (NYSDOH) outlining land-use restrictions that would be applied to the property in order for the state to approve the land transfer (NYSDOH, 1974). The restrictions were imposed with the objective of protecting human health and safety and to "minimize danger to life and property from radiation hazards." NYSDOH continues to maintain these land-use restrictions. The owner or future owner of the property is responsible for performing the necessary due diligence in the case of sale of the property or a change in surface conditions or land use to ensure compliance with the restrictions. A copy of the Commissioner's Orders is provided in **Appendix D**.

NYSDOH restrictions on the site indicate that the property cannot be used for residential purposes, schools, or hospitals but it can be used for industrial or commercial activities. No deliberate or intentional movement, displacement, or excavation of the soil is permitted unless an acceptable plan is approved by the NYSDOH. These restrictions could be lifted if deemed appropriate by the NYSDOH. The site is located on property currently zoned for general industrial use and it can be reasonably assumed that the future land use will remain as commercial or industrial property in the foreseeable future.

The WWTP is inactive and various structures have been partially and/or completely demolished (USACE, 2012). The condition of WWTP structures is summarized below (refer to **Figure 1-3**).

- An Imhoff tank, chlorine contact basin, and collection tank are present; the Imhoff tank is surrounded by a chain-link fence
- Former TNT waste lines, which terminated at a mixing house, were partially removed and the interiors were cleaned during an interim removal action (IRA) conducted in 1999 (illustrated on **Figure 1-4**)
- Several underground WWTP pipes are present
- The former mixing house has been deconstructed and removed
- A former pump house has been deconstructed and removed and only a portion of the northern concrete wall (below ground) and concrete floor remain
- A former acid neutralization building with attached dilution sump/weir has been partially deconstructed and the below ground portion is present; the structure is surrounded by a chain-link fence
- Two sludge beds are present, one of the beds (northern) has been partially removed
- A Venturi vault has been completely removed

- The site is enclosed with a fence that restricts public access

The site and surrounding area are generally flat and the topography gently slopes to the north. The site is overgrown with pasture grass and northern shrub. Wooded areas are dominated by maple, ash and oak trees. Within drainage swales, cattail-marsh grass is dominant. A variety of mammals, amphibians, reptiles, fish and bird species utilize the area within a one-half mile radius of the site. An inquiry of the U.S. Fish and Wildlife Service and New York State Department of Environmental Conservation (NYSDEC) was made during a screening level ecological risk assessment (SLERA). No federal or state-recognized endangered or threatened species are known to inhabit or breed at the site and no sensitive ecosystems are recognized on the site.

Surface soil consists of generally dry, clayey silt with some fine sand that has been graded during past DoD operations. The site is underlain by approximately 30 to 60 feet (ft) of unconsolidated glacial deposits, which overlie shale bedrock of the Queenston formation. Eight distinct stratigraphic layers have been identified under LOOW; fill material, alluvium, upper glacial till, middle silt till, glaciolacustrine clay, glaciolacustrine silt and sand, lodgment till and bedrock.

Groundwater occurs in low-permeability unconsolidated deposits and the water table surface generally conforms to the local topography. Groundwater at the site occurs at approximately 5 to 10 ft below ground surface (bgs). Regional groundwater flow in the unconsolidated deposits is to the north at a rate of approximately 0.11 ft per year (Golder, 1993). Lateral groundwater flow is restricted due to the discontinuous nature of saturated lenses.

1.3.2 Site History

The WWTP was comprised of a sanitary sewage pump house (pumping station), a Venturi vault, an Imhoff settling tank, sludge beds, a chlorine contact tank, an acid neutralization building with dilution sump/weir, a collection tank, final mixing houses, and underground pipes that were used to convey aqueous waste streams between these structures. The WWTP was used primarily to treat four types of wastewater: sanitary waste, acid waste, TNT production waste, and following the closing of LOOW, other process-related wastewater (e.g., boron production).

When operational, wastewater from TNT production operations was diluted with treated sanitary and industrial wastewaters prior to discharge to the Niagara River via a 30-inch diameter outfall. A single 30-inch diameter sanitary sewer line entered the WWTP from the east. Sanitary waste entered the pumping station and was then aerated in a Venturi vault. After aeration, solids were settled in the Imhoff tank. The treated liquid was gravity fed to a chlorine contact tank and then to a collection tank. Solids from the Imhoff tank were transferred to one of two sludge beds (northern sludge bed and southern sludge bed). At the collection tank, the treated sanitary wastewater was combined with neutralized aqueous waste. After mixing, the treated wastewater was discharged through the 30-inch diameter outfall to the Niagara River.

Acidic solutions resulted from acid production and storage, laboratory processes, and nitration processes associated with TNT production. A single acid waste sewer entered the WWTP from the east and terminated at a manhole approximately 20 ft north of the acid neutralization building. At this point, the waste stream was gravity fed into neutralization vaults. Acidic solution that exceeded the system's capacity was discharged from the manhole, via an overflow, to the Western Drainage Ditch. From the acid neutralization building, treated acid waste was

gravity fed to the collection tank where it was combined with the treated sanitary waste stream and concentrated chlorine.

TNT wastewater was conveyed to the WWTP through two lines entering from the north. The lines received production wastewater from TNT nitration areas, TNT washing facilities, and former AFP-68 process areas. TNT wastewater was directed to the mixing house where it was mixed with the treated sanitary and acid waste streams prior to discharge to the Niagara River.

After LOOW activities ceased, the WWTP was utilized by subsequent DoD operations including AFP-38, AFP-68, the IPPP, and Nike missile facility. The Boron-10 Plant was a non-DoD facility that also used the WWTP. Disposal of thiocyanate wastes at the WWTP has been reported (New York State Assembly Task Force on Toxic Substances [NYSATF], 1981). AFP-38 operated from approximately 1950 until 1979 and was used for rocket, missile, and laser research and development. AFP-68 operated from approximately 1957 until 1959 and was a boron-based, high-energy fuels research and development project. The Nike missile facility was operated by the U.S. Army from 1954 until 1966. The IPPP was built in 1956 for the production of high-efficiency fuels; this facility utilized some of the existing TNT production lines and the WWTP.

Aroclor 1254 was detected above the PRG in sludge/sediment within the Acid Neutralization Building Dilution Sump. This structure was connected to acid waste lines that originated at the following areas:

- Nitration houses associated with TNT production (1943-1944). This area was subsequently occupied by AFP-68 (1957-1959) and the Air Force IPPP (1954-1960), both government-owned, contractor operated facilities, and Chem-Trol/SCA/WM (1972 to present). The acid waste lines were plugged by Waste Management in 1978.
- An acid concentration area between 'N' and 'O' streets. This area is now located on DOE property (i.e. NFSS). The acid waste lines were plugged by USACE in 2006.

Following the completion of DOE investigation and remediation activities in 1992, the WWTP was designated VP X. Soil and sediment from VP X with elevated radioactivity were removed to depths of 1.2 ft and 0.5 ft bgs, respectively. Soil was removed from around the WWTP structures and near a former railroad track on the southern portion of the WWTP property; adjacent to the NFSS. Sediment was removed from the Western Drainage Ditch (DOE, 2010). VP X is a closed vicinity property (BNI, 1992).

The Town of Lewiston acquired the site in 1975 and the WWTP is no longer operational.

1.3.3 Historical WWTP Structures

The WWTP is inactive and various structures have been partially and/or completely demolished. The following provides process descriptions of the remaining structures on site where COC-contaminated sludge/sediment is contained.

1.3.3.1 Imhoff Tank and Sludge Beds

The Imhoff tank and associated sludge beds were a two-tiered system that was used to process sanitary sewage. Solids that settled in the Imhoff tank were digested and conveyed to beds where the sludge was spread and dried. Water drained from the sludge was transferred back to

the Imhoff tank for processing. Clarified water from the Imhoff tank was then chlorinated prior to discharge to the collection tank and mixing house.

1.3.3.2 Chlorine Contact Tank

The chlorine contact tank was used for chemical disinfection of the sanitary wastewater.

1.3.3.3 Acid Neutralization Building

The acid neutralization building was used to neutralize aqueous acid waste. The neutralization process used lump limestone or marble chips with high calcium carbonate content. Acid wastes entering the system percolated through the limestone or marble and were buffered to an acceptable pH level. In addition, further pH adjustments may have been performed with the addition of lime.

1.3.3.4 Underground Pipes

Underground pipes received wastewater from across LOOW and facilitated the movement of wastewater through the treatment process. Pipes investigated have been constructed of clay tile, steel, or wood, and are located between 2 ft and 18 ft bgs. The clay tile and wooden pipes were encased in concrete.

1.3.4 Previous USACE Investigations

An ongoing multi-phase RI is being performed to assess the nature and extent of contamination associated with LOOW operations and subsequent DoD operations at areas of concern (AOCs) eligible for investigation within the ongoing DERP-FUDS project. This FS is part of the ongoing investigation and remediation activities at LOOW.

During previous LOOW investigations, formerly used DoD AOCs, including the WWTP, were assessed to determine the appropriateness of combining areas into exposure units (EUs) to facilitate human health and ecological risk assessments. Details of the RI and IRA activities completed at LOOW are documented in the following reports:

- *Preliminary Contamination Assessment Report, Operable Unit No. 2, Volume I of II* (USACE, 1992) – hereinafter the "OU 2 PCA Report"
- *Report for Phase I Remedial Investigation at the Former Lake Ontario Ordnance Works, Niagara County, New York* (USACE, 1999) – hereinafter the "LOOW Phase I RI Report"
- *Demobilization and Closure Report: Interim Removal Action TNT Pipeline and Chemical Waste Sewer Lines at the Former Lake Ontario Ordnance Works, Lewiston/Porter, New York* (USACE, 2000) – hereinafter the "LOOW IRA Report"
- *Report of the Results for the Phase II Remedial Investigation at the Former Lake Ontario Ordnance Works, Niagara County, New York* (USACE, 2002) – hereinafter the "LOOW Phase II RI Report"
- *Report of Results for the Remedial Investigations of Underground Utility Lines, Formerly Used by the Department of Defense, Lake Ontario Ordnance Works, Niagara County, New York* (USACE, 2008b) – hereinafter the "LOOW Phase III RI Report"

- *Final Remedial Investigation Report for Phase IV Remedial Investigation/Feasibility Study at Formerly Used Defense Site The Former Lake Ontario Ordnance Works, Niagara County, New York* (USACE, 2011a) – hereinafter the "LOOW Phase IV RI Report"
- *Completion Report for Mitigation of Safety Hazards at the Lake Ontario Ordnance Works, Office of Economic Adjustment, Wastewater Treatment Plant, Lewiston, New York* (USACE, 2012) – hereinafter the "WWTP OEA Report"

1.3.4.1 Interim Remedial Actions

In 1999, USACE performed an IRA on the former TNT waste lines to remove contaminated sediment and water from the lines and close the lines in-place (**Figure 1-4**). Confirmatory soil samples (surface and subsurface) were collected adjacent to these lines on the site during the LOOW Phase IV RI. Analytical results confirmed that soils adjacent to the TNT waste lines are not contaminated with explosives. These lines are not evaluated in this FS.

The former TNT waste sewer terminated at the mixing house, which was removed during a removal action conducted by the USACE in 1999 (USACE, 2000). Since the Phase I RI, the Town of Lewiston has also removed the pump house building.

1.3.4.2 Phase II Remedial Investigation

The WWTP was investigated during the Phase I RI for DoD marker compounds. Results did not indicate constituent concentrations exceeding human health-based criteria.

1.3.4.3 Underground Utility (Phase III) Remedial Investigation

During the LOOW Phase III RI chemicals of potential concern (COPCs) were identified for the following analytical groups: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs, pesticides, polychlorinated biphenyls (PCBs), explosives, and metals (USACE, 2008b). USACE also collected split samples of water, sludge/sediment, and soil from various WWTP structures for radionuclides analysis (**Figure 1-5**).

Results indicate that chemically contaminated media include sludge/sediment within the Imhoff tank, chlorine contact tank, and wooden discharge line from the acid neutralization building and dilution sump/weir. The COPCs were identified at concentrations that may represent a potential human health concern. In addition, some of the reported concentrations for total chromium, lead, and mercury in sludge/sediment samples were greater than 20 times the corresponding Toxicity Characteristic Leaching Procedure (TCLP) maximum concentration listed in 40 CFR 261.24 (Table 1). This suggests that excavated sludge/sediment might be classified as hazardous (waste codes D007, D008, and D009). Low-level radionuclides were also detected in sludge/sediment samples from the Imhoff tank, chlorine contact tank, and acid neutralization building dilution sump. Radionuclides were not detected in corresponding water samples at concentrations greater than USEPA maximum contaminant levels (MCLs) or NYSDOH guidelines.

1.3.4.4 Phase IV Remedial Investigation

Environmental investigations conducted between 1992 and 2008 culminated in the LOOW Phase IV RI, which focused on determining the nature and extent of soil, groundwater, sludge/sediment, and WWTP water contamination at the site. Seven groundwater samples and

88 soil samples (both surface and subsurface) were collected and analyzed for VOCs, SVOCs, PCBs, explosives, pesticides and metals.

Surface and subsurface soil samples were collected throughout the site and targeted features (**Figures 1-6 and 1-7**). Two rounds of groundwater samples were collected from three monitoring wells (BP-14, BP-15, and BP-16) adjacent to former WWTP structures (**Figure 1-8**). Samples of sludge/sediment and water from accessible structures and underground lines were also collected (**Figures 1-9 and 1-10**). Additional groundwater samples were collected after the Phase IV RI was completed and analyzed for polycyclic aromatic hydrocarbons (PAHs) using methods capable of achieving project data quality objectives. The results of these additional analyses are provided in **Appendix A**.

Results of a human health risk assessment (HHRA) did not identify risks to human receptors associated with COPCs in the soil and groundwater. Two exposure scenarios were evaluated for sludge/sediment in the structures and underground pipes: 1) exposure to contaminated media in all structures and pipes, and 2) exposure to contaminated media in individual line types (e.g., sanitary sewer pipes, acid waste pipes, etc.). Receptors evaluated included a potentially exposed construction worker, commercial worker, maintenance worker, and trespassers (adolescent and adult). As a conservative measure, risk to residential receptors (child and adult) was also evaluated although the current NYSDOH order restricts residential use of the site. Results identified PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) and a PCB (Aroclor 1254) in the sludge/sediment as COCs. The non-carcinogenic hazard exceeded the USEPA's threshold of 1 for a potentially exposed construction worker and residents (child and adult) due to exposure to PCB (Aroclor 1254). Total cumulative carcinogenic risk for a potentially exposed construction worker and resident was above the USEPA threshold of 1×10^{-4} due primarily to PAHs. Total cumulative carcinogenic risk for a potentially exposed construction worker for combined exposure pathways to all COCs (PAHs and PCBs [Aroclor 1254]) in sludge was calculated as 2×10^{-4}, exceeding the upper end of the acceptable cancer risk range established by the USEPA (USEPA, 2011).

There are several uncertainties inherent in this determination of risk that were further examined in order to make an appropriate risk management decision for the site. For example, due to the limited detections of Aroclor 1254 and Aroclor 1260, the exposure point concentrations for these two PCBs were based on the maximum detected concentrations. In addition, updated guidance on dermal exposure has been issued since the risk assessment was drafted, indicating that the potential for dermal absorption of constituents by construction workers was overestimated in the RI (EPA 2007). Finally, differing assumptions for length of time that construction work would occur at the site were used in the cost estimate for this FS than what was used in the RI. The impact of these uncertainties was examined as the PRGs were refined for this FS (**Appendix C**), and the result of this refinement is presented in Section 2.3.

The SLERA determined that no sensitive or significant habitats are present at the site. The site is not managed or expected to be managed for ecological purposes. Furthermore, there is no evidence that ecological receptors have been affected or damaged by constituent concentrations and associated risks are within acceptable USEPA guidance.

The RI concluded that further environmental management decisions should be considered in a FS to address excess risk to construction workers potentially exposed to COCs in the sludge/sediment.

1.3.4.5 Summary of Confirmatory Groundwater Sample Results

Phase IV RI groundwater analytical results for PAHs were inconclusive due to laboratory reporting levels that exceeded the USEPA Regional Screening Level for tap water (USEPA, 2009). No other COPCs were identified in groundwater. Additional groundwater samples were collected in 2011 and analyzed using Method 8270LL for low-level analysis of PAH to meet the project data quality objectives and verify the presence or absence of COPCs in groundwater. Results indicated that PAHs are not present in groundwater (**Appendix A**). Groundwater is not a media of concern evaluated in this FS.

Since uranium was detected in groundwater at the adjacent NFSS above background and slightly above the uranium MCL, three downgradient monitoring wells were sampled to determine the off-site extent of uranium from NFSS. Uranium concentrations in wells MW-BP-15 and MW-BP-16 (located on the WWTP Site) were less than 1 picocurie per liter (pCi/L) above background, which is below the MCL. Uranium in well MW-BP-14 was below the background level.

1.3.4.6 OEA Safety Hazards Mitigation Project

A contract was issued to LATA-Sharp Remediation Services, LLC, using funds from the U.S. Department of Defense Office of Economic Adjustment (OEA), to mitigate public safety hazards at the site. Activities included deconstruction of the above ground portion of the acid neutralization building and complete deconstruction of the Venturi vault and pump station. Asbestos containing material (ACM) was removed from the above ground portion of the acid neutralization building and disposed off site at a permitted facility. The Town of Lewiston installed chain-link fences around the remaining acid neutralization building, the Imhoff Tank, and at an open area along the boundary with the National Grid easement. Sludge/sediment and water samples were collected from the Imhoff tank, chlorine contact tank, and collection tank. Water samples were collected from the Imhoff tank, chlorine contact tank, collection tank and acid neutralization building. All sludge/sediment and water samples were analyzed for VOCs, SVOCs, PCBs, explosives, pesticides, metals and radionuclides. Scale from a Venturi vault pipe was also sampled and analyzed for radionuclides based on elevated field screening measurements. Radionuclides screening, sampling, and analysis was performed due to proximity of the site to NFSS. Sample locations are illustrated on **Figure 1-5**.

Analytical results confirmed the presence of previously identified COCs (i.e., PCBs) in the sludge/sediment. Low-level radionuclides were also detected in the sludge/sediment. COCs and radionuclides were not detected in the water samples at concentrations above the project screening criteria or USEPA/NYSDOH MCLs (radionuclides). Analytical results are provided in **Appendix A**.

1.3.5 Nature and Extent of Contamination

Sludge/Sediment

Based on a refinement of the PRGs (**Appendix C**), a PCB (Aroclor 1254) is present in sludge/sediment at a concentration that may cause excess risk to potentially exposed construction workers. Although Aroclor 1254 was the only PCB identified as a COC, another PCB (Aroclor 1260) is present at concentrations greater than the project screening criteria. Total chromium, lead, and mercury concentrations are greater than 20 times the corresponding TCLP maximum concentration listed in 40 CFR 261.24, indicating that the sludge/sediment may qualify as D007, D008, and D009 waste. Low concentrations of radionuclides were identified in the sludge/sediment. Radionuclides are excluded from DERP-FUDS (as explained below); however their presence is considered in the screening and evaluation of remedial technologies and options presented in this FS.

Water

Analytical results do not indicate that chemical contaminants are present in water within the structures at concentrations greater than the project screening criteria. Radionuclides were not detected in the water at concentrations above the USEPA/NYSDOH MCLs.

Soil and Groundwater

Analytical results do not indicate that chemical contaminants are present in subsurface soil and groundwater at concentrations greater than the project screening criteria or human health risk levels. Radionuclide-contaminated soil was previously remediated by the DOE.

Radionuclides

The site is a former Vicinity Property (VP X) associated with the Niagara Falls Storage Site. Remediation of radiological contamination at the site was performed by the DOE under FUSRAP. Contaminated soils were removed and the property was closed in the 1980s. In March 2010, the DOE reviewed the previous remedial actions at VP X and concluded that all FUSRAP materials were remediated to meet DOE guidelines for unrestricted use (DOE 2010).

Structures, Underground Pipes, and other Construction/Demolition Materials

ACM was previously removed from the above-ground portion of the acid neutralization building and may be present in other building materials from remaining structures, lines, and debris. Low-level radionuclides were detected in pipe scale from the Venturi vault and may also be present in other building materials.

1.3.6 Contaminant Fate and Transport

1.3.6.1 Potential Routes of Migration

Based on previous investigations, the underground pipes do not appear to have granular bedding material and many were encased in concrete. Pursuant to a Consent Order issued by the NYSDEC in 1998 to Service Corporation of America, Inc., (the predecessor of CWM), the acid waste sewer and sanitary sewer lines were plugged hydraulically upgradient of the site, in the area just north of M Street on CWM property, northeast of the site (NYSDEC, 1978).

Analytical data from the RIs did not identify elevated COC concentrations in subsurface soil adjacent to and underlying any of the WWTP structures.

1.3.6.2 Contaminant Persistence

PCBs have low water solubility, strongly absorb to organics, and would preferentially partition to the sludge/sediment. The major fate process for PCBs in water is adsorption to sludge, sediment or other organic matter.

The less-chlorinated PCBs such as Aroclor 1242 are less persistent in the environment due to volatilization, solubility, and aerobic degradation. The more highly chlorinated PCBs such as Aroclor 1254 and Aroclor 1260 are extremely persistent in the environment. Natural attenuation of these compounds requires anaerobic reductive dechlorination to remove the chlorine, followed by aerobic processes to break the biphenyl ring. Dechlorination of the Aroclor is rarely complete. Dechlorination alters the type of PCB rather than changing the total amount of PCBs.

Aerobic degradation of PCBs is generally confined to compounds with fewer chlorine atoms; aerobic degradation affects the biphenyl ring to which the chlorine is attached. Of those PCBs included in the analytical suite, Aroclor 1260 has the highest number of chlorine atoms (60 percent chlorine content by weight) and is more susceptible to anaerobic dechlorination.

The estimated Henry's Law constant (K_H), or air to water distribution ratio, ranges from 10 atmosphere liters per mole (atm L mol^{-1}) for less chlorinated congeners to approximately 10^{-2} atm L mol^{-1} for more highly chlorinated congeners. As K_H decreases, the air to water ratio decreases; therefore, PCBs with smaller K_H values are less volatile (such as Aroclor 1254).

1.3.6.3 Potential Routes of Exposure to Receptors

Conceptual site models have been developed during the HHRA that identify potential receptors and routes of exposure to COCs within the structures and underground pipes. The human health conceptual site model is presented in **Figure 1-11**. Exposure pathways begin from potential sources and progress through the environment by various fate and transport processes to potential human receptors. For the structures and underground pipes; multiple exposure scenarios are possible based on property boundaries, routes of contact, type of underground utility, contaminated media, and potential receptors (USACE, 2011b). Additional routes of exposure may become complete if the structures containing the contaminated sludge/sediment fail.

1.4 Report Organization

This report is organized in the following manner:

- Section 1.0 presents an introduction
- Section 2.0 presents the RAO
- Section 3.0 identifies project-specific applicable or relevant and appropriate requirements (ARARs)
- Section 4.0 presents general response actions
- Section 5.0 identifies and screens treatment technologies and process options
- Section 6.0 develops and provides an initial screen of remedial alternatives
- Section 7.0 provides a detailed analysis of remedial alternatives
- Section 8.0 provides references

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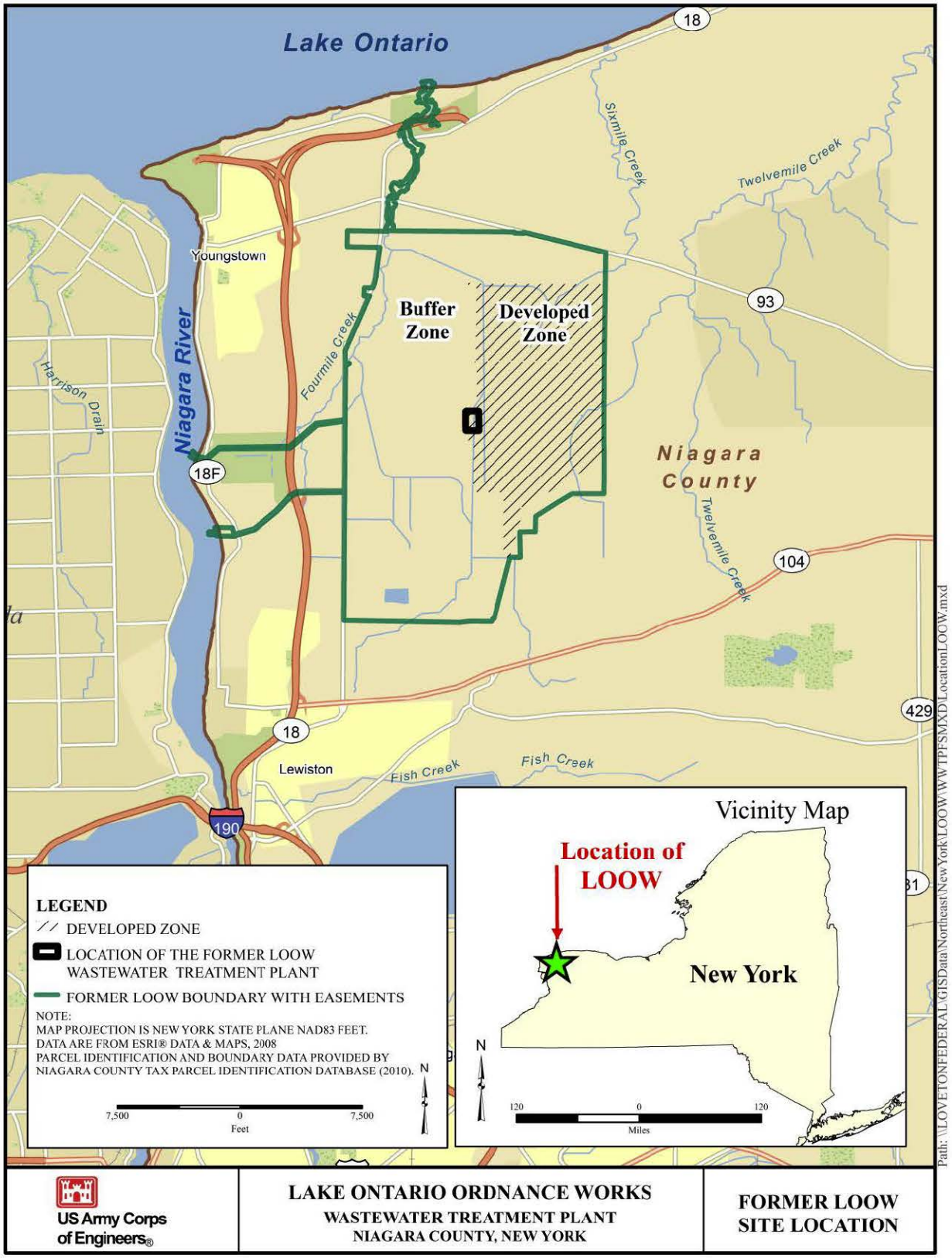

Figure 1-1: Former LOOW Site Location

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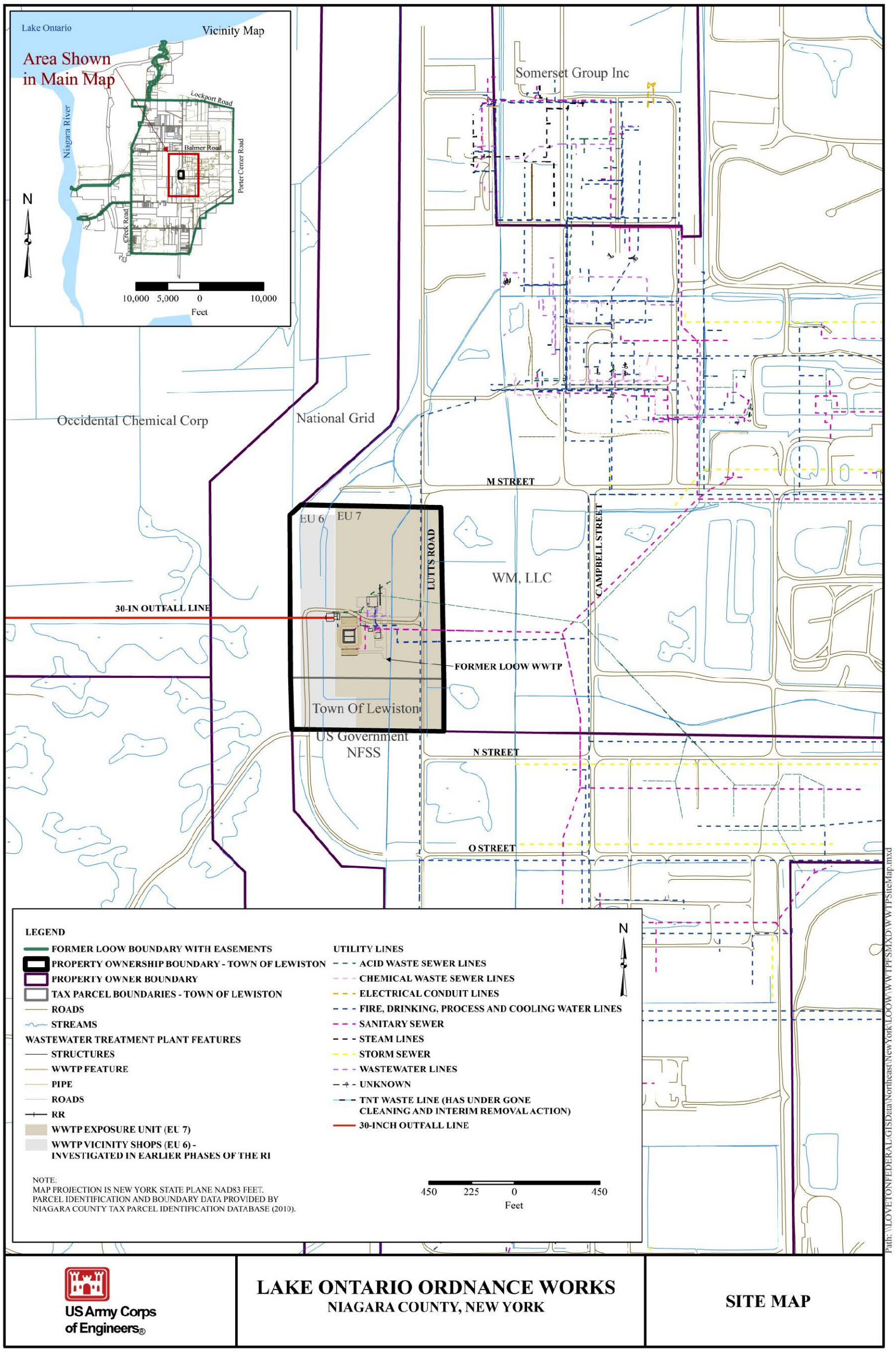

Figure 1-2: Site Map

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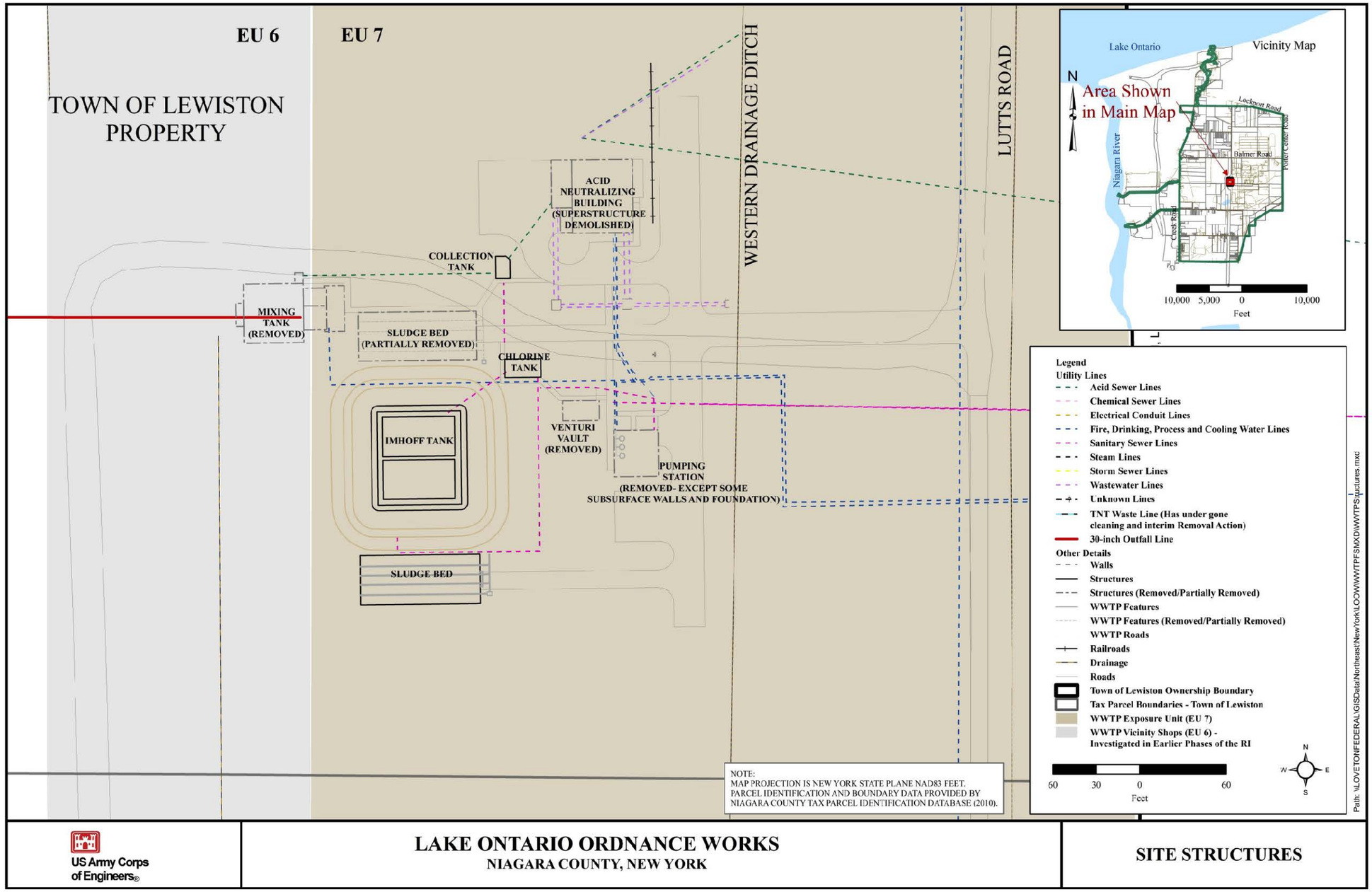

Figure 1-3: Site Structures

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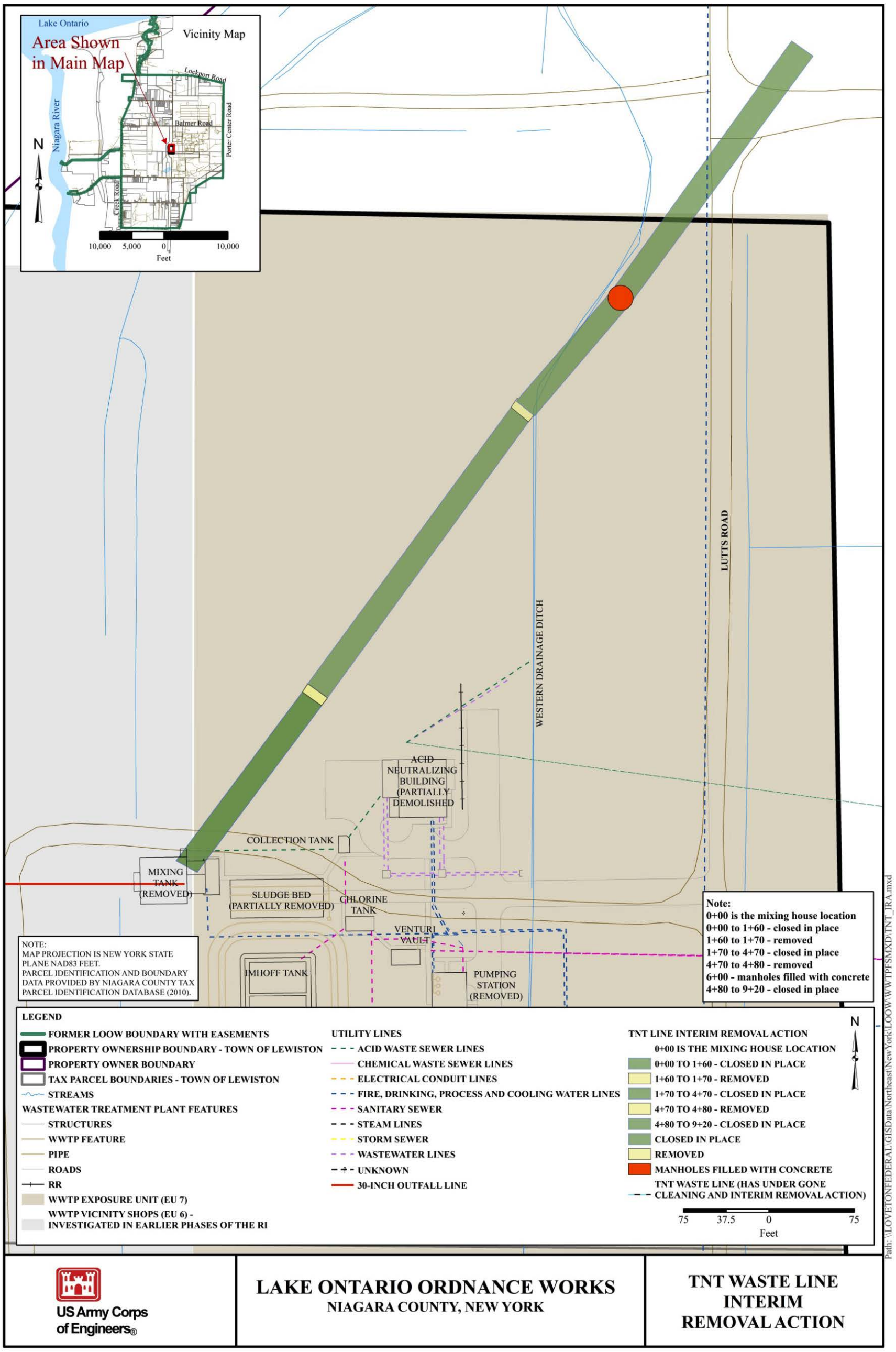

Figure 1-4: TNT Waste Line Interim Removal Action

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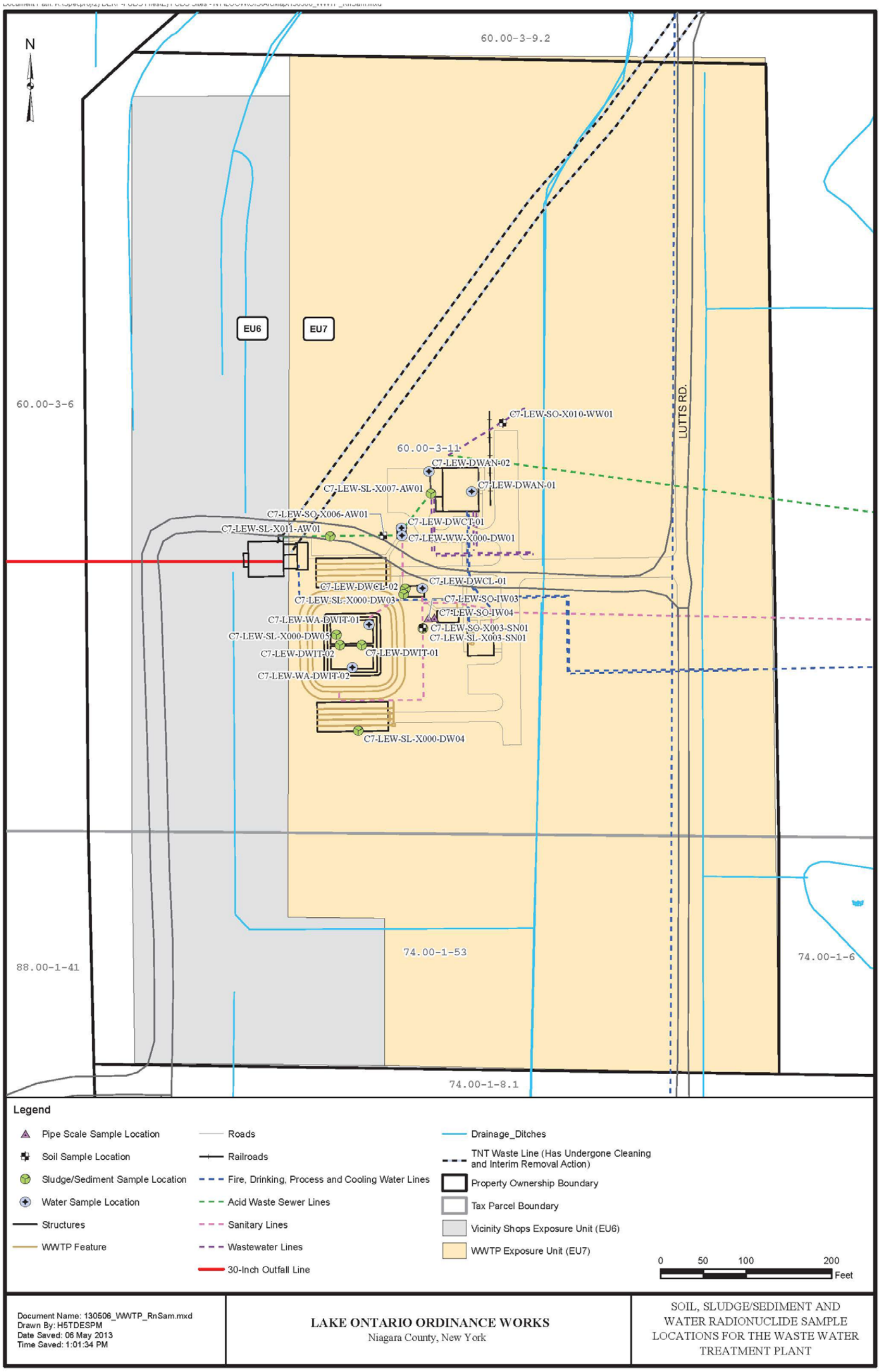

Figure 1-5: Radionuclide Sample Locations

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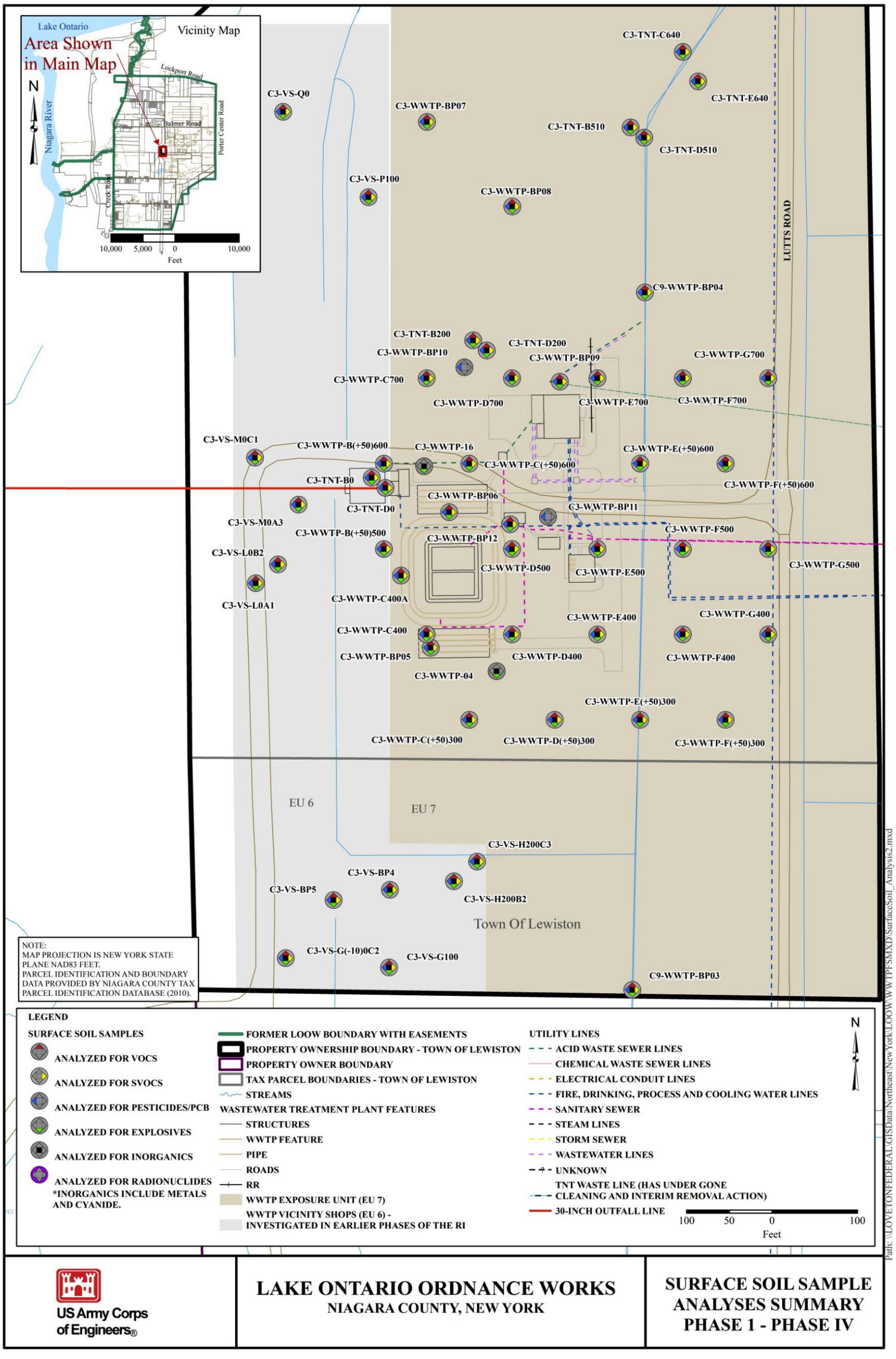

Figure 1-6: Surface Soil Sample Locations from Phase IV RI

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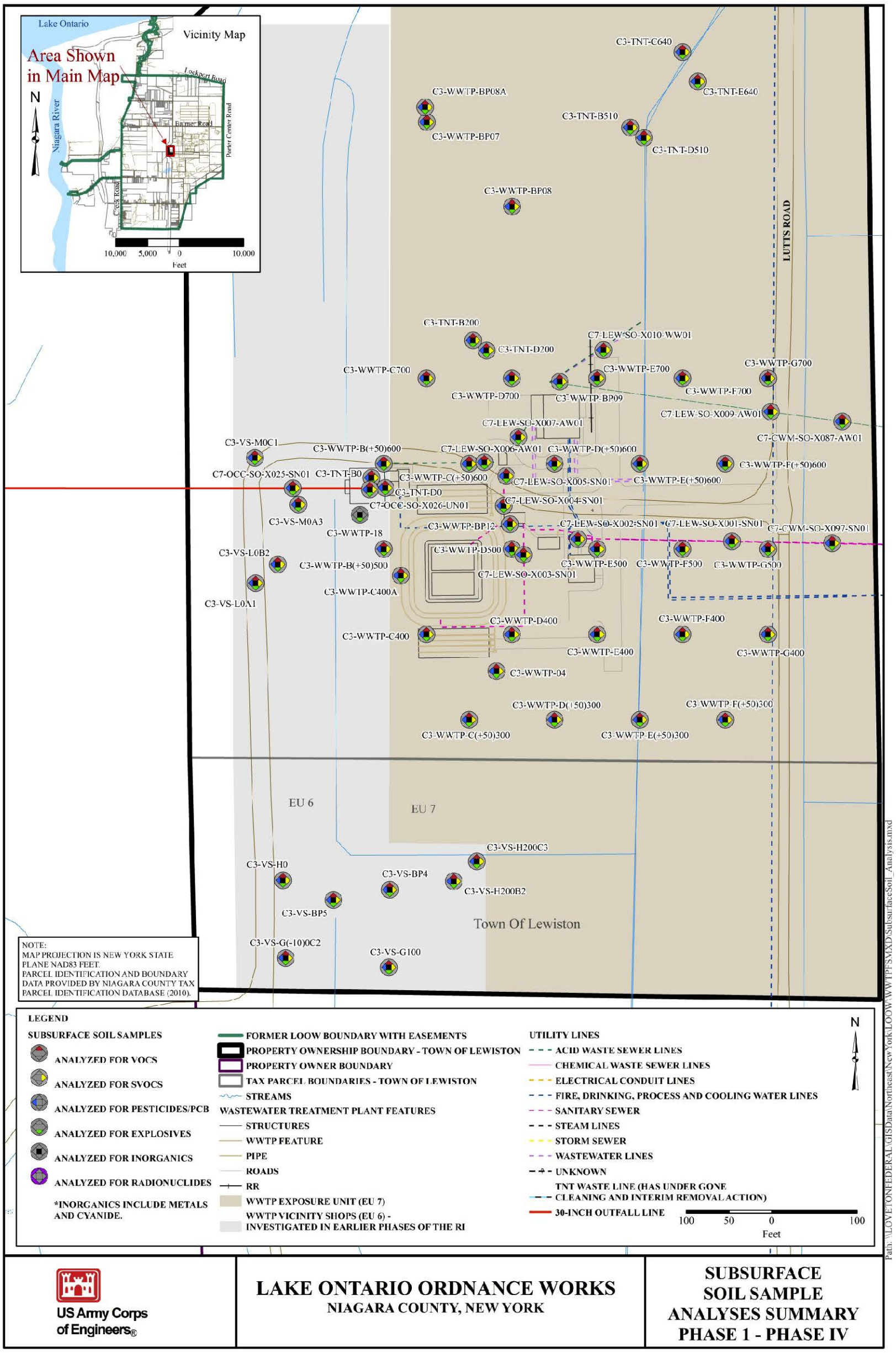

Figure 1-7: Subsurface Soil Sample Locations from Phase IV RI

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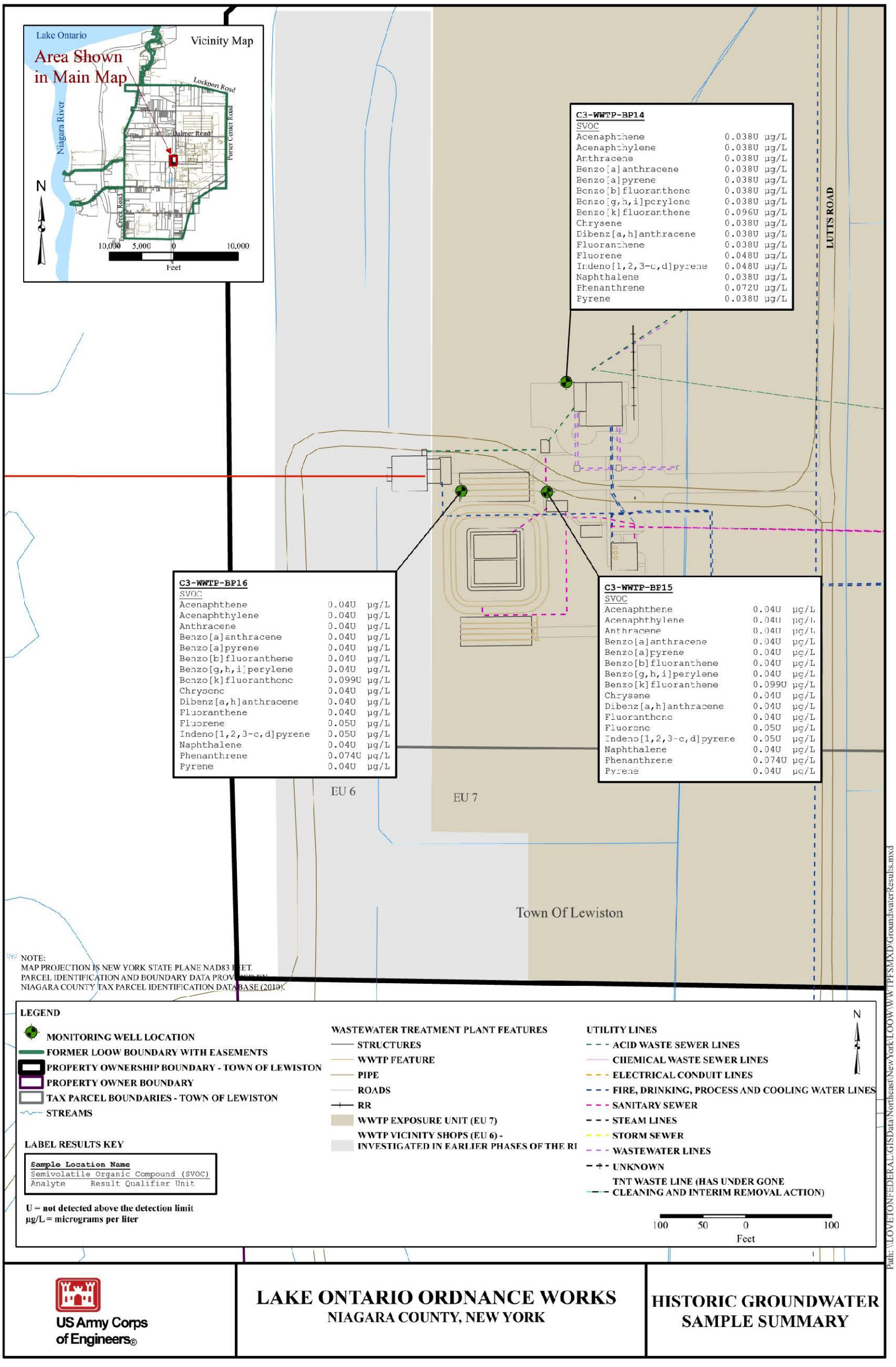

Figure 1-8: Groundwater Sample Locations from Phase IV RI

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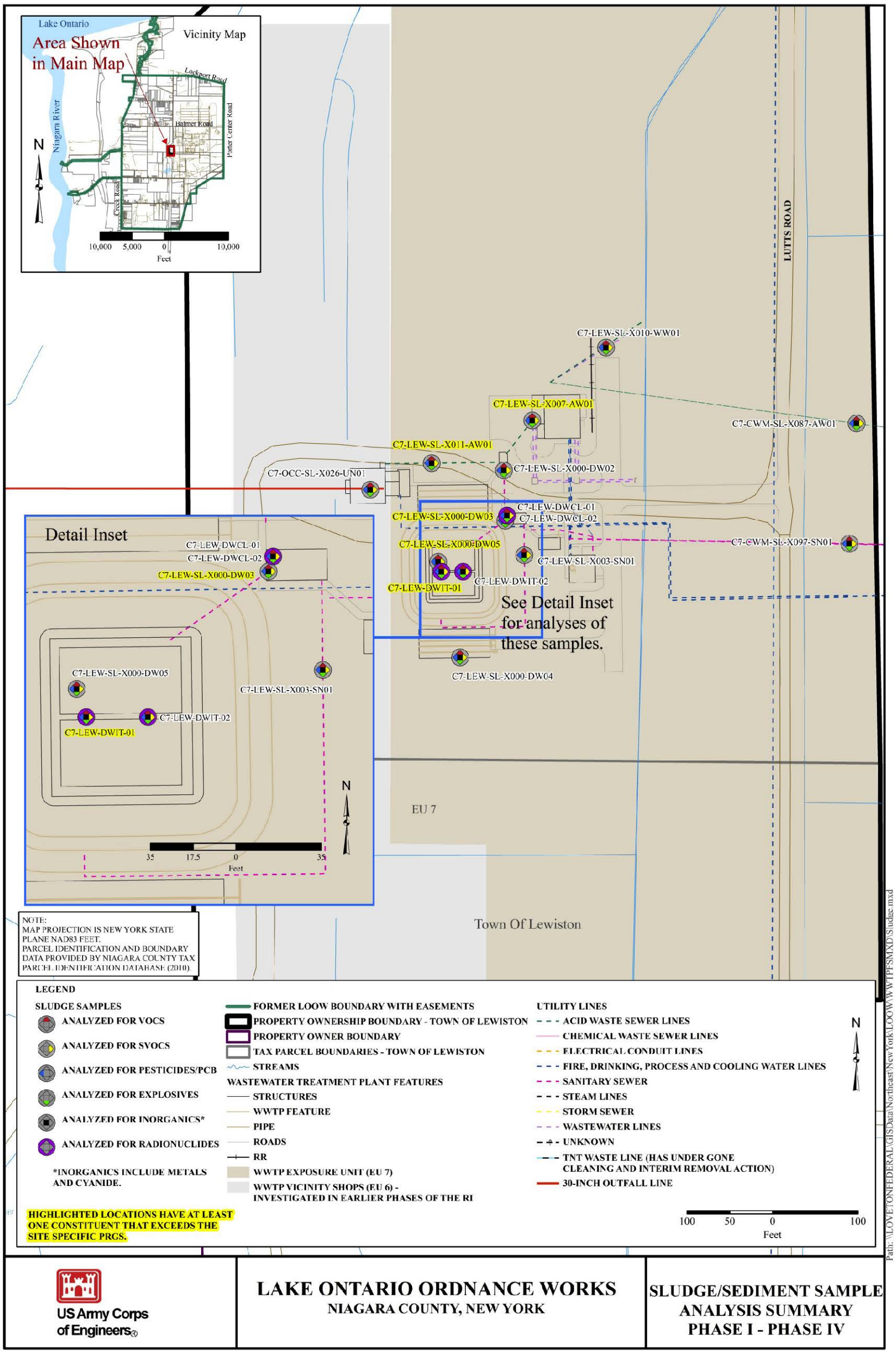

Figure 1-9: Sludge/Sediment Sample Locations from Phase IV RI

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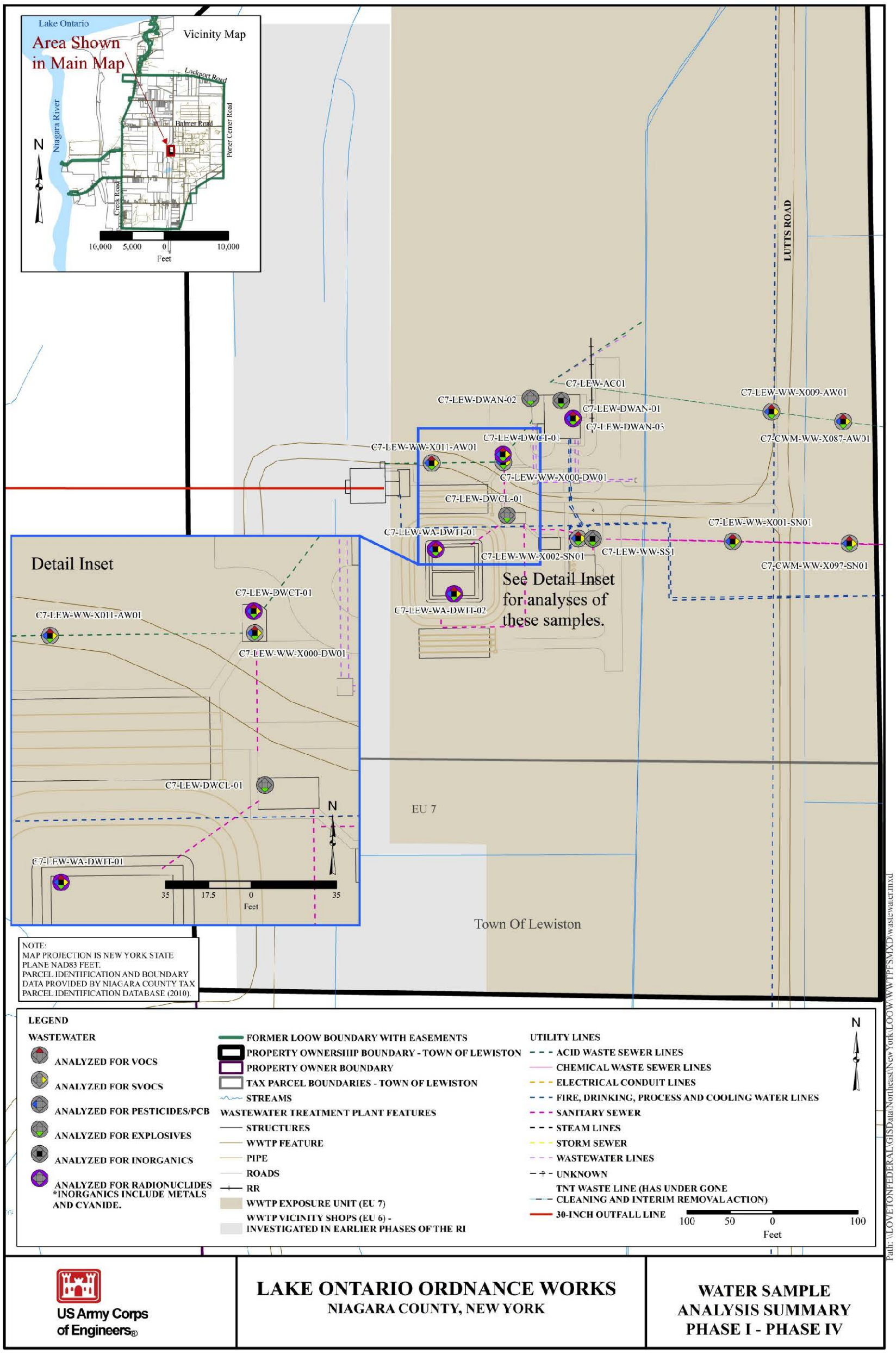

Figure 1-10: Water Sample Locations

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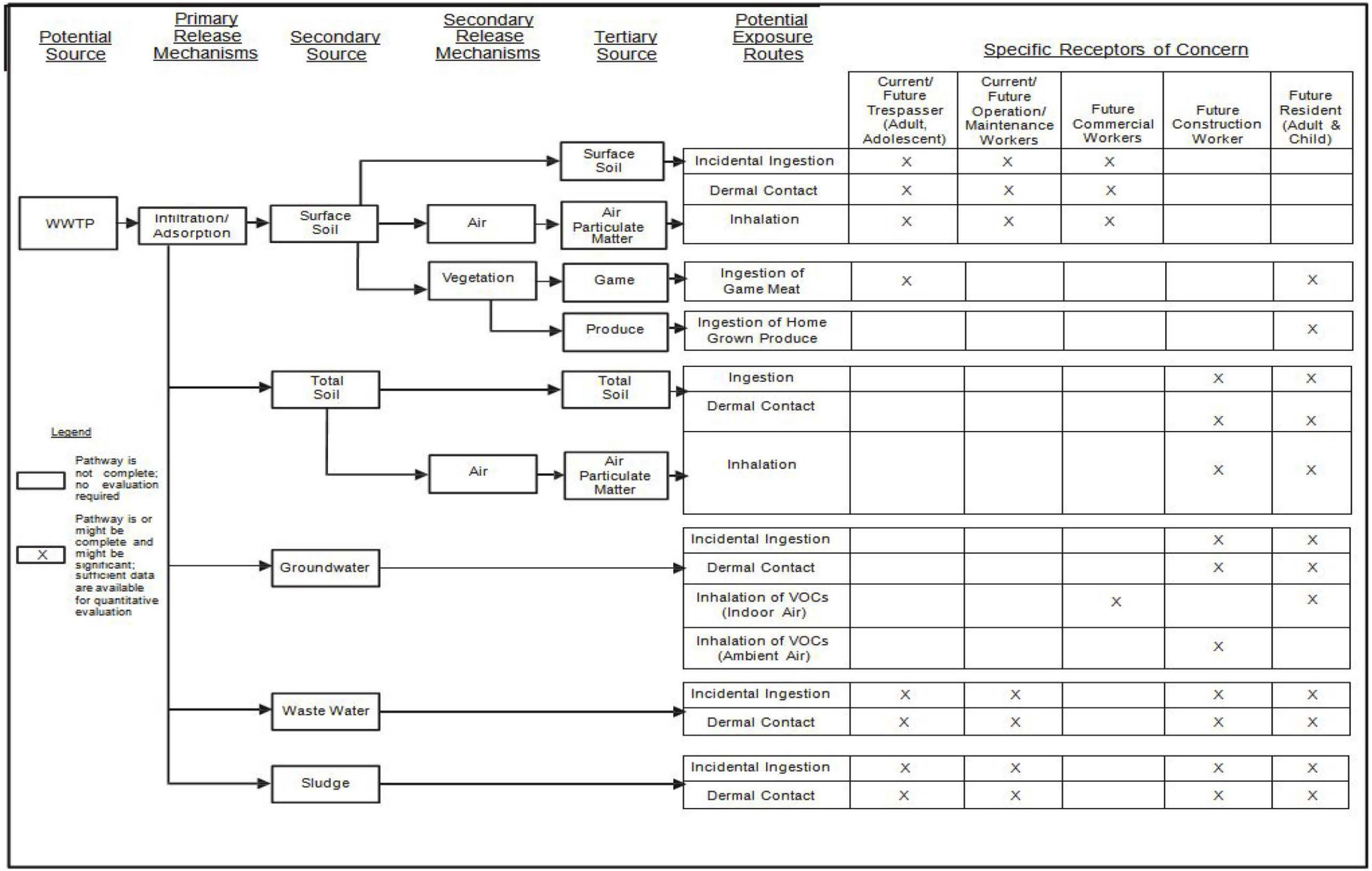

Figure 1-11: Human Health Conceptual Site Model for EU 7 – WWTP

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2.0 REMEDIAL ACTION OBJECTIVE

RAOs are developed to specify contaminants and media of concern, potential exposure pathways and remediation goals, and provide a basis for selecting appropriate remedial technologies and developing remedial alternatives for the site. Remedial goals establish acceptable levels of exposure that are protective of human health and the environment.

The RAO for this site is based on analytical results, ARARs, the HHRA, and the SLERA. This section identifies contaminated media, COCs, and the RAO, develops PRGs and estimates the volume of contaminated materials requiring remediation. The PRGs establish exposure levels that are protective of human health and the environment and also consider potential future land uses.

In assessing the need for remediation and evaluating remedial alternatives, two threshold criteria must be met under CERCLA and the National Contingency Plan (NCP):

- the remedy must be protective of human health and the environment
- the remedy must achieve ARARs

The RAO for this FS is to prevent direct contact (ingestion and/or dermal contact) with COCs in sludge/sediment that causes an unacceptable risk.

2.1 Impacted Media and Contaminants of Concern

The COC is Aroclor 1254, a PCB. As noted in Section 1.3.5, although Aroclor 1254 was the only PCB identified as a COC, another PCB (Aroclor 1260) is present at concentrations greater than the project screening criteria. Furthermore, the potential ARAR identified for this site addresses total PCB concentrations. The impacted media is sludge/sediment contained within the acid neutralization building and dilution sump/weir. Chromium, lead, and mercury are also present in the sludge/sediment at concentrations that might qualify the media as hazardous waste (D007, D008 and D009), if removed.

2.2 Estimated Volumes of Contaminated Media

Table 2-1 presents WWTP structure dimensions and estimated volumes of the structures, sludge/sediment, water, and construction and demolition (C&D) debris. The amount of sludge/sediment within the acid neutralization building could not be verified due to the presence of rubble and a floor above the basement. For estimating purposes, this FS assumes that the sludge/sediment occupies 10 percent of the structure volumes.

The volume of water within the structures has been estimated using a depth of 5 ft to the water surface.

The estimated volume of contaminated sludge/sediment in the acid neutralization building and dilution sump/weir is 214 CY. **Appendix B** provides historical WWTP drawings, quantity take-offs, and volume calculations.

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Table 2-1. Dimensions and Volume Estimates for Structures, Sludge/Sediment, Water, and Construction/Demolition Debris in the Acid Neutralization Building and Dilution Sump/Weir

Structure	Dimensions [a]				Volumes						
	Length	Diameter	Width	Depth	Structure [a]		Sludge/Sediment [b, c]		Water [d]	C&D Materials [a]	
	(ft)	(ft)	(ft)	(ft)	(ft^3)	(CY)	(ft^3)	(CY)	(gal)	(ft^3)	(CY)
Acid Neutralization Building	51	NA	42	23.5	50,337	1,864	5,034	186	296,450	9,318	345
Acid Neutralization Dilution Sump and Weir	34	NA	14	15.5	7,378	273	738	27	37,390	738	27
Totals:					**57,715**	**2,137**	**5,772**	**214**	**333,840**	**10,056**	**372**

Notes:
a - Structure dimensions and C&D material volumes taken from Catalytic Combustion Company Drawings 324-14-04, Underground Piping Disposal Plant Composite Surface and Drainage (10/23/57), and 324-02-23, Waste Collection Sumps & Effluent Discharge Chemical Waste Disposal Area (2/6/58).
b – assumes 10 percent of structure volume
c – dry weight basis
d – based on depth to water of 5 ft
C&D – construction and demolition
CY - cubic yards
ft - foot (feet)
gal - gallons
in - inches

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2.3 Risk–Based Cleanup Objectives

Under the National contingency Plan (NCP), acceptable exposure for known or suspected carcinogens is expressed in terms of lifetime cancer risk to an individual. As stated in Section 300.400(e)(2)(i)(A)(2) of the NCP, *"acceptable exposure levels are generally concentrations resulting in excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response"* (USEPA, 2011). For non-carcinogenic effects, acceptable exposure levels are generally concentrations that represent a HI of less than 1 (USEPA, 1988). USACE has established a site-specific acceptable exposure threshold for cumulative carcinogenic risk to an individual at 10^{-4} and non-carcinogenic effects to an individual at a HI of 1.

Based on the refinement of three of the exposure parameter values used in the HHRA, carcinogenic risk and non-carcinogenic effects to a potentially exposed construction worker from contact with PCBs in the sludge/sediment is 7×10^{-5} and 3, respectively (**Appendix C**). Since the total carcinogenic risk (7×10^{-5}) falls within the USEPA's acceptable incremental lifetime cancer risk range (of up to 1×10^{-4}), none of the carcinogenic chemicals (e.g., PAHs) are considered COCs.

The cleanup objective established for the site includes the remediation of PCB-contaminated sludge/sediment in order to eliminate the potential for unacceptable risk to the construction worker.

Because an ARAR is available that addresses the COC at the site (**Section 3.0**), no numerical risk-based cleanup objectives are utilized in this FS. The ARAR-based PRG is presented in **Table 2-2**.

Table 2-2. Human Health PRG for Potentially Exposed Construction Workers

COC	Maximum Detected Concentration (mg/kg)	Target Organ	
Aroclor 1254	60	Skin, Eyes	
COC	**Maximum Detected Concentration (mg/kg)**	**Target Organ**	**ARAR-based PRG (mg/kg)**
Total PCBs	65	Skin, Eyes	25[a]

Legend:
ARAR – Applicable or Relevant and Appropriate Requirements
mg/kg – milligrams per kilograms
The target Organ applies to non-cancer health effects (with corresponding Hazard Indices) only
a Cleanup level for bulk PCB remediation waste in low-occupancy areas (40 CFR Part 761.61(4)(i)(B))

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3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

CERCLA Section 121 (d)(2)(A) requires that remedial actions meet federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. Such remedial actions shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and control of further releases, which at a minimum, assures protection of human health and the environment. The remedial actions shall be relevant and appropriate under the circumstances presented by the release or threatened release of such substance, pollutant, or contaminant.

ARARs may either be federal or state statutes or regulations, with state ARARs being applicable or relevant and appropriate if promulgated, legally enforceable, identified in a timely manner, consistently applied, and more stringent than federal requirements.

The selected remedial action must address the identified ARARs, as defined by CERCLA, 42 United States Code (USC) 9601 et seq. in Section 121, or a waiver be obtained for those ARARs that are not satisfied under conditions allowed by CERCLA. Waivers are allowed for remedial actions that do not meet the requirements of the ARARs if the selected remedial action is part of a more inclusive remedial action designed to attain an acceptable level of control, compliance would result in greater risk to human health and/or the environment, compliance is technically impracticable from an engineering perspective, or the selected alternative remedial action would result in an equivalent level of control. In addition, waivers are allowed if a state has not consistently required or demonstrated the intention to consistently require that remedial action attain an acceptable level of control. This requirement for a waiver is in accordance with 40 CFR § 300.430(f) of the NCP and USACE guidance.

Agencies conducting remedial actions under CERCLA must ensure that the selected remedies comply with ARARs, defined in CERCLA Section 121(d)(2)(A) as:

> *"any standard, requirement, criteria, or limitation under any federal environmental law, including, but not limited to, the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Marine Protection, Research and Sanctuaries Act, or the Solid Waste Disposal Act"*

and/or

> *"any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation, including each such state standard, requirement, criteria, or limitation contained in a program approved, authorized, or delegated by USEPA that has been identified in a timely manner"*

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. An applicable requirement directly and fully addresses an element of the remedial action.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal environmental, state environmental, or facility siting laws that while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is suited to the particular site.

Only those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent that federal requirements may be applicable or relevant and appropriate.

Based on CERCLA guidance, there are three types of ARARs:

- Chemical-specific requirements, which define acceptable exposure concentrations or water quality standards
- Location-specific requirements, which may restrict remediation activities at sensitive or hazard-prone locations such as active fault zones, wildlife habitat and floodplains
- Action-specific requirements, which may control activities and/or technology

The following sections describe the three types of ARARs and provide examples of each. Any ARAR presented is considered preliminary until a remedial alternative has been selected and evaluated. **Table 3-1** provides a summary of ARARs that have been retained for evaluation in the detailed analysis of alternatives.

3.1 Action-Specific ARARs

Action-specific ARARs are technology-based rules that specify how a remedial alternative must be achieved and generally set performance or design, standards, controls or restrictions on particular alternative actions. Most action-specific ARARs address treatment, transportation, and disposal of hazardous waste. Action-specific ARARs that were considered in this FS are the Resource Conservation and Recovery Act (RCRA) (40 CFR 260-268), New York State hazardous waste regulations (6 NYCRR Parts 370-374 and 376), and Toxic Substances Control Act (TSCA) (40 CFR Part 761).

40 CFR 260-268 (Resource Conservation and Recovery Act (RCRA))

The federal Resource Conservation and Recovery Act (RCRA) (40 CFR Parts 260-268) regulates material that constitutes “hazardous waste” as defined in 40 CFR 261.3. Waste that has not been specifically listed (i.e. F-list under 40 CFR Part 261.31, K-list under 40 CFR Part 261.32, and P-list and U-list under 40 CFR Part 261.33) may still be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C - ignitability (D001), corrosivity (D002), reactivity (D003), and toxicity (D004 - D043). The TCLP is a soil sample extraction method for chemical analysis employed as an analytical method to simulate leaching through a landfill. The testing methodology is used to determine if a waste is characteristically hazardous.

PCBs are not a RCRA specifically-listed hazardous waste and TCLP data is not available for sludge in underground structures at the LOOW WWTP to confirm whether the sludge is hazardous or not. However, total chromium, lead, and mercury were detected in the sludge at concentrations greater than 20 times the TCLP maximum concentrations listed in 40 CFR

261.24. This suggests that excavated sludge/sediment may be classified as hazardous waste (codes D007, D008, and D009).

Pending hazardous waste confirmation with TCLP data, RCRA is identified as a potential action-specific ARAR for the LOOW WWTP. Substantive, non-procedural, non-permit-related parts of RCRA that may be potentially applicable or relevant and appropriate to the protectiveness of the proposed removal actions on the LOOW WWTP include:

- 40 CFR Part 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) - This Part regulates the treatment, storage and disposal of hazardous waste and includes construction and operation standards that may be applicable to on-site disposal alternatives evaluated in this FS.
- 40 CFR Part 268 (Land Disposal Restrictions) – This Part (40 CFR 268.48) identifies treatment standards required for hazardous wastes to be land disposed. The treatment standards for hazardous waste may be applicable for on-site disposal alternatives evaluated in this FS.

6 NYCRR Parts 370-374 and 376 (Hazardous Waste Management System)

In an August 26, 2013 letter to USACE, NYSDEC proposed 6 NYCRR Parts 370-373 as potentially relevant and appropriate regulations to address PCB in sludge in underground structures at the LOOW WWTP.

Hazardous wastes are governed by the regulatory program established by RCRA, 42 U.S.C. §§6901, *et seq.*, and its implementing regulations at 40 CFR Parts 260-272. RCRA provides for "cradle to grave" regulation of hazardous wastes, from the initial waste generators, to transporters, and finally hazardous waste TSDFs. The statute allows a state to be delegated primary authority for enforcement and administration of the hazardous waste program, provided it enacts a regulatory program at least as strict as RCRA (RCRA §3006, 42 U.S.C. §6926).

Like many states, New York has implemented a regulatory program by enacting the Industrial Hazardous Waste Act in 1978, which is found in Title 9 of Article 27 of the Environmental Conservation Law, and promulgating regulations contained at 6 NYCRR Parts 370-374 and 376. Accordingly, New York's hazardous waste regulations (or any other state that has been delegated the RCRA hazardous waste program), which largely parallel the federal regulations, generally apply *in lieu of* the federal regulations. Nonetheless, to the extent new federal mandates have not yet been added to the New York hazardous wastes regulations, the new federal regulations apply. Regulations in delegated states are updated from time to time to comply with new federal mandates, and in New York are often more stringent than those required by RCRA.

Substantive, non-procedural, non-permit-related parts of New York State's hazardous waste requirements may be appropriate to the protectiveness of the proposed removal actions on the LOOW WWTP include:

- 6 NYCRR Part 373 (Hazardous Waste Management Facilities) - This Part regulates the treatment, storage and disposal of hazardous waste and includes construction and operation standards that are applicable or relevant and appropriate to on-site disposal alternatives evaluated in this LOOW WWTP FS. The standards listed in 6 NYCRR Part 373 are the same as those listed under RCRA (40 CFR 264). Therefore, if TCLP data is indicative of hazardous waste, 40 CFR 264 would apply instead of 6 NYCRR Part 373.

- 6 NYCRR Part 376 (Land Disposal Restrictions) – This Part (6 NYCRR Part 376.4(e)) requires that PCB wastes regulated as hazardous waste by New York State solely due to the presence of PCBs, including sewer sludge containing PCBs greater than 50 ppm, be disposed of in accordance with federal regulations in 40 CFR Part 761. The treatment standards for hazardous waste are applicable for on-site disposal alternatives evaluated in this FS. The treatment standards listed in 6 NYCRR Part 376.4(e) are the same as those listed under RCRA (40 CFR 268.48). However, PCB alone is not considered a hazardous waste under RCRA, whereas it is under New York State hazardous waste regulations and therefore, this state regulation is more stringent than federal (RCRA) regulations and is considered a potential ARAR for on-site alternatives.
- 6 NYCRR Part 376 (Land Disposal Restrictions) – This Part (6 NYCRR Part 376.4(j)) identifies treatment standards required for hazardous wastes to be land disposed. The treatment standards for hazardous waste may be applicable for on-site disposal alternatives evaluated in this FS. However, the treatment standards listed in 6 NYCRR Part 376.4(j) are the same as those listed under RCRA (40 CFR 268.48). Therefore, if TCLP data is indicative of hazardous waste, 40 CFR 264 may be an ARAR instead of 6 NYCRR Part 376.

40 CFR Part 761 (*PCBs Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions) – TSCA*

40 CFR Part 761 provides for "prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB Items." Under 40 CFR Part 761.3, PCB remediation waste is defined as waste containing PCBs as a result of a spill, release, or other unauthorized disposal where the PCBs are present at the following concentrations:

- The materials currently have PCB concentrations of 50 parts per million (ppm) or greater, if the PCBs were disposed of prior to April 18, 1978
- The materials have any PCB concentrations if they were disposed of after July 2, 1979, and the original source (i.e., material that was spilled or released) had a PCB concentration of 50 ppm or greater

PCB remediation waste includes soil, sediments, dredged materials, muds, PCB sewage sludge, industrial sludge, and other porous and non-porous materials. The term applies to both in situ and ex situ wastes or materials.

The PCB regulations under 40 CFR 761 are potentially applicable to actions proposed to address PCBs at the LOOW WWTP since the environmental media of concern is sludge. Additionally, the maximum detected concentration of Aroclor 1254 in the sludge was 60 ppm, which is greater than the 50 ppm limit that triggers a PCB spill remediation. Since Waste Management plugged acid waste sewer and sanitary sewer lines that were hydraulically upgradient of the site in 1978, the PCBs in the LOOW WWTP likely originated prior to April 18, 1978.

The definition of a "low-occupancy area" under 40 CFR 761.3 is "any area where PCB remediation waste has been disposed of on site and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is: less than 840 hours (an average of 16.8 hours per week) for non-porous surfaces and less than 335 hours (an average of 6.7 hours per week) for bulk PCB remediation waste. Examples could include an electrical substation or a

location in an industrial facility where a worker spends small amounts of time per week (such as an unoccupied area outside a building, an electrical equipment vault, or in the non-office space in a warehouse where occupancy is transitory). Since a construction worker wearing no dermal and respiratory protection is anticipated to occupy the LOOW WWTP less than 335 hours per year, the LOOW WWTP was considered a "low occupancy area" in this FS.

Substantive, non-procedural, non-permit-related parts of TSCA that are potentially applicable to the protectiveness of the proposed removal actions on the LOOW WWTP include:

- 40 CFR Part 761.61(a)(4)(i)(B)(3) requires that bulk PCB remediation waste, with PCB concentrations greater than 25 ppm and less than or equal to 100 ppm, be covered with a cap meeting requirements listed in 40 CFR Part 761.61(a)(7) and 40 CFR Part 761.61(a)(8). If the site has a 6-inch concrete or asphalt cap, then PCB remediation waste may remain at concentrations between 25 mg/kg and 100 mg/kg. This part applies to any remedial alternative where PCB remediation waste will remain on site.
- 40 CFR Part 761.61(a)(5)(i)(B)(2)(iii) requires that bulk PCB remediation waste, with PCB concentrations greater than or equal to 50 ppm, be disposed of in a TSCA chemical waste landfill or a RCRA hazardous waste landfill. This part applies to any remedial alternative where PCB-contaminated sludge/sediment would be excavated and transported off-site for disposal.

3.2 Chemical-Specific ARARs

Chemical-specific ARARs are rules that define permissible concentrations of chemicals for various environmental media. They are generally based on health or risk-based criteria. Some apply state-wide while others are based on site-specific calculations.

Chemical-specific ARARs identify specific numerical standards for remediation of the COCs in media of concern (i.e. sludge/sediment) at the site. Chemical-specific ARARs provide health or risk-based concentration limits in various environmental media (i.e., soil, sediment, water, and air). The limits, detailed for specific hazardous substances, pollutants, or contaminants, are protective of human health and the environment. PCBs in sludge/sediment within underground structures have been identified as a COC at the site.

There are two chemical specific regulations being considered as potential ARARs for the site, TSCA (40 CFR Part 761) and NYSDEC's environmental remediation program requirements for inactive hazardous waste disposal sites (6 NYCRR Part 375).

40 CFR Part 761 – TSCA (*PCBs Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions)*

40 CFR Part 761 provides for "prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB Items." Under 40 CFR Part 761.3, PCB remediation waste is defined as waste containing PCBs as a result of a spill, release, or other unauthorized disposal where the PCBs are present at the following concentrations:

- The materials currently have PCB concentrations of 50 ppm or greater, if the PCBs were disposed of prior to April 18, 1978

- The materials have any PCB concentrations if they were disposed of after July 2, 1979, and the original source (i.e., material that was spilled or released) had a PCB concentration of 50 ppm or greater

PCB remediation waste includes soil, sediments, dredged materials, muds, PCB sewage sludge, industrial sludge, and other porous and non-porous materials. The term applies to both in situ and ex situ wastes or materials.

The PCB regulations under 40 CFR 761 are potentially applicable or relevant and appropriate to actions proposed to address PCBs (Aroclor 1254) at the LOOW WWTP since the environmental media of concern is industrial sludge. Additionally, the maximum detected concentration of Aroclor 1254 in the sludge was 60 ppm, which is greater than the 50 ppm limit that triggers a PCB spill remediation. Since Waste Management plugged acid waste sewer and sanitary sewer lines that were hydraulically upgradient of the site in 1978, the PCBs in the LOOW WWTP likely originated prior to April 18, 1978.

The definition of a "high-occupancy area" under 40 CFR 761.3 is "any area where PCB remediation waste has been disposed of on-site and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is: 840 hours or more (an average of 16.8 hours or more per week) for non-porous surfaces and 335 hours or more (an average of 6.7 hours or more per week) for bulk PCB remediation waste. Examples could include a residence, school, day care center, sleeping quarters, a single or multiple occupancy 40 hours per week work station, a school class room, a cafeteria in an industrial facility, a control room, and a work station at an assembly line."

The definition of a "low-occupancy area" under 40 CFR 761.3 is "any area where PCB remediation waste has been disposed of on-site and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is: less than 840 hours (an average of 16.8 hours per week) for nonporous surfaces and less than 335 hours (an average of 6.7 hours per week) for bulk PCB remediation waste. Examples could include an electrical substation or a location in an industrial facility where a worker spends small amounts of time per week (such as an unoccupied area outside a building, an electrical equipment vault, or in the non-office space in a warehouse where occupancy is transitory)."

The HHRA assumed a conservative value of 250 days per year in which a construction worker wearing no dermal and respiratory protection would be exposed to PCBs in sludge at the LOOW WWTP. As discussed in Appendix C of this report, this was revised to 195 days (1,560 hours assuming 8 hour work days) per year to account for a shortened construction season due to inclement weather in Western New York. However, typical construction associated with maintenance and development of this property would not nearly require this amount of time.

Although the risk assessment assumed a greater exposure frequency (1,560 hours per year) than the 335 hours per year limit that defines a "low-occupancy area", the examples provided in the TSCA definition of a low-occupancy area (i.e. electrical substation or a location in an industrial facility where a worker spends small amounts of time per week) better represent the anticipated future land use at the LOOW WWTP. Additionally, PCB-contaminated sludge is located in underground structures that greatly limit the accessibility to a construction worker. The actual anticipated exposure frequency to PCB-contaminated sludge would be less than 335 hours (i.e. 41 eight-hour work days) per year. Therefore, the low-occupancy definition would be more appropriate to apply to the circumstances of release of PCB-contaminated sludge to a

construction worker at the LOOW WWTP. Therefore, the LOOW WWTP was considered a "low-occupancy area" for the purposes of this FS.

Substantive, non-procedural, non-permit-related parts of TSCA that are potentially applicable or relevant and appropriate to the protectiveness of the proposed removal actions on the LOOW WWTP include:

- 40 CFR Part 761.61(a)(4)(i)(B) requires a bulk PCB remediation waste cleanup level less than or equal to 25 ppm for a low-occupancy area. This part applies to any remedial alternative where PCB remediation waste will be generated.

As such, the 25 ppm cleanup limit for total PCBs in 40 CFR Part 761.61(a)(4)(i)(B) would be applicable for sludge within the WWTP structures, which is considered a low-occupancy area. Sludge or porous surfaces (such as concrete) containing less than 1 ppm PCBs is unregulated for disposal under TSCA whether left on-site or removed from the site.

6 NYCRR Part 375 (Environmental Restoration Programs)

In an August 26, 2013 letter to USACE, NYSDEC proposed 6 NYCRR Part 375 as a potentially applicable regulation to address PCB in sludge in underground structures at the LOOW WWTP. The requirements set forth in 6 NYCRR 375 apply to the environmental remediation programs administered by NYSDEC on or after December 14, 2006, the effective date of this rule. The requirements of Subpart 375 apply to the development and implementation of remedial programs for inactive hazardous waste disposal sites, Brownfield Cleanup Program sites, and environmental restoration program sites including, but not limited to, sites which are listed on the National Priority List (NPL) or are being addressed by the DoD or the DOE.

Subpart 6.8 of 6 NYCRR Part 375provides numerical cleanup goals for soil to ensure that remedial actions are fully protective of public human health and the environment. The final Soil Cleanup Objectives (SCOs) presented in 6 NYCRR 375 reflect consideration of public health, groundwater, and ecological resources. The SCOs, while generic, are specific to land-use categories, including sites with unrestricted land use, as well as for sites where land-use restrictions or engineering controls may limit possible exposures (residential, restricted residential, commercial, and industrial). The unrestricted SCOs are inherently protective of adjacent residential uses.

Remedial Program SCOs listed in 6 NYCRR Part 375-6 apply to the development and implementation of the remedial programs for soil and other media at:

- Inactive hazardous waste disposal sites (listed in the Registry which are either on the national priorities list (NPL) or are being addressed by the department of defense or the department of energy)
- Brownfield sites
- Environmental restoration sites

Since the LOOW WWTP is not a NYSDEC-regulated inactive waste disposal site, a brownfield site, or environmental remediation site, this state regulations is not applicable to the former LOOW WWTP. However, further evaluation was conducted to determine if this state regulation was relevant and appropriate to the circumstances of release at the site and more stringent than federal regulations (i.e. TSCA).

6 NYCRR Part 375-6.4 discusses and Table 375-6.8(b) identifies restricted use soil cleanup objectives (SCOs) for PCBs in residential, restricted-residential, commercial, and industrial settings and for the protection of groundwater and ecological receptors.

The reasonable future land use of the LOOW WWTP was identified as industrial, with a construction worker as the receptor with reasonable maximum exposure for this intended future land use. Industrial land use is defined in 6 NYCRR Part 375-1.8(g)(2)(iv) as "the land use category which shall only be considered for the primary purpose of manufacturing, production, fabrication or assembly processes and ancillary services. Industrial use does not include any recreational component."

Since the environmental media of concern at the LOOW WWTP for PCBs is industrial sludge in an underground structure, not soil which is addressed by this state regulation, 6 NYCRR Part 375-6.4 is not applicable to the LOOW WWTP. Additionally, since the SCO for PCBs at industrial sites under 6 NYCRR Part 375-6.8 (25 ppm) is not more stringent than the 25 ppm cleanup limit for total PCBs under the federal regulation (i.e. TSCA), it was determined that 6 NYCRR Part 375 was not a chemical-specific ARAR for the LOOW WWTP.

3.3 Location-Specific ARARs

Location-specific ARARs are requirements that limit the concentration of hazardous substances or activities solely because of geographical location, land use, or site characteristics. Potential location-specific ARARs include the protection of floodplains and wetlands; wilderness areas, wildlife refuges, and scenic rivers; historical sites and archaeological findings; and/or rare, threatened, or endangered species. Based on a desktop review of NYSDEC wetland maps, there are no wetlands located in the site footprint; however, a jurisdictional determination is required for potential federal wetlands. Also, the LOOW WWTP is not located within a 100-year floodplain.

No substantive, non-procedural, non-permit-related location-specific ARARs have been identified for the LOOW WWTP that are applicable to the circumstances of release or remedial alternatives considered that would impact their protectiveness.

3.4 To-Be-Considered Standards

To-be considered (TBC) standards are non-promulgated federal or state advisories, criteria, or guidance regarding protection of human health or the environment which may be reasonably related to the remedial action. TBC criteria do not have the status of ARARs, however, as specified in the NCP they should be identified as supplements to the ARARs where ARARs do not exist and/or when existing ARARs are inadequate. There is no legal requirement to comply with TBCs.

3.5 Waivers

Under CERCLA, a selected remedial action must meet all the requirements of the identified ARARs unless a waiver from a specific requirement has been granted. A waiver from compliance with a specific ARAR can be granted for an alternative under the following circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will meet ARARs

- Compliance with the ARAR is technically impractical from an engineering perspective
- Compliance with the ARAR will result in a greater risk to human health and the environment than other alternatives
- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach
- With respect to a state ARAR, the state has not consistently applied, or demonstrated the intention to consistently apply the promulgated requirement in similar circumstances at other remedial actions within the state

No waivers have been identified as currently applicable.

3.6 Identified ARARs, TBC Criteria, and Waivers

Table 3-1 presents preliminary ARARs retained for evaluation.

Table 3-1. Applicable or Relevant and Appropriate Requirements (ARAR)[1]

Authority	Citation	Requirement Synopsis	Determination	Comments
Action-Specific ARARs				
RCRA, 42 USC § 6901, *et seq.*	40 CFR Parts 264 and 268	Federal regulations that establish requirements for treatment, storage, and disposal of PCBs.	Potential ARAR for remedial alternatives where PCB remediation waste will remain on site.	Will be considered an ARAR for on-site actions if hazardous waste is confirmed by TCLP data.
NYS ECL, 27, Title 9	6 NYCRR Parts 373 and 376	NYS regulations that provide construction and operation standards (Part 373) and disposal restrictions (Part 376.4(j) for the treatment, storage and disposal of hazardous waste.	Potential ARAR for remedial alternatives where PCB remediation waste will remain on-site.	Will be considered an ARAR for on-site actions if hazardous waste is not confirmed by TCLP data since PCB alone is a state-, but not a RCRA-regulated hazardous waste. PCB detections over 50 ppm alone are not federally-regulated under RCRA.
NYS ECL, Article 27, Title 9	6 NYCRR Part 376	NYS regulations (Part 376.4(e) that impose land disposal restrictions; wastes containing greater than 50 ppm PCBs must be disposed in accordance with federal regulations in 40 CFR Part 761.	ARAR for remedial alternatives where PCB remediation waste will remain on site.	Whether hazardous waste is confirmed by TCLP data or not, the PCB detections over 50 ppm classify the sludge in underground structures at the LOOW WWTP as state-regulated hazardous waste. PCB detections over 50 ppm alone are not federally-regulated under RCRA. Since PCBs are not defined as hazardous wastes under RCRA (40 CFR Part 261),

[1] No substantive, non-procedural, non permit-related location-specific ARARs have been identified for the LOOW WWTP that are applicable to the circumstances of release or remedial alternatives considered that would impact their protectiveness.

Table 3-1. Applicable or Relevant and Appropriate Requirements (ARAR)[1]

Authority	Citation	Requirement Synopsis	Determination	Comments
				therefore, they are not subject to RCRA's land disposal restrictions (40 CFR Part 268).
TSCA, Title 1, 15 USC § 2605	40 CFR Parts 761.61	Federal regulations that establish requirements for cleanup and disposal options for PCB remediation waste (761.61(a)(4)(i)(B)(3)).	Potential ARAR for remedial alternatives where PCB remediation waste will remain on site.	Provides cap requirements for PCB remediation waste remaining on site at concentrations between 25 and 100 ppm.
Chemical-Specific ARARs				
TSCA, Title 1, 15 USC § 2605	40 CFR Part 761.61(a)(4)(i)(B)	Federal regulations that establish cleanup levels for cleaning, decontaminating, or removing PCB remediation waste.	Potential ARAR for remedial alternatives where sludge/sediment will be excavated and disposed off site.	Sludge containing PCBs greater than 50 ppm in low-occupancy areas shall be remediated to 25 ppm.

Legend:
CFR - Code of Federal Regulations
ECL – Environmental Conservation Law
USC – United States Code

4.0 GENERAL RESPONSE ACTIONS

General response actions describe a broad variety of remedial measures that are capable of satisfying the RAOs for a site. A general response action may consist of several remedial action technologies and process options. These response actions will address the RAOs by either reducing the contaminant concentrations below the site-specific PRGs or by preventing exposure to the contaminated medium by the receptor of concern. In addition, general response actions should consider the integrity and age of the structures containing the contaminated material. Available data does not indicate that a release from the structures and underground lines has occurred.

Before screening remedial technologies, general response actions must be identified that are applicable to the contaminated media and COCs. The following general response actions, either alone or in conjunction with other response actions, may achieve the site RAO.

- No Response Action
- Passive Response Actions
- Active Response Actions

4.1 No Response Action

CERCLA guidance requires consideration of a no response action as a baseline for comparison with other potential response actions and remedial alternatives. The no response action provides no remedial actions for the contaminated media and therefore, no technologies or process options are included.

4.2 Passive Response Actions

Passive response actions involve monitoring contaminant concentrations and establishing and maintaining land-use controls (LUCs). The LUCs typically consist of institutional controls (ICs) and engineering controls/access restrictions that eliminate or minimize potential exposure to contaminants at the site.

4.2.1 Risk and Hazard Management

Risk and hazard management is a limited action response restricting site access and inhibiting future land and resource use as the primary means for mitigating risk to potential receptors. As long as restrictions remain in place, contamination would not be actively remediated. An institutional action is considered a limited action in which monitoring is incorporated with the LUC to limit or eliminate the potential for exposure to contaminants.

4.2.2 Containment

Containment is a response restricting or eliminating the transfer or migration of contaminants by installing barriers, effectively controlling or “containing” the contaminants, thereby mitigating the potential exposure risk. Containment actions isolate the contaminated media from the receptors of concern and include, and but are not limited to, capping and subsurface barriers.

4.3 Active Response Actions

Active response actions include measures to remove or treat the contaminant mass in order to eliminate or minimize the potential for exposure.

4.3.1 Removal

Removal is an active response that removes or recovers the contaminants by a variety of methods, such as excavation, pumping, or dredging. The recovery and/or removal of source materials effectively remediates and mitigates potential exposure risks by reducing the contaminant volume at the site, but does not reduce the overall volume or concentration of the COCs. Recovery actions are often used in combination with other response actions, such as treatment or disposal.

4.3.2 Treatment

Treatment is an active response, either in situ or ex situ, which utilizes biological, chemical, physical, or thermal methods to reduce the toxicity, mobility and/or volume of the contaminants. Treatment actions are typically preferred under CERCLA/SARA.

4.3.3 Disposal

Disposal is an active response that does not reduce the volume or concentration of COCs, but reduces the mobility of the contaminants by placing the contaminated media at in an engineered containment facility in a manner that protects human health and the environment.

4.4 Ongoing Response Actions

LUCs have been instituted by NYSDOH pursuant to the Commissioner's Orders and are listed below. **Appendix D** includes copies of NYSDOH correspondence that documents these LUCs. The restrictions could be lifted if deemed appropriate by the NYSDOH.

- The property shall not be developed or used for industrial, commercial, or residential purposes. Any existing use can continue but not be expanded or broadened.
- The property may be used for recreational purposes if the owner takes adequate precautions and persons only make intermittent or occasional recreational use of the land.
- Five days written notice to NYSDOH is required for a proposed sale, transfer, or conveyance of the property.
- All restrictions will continue until NYSDOH determines radiation levels are safe.
- Decontamination by other than an official agency will require application and approval of an acceptable plan by NYSDOH.
- No deliberate or intentional movement, displacement, or excavation of soil is permitted unless there is an acceptable plan approved by NYSDOH.

Access restrictions in-place at the site include perimeter and internal fencing and gates preventing access to the remaining structures.

5.0 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

Potentially applicable, media-specific, remedial action technologies and process options for each general response action are identified in this section. Under each there are multiple potentially applicable process options, which refer to a specific treatment method. For example, under risk and hazard management, process options include ICs, engineering controls, access restrictions, and long-term monitoring (LTM).

During implementation of a remedial technology or process option, protection of the workers, the public, and the environment from contamination would be achieved through the execution of an approved site-specific safety and health plan, use of proper construction techniques, and monitoring.

Technologies and process options discussed in this section have been screened to determine if they are applicable and capable of achieving the RAO by addressing contaminated sludge/sediment within the acid neutralization building and dilution sump/weir. A description and initial screening of each process option is provided in **Table 5-1**.

5.1 Identification of Technology Types and Process Options

5.1.1 No Action

Under no action, measures would not be implemented to monitor site COCs or to reduce the toxicity, mobility, or volume of the contaminated media. Existing LUCs and access restrictions would not be maintained. LTM would not be performed to evaluate any potential future releases of contaminants from the structures.

5.1.2 Risk and Hazard Management

Risk and hazard management would reduce and/or eliminate exposure to the contaminated media by using a combination of ICs, engineering controls, access restrictions, and LTM. It does not include active remedial measures that would reduce the toxicity, mobility, or volume of the contaminated sludge/sediment.

5.1.3 Containment

Containment is a passive response that would not reduce the toxicity or volume of COCs, but would reduce the mobility and potential for migration of COCs from the structures. Containment is commonly one process option in an alternative that includes LUCs to mitigate exposure and LTM to detect potential releases to soil and groundwater.

Potential containment process options that have been evaluated include capping and installation of subsurface barriers consisting of slurry or grout walls.

5.1.4 Removal

Removal technologies would reduce and/or eliminate the volume of the contaminated media at the site. Removal alone would not reduce the toxicity of the contaminated media.

Process options screened include pumping, flushing, and excavation. Pumping and flushing could be used to remove water and loose sludge/sediment. Excavation could be used to remove loose C&D materials within the structures, the structures and lines, and any remaining sludge/sediment. In combination, these options would address the contaminated media and achieve the RAO.

Removal options are commonly used in conjunction with other process options, such as ex situ or in situ treatment to reduce the contaminant volume and/or toxicity. Risk and hazard management activities (e.g., LUCs and LTM) might be required if the remedial action does not remove COCs to levels that would allow for unlimited use (UU) and unrestricted exposure (UE).

5.1.5 Ex Situ Treatment

Ex situ treatment includes biological, physical/chemical, and thermal treatment technologies. These are active remedial measures that reduce the toxicity, mobility, and volume of contaminated media.

Compared to in situ treatment, ex situ treatment generally requires shorter time periods and provides more certainty about the uniformity of treatment. Ex situ treatment methods generally provide the ability to homogenize, screen, and continuously mix the contaminated media. Ex situ treatment requires removal of the contaminated media to a treatment cell or facility, which typically increases material handling/worker exposure considerations.

Ex situ biological treatment technologies are destruction or transformation techniques that stimulate microorganisms to use the contaminants as an energy source by creating a favorable environment. These technologies are capable of providing some combination of electron acceptors, electron donors, nutrients, and moisture while controlling the temperature and pH. Microorganisms adapted for degradation of the specific contaminants may be applied to enhance the process.

Ex situ physical/chemical treatment technologies use the physical properties of the contaminants or the contaminated medium to destroy, separate, or immobilize the contamination. Ex situ physical/chemical treatment technologies can typically be completed in short time periods. Equipment is readily available and the residuals may require disposal.

Ex situ thermal treatment technologies offer rapid cleanup times but are typically the most costly process options. Cost is driven by energy and equipment costs and is both capital and operation and maintenance (O&M) intensive. Ex situ thermal technologies, such as hot gas decontamination, incineration, open burn/open detonation, pyrolysis, and thermal desorption use heat to volatize, incinerate, detonate, or immobilize contaminants.

Ex situ treatment process options that have been evaluated are listed below.

- Biological Treatment
  - Biopiles
  - Composting
  - Landfarming
  - Slurry Phase Biological Treatment
- Physical/Chemical Treatment

  - Chemical Extraction
  - Chemical Reduction/Oxidation
  - Dehalogenation
  - Separation
  - Soil Washing
  - Solidification/Stabilization
- Thermal Treatment
  - Hot Gas Decontamination
  - Incineration
  - Open Burn/Open Detonation
  - Pyrolysis
  - Thermal Desorption

Following treatment, the material would be used as backfill or disposed, either on site or off site. These technologies are typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM) when the remedial action does not allow for UU/UE.

5.1.6 In Situ Treatment

In situ treatment technologies include biological, physical/chemical, and thermal methods. These are active remedial measures that reduce the toxicity, mobility, and volume of the contaminated media.

In situ treatment is conducted in place and does not require the contaminated media to be removed and transported. Compared to ex situ treatment, in situ treatment methods generally require greater time and provide less certainty about the uniformity of treatment due to subsurface variability. In addition, completion of in situ treatment is more difficult to verify.

In situ biological treatment technologies are destruction or transformational techniques that stimulate microorganisms to grow and use the contaminants as an energy source by creating a favorable environment. Bioventing and enhanced biodegradation are common process options.

In situ physical/chemical treatment technologies use the physical and/or chemical properties of the contaminants or the contaminated medium to destroy, separate, or contain the contamination. Chemical oxidation, soil flushing, soil vapor extraction, and solidification/stabilization are readily available and implementable process options. Soil vapor extraction uses the contaminant's volatility to separate it from the contaminated media. Chemical oxidation converts the contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, or inert. Soil flushing uses the contaminant's solubility in liquid to physically separate it from the contaminated media. Solidification encapsulates the contaminant while stabilization physically alters or binds with the contaminant.

In situ thermal treatment technologies offer quick cleanup times but generally result in the highest cost, which is driven by energy and equipment costs. These methods are typically capital and O&M intensive. In situ steam/hot air injection, electrical resistance/electromagnetic heating,

or fiber optic/radio frequency heating are demonstrated technologies. Thermal injection or heating is used to increase the volatilization rate of semi-volatiles and facilitate their extraction.

In situ treatment process options that have been evaluated are listed below.

- Biological Treatment
  - Bioventing
  - Enhanced Biodegradation
  - Phytoremediation
- Physical/Chemical Treatment
  - Chemical oxidation
  - Electrokinetic Separation
  - Fracturing
  - Soil Flushing
  - Soil Vapor Extraction
  - Solidification/Stabilization
- Thermal Treatment
  - Steam/Hot Air Injection
  - Electrical Resistance/Electromagnetic Heating
  - Fiber Optic/Radio Frequency Heating

These technologies are typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM) when the remedial action does not allow for UU/UE.

5.1.7 Disposal

Disposal is an active response action that would reduce and/or eliminate the mobility and volume of the contaminated media at the site but would not reduce its overall toxicity and volume.

On-site and off-site disposal options were screened. Disposal technologies are readily available, implementable, and routinely used in conjunction with removal. Characterization of the contaminated media would be required prior to transportation and disposal at an appropriately permitted off-site facility or at an on-site constructed cell. Treatment is often performed to reduce the toxicity or volume of the contaminated media prior to disposal.

On-site disposal is typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM).

5.2 Summary of Initial Screening

The initial screening of technology types and process options included those, which if implemented, may achieve the RAO for the site. Technology types and process options that were not applicable based on one or more considerations were removed from further consideration. **Table 5-1** presents a summary of the initial screening of technology types and process options; those considered appropriate for further evaluation are listed below.

- Risk and Hazard Management
  - ICs
  - Engineering Controls/Access Restrictions
  - LTM
- Containment
  - Capping
- Removal
  - Pumping
  - Flushing
  - Mechanical Excavation
- Ex Situ Biological Treatment (assuming excavation)
  - Biopiles
  - Composting
  - Landfarming
  - Slurry Phase Biological Treatment
- Ex Situ Physical/Chemical Treatment (assuming excavation)
  - Chemical Extraction
  - Chemical Reduction/Oxidation
  - Dehalogenation
  - Separation
  - Soil Washing
  - Solidification/Stabilization
- Ex Situ Thermal Treatment (assuming excavation)
  - Incineration
  - Pyrolysis
  - Thermal Desorption
- In Situ Physical/Chemical Treatment
  - Solidification/Stabilization
- Disposal

  Off-site Disposal

5.3 Evaluation of Process Options

Retained process options are evaluated against the criteria described below.

Effectiveness: Evaluates 1) the potential effectiveness of process options in addressing the contaminated media and meeting the RAO and PRGs, 2) the potential impacts to human health and the environment during implementation, and 3) how proven and reliable the process is with respect to the contaminants and site-specific conditions.

Implementability: Evaluates both the technical and administrative feasibility of implementing a process option. Technical implementability is an initial screen to eliminate those options that are clearly ineffective or unworkable.

Cost: Evaluates in a limited fashion the relative capital and O&M costs of the process options. Preliminary cost estimates are made on the basis of engineering judgment and each process option is evaluated as to whether costs are high, medium, or low relative to other process options evaluated. A 30-year period of performance is considered for ICs, engineering controls, access restrictions, and LTM.

Summary: Outlines the evaluation criteria in a limited fashion and both the positive and negative attributes of each process option in a site-specific manner. Each summary focuses on the evaluation of effectiveness, implementability, and cost in accordance with CERCLA guidance.

5.3.1 No Action

Effectiveness: No action would not reduce toxicity, mobility, or volume of COCs at the site. This option would not be effective in reducing the volume of contaminated material, would not meet the PRGs, and would not reduce the potential exposure to contaminants. Furthermore, the current LUCs would not be maintained.

Implementability: No activity would be implemented with this option.

Cost: There is no cost associated with this action.

Summary: No action provides a baseline for comparing the other alternatives. Because no remedial actions would be implemented, long-term health and environmental risks for the site would essentially be the same as those identified in the baseline risk assessment. Cost would be low in comparison to other evaluated options.

5.3.2 Risk and Hazard Management

Effectiveness: ICs, engineering controls, access restrictions, and LTM would not reduce toxicity, mobility, or volume of the contaminants. This option would limit human exposure and provide more long-term protection than no action. ICs, engineering controls, access restrictions, and LTM are routinely implemented and used, although they more typically are applied in conjunction with other options.

Implementability: ICs, engineering controls/access restrictions, and LTM are both technically and administratively feasible. ICs and access restrictions are already in place at the site. LTM is commonly used at sites where contaminants remain. Implementation would consist of deed restrictions, maintenance of the perimeter fencing, site inspections, and environmental monitoring. Administrative measures would be required to execute long-term management and provide coordination with various stakeholders and regulators.

Cost: The relative cost for risk and hazard management is low compared to other process options considered for the site.

Summary: ICs, engineering controls/access restrictions, and LTM are options that could be used to address COCs identified at the site. They are commonly used in conjunction with other remedial technologies and are maintained for further consideration.

5.3.3 Containment

Effectiveness: Containment via capping would be effective in reducing the potential for direct contact with contaminated sludge/sediment. The potential for migration of contaminants to soils or groundwater would also be reduced by eliminating water infiltration into the contaminated media. This process option meets the 40 CFR Part 761 requirement for capping waste containing PCBs at concentrations between 25 mg/kg and 100 mg/kg.

Implementability: Containment can be implemented in a relatively short time using conventional construction and labor.

Cost: Capping costs are typically low to. Capping would require periodic long-term costs associated with monitoring and the implementation of LUC/ICs.

Summary: Containment of the contaminated sludge/sediment via capping would prevent direct contact with COCs. Capping could be used in conjunction with LUC/ICs to meet the RAO and are retained for further consideration.

5.3.4 Removal

Effectiveness: Pumping, flushing, and excavation would be effective in reducing the contaminant toxicity, mobility, and volume at the site and achieve the PRGs for contaminated media. These options would not reduce the overall toxicity and volume of the contaminated media. Flushing would increase the volume of water that would require handling and (possibly) treatment/disposal. Removal processes could be used in conjunction with off-site disposal at a permitted TSDF that uses reduction technologies. Potential impacts to human health and the environment could be mitigated by implementing a worker health and safety program and by using proper construction and monitoring methods. In conjunction with other options, removal would provide long-term protection to human health and the environment. Pumping, flushing, and excavation are proven, reliable remediation methods that have been successfully implemented at sites with similar contaminants and site conditions.

Implementability: Removal options are technically and administratively feasible. Labor and equipment is readily available and standard construction methods are commonly used.

Cost: Pumping, flushing, and excavation would require moderate capital, low O&M, and moderate overall costs compared to other evaluated options. Construction costs associated with this activity can be estimated with a relatively high degree of accuracy.

Summary: Removal options are reliable processes that would address the contaminated media. Pumping and excavation are maintained for further consideration. Flushing is not retained for further consideration because it would increase the total volume of water that would be generated.

5.3.5 Ex Situ Treatment

5.3.5.1 Ex Situ Biological Treatment

Biopiles, composting, landfarming, and slurry phase biological treatment are evaluated.

Effectiveness: Bioremediation of PCBs involves the ability of microorganisms to use the contaminants as an energy source and degrade the contaminants into simpler forms including carbon dioxide and water. Bioremediation technologies for PCBs have shown some degree of success in laboratory and pilot-scale applications and have been selected as the remedial action at two Superfund sites (EPA, 2012). However, the characteristics of these sites, PCB congeners, and concentrations are distinctly different from the conditions present at the LOOW WWTP. Impacts to human health and the environment during implementation could be mitigated by using proper health/safety and construction/monitoring techniques.

Implementability: Comprehensive field-scale research would be needed to advance bioremediation at the site. Treatability studies and/or pilot tests would be required to determine the reliability of the processes. Repeat applications and ability to monitor the effectiveness of the remedy are feasible.

Cost: The costs associated with field-scale research are high. Implementation costs for the processes, except slurry phase biological treatment, would require low capital, O&M, and overall costs. Slurry phase biological treatment has high capital cost, moderate O&M cost, and moderate overall cost.

Summary: Ex situ biological treatment technologies for PCBs is an emerging technology that would require field research to determine applicability at the site. These options are not maintained for further consideration.

5.3.5.2 Ex Situ Physical/Chemical Treatment

Chemical extraction, chemical reduction/oxidation, dehalogenation, separation, soil washing, and solidification/stabilization are evaluated.

Effectiveness: Ex situ physical/chemical treatment processes have varying degrees of effectiveness. Chemical extraction and soil washing processes have limited effectiveness on the treatment of PCBs. Chemical reduction/oxidation and dehalogenation processes may be effective. Separation processes such as dewatering would reduce the volume of contaminated sludge/sediment. Solidification/stabilization would effectively treat the PCBs. Impacts to human health and the environment during implementation could be mitigated by using proper health/safety and construction/monitoring techniques.

Implementability: These processes are technically and administratively implementable and the equipment is commercially available. Chemical extraction, soil washing, and solidification/stabilization are more easily implemented and more reliable than the other processes. Chemical extraction and soil washing would produce a greater volume of liquid that might require treatment and disposal. A treatability study and/or pilot test would be required for solidification/stabilization. Administrative approvals may be required for all processes.

Cost: All processes, except separation and solidification/stabilization, would require high capital costs, moderate O&M costs, and moderate overall costs. Separation and solidification/ stabilization would require moderate capital cost, low O&M cost, and moderate overall cost.

Summary: Separation and solidification are potentially reliable processes for treatment of the PCB-contaminated sludge/sediment and are retained for further consideration. Chemical extraction, chemical reduction/oxidation, dehalogenation, and soil washing processes are not retained for further consideration.

5.3.5.3 Ex Situ Thermal Treatment

Incineration, pyrolysis, and thermal desorption are evaluated.

Effectiveness: Incineration and thermal desorption processes would destroy the PCBs. Pyrolysis has limited effectiveness treating PCBs and may potentially contribute to an increase in toxicity. If implemented, incineration and thermal desorption could achieve the PRGs and, properly executed, would not impact human health and the environment.

Implementability: All evaluated thermal treatment processes would not be technically or administratively implementable. The commercial availability of thermal treatment equipment or facilities is limited and operation requires a TSCA permit for PCB incineration.

Cost: All processes, except thermal desorption, would require high capital costs, high O&M costs, and high overall costs. Thermal desorption would require high capital and O&M costs and moderate overall costs.

Summary: Ex situ thermal treatment processes are not implementable at the site. They are not retained for further consideration.

5.3.6 In Situ Treatment

Biological, physical/chemical, and thermal processes are evaluated.

Effectiveness: In situ biological treatment involves using microorganisms to degrade the contaminants into simpler forms including carbon dioxide and water. It is uncertain whether biological treatment would reduce the PCB concentrations to the PRG. In situ solidification/stabilization would reduce the toxicity and mobility of site COCs. Properly executed, solidification/stabilization would not impact human health and the environment.

Implementability: In situ biological treatment and solidification/stabilization would be moderately difficult to implement, both technically and administratively. Biological treatment of PCBs is an emerging technology that would require field research to determine its applicability at the site. Dewatering and removal of any C&D materials (known to be present in the acid neutralization building basement) would be required beforehand. LUC/ICs and LTM would be required for solidification/stabilization because the process would not remediate the site to a level that provides UU/UE. In situ thermal treatment processes cannot be implemented for contaminated sludge/sediment within underground structures. All in situ treatment methods may require administrative approvals.

Cost: The capital costs associated with field-scale research for in situ biological treatment are high; O&M costs are moderate and overall costs are high. In situ solidification/stabilization would require moderate capital, O&M, and overall costs. In situ thermal treatment costs are high.

Summary: Solidification/stabilization is a viable process option for remediation of PCB contaminated sludge/sediment at the site; it is retained for further consideration. Biological and

thermal treatment processes would not be effective and/or implementable and are not retained for further consideration.

5.3.7 Disposal

Effectiveness: Disposal at a permitted off-site facility or engineered cell constructed on site would prevent the contaminants from migrating, would protect human health and the environment, and would reduce contaminant mobility.

Implementability: Disposal is technically implementable and reliable. Permitted off-site TSDFs that can accept contaminated media from the site are available. Waste characterization, acceptance (by the disposal facility and host state), and transportation would be required. On-site disposal in an engineered cell may be administratively difficult because the property is owned by the Town of Lewiston.

Cost: Off-site disposal would require high capital, low O&M, and moderate overall costs. On-site disposal would require high capital, moderate O&M, and high overall costs.

Summary: Off-site disposal is a viable option that is maintained for further consideration. On-site disposal is less feasible and not retained for further consideration.

5.4 Summary of Evaluation

Potential process options evaluated included those, which if implemented as part of an alternative, may achieve the RAO for the site. **Table 5-2** provides a summary of the evaluation.

Those process options that ranked lower for either effectiveness or implementability and higher for cost were removed from further consideration and not carried forward to the development of alternatives. Processes that ranked higher for either effectiveness or implementability and lower for cost were retained for further consideration. These are listed below and carried forward to the development and evaluation of alternatives in Section 6.0.

- No Action
  - No Action
- Risk Hazard Management
  - ICs
  - Engineering Controls/Access Restrictions
  - LTM
- Containment
  - Capping
- Removal
  - Pumping
  - Excavation
- Ex Situ Physical/Chemical Treatment (assuming excavation)
  - Separation

    - Solidification/Stabilization
- In Situ Physical/Chemical Treatment
    - Solidification/Stabilization
- Disposal
    - Off-site Disposal

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Table 5-1. Initial Screening of Technology Types and Process Options

General Response Action	Technology Type	Process Option	Description	Comments
No Action	No Action	No Action	No further action	Required for consideration by the NCP
Passive Response Action	Risk Hazard Management	ICs	Legal instruments that minimize the potential for human exposure to contamination by limiting land or resource use	Potentially applicable
		Engineering Controls/Access Restrictions	Equipment and materials used to eliminate or reduce human exposure to contamination via physical barriers and other restrictions to access	Potentially applicable
		LTM	Monitor potential impacts to the environment	Potentially applicable
		Monitored Natural Attenuation	The monitoring of natural attenuation (i.e. the reduction of toxicity, mobility, and volume of contaminants by naturally occurring biological, chemical, and physical processes)	Not feasible for COCs and contaminated sludge located in subsurface structures Limited effectiveness for more highly chlorinated PCBs which are extremely persistent in the environment PCB dechlorination is rarely complete and alters the type of PCB, rather than changing the total amount of PCBs
	Containment	Slurry Wall/ Grout Curtain	Subsurface barriers that consist of vertically excavated trenches filled with slurry or cementitious grout; the barriers retard groundwater flow	Not applicable for contaminated sludge/sediment located in subsurface structures
		Capping	Caps used for contaminant source control; including asphalt/concrete caps, RCRA Subtitle C caps, and RCRA Subtitle D caps	Potentially applicable
		Grout Injection	Process of forcing grout into the subsurface or a void by pressure pumps	Not applicable for contaminated sludge/sediment located in subsurface structures
Active Response Action	Removal	Pumping	Extraction and collection of liquids (and suspended solids) via vacuum pumps	Potentially applicable
		Flushing	Injection and collection of liquids (and suspended solids) via pressure pumps	Potentially applicable
		Manual Excavation	Small scale removal/extraction of subsurface material and/or structures using manual methods	Not feasible due to location of the contaminated sludge/sediment
		Mechanical Excavation	Removal/extraction of subsurface material and/or structures using construction equipment	Potentially applicable
	Ex Situ Biological Treatment (assuming excavation)	Biopiles	Excavated solids are mixed with amendments and placed in aboveground enclosures; this is an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps	Potentially applicable; requires field research to determine applicability at the site
		Composting	Contaminated solids are excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes; proper amendment selection ensures adequate porosity and provides a balance of carbon and nitrogen to promote thermophilic, microbial activity	Potentially applicable; requires field research to determine applicability at the site

Table 5-1. Initial Screening of Technology Types and Process Options

General Response Action	Technology Type	Process Option	Description	Comments
		Landfarming	Contaminated solids are excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste	Potentially applicable; requires field research to determine applicability at the site
		Slurry Phase Biological Treatment	Aqueous slurry is created by combining sludge/sediment with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the contaminants. Upon completion of the process, the slurry is dewatered and the treated solids are disposed. Includes slurry-phase bioreactors.	Potentially applicable; requires field research to determine applicability at the site
	Ex Situ Physical/Chemical Treatment (assuming excavation)	Chemical Extraction	Contaminated sludge/sediment and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use. Includes acid extraction and solvent extraction.	Potentially applicable
		Chemical Reduction/ Oxidation	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.	Potentially applicable
		Dehalogenation	Reagents are added to solids contaminated with halogenated organics. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants. Includes base-catalyzed decomposition and glycolate/alkaline polyethylene glycol.	Potentially applicable
		Separation	Separation techniques concentrate contaminated solids through physical and chemical means. These processes seek to detach contaminants from their medium (i.e., the soil, sand, and/or binding material that contains them). Includes gravity separation, magnetic separation, and sieving/physical separation.	Potentially applicable
		Soil Washing	Contaminants sorbed onto fine particles are separated from bulk solids in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	Potentially applicable
		Solidification /Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). Includes bituminization, emulsified asphalt, pozzolan/Portland cement solidification, sludge stabilization, and vitrification/molten glass.	Potentially applicable
	Ex Situ Thermal Treatment (assuming excavation)	Hot Gas Decontamination	The process involves raising the temperature of the contaminated equipment or material for a specified period of time. The gas effluent from the material is treated in an afterburner system to destroy all volatilized contaminants.	Not applicable
		Incineration	High temperatures, 870-1,200 °C (1,600- 2,200 °F), are used to combust (in the presence of oxygen) organic constituents in wastes. Includes circulating bed combustor, fluidized bed, infrared combustion, and rotary kilns.	Potentially applicable
		Open Burn/Open Detonation	In open burn operations, explosives or munitions are destroyed by self-sustained combustion, which is ignited by an external source, such as flame, heat, or a detonatable wave. In open detonation operations, detonatable explosives and munitions are destroyed by a detonation, which is generally initiated by the detonation of an energetic charge.	Not applicable; USEPA prohibited open burning of PCB waste in the PCB Disposal Amendments Rule [40 CFR 761.50(a)(1)]

Table 5-1. Initial Screening of Technology Types and Process Options

General Response Action	Technology Type	Process Option	Description	Comments
		Pyrolysis	Chemical decomposition is induced in organic materials by heat in the absence of oxygen. Organic materials are transformed into gaseous components and a solid residue (coke) containing fixed carbon and ash. Includes rotary kiln, fluidized bed furnace, and molten salt destruction.	Potentially applicable
		Thermal Desorption	Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. Includes high- and low-temperature thermal desorption.	Potentially applicable
	In Situ Biological Treatment	Bioventing	Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation.	Not applicable for saturated sludge/sediment in underground structures
		Enhanced Biodegradation	The activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in situ biological degradation of organic contaminants or immobilization of inorganic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials.	Not feasible due to location of the contaminated sludge/sediment
		Phytoremediation	Process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic. Includes enhanced rhizosphere biodegradation, phyto-accumulation, phyto-degradation, and phyto-stabilization.	Not feasible due to location of the contaminated sludge/sediment
	In Situ Physical/Chemical Treatment	Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. Includes ozone addition, peroxide, and permanganate.	Not feasible due to location of the contaminated sludge/sediment
		Electrokinetic Separation	Process removes metals and organic contaminants from low-permeability soil, mud, sludge, and marine dredging. Uses electrochemical and electrokinetic processes to desorb, and then remove, metals and polar organics. This in situ soil processing technology is primarily a separation and removal technique for extracting contaminants from soils.	Not applicable for sludge/sediment in subsurface structures
		Fracturing	Cracks are developed by fracturing beneath the surface in low-permeability and over-consolidated sediments to open new passageways that increase the effectiveness of many in situ processes and enhance extraction efficiencies. Includes blast-enhanced fracturing, lasagna process, and pneumatic fracturing.	Not applicable for loose, saturated sludge/sediment in underground structures
		Soil Flushing	Water, or water containing an additive to enhance contaminant solubility, is applied to the soil or injected into the groundwater to raise the water table into the contaminated soil zone. Contaminants are leached into the groundwater, which is then extracted and treated.	Not applicable for sludge/sediment in subsurface structures
		Soil Vapor Extraction	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil through extraction wells. This technology also is known as in situ soil venting, in situ volatilization, enhanced volatilization, or soil vacuum extraction.	Not applicable for PCBs and saturated sludge/sediment in subsurface structures
		Solidification/Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). Includes bituminization, emulsified asphalt, pozzolan/Portland cement solidification, sludge stabilization, soluble phosphates, and vitrification/molten glass.	Potentially applicable

Table 5-1. Initial Screening of Technology Types and Process Options

General Response Action	Technology Type	Process Option	Description	Comments
	In-situ Thermal Treatment	Thermal Treatment	Steam/hot air injection or electrical resistance/electromagnetic/fiber optic/radio frequency heating is used to increase the volatilization rate of semi-volatiles and facilitate extraction. Includes electrical resistance heating, radio frequency/electromagnetic heating, and hot air/steam injection.	Not applicable for sludge/sediment in subsurface structures
	Disposal	Off-site Disposal	Contaminated material is removed and transported to permitted off-site treatment and disposal facilities. Pretreatment may be required.	Potentially applicable
		On-site Disposal	Following adequate treatment of contaminated material, remediated material is disposed of on site.	Not applicable for PCB-contaminated sludge/sediment in accordance with 40 CFR 761.61(a)(1)(i)(C)

Legend:

CFR – Code of Federal Regulations
COC – constituent of concern
IC – institutional control
LTM – long-term monitoring
NCP – National Contingency Plan
PCBs – polychlorinated biphenyls
RCRA – Resource Conservation and Recovery Act
Red highlighted - Process Option has been eliminated from consideration

Sources:

CLU-IN, Contaminated Site Clean-Up Information (USEPA, 2013)
Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (FRTR, 2013)

Table 5-2. Evaluation of Potential Process Options

General Response Action	Technology Type	Process Option	Effectiveness/Reliability	Implementability	Relative Cost			Conclusions
					Capital	O&M	Overall	
No Action	None	No Action	Not effective in reducing the contamination or exposure pathways	Easily implemented; not acceptable to community and regulators	Low	Low	Low	Retained as a baseline for comparison with other options
Passive Response Action	Risk and Hazard Management	ICs	Effectiveness depends on implementation; no contaminant reduction	Administrative decisions would be easily implemented since some LUCs are already in place; requires continued maintenance and landowner acceptance	Low	Low	Low	Retained, to be used in conjunction with other process options
		Engineering Controls/Access Restrictions	Effectiveness depends on implementation; no contaminant reduction	Readily available and currently in place; requires continued maintenance and landowner acceptance	Low	Low	Low	Retained, to be used in conjunction with other process options
		LTM	Effective in tracking potential environmental impacts; no contaminant reduction	Easily implemented; standard technology	Low	Moderate	Moderate	Retained, to be used in conjunction with other process options
	Containment	Capping	Effective for preventing direct contact with contaminated materials and reducing infiltration	Easily implemented; standard technology	Moderate	Moderate	Moderate	Retained, to be used in conjunction with other process options
Active Response Action	Removal	Pumping	Effective and well proven technology to remove contaminated media	Easily implemented; standard technology	Low	Low	Low	Retained based on effectiveness, reliability, implementability, and cost; to be used in conjunction with other process options
		Flushing	Effective and well proven technology to remove contaminated media; increases amount of water generated	Easily implemented; standard technology	Moderate	Low	Moderate	Not retained due to potential for increased wastewater generation
		Mechanical Excavation	Effective and well proven technology to remove contaminated media	Easily implemented; standard technology	Moderate	Low	Moderate	Retained based on effectiveness, reliability, implementability, and cost; to be used in conjunction with other process options
	Ex Situ Biological Treatment (assuming excavation)	Biopiles	Requires field research to determine applicability at the site; may be ineffective	Potentially implementable; all materials and equipment are commercially available; treatability tests are required	High	Low	Low	Not retained because of limited effectiveness
		Composting	Requires field research to determine applicability at the site; may be ineffective	Potentially implementable; all materials and equipment are commercially available; treatability tests are required	High	Low	Low	Not retained because of limited effectiveness

Table 5-2. Evaluation of Potential Process Options

General Response Action	Technology Type	Process Option	Effectiveness/Reliability	Implementability	Relative Cost			Conclusions
					Capital	O&M	Overall	
		Landfarming	Requires field research to determine applicability at the site; may be ineffective	Potentially implementable; all materials and equipment are commercially available; treatability tests are required	High	Low	Low	Not retained because of limited effectiveness
		Slurry-Phase Biological Treatment	Requires field research to determine applicability at the site; may be ineffective	Potentially implementable; all materials and equipment are commercially available; treatability tests are required; dewatering of fines is required	High	Moderate	Moderate	Not retained because of limited effectiveness
	Ex Situ Physical /Chemical Treatment (assuming excavation)	Chemical Extraction	Technology effective at treating PCBs; limited effectiveness on sediments comprised of primarily clays and silts; volume of wastewater is increased	Implementable and reliable	High	Moderate	Moderate	Not retained due to limited effectiveness and increased wastewater generation
		Chemical Reduction / Oxidation	Limited effectiveness on the treatment of PCBs.	Potentially implementable; all materials and equipment are commercially available	High	Moderate	Moderate	Not retained because of limited effectiveness
		Dehalogenation	Effective for halogenated compounds (PCBs)	Potentially implementable; all materials and equipment are commercially available	High	Moderate	Moderate	Not retained because of limited effectiveness
		Separation	Separation would effectively dewater sludge/sediment since PCBs readily partition to the solids.	Potentially implementable; all materials and equipment are commercially available	Moderate	Low	Moderate	Retained, to be used in conjunction with other process options
		Soil Washing	Effective for treating the PCBs. Limited effectiveness on sludge/sediments comprised of primarily clays and silts; volume of wastewater is increased	Implementable and reliable	High	Moderate	Moderate	Not retained due to limited effectiveness and increased wastewater generation
		Solidification /Stabilization	Effective for PCBs	Implementable and reliable; treatability studies may be required; volume is increased	Moderate	Moderate	Moderate	Retained because of potential effectiveness and implementability
	Ex Situ Thermal Treatment (assuming excavation)	Incineration	Would destroy the PCBs	Cannot be implemented because there are no commercially available off-site treatment facilities/mobile incinerators that hold a TSCA permit to incinerate PCB-contaminated materials and also accept material potentially containing low-level radionuclides	High	High	High	Not retained based on implementability

Table 5-2. Evaluation of Potential Process Options

General Response Action	Technology Type	Process Option	Effectiveness/Reliability	Implementability	Relative Cost			Conclusions
					Capital	O&M	Overall	
		Pyrolysis	Limited demonstrated effectiveness for pyrolytic systems treating, which may react to form other more toxic compounds.	Cannot be implemented because there are no commercially available pyrolytic systems that hold a TSCA permit to incinerate PCB-contaminated materials and also accept material potentially containing low-level radionuclides	High	High	High	Not retained based on implementability
		Thermal Desorption	High-temperature technology effectively destroys PCBs	Cannot be implemented because there are no commercially available thermal desorption systems that hold a TSCA permit to incinerate PCB-contaminated materials and also accept material potentially containing low-level radionuclides	High	High	High	Not retained based on implementability
	In Situ Physical /Chemical Treatment	Solidification /Stabilization	Effective for PCBs	Easily implemented, would require removal of subgrade floors, loose C&D materials, and water within the structures	Moderate	Moderate	Moderate	Retained because of potential effectiveness
	Disposal	Off-site Disposal	Effectively reduces mobility of and limits exposure to PCBs	Easily implemented, would require removal of subgrade floors, loose C&D materials, and water within the structures	High	Low	Moderate	Retained because of potential effectiveness and implementability

Legend:

COC – constituent of concern
IC – institutional control
LTM – long-term monitoring
LUC – land-use control
O&M – operation and maintenance
PAHs – polycyclic aromatic hydrocarbons
PCBs – polychlorinated biphenyls
TSCA – Toxic Substances Control Act
Red highlighted - Process Option has been eliminated from consideration

Sources:

CLU-IN, Contaminated Site Clean-Up Information (USEPA, 2013)
Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (FRTR, 2013)

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6.0 DEVELOPMENT AND EVALUATION OF ALTERNATIVES

In this section the remedial action technologies and process options that were retained after the initial screening and evaluation are assembled into alternatives that represent a range of remedial options. This section also documents the results of the screening process to eliminate those alternatives with only limited opportunity for success at the site.

The general response actions that are either required by CERCLA or considered applicable for the site include: No Action, Limited Action, Treatment in Place, and Removal, Treatment, and Disposal. The Limited Action, Treatment in Place, and Removal, Treatment, and Disposal response actions meet the threshold criteria for:

- Overall protection of human health and the environment
- Compliance with ARARs

No action does not meet these threshold criteria.

6.1 Development of Alternatives

Requirements specified by the USEPA in the NCP for developing alternatives include the following:

- A No Action alternative should be developed
- One or more alternatives should be considered that involve little or no treatment, but provide protection of human health and the environment primarily by preventing or controlling exposure to hazardous substances, pollutants, or contaminants through engineering controls
- A range of alternatives should be developed in which the principal element is treatment resulting in reduced toxicity, mobility, or volume of the contaminants

Six potential remedial alternatives, listed in **Table 6-1**, have been developed for the site on the basis of these requirements, the site contaminants, and site conditions.

Table 6-1. Potential Remedial Alternatives

Alternative	**Process Options**										
	No Action	**Institutional Controls**	**Access Restrictions**	**Long-Term Monitoring**	**Pumping**	**Excavation**	**Capping**	**Ex Situ Separation**	**Ex Situ Solidification/ Stabilization**	**In Situ Solidification**	**Off-site Disposal**
Alternative 1: No Action	X										
Alternative 2: Capping		X	X	X	X		X			X	
Alternative 3: Complete Excavation and Off-site Disposal					X	X		X			X
Alternative 4: Removal of Sludge/Sediment and Water with Off-site Disposal					X	X		X			X
Alternative 5: Removal of Sludge/Sediment and Water, Ex Situ Solidification/Stabilization with Off-site Disposal					X	X		X	X		X
Alternative 6: In Situ Solidification		X	X	X	X					X	

The potential alternatives are evaluated against three criteria: effectiveness, implementability, and cost.

- *Effectiveness:* a measure of how the alternative will protect human health and the environment and meet ARARs. Each alternative is evaluated with respect to its protectiveness and how it will reduce the toxicity, mobility, and volume of the COCs. Both short- and long-term components are evaluated; short term referring to the construction and implementation period, and long term referring to the period after the remedial action is complete. Reduction of toxicity, mobility, or volume refers to changes in one or more characteristics of the hazardous substances or contaminated media by the use of treatment that decreases the inherent threats or risks.
- *Implementability:* a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations until a remedial action is complete; it also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, after the remedial action is complete. Administrative feasibility refers to the ability to obtain

approvals from other offices and agencies, the availability of treatment, storage, and disposal services and capacity, and the requirements for, and availability of, specific equipment and technical specialists.

- *Cost:* cost estimates for the alternatives are based on a variety of cost estimating data; including cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. The cost estimates are used to compare the alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

6.2 Alternative 1: No Action

6.2.1 Description

No action does not include active remediation, controls, or monitoring. Current LUCs are not considered and existing access restrictions would not be maintained. In addition, no public awareness or education/training would be initiated regarding potential risks associated with PCB contamination at the site.

6.2.2 Evaluation

Effectiveness: All activities at the site would cease including the maintenance of access restrictions. No action would not significantly reduce the contaminant mass and potential risk to receptors in the short-term. Natural degradation through physical, chemical and biological processes may reduce the contaminant concentrations over time. The contaminants are not expected to migrate to subsurface soil or groundwater in the near future.

The no action alternative would not achieve the RAO for the site. Landowner and community acceptance would be difficult since the RAO and PRGs would not be attained and potential risk to human health and the environment would not be addressed.

Implementability: No activities would be performed, including LTM, five-year reviews, and site closeout activities.

Cost: There are no costs associated with the no action alternative.

Summary: No action is technically feasible, implementable and has no cost. The contaminated media would not be addressed. Landowner and community acceptance would be difficult to obtain. No action has been retained pursuant to NCP requirements and will be evaluated in the detailed analysis to provide a baseline for comparison with the other alternatives.

6.3 Alternative 2: Capping

6.3.1 Description

Capping would prevent human exposure to contaminants in the acid neutralization building and dilution sump/weir and comply with the requirements of 40 CFR 761. The contaminant mobility would be reduced by placement of a low-permeability cap over the sludge/sediment and by solidifying the contaminated media to increase its strength. The toxicity and volume of the contaminated media would not be reduced.

Water within the structures would be removed by pumping. The sludge/sediment in the acid neutralization buildingand dilution sump/weir would be solidified to strengthen the material and then capped with a minimum of 6 inches of concrete.

This alternative would include post-remedy LUCs, LTM, five-year reviews, and site close-out activities. LUCs would include ICs (deed restrictions, easements, prohibitions, and building or excavation permit requirements) access restrictions (fencing and signs), and informational devices (fact sheets, public information meetings, and articles/advertisements in conjunction with five-year reviews). The LTM program would consist of a network of groundwater wells that would be monitored periodically to evaluate the potential for contaminants leaching into groundwater. Five-year reviews would be required because contaminant concentrations would not be reduced to levels that allow for UU/UE. Site close-out documentation would be needed at the end of the LTM period.

6.3.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. Capping would not reduce the toxicity and mobility of the contaminated sludge/sediment. The contaminated material volume would increase due to the addition of solidifying reagents. Residual contamination would remain on site.

Implementability: Capping would employ standard construction methods and labor. Impacts to human health and the environment during the remedial action could be mitigated by using proper health/safety and construction/monitoring techniques. Capping would hinder future use of the site. ICs and access restrictions are currently in place pursuant to the NYSDOH Commissioner's Orders. The federal government would need to acquire the right to restrict property access to ensure future protection. The administrative feasibility of this action is considered difficult.

Cost: The capital cost for this alternative is ranked moderate. Future costs are ranked moderate and include LTM, maintenance of ICs and access restrictions, five-year reviews, and site close-out activities. A 30-year period of performance is assumed for cost estimating purposes.

Summary: This alternative meets the RAO and the 40 CFR 761 requirement for capping waste containing PCBs at concentrations between 25 mg/kg and 100 mg/kg. It is carried through to the detailed analysis in Section 7.0 because it is protective of human health and the environment. Successful implementation would require landowner and community cooperation.

6.4 Alternative 3: Complete Excavation with Off-site Disposal

6.4.1 Description

Complete excavation with off-site disposal would include the removal and off-site disposal of all WWTP structures, the sludge/sediment, and water contained within the structures. Contaminated materials would be analyzed and subsequently transported to a permitted TSDF. Some pretreatment may be necessary to meet land disposal restrictions. The water within the structures would be removed by pumping. The sludge/sediment would be excavated, temporarily staged on site, dewatered, sampled, and transported to a permitted TSDF.

Excavated structures and lines (C&D materials) would be screened for contamination, managed on site, and sampled. Contaminated C&D materials would be transported off site to a permitted TSDF; non-contaminated C&D materials would be salvaged for reuse or disposed in a Subtitle D landfill.

Disposal characterization would be required under the land disposal restrictions. At a minimum, testing would be performed to determine RCRA characteristics, PCB concentrations, and compliance with TSDF requirements. The disposal of hazardous wastes, if present, is regulated by RCRA (40 CFR Parts 261-265). The management of PCB waste is regulated by TSCA (40 CFR Parts 700-799). The U.S. Department of Transportation (USDOT) regulates the transport of hazardous materials (49 CFR Parts 172-179, 49 CFR Part 1387, and USDOT-E-8876).

All excavated areas would be backfilled with clean soil to existing grade and reseeded.

6.4.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. All contaminated media would be removed and UU/UE conditions are expected. Overall reduction of the contaminants would require pretreatment at the TSDF.

Implementability: This alternative is technically feasible. Standard construction methods and labor are required, which are readily available. Impacts to human health and the environment during the remedial action could be mitigated by using proper health and safety measures, approved construction methods, and monitoring. The alternative is not administratively feasible because contamination of the structures (i.e. concrete floors and walls) has not been documented and their removal/off-site disposal would violate DoD regulations established under the Formerly Used Defense Sites Program for building demolition/debris removal (Department of the Army, 2004).

Cost: Capital cost for this alternative is high. O&M, LTM, and five-year review costs are not anticipated because the site would be remediated to a UU/UE condition.

Summary: This alternative does not comply with DoD policy regarding building demolition/debris removal and is not retained for detailed analysis.

6.5 Alternative 4: Removal of Sludge/Sediment and Water with Off-site Disposal

6.5.1 Description

This alternative would include removal of sludge/sediment and water within the acid neutralization building and dilution sump/weir. The structures and underground lines would not be removed.

The sludge/sediment and water would be removed by pumping and/or excavation and then processed to reduce the moisture content of the solids. Afterwards, the solids would be temporarily staged, sampled and analyzed for disposal characterization, and transported to a permitted TSDF. Some additional pretreatment may be necessary to meet land disposal restrictions.

Disposal characterization would be required under the land disposal restrictions. At a minimum, testing would be performed to determine PCB concentrations and compliance with TSDF requirements.

The structures would be cleaned to remove any residual solids. Any C&D materials would be processed and disposed off site. All contaminated media would be removed to achieve a UU/UE condition.

6.5.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. It is assumed that pumping would adequately remove all water and contaminated sludge/sediment. The mobility of the contaminants would be reduced by placement in a TSDF. Reduction of the toxicity and volume of COCs and other contaminated materials within the sludge/sediment would require pretreatment at the TSDF.

Implementability: This alternative is fully implementable and both technically and administratively feasible. Standard construction methods and labor are required, which are readily available. Impacts to human health and the environment during the remedial action could be mitigated by using proper health/safety and construction/monitoring techniques. The disposal options for materials containing PCBs above 50 ppm are limited. ICs and access restrictions are currently in place pursuant to the NYSDOH Commissioner's Orders. The administrative feasibility of this action is not considered difficult.

Cost: Capital cost for this alternative is ranked moderate. O&M, LTM, and five-year review costs are not anticipated because the site would be remediated to a UU/UE condition.

Summary: Excvation with off-site disposal is a widely implemented and well proven remedial action alternative. This alternative is effective and implementable and has been retained for detailed analysis in Section 7.0.

6.6 Alternative 5: Ex Situ Solidification/Stabilization with Off-site Disposal

6.6.1 Description

This alternative would include removal of sludge/sediment and water. The structures and underground lines would not be removed.

The sludge/sediment and water within the structures would be removed by pumping and then processed via gravity separation to concentrate the solids. The sludge/sediment would be placed in a treatment cell constructed on site, sampled and analyzed to determine if it is subject to regulation under RCRA, and treated using solidification/stabilization. The treated material would be sampled, analyzed, and transported off site to a permitted TSDF. The treatment cell would be decommissioned afterwards.

Treatability testing would be required to characterize the untreated contaminated material and evaluate the solidification/stabilization technology performance under different operating conditions. Testing may include both bench-scale and pilot testing. Quality control testing would be required during implementation to verify consistency and the achievement of performance goals. Disposal characterization would be required under the land disposal restrictions. Static leach testing would be performed to determine PCB concentrations and compliance with TSDF requirements. Sampling and analysis of the treatment cell and underlying soils would be required during decommissioning to verify that any residually-contaminated materials are removed and properly disposed.

The acid neutralization building and dilution sump/weir would be cleaned to remove any residual solids. Any C&D materials would be processed and disposed off site. All contaminated media would be removed to achieve a UU/UE condition.

6.6.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. The mobility and toxicity of the PCBs would be reduced by solidification/stabilization and placement in a TSDF. The volume of material requiring off-site disposal would be increased.

Implementability: The alternative is readily implementable and reliable. Treatability studies would be required to provide site-specific information to evaluate solidification/stabilization and to develop design parameters and scale up requirements for full-scale implementation. The treatment cell would be designed, constructed on site, and decommissioned at completion of the remedial action. The disposal options for materials containing PCBs above 50 ppm are limited. ICs and access restrictions are currently in place pursuant to the NYSDOH Commissioner's Orders. The administrative feasibility of this action is considered difficult.

Cost: Capital cost for this alternative is ranked as high. O&M, LTM, and five-year review costs are not anticipated because the site would be remediated to a UU/UE condition.

Summary: This alternative differs from Alternative 4 by the treatment of sludge/sediment on site prior to transportation and disposal. Additional costs and schedule impacts would be incurred from the treatability testing and the design, construction, and decommissioning of the treatment cell. This alternative is not retained for detailed analysis in Section 7.0 because it provides no additional substantial benefits compared to the other evaluated alternatives that that are retained for detailed analysis.

6.7 Alternative 6: In Situ Solidification

6.7.1 Description

This alternative would solidify in place all sludge/sediment using a cementitious grout and cover the solidified material with several feet of controlled low-strength material (flowable fill). Water from the structures would be removed prior to solidification.

Treatability studies would be required to provide site-specific information to evaluate solidification and to develop design parameters and scale up requirements for full-scale implementation. Testing may include both bench-scale and pilot testing. Quality control testing would be required during implementation to verify consistency and the achievement of performance goals.

This alternative would include post-remedy LUCs, LTM, five-year reviews, and site close-out activities.

6.7.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. In situ solidification would reduce the toxicity and mobility of the contaminated sludge/sediment. The volume would increase due to the addition of solidifying reagents. Residual contamination would remain on site. This alternative would comply with the TSCA ARAR (40 CFR Part 761.61(4)) since PCBs would remain on site (between 25 mg/kg and 100 mg/kg) and the solidified sludge/sediment would be covered with several feet of flowable fill, which would meet the intent of the 6-inch concrete capping requirement.

Implementability: In situ solidification is an established remedial process that employs standard construction methods and labor. In situ solidification would be moderately difficult to

implement in underground structures. In addition, the solidified material may hinder future site use. ICs and access restrictions are currently in place pursuant to the NYSDOH Commissioner's Orders. The federal government would need to acquire the right to restrict access to the property in order to ensure future protection. The administrative feasibility of this action is considered difficult.

Cost: Capital cost for this alternative is ranked as moderate. Future costs are ranked as moderate and include LTM, maintenance of ICs and access restrictions, five-year reviews, and site close-out activities. A 30-year period of performance is assumed for cost estimating purposes.

Summary: This option provides in place treatment of the contaminated materials, meets the RAO, and is consistent with the NCP. Successful implementation would require landowner and community cooperation. It has been retained for detailed analysis in Section 7.0.

6.8 Summary of Evaluated Remedial Alternatives

The following remedial alternatives were retained for detailed analysis:

- *Alternative 1: No Action* – retained as required by the NCP to be used a baseline for comparison with other alternatives.
- *Alternative 2: Capping* – retained because it satisfies the RAO and meets the ARARs.
- *Alternative 4 – Removal of Sludge/Sediment and Water with Off-site Disposal* – retained because it satisfies the RAO, meets the ARARs, reduces the toxicity and mobility of the contaminants by disposal at a TSDF, and restores the site to a UU/UE condition.

  Alternative 6: In Situ Solidification – retained because it satisfies the RAO, meets the ARARs, and satisfies the statutory preference for treatment that reduces the toxicity and mobility of the contaminants.

7.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents a detailed analysis of the remedial alternatives remaining after the screening and evaluation performed in Section 6.0. The criteria used to evaluate each alternative are presented below. **Table 7-1** provides a summary of the comparative analysis.

Protection of Human Health and the Environment: Assesses whether the alternative is protective of human health and the environment.

Compliance with ARARs: Evaluates whether the alternative is compliant with the identified ARARs.

Short-term Effectiveness: Evaluates the impact on human health and the environment during the construction and implementation of the technology based on the protection of the community, on-site workforce, environment, and time to complete the remedial action.

Long-term Effectiveness and Permanence: Evaluates the protection of human health and the environment after the remedial action has been completed. This criterion is based on the magnitude of remaining risk and the adequacy and reliability of control measures.

Reduction of Toxicity, Mobility or Volume Through Treatment: Evaluates the anticipated performance of the remedial alternative based on the amount of waste material to be destroyed or treated, irreversibility of treatment, type and quantity of residuals remaining, treatment process, and degree of reduction.

Implementability: Addresses the technical and administrative feasibility of implementing the remedial action. Technical feasibility includes construction and operations, availability of services, reliability of technology, ease of undertaking additional, unforeseen remedial action and monitoring. Administrative feasibility includes activities related to coordination between regulatory agencies, stakeholders and the project team. Availability of services includes necessary personnel and equipment, technology, service providers, and treatment, storage and disposal capacities.

Cost: Addresses the capital and annual costs, including a contingency for unanticipated expenses. Capital cost includes all direct and indirect cost associated with the remedial technology. O&M costs include post-construction costs necessary to continue an effective remedial response action.

Regulator Acceptance: Addresses the concerns local, state, and federal regulatory agencies may have regarding the remedial alternatives evaluated and the proposed alternative. This criterion will be evaluated following comment on the FS report and Decision Document.

Community Acceptance: Addresses the concerns stakeholders and/or community members may have regarding the remedial alternatives evaluated and the proposed alternative. This criterion will be evaluated following comment on the FS report and Decision Document.

7.1 Alternative 1: No Action

7.1.1 Description

The no action alternative is considered in accordance with NCP requirements found in 40 CFR 300.430(e)(6). Under this alternative, no remedial actions would be undertaken to address

contaminants at the site. For this FS it is assumed that LUCs and access restrictions would not be maintained.

7.1.2 Assessment

Protection of Human Health and the Environment: The no action alternative would not protect human health and the environment as it does not actively address the potential risks associated with the site contaminants.

Compliance with ARARs: Since no remedial actions would be conducted and access restrictions would not be maintained, this alternative would not comply with the identified ARARs. This alternative does not satisfy the statutory preference for treatment as a principal element of remedial response.

Short-Term Effectiveness: No additional short-term exposure risks to remediation workers or the community would result since no remedial action would take place. There would be no short-term impacts to the environment. Site data suggests that COCs have persisted for over 60 years and will persist for the foreseeable future.

Long-Term Effectiveness: Release of contaminants to the environment is possible in the long term. No reduction in toxicity, mobility, or the volume of contaminants would be achieved. LUCs and access restrictions would not be maintained.

Reduction of Toxicity, Mobility, or Volume Through Treatment: The no action alternative does not actively treat or remove the contaminants. Reduction would only occur by natural attenuation processes.

Implementability: The no action alternative can be readily implemented since no actions would be undertaken.

Cost: There would be no capital or O&M costs associated with the no action alternative.

7.2 Alternative 2: Capping

7.2.1 Description

The capping alternative involves covering contaminated sludge/sediment in the acid neutralization building and dilution sump/weir and covering the material to minimize the potential for human contact with the COCs. Solidifying reagents would be added to increase the strength of the sludge/sediment in order to withstand the cap load. Water in the structures would be removed beforehand to meet the required liquid-to-solid ratio for the solidifying reagents. The water would be temporarily staged on-site in tanks and appropriately discharged. A 6-inch concrete cap would be placed over the strengthened sludge/sediment. The structures and underground pipes would remain. Contaminants would also remain in the sludge/sediment at levels that would not allow UU/UE. LUCs, LTM, and five-year reviews would be required.

Major activities that would be required for this alternative are summarized below.

- A treatability study would be conducted to develop a design mix that would meet the performance requirement for strength. Pilot testing may be required to verify whether the sludge/sediment can be adequately mixed within the structures.
- Project planning documents would include a Construction Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring,

Water Management, and Erosion/Sedimentation Control Plan, Waste Management, Transportation, and Disposal Plan, and Site Restoration Plan.

- Equipment and personnel would be mobilized to the site. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- Vegetation would be cleared and areas would be established for a reagent batch plant.
- Any loose C&D materials within the structures would be excavated, staged on site, scanned for radioactivity, and sampled for laboratory analysis (PCBs and TCLP metals). Radionuclides analysis would be performed on materials with scanning measurements greater than twice background. Contaminated C&D materials would be transported off site to a permitted TSDF and non-contaminated materials would be salvaged for reuse or disposed in a Subtitle D landfill.
- The acid neutralization building first floor would be removed using standard demolition methods to provide access to the bottom of the structure. The excavated concrete floor would be staged on site, screened, sampled, and disposed as described above.
- Sludge/sediment within the structures would be solidified in place using excavator-mounted injectors (i.e. rake injecting or rotary blending equipment).
- Self-compacting fill would be placed over the strengthened sediment/sludge.
- A minimum 6-inch thick concrete cap would be poured over the fill.
- Monitoring wells would be installed for LTM.
- The site would be restored to pre-remedial action conditions.
- The remediation contractor would demobilize from the site.

Estimated quantities are documented in **Appendix B** and summarized below.

- Water within the structures: 334,000 gal
- Sludge/sediment: 214 CY
- Solidification reagents (10 percent of sludge/sediment volume): 21 CY
- Self-compacting fill: 1,840 CY
- Concrete: 50 CY

ICs would be implemented that include proprietary controls (easements), governmental controls (deed restrictions), and informational devices (signs, state registries, and deed notices). Periodic reviews of established ICs would be required and updates would be necessary if future site conditions change. Engineering controls, including physical access restrictions (fencing), would be installed and maintained. Personal protective equipment (PPE) would be required when conducting intrusive activities.

Long-term monitoring would consist of groundwater monitoring to assess the potential for contaminant migration from the structures. Upgradient and downgradient wells would be sampled annually and analyzed for PCBs.

Five-year reviews would be required. Site close-out documentation would be required when the COC concentrations have been reduced to below the remediation levels.

7.2.2 Assessment

Protection of Human Health and the Environment: The capping alternative would be protective of human health and the environment. LUCs would prevent receptor exposure to PCBs and the LTM program would detect any potential leaching from the structures. This alternative would protect human health and the environment by reducing the potential for contaminant leaching and by minimizing potential receptor exposure via restricted access and groundwater monitoring.

Compliance with ARARs: This alternative complies with the 40 CFR Part 761 requirement for capping waste containing PCBs at concentrations between 25 mg/kg and 100 mg/kg.

Short-Term Effectiveness: There would be additional risks to site personnel and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Waste Management, Transportation, and Disposal Plan. The RAO would be achieved during the remedial action, which is estimated to require 16.5 months.

Long-Term Effectiveness: Release of COCs from the solidified sludge is possible in the long term. The toxicity, mobility, or volume of contaminants would not be reduced and risk to the evaluated receptor (future site construction worker) would persist. The magnitude of residual risk would be unchanged. The LUCs and LTM program would ensure that any exposure to human and environmental receptors remain within acceptable levels.

Reduction of Toxicity, Mobility, or Volume Through Treatment: This alternative would not reduce the toxicity or volume of site contaminants. The mobility of contaminants may be reduced by capping, which would reduce infiltration, and by solidification, which might reduce leaching. The RI data has demonstrated that COCs are not leaching from the structures, however, COC concentrations in groundwater would be evaluated during the LTM program and five-year reviews.

Implementability: The technical implementability of this alternative may be limited by the ability to thoroughly mix the contaminated media with reagents using standard mixing equipment. ICs would be used to supplement engineering controls and also must be operated, monitored, and evaluated as long as the risks are present at the site. The administrative feasibility of this action is considered difficult.

Cost: As shown in **Table 7-1**, the total estimated present worth cost for this alternative is $6,032,178, which is based on an estimated capital cost of $5,106,085 and estimated O&M cost of $926,093. Operation, maintenance, and monitoring costs would be associated with LTM, site inspections, LUC/IC enforcement, five-year reviews, and informational activities. Quantities are provided in **Appendix B**. Assumptions and cost calculations are provided in **Appendix E**.

7.3 Alternative 4: Removal of Sludge/Sediment and Water with Off-site Disposal

7.3.1 Description

This alternative would include the removal of sludge/sediment and water within the acid neutralization building and dilution sump/weir. The structures would not be removed.

The sludge/sediment and water would be removed by pumping and/or excavation and then dewatered. Following dewatering, the solids would be temporarily staged, sampled and analyzed for disposal characterization, and transported to a permitted TSDF. Some additional pretreatment may be necessary to meet land disposal restrictions. Disposal characterization would be required under the land disposal restrictions. At a minimum, testing would be performed to determine RCRA characteristics, PCB concentrations, radionuclide concentrations, and compliance with TSDF requirements.

The water would be temporarily staged on-site in tanks and appropriately discharged.

This alternative would not include post-remedy LUCs, LTM, and five-year reviews.

Major activities that would be required for this alternative are summarized below.

- Project planning documents would include a Construction Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, Waste Management, Transportation, and Disposal Plan, and Site Restoration Plan.
- Equipment and personnel would be mobilized to the site. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- Vegetation would be cleared and areas would be established for water containment/treatment (frac tanks and treatment equipment, if necessary).
- Any connected pipes would be plugged to prevent water from draining into the structures.
- Any loose C&D materials within the structures would be excavated, staged on site, scanned for radioactivity, and sampled for laboratory analysis (PCBs, TCLP parameters and disposal facility requirements). Radionuclides analysis would be performed on materials with scanning measurements greater than twice background. Contaminated C&D materials would be transported off-site to a permitted TSDF and non-contaminated materials would be salvaged for reuse or disposed in a Subtitle D landfill.
- The acid neutralization building floors would be removed using standard demolition methods to provide access to the bottom of the structure. The excavated materials would be staged on-site, screened, sampled, and disposed as described above.
- Sludge/sediment within the structures would be removed using conventional excavating or pumping equipment.
- The side walls and floors of the structures would be cleaned using high pressure steam/water and inspected for cracks or openings.
- Self-compacting fill would be placed in the empty structures.
- The site would be restored to pre-remedial action conditions.

- The remediation contractor would demobilize from the site.

Estimated quantities are documented in **Appendix B** and summarized below.

- Water within the structures: 334,000 gal
- Sludge/sediment: 214 CY
- Self-compacting fill: 2,140 CY

7.3.2 Assessment

Protection of Human Health and the Environment: The removal of sludge/sediment with off-site disposal would protect human health and the environment and achieve RAO.

Compliance with ARARs: This alternative complies with the identified ARARs as contaminated media and materials would be excavated and disposed off site in a permitted facility.

Short-Term Effectiveness: There would be additional risk to the community, site personnel, and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Program, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Waste Management, Transportation, and Disposal Plan. The RAO and PRGs would be achieved during the remedial action, which is estimated to require 17 months.

Long-Term Effectiveness: Removal of contaminated sediment with off-site disposal would remove all contaminants and restore the site to a UU/UE condition. LUCs and LTM would not be required. The TSDF would be required to manage the treated/landfilled wastes from the site. The adequacy and reliability of controls at the TSDF would be assured by the facility's permit requirements and environmental surveillance program.

Reduction of Toxicity, Mobility, or Volume Through Treatment: Removal and off-site disposal permanently eliminates the toxicity, mobility, and volume of contaminants at the site. Waste treatment at the TSDF, if necessary, would reduce the toxicity and/or volume of the contaminants. Contaminant mobility at the TSDF would be reduced by the facility's engineering controls.

Implementability: This alternative is technically and administratively feasible. Excavation, transportation, and disposal is reliable, relatively easy to implement, and would utilize services and materials that are readily available.

Cost: As shown in **Table 7-1**, the total estimated present worth cost for this alternative is $5,922,792. There would be no O&M costs associated with this alternative. Quantities are provided in **Appendix B** and assumptions and cost calculations are provided in **Appendix E**.

7.4 Alternative 6: In Situ Solidification

7.4.1 Description

The in situ solidification alternative involves immobilizing contaminated sludge/sediment and potentially contaminated construction materials. Solidification would mix the contaminated materials with inorganic cementitious/pozzolanic reagents to transform them onto a durable, solid, low hydraulic conductivity material. Water within the structures would be removed prior to solidification in order to meet a prescribed liquid-to-solid ratio for the solidifying reagents.

The water would be temporarily staged on site in tanks and appropriately discharged. The structures would remain. Contaminants would also remain in the solidified mass at levels that would not allow UU/UE. LUCs, LTM and five-year reviews would be required.

Major activities that would be required for this alternative are summarized below.

- A treatability study would be conducted to develop a design mix that would meet performance specifications for strength, hydraulic conductivity, and leachability. Pilot testing may be required to verify whether the sludge/sediment can be adequately mixed within the structures and underground lines.
- Project planning documents would include a Construction Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, Waste Management, Transportation, and Disposal Plan, and Site Restoration Plan.
- Equipment and personnel would be mobilized to the site. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- Vegetation would be cleared and areas would be established for water containment/ treatment (frac tanks and treatment equipment, if necessary) and a reagent batch plant.
- Any loose C&D materials within the structures would be excavated, staged on site, scanned for radioactivity, and sampled for laboratory analysis (PCBs TCLP metals, and disposal facility requirements). Radionuclides analysis would be performed on materials with scanning measurements greater than twice background. Contaminated C&D materials would be transported off site to a permitted TSDF and non-contaminated materials would be salvaged for reuse or disposed in a Subtitle D landfill.
- The acid neutralization building floors would be removed using standard demolition methods to provide access to the bottom of the structure. The excavated concrete floor would be staged on site, screened, sampled, and disposed as described above.
- Sludge/sediment within the structures would be solidified in place using excavator-mounted injectors (i.e. rake injecting or rotary blending equipment).
- Controlled low-strength material (flowable fill) would be placed over the solidified sludge/sediment to fill the open space to the top of the structures.
- Monitoring wells would be installed for LTM.
- The site would be restored to pre-remedial action conditions.
- The remediation contractor would demobilize from the site.

Estimated quantities are documented in **Appendix B** and summarized below.

- Water within the structures and pipes: 334,000 gal
- Sludge/sediment: 214 CY
- Reagent volume (10 percent of sludge/sediment volume): 21 CY
- Self-compacting fill: 1,890 CY

7.4.2 Assessment

Protection of Human Health and the Environment: The in situ solidification alternative would protect human health and the environment by creating a solid mass that encapsulates the contaminants, making them inaccessible to potential receptors.

Compliance with ARARs: This alternative complies with identified ARARs as contaminated media would remain at concentrations above 50 ppm, but be treated in place to produce a solid, low hydraulic conductivity mass that would meet the TSCA capping requirements (40 CFR Part 761.61(4)).

Short-Term Effectiveness: There would be additional risk to site personnel and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Program, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Waste Management, Transportation, and Disposal Plan. The RAO would be achieved during the remedial action, which is estimated to require 16.5 months.

Long-Term Effectiveness: The long-term effectiveness would be demonstrated by leach testing conducted during the treatability study. The effectiveness of solidification for treatment of PCBs has been documented (ITRC, 2011) and is expected to be long-term effective for this site. LUCs and LTM would be required after implementation.

Reduction of Toxicity, Mobility, or Volume Through Treatment: This alternative encapsulates the contaminated material into a solid mass that reduces their toxicity and mobility. The addition of cementitious/pozzolanic reagents would increase volume of contaminated media.

Implementability: The technical implementability of this alternative may be limited by the ability to thoroughly mix the contaminated media with reagents using standard mixing equipment. ICs would be used to supplement engineering controls and also must be operated, monitored, and evaluated as long as the risks are present at the site. The administrative feasibility of this action is considered difficult.

Cost: As shown in **Table 7-1**, the total estimated present worth cost for this alternative is $6,011,314, which is based on an estimated capital cost of $5,085,220 and estimated O&M cost of $926,094. Quantities are provided in **Appendix B** and assumptions and cost calculations are provided in **Appendix E**.

7.5 Comparative Analysis of Remedial Alternatives

The comparative analysis of alternatives provides the basis for selecting a remedial action. **Table 7-1** presents a summary of the analysis of each remedial alternative.

Table 7-1. Comparative Analysis of Alternatives

Alternative	**Protection of HH&E**	**Compliance with ARARs**	**Short-Term Effectiveness**	**Long-Term Effectiveness**	**Reduction of Toxicity, Mobility, or Volume Through Treatment**	**Implementability**	**Costs ($-2013)**		
							Total	**Capital**	**Operation, Maintenance, and Monitoring**
Alternative 1: No Action	○	○	●	○	○	○	$0	$0	$0
Alternative 2: Capping	●	●	●	●	○	●	$6,032,178	$5,106,085	$926,093
Alternative 4: Removal of Sludge/Sediment and Water with Off-site Disposal	●	●	●	●	●	●	$5,922,792	$5,922,792	$0
Alternative 6: In Situ Solidification	●	●	●	●	●	●	$6,011,314	$5,085,220	$926,094

Legend:
ARARs – applicable or relevant and appropriate requirements
HH&E – human health and the environment

Ratings			
Factors	●	●	○
Protection of HH&E	Protective	Moderate rating or not all factors addressed	Not protective
Compliance with ARARs	Compliant	Moderate rating or not all factors addressed	Non-compliant
Short-Term Effectiveness	Protective of the community and workers during the remedial action, low environmental impacts, low period of time to achieve RAOs	Moderate rating or not all factors addressed	Not protective of the community and workers during the remedial action, high environmental impacts, long period of time to achieve RAOs
Long-Term Effectiveness	Low residual risk, adequate and reliable controls	Moderate rating or not all factors addressed	High residual risk, inadequate and unreliable controls
Reduction of Toxicity, Mobility, or Volume	Will reduce toxicity, mobility, and volume through treatment	Moderate rating or not all factors addressed	Will not reduce toxicity, mobility, and volume through treatment
Implementability	Easy to implement, available services and materials, administratively feasible	Moderate rating or not all factors addressed	Difficult to implement, limited availability of services and materials, and low administrative feasibility

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Appendix A
Additional Groundwater and Radionuclides Data

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Groundwater Data

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Table A-1
2011 Groundwater Analytical Data

Analyte	**Background Threshold Value[1]**	**USEPA RSL for Drinking Water[2]**	**Sample ID: Sample Date: Units**	C3-WWTP-MW-BP14 10/13/2011	C3-WWTP-MW-BP15 10/13/2011	C3-WWTP-MW-BP16 10/13/2011
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	---	40 *	µg/L	0.038 U	0.040 U	0.040 U
Acenaphthylene	---	NS	µg/L	0.038 U	0.040 U	0.040 U
Anthracene	---	130 *	µg/L	0.038 U	0.040 U	0.040 U
Benzo(a)anthracene	---	0.029	µg/L	0.038 U	0.040 U	0.040 U
Benzo(a)pyrene	---	0.0029	µg/L	0.038 U	0.040 U	0.040 U
Benzo(b)fluoranthene	---	0.029	µg/L	0.038 U	0.040 U	0.040 U
Benzo(g,h,i)perylene	---	NS	µg/L	0.038 U	0.040 U	0.040 U
Benzo(k)fluoranthene	0.29	0.29	µg/L	0.096 U	0.099 U	0.099 U
Chrysene	---	2.9	µg/L	0.038 U	0.040 U	0.040 U
Dibenz(a,h)anthracene	---	0.0029	µg/L	0.038 U	0.040 U	0.040 U
Fluoranthene	---	63 *	µg/L	0.038 U	0.040 U	0.040 U
Fluorene	---	22 *	µg/L	0.048 U	0.050 U	0.050 U
Indeno(1,2,3-cd)pyrene	---	0.029	µg/L	0.048 U	0.050 U	0.050 U
Naphthalene	---	0.14	µg/L	0.038 U	0.040 U	0.040 U
Phenanthrene	---	50	µg/L	0.072 U	0.074 U	0.074 U
Pyrene	---	8.7 *	µg/L	0.038 U	0.040 U	0.040 U

Legend:
[1] - background threshold values based on data presented in the NFSS RI (USACE, 2007)
[2] - USEPA Regional Screening Level for Tapwater (USEPA, 2012). In the absence of a USEPA RSL, the NYSDEC Groundwater TOGS value was used.
** - screening level based on 1/10th non-carcinogenic value from USEPA for RSL for Tapwater (USEPA, 2012)*
NS = none specified
µg/L = micrograms per liter
Laboratory Qualifiers:
U - analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

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Radionuclides Data

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Table A-2
Radionuclides Data
WWTP Water Samples
Phase III RI

	Sample ID:	C7-LEW-WW-X00-AN12 [1]	C7-LEW-WW-X000-DW01	C7-LEW-WW-X00-DW03 [1]	C7-LEW-WW-X00-DW05 [1]
	Location:	Acid Neutralization Bldg	Collection Tank	Chlorine Contact Tank	Imhoff Tank
	Sample Date:	9/1/2006	8/16/2006	8/31/2006	8/31/2006
Analyte	**Units**				
Radium-226	pCi/L	0.16U	0.34J	0.13U	0.07U
Radium-228	pCi/L	0.66U	0.66U	0.3U	0.22U
Thorium-228	pCi/L	0.09U	0.14J	0.02U	0.05U
Thorium-230	pCi/L	0.3J	0.18J	0.14U	0.099J
Thorium-232	pCi/L	-0.017U	0.034U	0.017U	-0.005U
Uranium-234	pCi/L	1.44	4.77	0.125J	0.73
Uranium-235	pCi/L	0.075J	0.28J	0.014U	0.018U
Uranium-238	pCi/L	1.13	4.33	0.168J	0.68

Legend:
1 - not shown on Figure 1-5
pCi/L = picocuries per liter
Laboratory Qualifiers:
J - estimated value
U - analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

Table A-3
Radionuclides Data
WWTP Water Samples
OEA Safety Hazards Mitigation Project

	Sample ID:	C7-LEW-DWAN-01	C7-LEW-DWAN-02	C7-LEW-DWAN-03	C7-LEW-DWCH-01 [2]	C7-LEW-DWCT-01	C7-LEW-WA-DWIT-01	C7-LEW-WA-DWIT-02
	Sample Name:	AN-WA-01	AN-WA-02	AN-WA-03 [1]	CH-WA-01	CT-WA-01	IT-WA-01	IT-WA-02
	Location:	acid neutralization bldg	acid neutralization bldg	acid neutralization bldg	chlorine contact tank	collection tank	Imhoff tank	Imhoff tank
	Matrix:	water	water	water	water	water	water	water
	Sample Date:	4/26/2011	4/26/2011	4/26/2011	4/26/2011	4/26/2011	4/27/2011	4/27/2011
Analyte	**Units**							
Alpha	pCi/l	5.7	8.4	7.1	3 U	3 U	3 U	3 U
Beta	pCi/l	4 U	4 U	4 U	4.8	4	9.4	9.8
Plutonium-238	pCi/l	0.038U	0.069U	0.11U	0.041U	0.08U	0.079U	0.076U
Plutonium-239/240	pCi/l	0.028U	0.064U	0.076U	0.03U	0.056U	0.045U	0.042U
Radium-226	pCi/l	0.124	0.141	1 U	1 U	0.126	1 U	1 U
Radium-228	pCi/l	0.71U	0.71U	0.66U	1.3U	0.76U	0.7U	0.73U
Strontium-90	pCi/l	3 U	3 U	0.36	3 U	3 U	3 U	3 U
Thorium-228	pCi/l	0.11U	0.066U	0.067U	0.053U	0.059U	0.097U	0.16U
Thorium-230	pCi/l	0.1 U	0.029	0.1 U	0.1 U	0.042	0.1 U	0.1 U
Thorium-232	pCi/l	0.051U	0.02U	0.047U	0.033U	0.031U	0.06U	0.058U
Uranium-234	pCi/l	1.46	1.74	1.36	0.149	2.95	0.293	0.217
Uranium-235/236	pCi/l	0.049	0.057	0.037	0.1 U	0.144	0.1 U	0.1 U
Uranium-238	pCi/l	1.07	1.42	1.06	0.141	2.53	0.302	0.273

Legend:

1 - Sample AN-WA-03 is a field replicate of sample AN-WA-01

2 - co-located with sludge/sediment sample C7-LEW-DWCL-01

pCi/L = picocuries per liter

Laboratory Qualifiers:

U - analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

Table A-4
Radionuclides Data
Sludge/Sediment and Soil Samples
Phase III RI

	Sample ID:	C7-LEW-SL-X003-SNO1	C7-LEW-SL-X007-AW01	C7-LEW-SL-X011-AW01	C7-LEW-SL-X000-DW04	C7-LEW-SL-X000-DW03	C7-LEW-SL-X000-DW05	C7-LEW-S0-X003-SN01	C7-LEW-S0-X006-AW01	C7-LEW-S0-X010-WW01
	Location:	6-in tile pipe between Imhoff tank & venturi vault	24-in wood pipe between acid neutralization bldg & collection tank	24-in wood pipe between collection tank & mixing tank	south sludge bed	chlorine contact tank	Imhoff tank	6-in tile pipe between Imhoff tank & venturi vault	24-in wood pipe between collection tank & mixing tank	42-in concrete pipe between acid neutralization bldg & Western Drainage Ditch
	Matrix:	sludge/sediment	sludge/sediment	sludge/sediment	sludge/sediment	sludge/sediment	sludge/sediment	soil	soil	soil
	Sample Date:	8/15/2006	8/17/2006	8/17/2006	8/22/2006	8/31/2006	8/31/2006	8/15/2006	8/16/2006	8/17/2006
Analyte	**Units**									
Actinium-228	pCi/g	NA	NA	1.73	0.327	0.46	1.18	NA	NA	1.13
Bismuth-214	pCi/g	NA	3.85	1.4	0.339	1.67	1.8	NA	NA	NA
Cesium-137	pCi/g	NA	0.57	NA	NA	NA	1.2	NA	NA	NA
Lead-210	pCi/g	3.7	NA	NA	NA	2.22	4.8	0.8	NA	NA
Lead-212	pCi/g	1.19	1.86	1.11	0.372	0.393	1.05	0.7	0.87	0.91
Lead-214	pCi/g	1.33	5	1.51	0.345	1.73	1.77	NA	0.95	0.84
Potassium-40	pCi/g	28.7	11.9	13.5	8.6	8.8	7.8	17.7	22.1	16.3
Protactinium-234M	pCi/g	NA	NA	NA	NA	NA	38	NA	NA	NA
Radium-226	pCi/g	1.33	5	1.51	0.339J	1.67	1.8	0.7	0.95	0.84
Radium-228	pCi/g	1.24	2.49	1.73	0.327J	0.46J	1.18	0.93	1.2	1.13
Thallium-208	pCi/g	0.5	0.38	0.46	0.158	0.174	0.26	0.37	0.293	NA
Thorium-228	pCi/g	1.3	1.61	1.25	0.46J	0.59	0.95	0.86	1.08	0.86
Thorium-230	pCi/g	1.36	1.82	1.61	0.44J	2.38	2.69	0.8	0.96	0.83
Thorium-232	pCi/g	1.24	0.5	1.05	0.47J	0.65	0.97	0.74	0.87	0.89
Thorium-234	pCi/g	NA	NA	3.2	NA	5.36	30.2	NA	NA	NA
Uranium-234	pCi/g	1.27	2.13	5.74	0.52	13	30	0.69	0.9	0.89
Uranium-235	pCi/g	0.108J	0.114J	0.289J	0.026J	0.63	1.56	0.022U	0.034J	0.055J
Uranium-238	pCi/g	1.34	2.14	4.98	0.44J	13	29.4	0.73	1.01	0.95

Legend:
NA = not analyzed
pCi/g = picocuries per gram
Laboratory Qualifiers:
J - estimated value
U - analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

Table A-5
Radionuclides Data
Sludge/Sediment Samples
OEA Safety Hazards Mitigation Project

	Sample ID:	C7-LEW-DWCL-01	C7-LEW-DWCL-02	C7-LEW-DWIT-01	C7-LEW-DWIT-02
	Sample Name:	CH-SL-01	CH-SL-02 [1]	IT-SL-01	IT-SL-02
	Location:	chlorine contact tank	chlorine contact tank	Imhoff tank	Imhoff tank
	Sample Date:	4/27/2011	4/27/2011	4/27/2011	4/27/2011
Analyte	**Units**				
Actimium-228	pCi/g	1.24	1.06	NA	0.95
Alpha	pCi/g	60	58	57	43.6
Beta	pCi/g	49.6	46.6	42	47.8
Bismuth-214	pCi/g	3.3	3.98	6.42	2.3
Cesium-137	pCi/g	0.63	0.6	0.77	0.64
Lead-210	pCi/g	4.6	6.4	16	0.51
Lead-214	pCi/g	4.27	0.76	6.98	2.26
Plutonium-238	pCi/g	0.013U	0.026U	0.035U	0.025U
Plutonium-239/240	pCi/g	0.075	0.062	0.173	0.196
Potassium-40	pCi/g	3.7	8.4	14.4	9.1
Radium-226	pCi/g	2.8	3.16	5.36	2.03
Radium-228	pCi/g	0.16U	1.23	0.47	0.38
Strontium-90	pCi/g	0.56U	0.66U	0.28U	0.59U
Thallium-208	pCi/g	0.55	NA	NA	NA
Thorium-228	pCi/g	0.66	0.552	0.508	0.428
Thorium-230	pCi/g	3.25	2.91	2.77	1.8
Thorium-232	pCi/g	0.549	0.546	0.561	0.38
Thorium-234	pCi/g	21	24.6	27.2	24.1
Uranium-234	pCi/g	19.4	21	20.1	19.9
Uranium-235	pCi/g	2.12	1.37	NA	1.35
Uranium-235/236	pCi/g	0.84	1	0.88	0.85
Uranium-238	pCi/g	19.1	22	19.7	18.7

Legend:

1 - Sample CH-SL-02 is a field replicate of CH-SL-01
NA = not analyzed
pCi/g = picocuries per gram

Laboratory Qualifiers:

U = analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

Table A-6
Radionuclides Data
Pipe Scale Samples
OEA Safety Hazards Mitigation Project

	Sample Location:	C7-LEW-SO-IW03	C7-LEW-SO-IW03 DUP	C7-LEW-SO-IW04
	Sample Name:	IW-S0-03	IW-S0-03	IW-SO-04
	Sample Date:	6/20/2011	6/20/2011	6/20/2011
Analyte	**Units**			
Actinium-227	pCi/g	0.79U	1.01U	1.03U
Actinium-228	pCi/g	0.19U	0.153	0.18U
Alpha	pCi/g	36.1	NA	38.4
Aluminum-26	pCi/g	0.035U	0.024U	0.021U
Americium-241	pCi/g	0.21U	0.23U	0.142U
Antimony-124	pCi/g	0.084	0.029U	0.109U
Antimony-125	pCi/g	0.059U	0.072U	0.057U
Beryllium-7	pCi/g	0.17U	0.21U	0.18U
Beta	pCi/g	54.7	NA	53.8
Bismuth-212	pCi/g	0.33U	0.35U	0.34
Bismuth-214	pCi/g	0.17U	0.337	0.63
Cesium-134	pCi/g	0.041U	0.029U	0.063
Cesium-137	pCi/g	0.127	0.116	0.1
Cerium-139	pCi/g	0.035U	0.02U	0.034U
Cerium-144	pCi/g	0.27U	0.151U	0.22U
Chromium-51	pCi/g	0.19U	0.19U	0.161U
Cobalt-56	pCi/g	0.043	0.04	0.076U
Cobalt-57	pCi/g	0.022	0.018U	0.02U
Cobalt-58	pCi/g	0.032U	0.026U	0.031U
Cobalt-60	pCi/g	0.024U	0.024U	0.022U
Europium-152	pCi/g	0.128U	0.116U	0.091U
Europium-154	pCi/g	0.16	0.24U	0.208
Europium-155	pCi/g	0.135	0.177	0.089U
Iron-59	pCi/g	0.044U	0.04U	0.039U
Iodine-131	pCi/g	0.024U	0.029U	0.024U
Lead-210	pCi/g	2.1U	2.1U	2.1U
Lead-212	pCi/g	0.106	0.107	0.071U
Lead-214	pCi/g	0.322	0.365	0.265
Manganese-54	pCi/g	0.024U	0.028U	0.033U
Niobium-94	pCi/g	0.025U	0.028U	0.025U
Niobium-95	pCi/g	0.212	0.212	0.232
Plutonium-238	pCi/g	0.008U	0.044U	0.053U
Plutonium-239/240	pCi/g	0.037	0.047	0.066U
Polonium-210	pCi/g	0.91U	1.19U	0.72U
Potassium-40	pCi/g	0.69U	1.22	0.78
Proactinium-231	pCi/g	4.2U	4.3U	4U
Proactinium-234m	pCi/g	93	90	107
Radium-226	pCi/g	0.42	0.68	0.59
Radium-228	pCi/g	0.59U	0.61U	0.53U
Total Radium	pCi/g	1.44	NA	1.04
Ruthenium-106	pCi/g	0.23U	0.24U	0.32U
Rutherfordium-208	pCi/g	0.043U	0.052U	0.05U
Scandium-46	pCi/g	0.023U	0.024U	0.022U
Silver-110m	pCi/g	0.035U	0.025U	0.031U
Sodium-22	pCi/g	0.026U	0.025U	0.024U
Strontium-90	pCi/g	0.37	0.28U	0.28U

Table A-6
Radionuclides Data
Pipe Scale Samples
OEA Safety Hazards Mitigation Project

	Sample Location:	C7-LEW-SO-IW03	C7-LEW-SO-IW03 DUP	C7-LEW-SO-IW04
	Sample Name:	IW-S0-03	IW-S0-03	IW-SO-04
	Sample Date:	6/20/2011	6/20/2011	6/20/2011
Analyte	**Units**			
Thorium-227	pCi/g	27U	0.12U	0.21U
Thorium-228	pCi/g	0.106	0.102	0.078U
Thorium-230	pCi/g	0.46	0.459	0.252
Thorium-232	pCi/g	0.119	0.075	0.038
Thorium-234	pCi/g	40.9	49.3	50.6
Uranium-232	pCi/g	15.3	15.3	15
Uranium-234	pCi/g	62.3	50.3	61.5
Uranium-235 *	pCi/g	2.89/3.27	2.88/2.22	3.18/2.97
Uranium-238	pCi/g	63.4	48.7	61.3
Zinc-65	pCi/g	0.075U	0.049U	0.069U

Legend:

** - results from analysis by methods 714R12 and 713R12*

NA = not analyzed

pCi/g = picocuries per gram

Laboratory Qualifiers:

U - analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

Appendix B
Wastewater Treatment Plant Drawings and Quantity Estimates

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Table B-1
Contaminated Material Volume Estimate

Structure	Dimensions			Volume	
	Length	Width	Depth	Sludge/Sediment [1]	
	ft	ft	ft	ft^3	yd^3
Acid Neutralization Bldg	51	42	23.5	5,034	186
Acid Neutralization Dilution Sump and Weir	34	14	15.5	738	27
Total:				**5,772**	**214**

Notes:

1 - Sludge volumes estimated as 10% of structure volume
Structure dimensions taken from reference drawings:
Catalytic Combustion Corp. #324-02-23, mod. 2/6/58
Catalytic Combustion Corp. #324-14-04, mod. 10/1/57

Table B-2

Material Quantities

Building Structures

Area	Length	Width	Dia	Depth	Volume		Notes & Assumptions
	ft	ft	ft	ft	ft^3	yd^3	
Acid Neutralization Bldg	51	42		23.5	50,337	1,864	reinforced concrete
Dilution Sump & Weir	34	14		15.5	7,378	273	as above
Total					57,715	**2,138**	

C & D Materials

Area	Length	Width/Dia	Depth	Thickness (est.)	Volume		Notes & Assumptions
	ft	ft	ft	ft	ft^3	yd^3	
Acid Neutralization Bldg floors (2)	51	42		1	4,284	159	reinforced concrete
Misc debris in Acid Neutralization Bldg					5,034	186	assumes 10% of structure volume
Misc debris in Dilution Sump & Weir					738	27	as above
Total					10,056	**372**	

Sludge/Sediment

Area	Volume		Notes & Assumptions
	ft^3	yd^3	
Acid Neutralization Bldg	5,034	186	assumes 10% of structure volume
Dilution Sump & Weir	738	27	as above
Total	5,772	**214**	

Water

Area	Volume	Notes & Assumptions
	gal	
Acid Neutralization Bldg	296,450	assumes SWL 5' bgs
Dilution Sump & Weir	37,390	" "
Total	**333,840**	

Table B-3
Waste Types and Quantity Estimates

Water

Structure	Volume	Phase III RI Split Samples		OEA Safety Hazards Mitigation Project Samples		Estimated Disposal Volumes (gal)				
	(gal)	Sample ID	Results	Sample ID	Results - Detected Constituents	LARW	RCRA	LAMW	TSCA	Non-Haz
Dilution Sump & Weir	37,390	---	---	---	---	0	0	0	0	37,390
Acid Neutralization Bldg	296,450	---	---	AN-WA-01	Gross Alpha, Ra226, U234, U235 & U238 all below EPA MCLs	0	0	0	0	296,450
		---	---	AN-WA-02	Gross Alpha, Ra226, U234, U235 & U238 all below EPA MCLs					
		---	---	AN-WA-03	Gross Alpha, Sr90, Ra 226, U234, U235 & U238 all below EPA MCLs					
Total	333,840				Total					**333,840**

Contaminant	EPA MCL	Ref
Ra 226, 228	5 pCi/L	http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides
Gross Alpha (adj)	15 pCi/L (not including Ra)	As above
Beta Activity	4 mrem/yr *	As above
U (KPA)	30 ug/L	As above
U (Alpha Spec)	27 pCi/L	Federal Register, Vol. 65, No. 236, 40 CFR Parts 9, 141, and 142
Gross Beta	50 pCi/L*	http://www.health.ny.gov/environmental/water/drinking/annual_water_quality_report/guidance.htm
		* - New York State Department of Health considers 50 pCi/L to be the level of concern for beta particles

Sludge/Sediment

Structure	Volume	Phase III RI Split Samples		OEA Safety Hazards Mitigation Project Samples		Estimated Disposal Volumes (yd^3)				
	(yd^3)	Sample ID	Results	Sample ID	Results - Detected Constituents	LARW	RCRA	LAMW	TSCA	Non-Haz
Dilution Sump & Weir	27	PIPES-C7-LEW-SL-X07-AW01-4	Cs137, Ra226, Ra228 & Th228 (1.2 - 2.2x background)	---	---	0	0	0	27	0
Acid Neutralization Bldg	186	---	---	---	---	0	0	0	186	0
Total	214				Total				**214**	

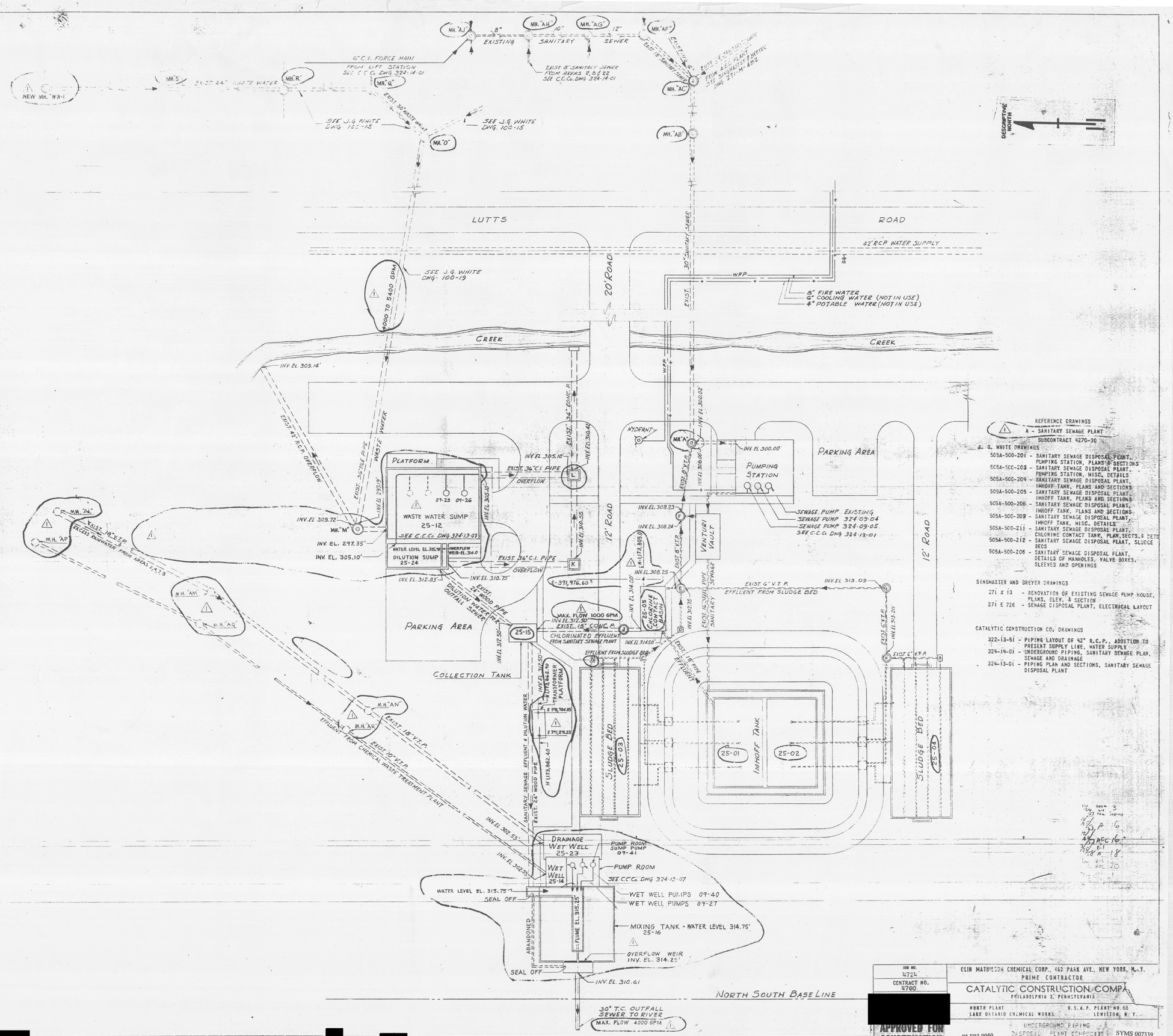
C&D Materials

Structure	Volume	Phase III RI Split Samples		OEA Safety Hazards Mitigation Project Samples		Estimated Disposal Volumes (yd^3)				
	(yd^3)	Sample ID	Results	Sample ID	Results - Detected Constituents	LARW	RCRA	LAMW	TSCA	Non-Haz
Dilution Sump & Weir	27	---	---	---	---	0	0	0	0	27
Acid Neutralization Bldg	345	---	---	---	---	0	0	0	0	345
Total	372				Total					**372**

Notes

C&D	construction & demolition
yd^3	cubic yards
gal	gallons
LARW	Low Activity Radioactive Waste
LAMW	Low Activity Mixed Waste
RCRA	Resource Conservation Recovery Act
TSCA	Toxic Substances Control Act

324-14-0



REFERENCE DRAWINGS

B - WASTE DISPOSAL PLANT - (CHEMICAL)
SUBCONTRACT 4270-56

J. G. WHITE DRAWINGS

SEWAGE TREATMENT PLANT

505A-500-218 - MIXING TANK - PLANS & SECTIONS
505A-500-223 - COLLECTION TANK - REINFORCING DETAILS
505A-500-231 - MIXING TANK - WOOD FLUME DETAILS
505A-500-907 - MIXING TANK - PIPING LAYOUT
505A-500-912 - PERMANENT SCREEN FOR 30" OUTLET OF MIXING TANK
505A-500-913 - MIXING TANK WET WELL - HIGH LEVEL ALARM

[illegible] NEUTRALIZATION PLANT BLDG 505A

[illegible] & OPENINGS IN CONCRETE
[illegible] REINFORCING OF STEEL DETAILS - GROUND FLOOR
[illegible] STEEL SUPPORTS FOR C.I. PIPE - PLAN & DETAILS
[illegible] DETAILS OF MONORAIL BEAMS
[illegible] CONCRETE THRUST BLOCK FOR 36" DIA. C.I. PIPE
[illegible] 303 - GROUND FLOOR - REINFORCED CONCRETE
[illegible] 304 - BASE FLOOR - REINFORCED CONCRETE
505A-500-305 - ARCHITECTURAL - PLANS AND DETAILS - FIRST FLOOR
505A-500-306 - ARCHITECTURAL - PLANS & DETAILS - SECOND FLOOR
505A-500-307 - ARCHITECTURAL - ELEVATIONS AND DETAILS
505A-500-401 - PLUMBING DIAGRAMS
505A-500-909 - LEVEL GAUGES
505A-500-910 - ADJUSTABLE WEIR
505A-500-914 - LINE TANK LAYOUT
505A-500-915 - 36" SLUICE GATE

C.C.Co. DRAWINGS

324-02-23 - ENGINEERING FLOW DIAGRAM - DISPOSAL PLANT
324-13-07 - PIPING - DISPOSAL PLANT - EFFLUENT BLENDING

324-14-[illegible] - INSTRUMENTATION - LAYOUT - SCHEMATICS AND DETAILS

324-16-[illegible] - ELECTRICAL - WIRING DIAGRAMS & DETAILS
324-16-[illegible] - ELECTRICAL - PLAN - LIGHTING & POWER - WASTE WATER BLDG.
324-16-[illegible] - ELECTRICAL - PLAN - LIGHTING & POWER - MIXING TANK

324-17-[illegible] - CONCRETE - REHABILITATION OF WASTE WATER BUILDING
324-17-[illegible] - CONCRETE - REHABILITATION OF MIXING TANK

REFERENCE DRAWINGS

A - SANITARY SEWAGE PLANT
SUBCONTRACT 4270-30

J. G. WHITE DRAWINGS

505A-500-201 - SANITARY SEWAGE DISPOSAL PLANT, PUMPING STATION, PLANS & SECTIONS
505A-500-203 - SANITARY SEWAGE DISPOSAL PLANT, PUMPING STATION, MISC. DETAILS
505A-500-204 - SANITARY SEWAGE DISPOSAL PLANT, IMHOFF TANK, PLANS AND SECTIONS
505A-500-205 - SANITARY SEWAGE DISPOSAL PLANT, IMHOFF TANK, PLANS AND SECTIONS
505A-500-206 - SANITARY SEWAGE DISPOSAL PLANT, IMHOFF TANK, PLANS AND SECTIONS
505A-500-209 - SANITARY SEWAGE DISPOSAL PLANT, IMHOFF TANK, MISC. DETAILS
505A-500-211 - SANITARY SEWAGE DISPOSAL PLANT, CHLORINE CONTACT TANK, PLAN, SECTS. & DETS
505A-500-212 - SANITARY SEWAGE DISPOSAL PLANT, SLUDGE BEDS
505A-500-206 - SANITARY SEWAGE DISPOSAL PLANT, DETAILS OF MANHOLES, VALVE BOXES, SLEEVES AND OPENINGS

SINGMASTER AND BREYER DRAWINGS

271 A 13 - RENOVATION OF EXISTING SEWAGE PUMP HOUSE, PLANS, ELEV. & SECTION
271 E 726 - SEWAGE DISPOSAL PLANT, ELECTRICAL LAYOUT

CATALYTIC CONSTRUCTION CO. DRAWINGS

322-13-51 - PIPING LAYOUT OF 42" R.C.P., ADDITION TO PRESENT SUPPLY LINE, WATER SUPPLY
324-14-01 - UNDERGROUND PIPING, SANITARY SEWAGE PLAN, SEWAGE AND DRAINAGE
324-13-01 - PIPING PLAN AND SECTIONS, SANITARY SEWAGE DISPOSAL PLANT

JOB NO. 4724	CLIN MATHIESON CHEMICAL CORP., 460 PARK AVE., NEW YORK, N. Y.
CONTRACT NO. 4700	PRIME CONTRACTOR
	CATALYTIC CONSTRUCTION COMPA
	PHILADELPHIA 2, PENNSYLVANIA
	NORTH PLANT — LAKE ONTARIO CHEMICAL WORKS — U.S.A.E.P. PLANT NO. 68 — LEWISTON, N. Y.
[redacted]	UNDERGROUND PIPING — DISPOSAL PLANT COMPOSITE — SEWAGE AND DRAINAGE
APPROVED FOR CONSTRUCT[redacted]	PLF03 0050 — SYMS 007339
	324-11-01

[redacted]

CLIN MATHIESON CHEMICAL CORP. NIAGARA FALLS, N. Y. — RECOMMENDED FOR APPROVAL BY: [illegible]

AIR FORCE PLANT REPRESENTATIVE — RECOMMENDED BY: ____ DATE ____

DIRECTOR, PROCUREMENT PRODUCTION — APPROVED BY: ____ DATE ____

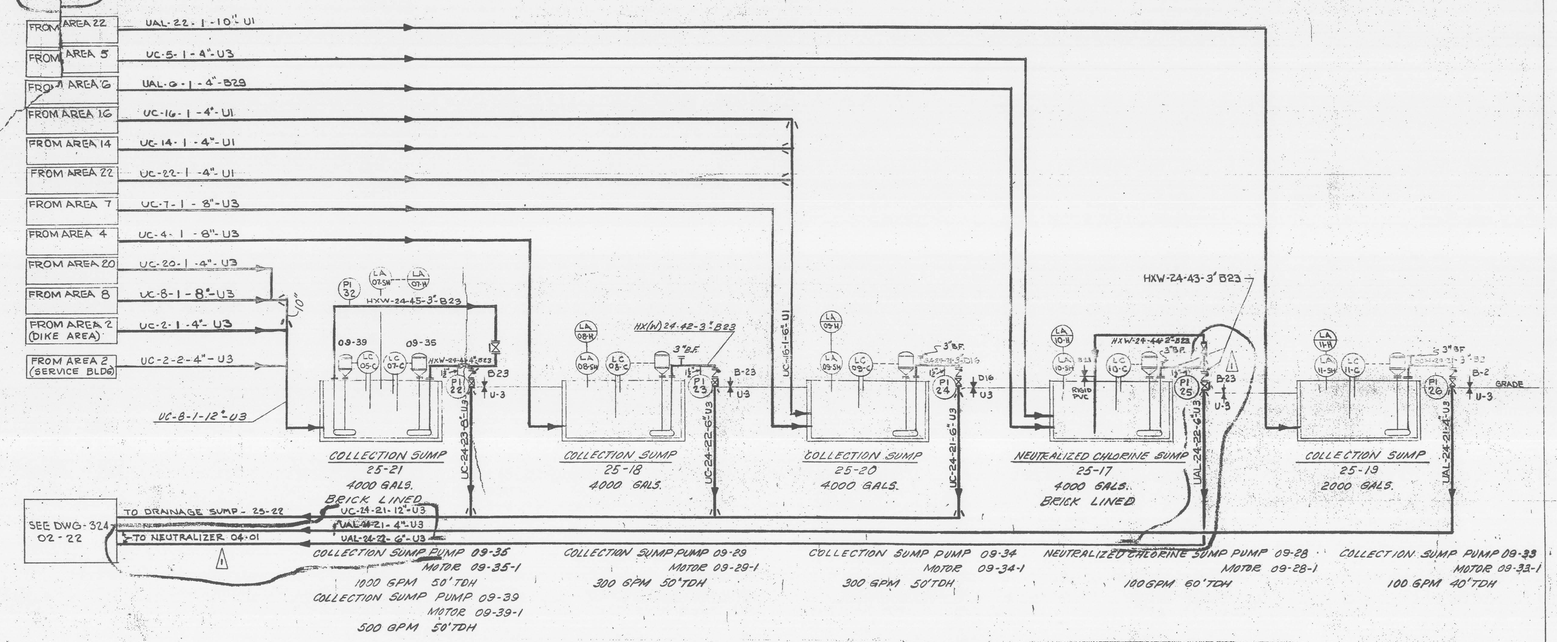
CHIEF, INDUSTRIAL PREPAREDNESS BRANCH, PRODUCTION & PROCUREMENT DIVISION, HEADQUARTERS AIR MATERIEL COMMAND

324-02-23

NOTE

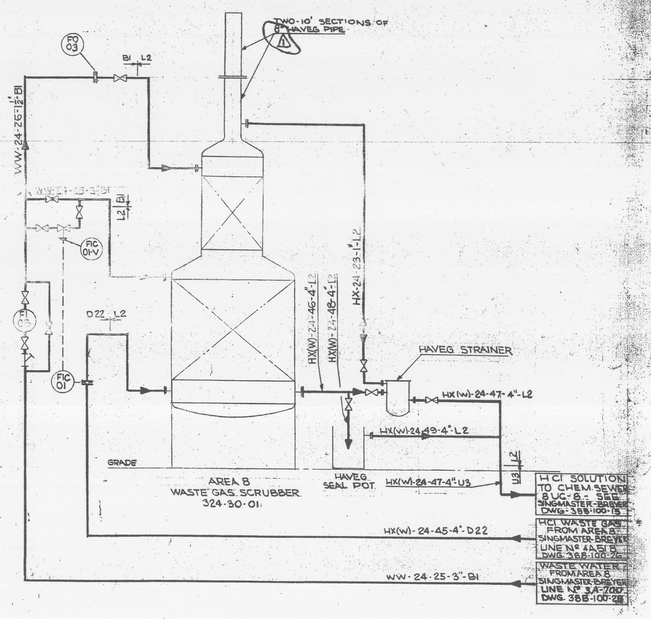
FOR NOTES, LEGEND AND REFERENCE DRAWINGS, SEE DRAWING 324-02-21.

EXISTING LINES



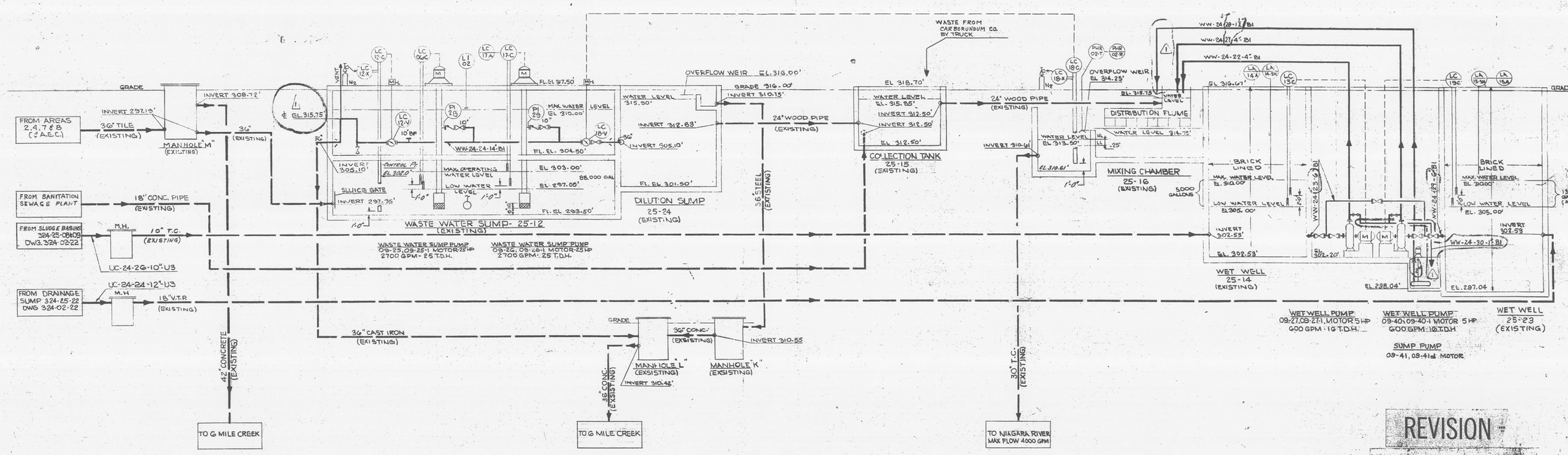
UNDERGROUND CHEMICAL COOLING WATER WASTE COLLECTING SYSTEM

SUBCONTRACT 4270-55



AREA 8 WASTE GAS SCRUBBER

SUBCONTRACT 4270-47



CHEMICAL WASTE DISPOSAL AREA

SUBCONTRACT 4270-56

REVISION

FOR APPROVAL

PL.F03 0043

[redacted]

OLIN MATHIESON CHEMICAL CORP., 460 PARK AVE., NEW YORK, N.Y.
PRIME CONTRACTOR

CATALYTIC CONSTRUCTION COMPANY
PHILADELPHIA 2, PENNSYLVANIA

NORTH PLANT — LAKE ONTARIO CHEMICAL WORKS — U.S.A.F. PLANT NO. 68 — LEWISTON, N.Y.

ENGINEERING FLOW SHEET
WASTE COLLECTION SUMPS & EFFLUENT DISCHARGE
CHEMICAL WASTE DISPOSAL AREA

SYMS 007355

REV. NO.	DATE	DESCRIPTION	BY	CK.	CCCO. & DATE	OPERATION & DATE
1	4/21/58	EXTENDED LINE WW-24-30-1"-B1 TO SUMP, REROUTED WW-24-28-1"-B1 TO 25-16, COMPLETED LINE DESIGNATIONS, DELETED LINE SOH-16-32-25 F.B.; ADDED CHECK VALVE ON LINE HXW-24-43-3"-B23; CHANGED SIZE UAL-24-21-U3 TO 4"-U3; CHANGED SIZE & REROUTED LINE UAL-24-22-6"-U3; CHANGED ELEV. ON 36" CAST IRON LINE AT WASTE WATER SUMP 25-12.	[redacted]			
0	3/7/58	APPROVED FOR CONSTRUCTION				

CATALYTIC CONSTRUCTION COMPANY SUBMITTED: [redacted] DATE: 3-21-58	OLIN MATHIESON CHEMICAL CORP. NIAGARA FALLS, N.Y. DATE: 4-7-58	AIR FORCE PLANT REPRESENTATIVE RECOMMENDED BY: DATE:	DIRECTOR, PROCUREMENT & PRODUCTION: NAME: RECOMMENDED BY: DATE:

APPROVED BY: DATE:
CHIEF, INDUSTRIAL PREPAREDNESS BRANCH, PRODUCTION & RESOURCES DIVISION, HEADQUARTERS AIR MATERIEL COMMAND

SCALE: NONE — SHEET:

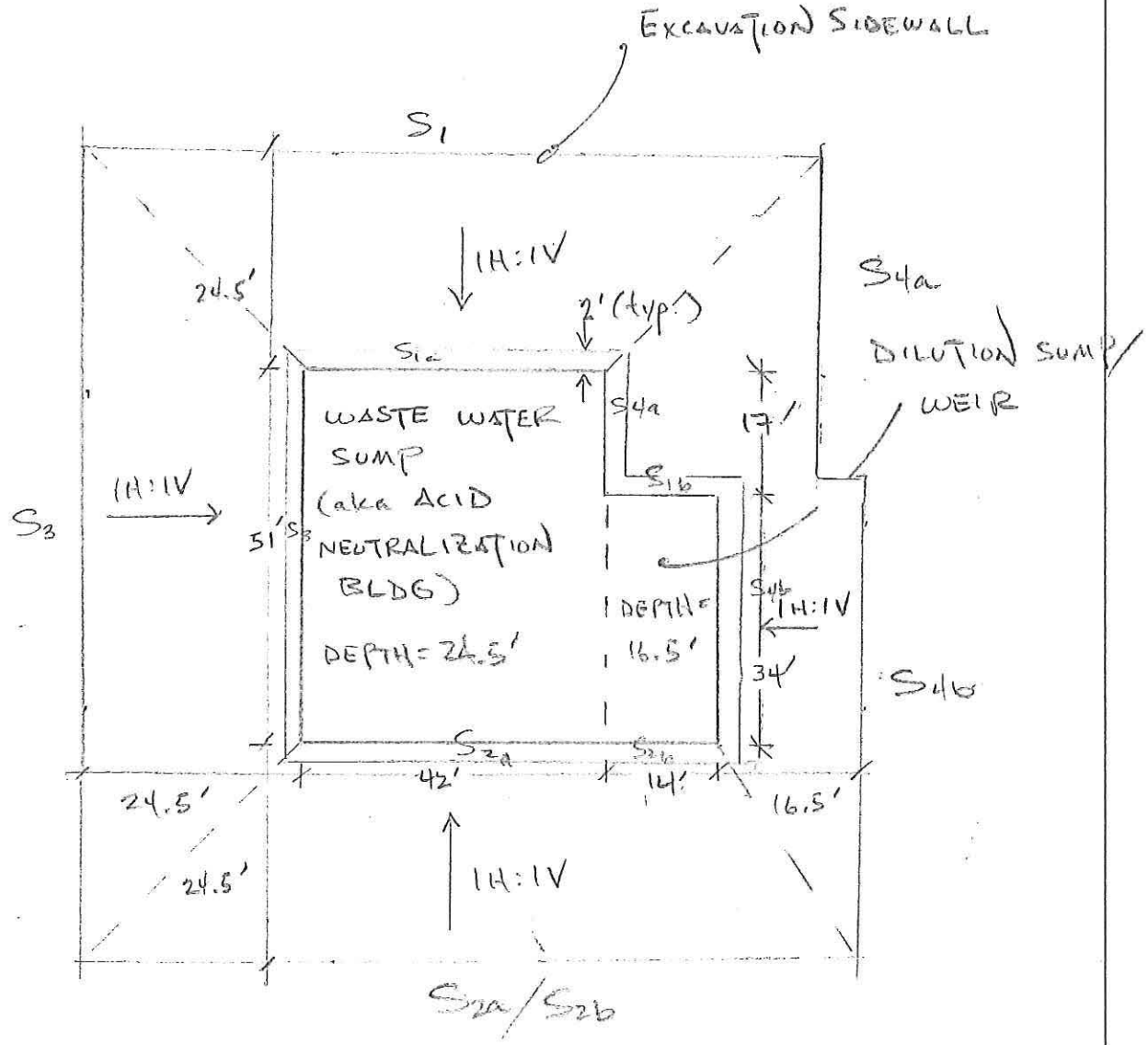
AMC PROJECT NO. OM-23-3 — DRAWING NO. 324-02-23

STAEDTLER® No. 937 811E Engineer's Computation Pad

VOLUME ESTIMATES

ACID NEUTRALIZATION BLDG & DILUTION SUMP

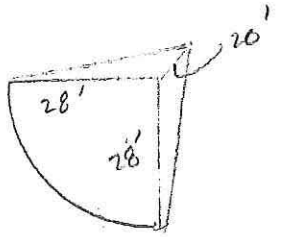
- DIMENSIONS FOR BLDG & SOIL EXCAVATION VOLUMES



STAEDTLER® No. 937 811E Engineer's Computation Pad

VOLUME ESTIMATE

SOIL @ IMHOFF TANK



END SECTIONS

$$V = \frac{4}{3} a * b * h \left(\frac{1}{8}\right)$$

$$= \frac{1}{6}(20' * 28' * 28')$$

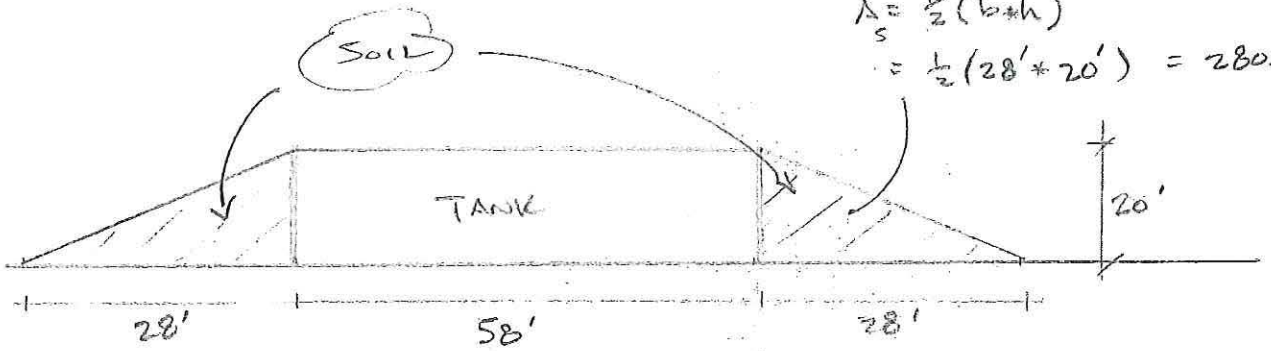
Total 4 end sections @

$$V_{TOT} = \frac{2}{3}(20' * 28' * 28')$$

$$10,453 \text{ ft}^3$$

$$A_s = \frac{1}{2}(b * h)$$

$$= \frac{1}{2}(28' * 20') = 280 \text{ ft}^2$$



IMHOFF TANK PROFILE
(VIEW SOUTH)

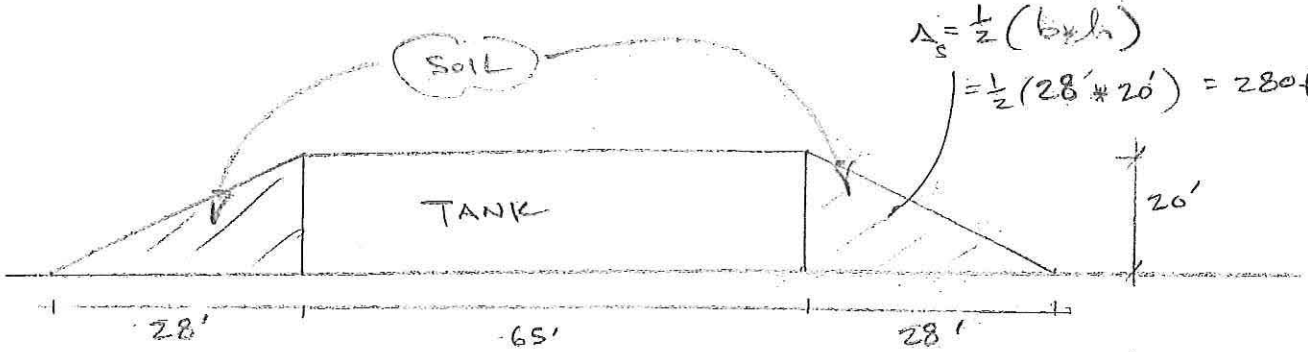
$$V_{SOIL} = \frac{1}{2}(28' * 20') * (2 * 65')$$

$$= 28' * 20' * 65'$$

$$= 36,400 \text{ ft}^3$$

$$A_s = \frac{1}{2}(b * h)$$

$$= \frac{1}{2}(28' * 20') = 280 \text{ ft}^2$$



IMHOFF TANK PROFILE
(VIEW WEST)

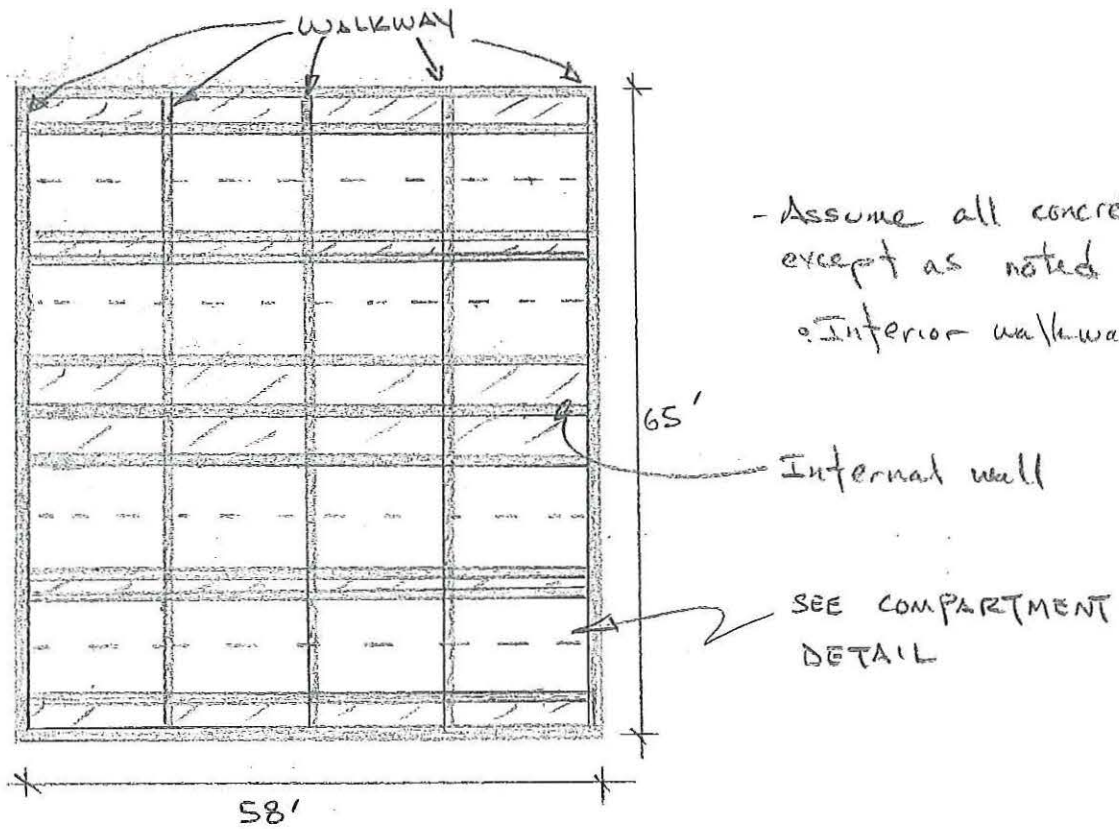
$$V_{SOIL} = \frac{1}{2}(28' * 20') * (2 * 58')$$

$$= 28' * 20' * 58'$$

$$= 33,480 \text{ ft}^3$$

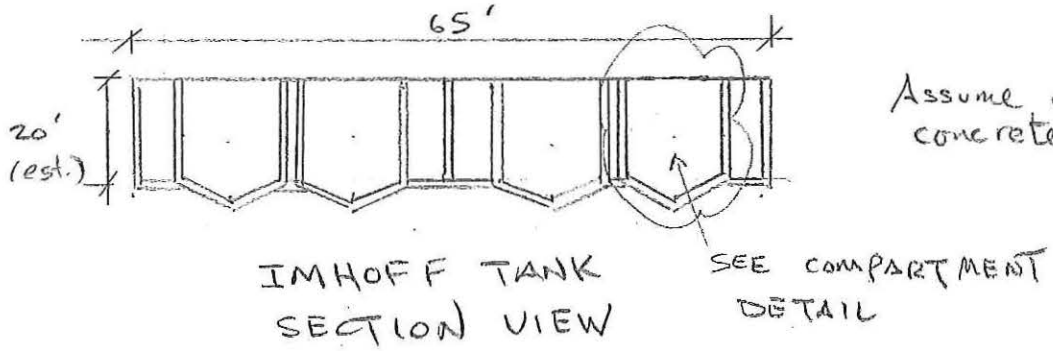
STAEDTLER® No. 937 811E Engineer's Computation Pad

IMHOFF TANK



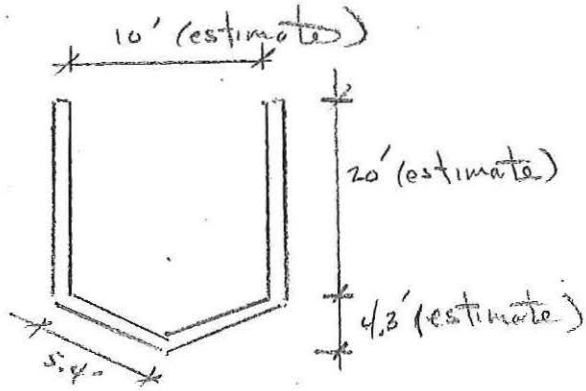
- Assume all concrete = 1 ft. except as noted
  - Interior walkways = 0.5'

IMHOFF TANK PLAN VIEW (FROM PHOTOGRAPHS)



Assume all concrete = 1 ft.

IMHOFF TANK SECTION VIEW



COMPARTMENT DETAIL

IMHOFF TANK
WALKWAY

IMHOFF TANK
COMPARTMENT
4' (est.)
COMP
ENT

TM HOFF TANK
4'
(est.)

IMHOFF TANK
CONCRETE BLOCKS
LODGE BASIN
PIPE FROM TANK

IMHOFF TANK
CONCRETE BLOCKS
SLUDGE BASIN

OVERFLOW
WEIR
DILUTION
SUMP
36" CI PIPE
24" WOOD
PIPE
WL
EST.
INVERT ELEV.
= 312.83'

Appendix C
Development of Site-Specific Preliminary Remediation Goals

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RE-EVALUATION OF SIGNIFICANT CONTRIBUTORS TO RISK, AND REFINEMENT OF SITE-SPECIFIC PRELIMINARY REMEDIATION GOALS

The site-specific preliminary remediation goals (PRGs) are chemical limits calculated based upon toxicity values and site-specific exposure conditions evaluated in the human health risk assessment (HHRA) (USACE, 2011). The HHRA selected the upper end of the carcinogenic risk range of 10^{-4} and non-carcinogenic hazards greater than 1 as the point of departure. EU 7 was considered for further investigation if cumulative carcinogenic risks or hazards were greater than the point of departure for any of the receptors evaluated. For EU 7, only the construction worker and the resident (adult and child) had risk results above the point of departure. EU 7 is subject to land use restrictions from the New York State Department of Health (NYSDOH) that specifies the property cannot be used for residential purposes, schools, and hospitals but can be used for industrial or commercial activities. Based upon the land use restrictions and the current use and zoning of EU 7, only the construction worker is considered as a receptor of concern within EU 7.

As noted in Section 1.3.4.4, several uncertainties inherent in the HHRA were further evaluated in order to make appropriate risk management decisions in this FS. The first uncertainty involves the amount of dermal exposure to sludge that may occur to a construction worker. As indicated in Table 4 of this appendix, a skin surface area of 5,463 cm^2 was assumed for the construction worker, based on best professional judgment and as used for the previously published *Baseline Risk Assessment for the Niagara Falls Storage Site* (USACE 2007). That risk assessment was drafted before the EPA finalized and updated its *Supplemental Guidance for Dermal Risk Assessment* ("RAGS Part E") (USEPA 2007). The skin surface area used for the construction worker assumes head, lower legs, hands, and forearm exposures. That amount of exposed skin would be appropriate for a resident but it is not realistic for a construction worker, who would be clothed in long pants and a short sleeve shirt (at a minimum) as part of the personal protective equipment he/she would don for the job. Instead, RAGS Part E recommends a lower value of 3,300 cm^2 exposed skin surface area available for dermal absorption of constituents from contaminated soil or sediment to adult workers, representing exposed head, hands, and forearms. In addition, RAGS Part E also recommends that a slightly lower value for the soil adherence factor be used than what was used in the HHRA. A value of 0.2 mg/cm^2 is recommended over the previously used value of 0.3 mg/cm^2. The EPA guidance indicates that this adherence factor is for a high contact soil exposure activity (such as for a utility worker) and is consistent with our conceptual site model and a reasonable maximum exposure for the construction worker.

The second uncertainty in the exposure assessment for the construction worker involves the exposure frequency, or number of days per year the construction worker would be working and exposed to contaminated media at the site. For the HHRA, an overly conservative value of 250 days per year was chosen, based on a full year-round construction season (5 days a week for 50 weeks). However, the construction season in Western New York is usually suspended during inclement weather. For the purposes of this FS, a more realistic construction season lasting 39 weeks (5 days per week or 195 days total) was assumed. This estimate of construction duration represents a conservative estimate that includes extensive environmental monitoring, sampling, analysis and off-site disposal of contaminated materials. Typical construction associated with development of the property may not require as much time.

Within the HHRA, the Summary of Significant Contributors to Risk was presented for each receptor with risk results greater than the point of departure. These tables present all COPCs with carcinogenic risks greater than 10^{-6} and non-carcinogenic risks greater than 0.1. Site-specific PRGs are refined from these tables for all COPCs originally identified in the HRA "Summary of Significant Contributors to Risks".

The refinement of the PRGs was accomplished by updating these 3 exposure parameter values in

Table 4 (exposure frequency and dermal exposure parameter values of exposed skin surface area and adherence factor) and revising the risk assessment estimate and resulting PRG calculations accordingly.

The following equation was used to calculate site-specific PRGs:

For carcinogens:

$$\text{Site-specific PRG} = \frac{TR\ x\ Risk}{EPC}$$

Where,

PRG	=	Preliminary remediation goal
TR	=	Target Carcinogenic Risk Level (i.e., 10^{-6}, 10^{-5}, 10^{-4})
Risk	=	Chemical-specific Cumulative Carcinogenic Risk shown in HHRA
EPC	=	Chemical-specific Exposure Point Concentration

For non-carcinogens:

$$\text{Site-specific PRG} = \frac{THQ\ x\ HQ}{EPC}$$

Where,

PRG	=	Preliminary remediation goal
THQ	=	Target Hazard Quotient (i.e., 1 or 0.1)
HQ	=	Chemical-specific Total Hazard Quotient shown in HHRA
EPC	=	Chemical-specific Exposure Point Concentration

The updated total resulting risk from the updated exposure parameter values and resulting PRG calculations are presented in Table 1. Chemicals and media of concern presented in Table 1 were further reviewed to evaluate which exposure pathways contributed significantly to risk. Only exposure pathways that present cumulative carcinogenic risks greater than 10^{-4} or a non-carcinogenic hazard index of 1 were considered further. Therefore, exposure to wastewater is not considered a concern. Within EU 7, only the construction worker exposure to sludge resulted in non-carcinogenic hazards greater than 1. When the exposure frequency and dermal exposure factors are reduced, the total carcinogenic risk for construction worker exposure to sludge is reduced to 7E-05, which falls within the EPA's acceptable incremental lifetime cancer risk range. Therefore, none of the carcinogenic chemicals are considered COCs. Chemicals within the sludge exposure pathways are considered COCs if their non-carcinogenic hazard quotient was greater than 1, and they contributed to 10% of the risk or hazard. This indicates that Aroclor-1254 remains the sole COC for construction worker exposure to sludge at the WWTP, with a hazard index of 3. Table 2 presents a comparison of the risk based PRGs (based on both cancer risks and non-cancer hazards) with the ARAR-based cleanup objective for Aroclor-1254. Because an ARAR is available which addresses this COC, the ARAR-based cleanup objective will be used in this FS.

Tables 3 through 5 present the input parameters used for the risk calculations. Table 3 presents the EPCs for the COC for the industrial scenario in sludge calculated using ProUCL. Table 4 presents the exposure parameters used in the HHRA and updated for this assessment for the construction worker ingestion and dermal contact with sludge. Table 5 presents the toxicity values used in the HHRA for the COC.

REFERENCES:

USACE, 2007. *Baseline Risk Assessment for the Niagara Falls Storage Site*, Prepared by Science Applications International Corporation, December

USACE, 2011. *Final Human Health Risk Assessment for the WWTP EU7 at the Former Lake Ontario Ordnance Works, Niagara County, New York. Appendix G of the Final Remedial Investigation Report for Phase IV Remedial Investigation/Feasibility Study at Formerly Used Defense Site The Former Lake Ontario Ordnance Works, Niagara County, New York.* Prepared by ERT. March.

USEPA, 2007, *Risk Assessment Guidance for Superfund, Supplemental Guidance for Dermal Risk Assessment (RAGS E)*, update to 2004 final version.

Table 1
REVISIONS TO SIGNIFICANT CONTRIBUTORS TO RISK AND REFINEMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
EU 7 - TOWN OF LEWISTON, WASTEWATER TREATMENT PLANT (WWTP)
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adul

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk							Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	EPC mg/kg	PRG @1E-06	PRG@ HI=1		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Sludge	Sludge	Underground Utilities WWTP	**Inorganics**								**Inorganics**					
			CHROMIUM (VI)	1.E-06	--	--	1.E-06	4.E+02			CHROMIUM (VI)	None	0.05	--	--	0.1
			MANGANESE	--	--	--	NA	2.E+04			MANGANESE	Central Nervous System	0.2	--	--	0.2
			MERCURY	--	--	--	NA	3.E+01			MERCURY	Central Nervous System	0.1	--	--	0.1
			PAHs								**PAHs**					
			BENZ(A)ANTHRACENE	2.E-06	3.E-06	--	4.E-06	4.05E+02			BENZ(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	4.E-06	7.E-06	--	1.E-05	1.00E+03			BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(K)FLUORANTHENE	8.E-08	1.E-07	--	2.E-07				BENZO(K)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	2.E-05	3.E-05	--	5.E-05	4.27E+02			BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	2.E-06	3.E-06	--	5.E-06	4.34E+01			DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	1.E-06	2.E-06	--	3.E-06	2.90E+02			INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs								**Pesticides/PCBs**					
			AROCLOR-1254	6.E-07	1.E-06	--	2.E-06	6.E+01	3.3E+01	1.9E+01	AROCLOR-1254	Eyes, Skin	1	2	--	3
			AROCLOR-1260	6.E-08	1.E-07	--	2.E-07	5.5E+00	3.3E+01		AROCLOR-1260	NA	--	--	--	NA
			Semivolatiles								**Semivolatiles**					
			BIS(2-ETHYLHEXYL)PHTHALATE	8.E-08	1.E-07	--	2.E-07				BIS(2-ETHYLHEXYL)PHTHALATE	Liver	0.02	0.03	--	0.0
			(Total)	3.E-05	5.E-05	---	7.E-05				(Total)		1	2	---	4
			Total Risk Across Sludge (Underground Utilities)				**7.E-05**				**Total Hazard Index Across Sludge (Underground Utilities)**					**4**
Wastewater	Wastewater	Underground Utilities WWTP	**Inorganics**								**Inorganics**					
			CHROMIUM (VI)	1.E-08	1.E-06	--	1.E-06	7.49E-02 mg/L			CHROMIUM (VI)	None	0.0005	0.1	--	0.1
			(Total)	1.E-08	1.E-06	---	1.E-06				(Total)		0.000	0.1	---	0.1
			Total Risk Across Wastewater (Underground Utilities)				**1.E-06**				**Total Hazard Index Across Wastewater (Underground Utilities)**					**0.1**
			Total Carcinogenic Risk				**7.E-05**				**Total Hazard Index Across All Media and All Exposure Routes**					**4**

Total Hazard Index Liver, Sludge	**0.0**
Total Hazard Index CNS, Sludge	**0.3**
Total Hazard Index Eyes, Sludge	**3**
Total Hazard Index Skin, Sludge	**3**
Total Hazard Index Chromium, Sludge	**0.05**
Total Hazard Index Skin, Wastewater	**0.05**

TABLE 2
SUMMARY OF HUMAN HEALTH PRGS – INDUSTRIAL
TOWN OF LEWISTON, WASTEWATER TREATMENT PLANT SLUDGE IN UNDERGROUND UTILITIES
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Chemical of Concern	Maximum Detected Concentration (mg/kg)	Target Organ	Risk-Based PRG (mg/kg)			NYSDEC SCO[a] (mg/kg)	NYSDEC SCO[a] (mg/kg)
			Risk = 1E-4	HI = 0.1	HI = 1	Commercial	Industrial
PCBs							
AROCLOR 1254	6	Skin, Eyes	3,300	1.9	19	1	25

PRG = Preliminary Remediation Goal
SCO = Soil Cleanup Objective
EPC = Exposure Point Concentration
HI = Hazard Index
PCB = Polychlorinated Biphenyl

a) NYSDEC SCO taken from Table 375-6.8(b), Restricted Use Soil Cleanup Objectives.

TABLE 3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION FOR CHEMICALS OF CONCERN
EU 7 - TOWN OF LEWISTON, WASTEWATER TREATMENT PLANT (WWTP) - SLUDGE - INDUSTRIAL
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Current/Future - Industrial
Medium: Sludge
Exposure Medium: Sludge
Exposure Point: Town of Lewiston WWTP

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
PCBS									
AROCLOR-1254	mg/kg	3.01E+01	1.06E+02	6.00E+01	J	mg/kg	6.00E+01	Maximum	UCLM>Maximum

Note: EPC statistics calculated with USEPA ProUCL 4.00.4. USEPA, 2009. *Statistical Software ProUCL 4.0 for Environmental Applications For Data Sets with and without Nondetect Observations* . Technical Support Center for Monitoring and Site Characterization.

95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.

95%UCLM-KMt indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) student's t-test.

TABLE 4
UPDATED EXPOSURE PARAMETER VALUES USED FOR CONSTRUCTION WORKER DAILY SOIL INTAKE EQUATIONS
EU 7 - TOWN OF LEWISTON, WASTEWATER TREATMENT PLANT (WWTP)
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Sludge
Exposure Point: EU 7 - WWTP
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	48	U.S. EPA 1991 (1)	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	**195**	**FS Cost Estimate (2)**	
	ED	Exposure Duration	yr	1	U.S. EPA 1991	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	365	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	**3,300**	**U.S. EPA 2007 (3)**	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2007	
	AF	Adherence Factor	mg/cm^2	**0.2**	**U.S. EPA 2007 (3)**	
	EF	Exposure Frequency	event/yr	**195**	**FS Cost Estimate (2)**	
	ED	Exposure Duration	yr	1	BPJ (1)	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	365	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	

Notes: **Bolded factors have been updated from USACE 2011**
BPJ = Best Professional Judgement
(1) Assumed 10% of construction worker soil ingestion rate of 480 mg/day.
(2) Assumes 5 days per week for a 39 week construction season
(3) Latest recommended values for dermal exposure to construction and outdoor workers

References:
United States Environmental Protection Agency (USEPA), 1989. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* . EPA/540/1-89/002. Interim Final. Decem
USEPA, 1991. *Risk Assessment Guidance for Superfund Volume I-Human Health Evaluation Manual: Supplemental Guidance-"Standard Default Exposure Factors"* (Interim Final). Publication 9285.6-03.
USEPA 2007 *Risk Assessment Guidance for Superfund, Supplemental Guidance for Dermal Risk Assessment (RAGS E)* , update to 2004 final version.

TABLE 5
TOXICITY INFORMATION OF CHEMICALS OF CONCERN IN SLUDGE AT
EU 7 - WASTEWATER TREATMENT PLANT (WWTP)
FORMER LAKE ONTARIO ORDNANCE WORKERS (LOOW)

Analyte	CAS No.	SFO (mg/kg-day)$^{-1}$	Reference	IUR (ug/m^3)$^{-1}$	Reference	Cancer WOE	RfD (mg/kg-day)	Reference	RfC (mg/m^3)	Reference	Mutagen	RAGS Part E GIABS	RAGS Part E ABS
Polychlorinated Biphenyls (PCBs)													
Aroclor 1254	11097-69-1	2.0E+00	IRIS	5.7E-04	IRIS	B2	2.0E-05	IRIS	NA	IRIS		1	0.14

Notes:
SFO = Oral Slope Factor
WOE = Weight of Evidence
RfD = Reference Dose
RfC = Reference Concentration
M = Analyte has been determined to have a mutagenic mode of action for early-life exposures (<16 years of age)
GIABS = Gastrointestinal Absorption Efficiencies (USEPA 2004)
ABS = Absorption Fraction from Soil (USEPA 2004)
NA = Not available

RAGS Part E , USEPA, 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* . EPA/540/R/99/005. July.
IRIS = Integrated Risk Information System, online database available at: http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList.
ATSDR = Agency for Toxic Substance and Disease Registry, Minimal Risk Level. February 2012.
CalEPA = California Environmental Protection Agency, Cancer Potency Factor

Cancer Weight of Evidence:
A - Human carcinogen
B1 - Limited evidence of carcinogenicity in humans
B2 - Sufficient evidence in animals, but inadequate evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Appendix D
Current Institutional Controls

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STATE OF NEW YORK : DEPARTMENT OF HEALTH

RECEIVED
AUG - 5 1974
N. Y. STATE DEPARTMENT OF HEALTH
BUFFALO REGIONAL OFFICE

IN THE MATTER

OF

CERTAIN LANDS TO BE ACQUIRED BY OR TRANSFERRED TO THE TOWN OF LEWISTON, NIAGARA COUNTY, STATE OF NEW YORK

ORDER

1974 amend

WHEREAS, the Commissioner of Health of the State of New York is directed by the Public Health Law to take cognizance of the interests of health and life of the People of the State, and of all matters pertaining thereto and to exercise the functions, powers and duties of the Department of Health prescribed by law and is directed to enforce the Public Health Law and the State Sanitary Code; and

WHEREAS, Section 16.18 of the State Sanitary Code provides:

"(a) The department may, by rule, regulation or order, impose upon any person possessing a radiation source such requirements in addition to those set forth in this Part, as it deems appropriate or necessary to protect the public health and safety and to minimize danger to life and property from radiation hazards."; and

WHEREAS, the Commissioner of Health of the State of New York or those acting by and on his behalf did heretofore discover the existence of hazardous radioactive emissions from the soil of certain lands in the Town of Lewiston, Niagara County, New York, now or formerly owned by the United States Atomic Energy Commission and now or formerly known as the Lake Ontario Ordnance Works and used, among other things, as a sewage disposal facility and/or storage area for radioactive materials; and

WHEREAS, it appears that certain arrangements have been made by and between the Town of Lewiston, Niagara County and the United States Department of Health, Education and Welfare for the acquisition by and transfer to said Town of Lewiston of approximately 22 acres of said lands, as more particularly hereinafter described, for the construction thereupon of certain sewage facilities under a certain Federal grant to be made to said Town of Lewiston; and

WHEREAS, it appears necessary, in the event the said lands are acquired by and transferred to the Town of Lewiston as proposed, to impose reasonable restrictions on the development and use of said lands for the purpose of protecting the public health and safety and to minimize danger to life and property from radiation hazards existing thereon; and

WHEREAS, it appears that the Town of Lewiston, County of Niagara, in the event that said lands aforesaid are acquired by and transferred to it, is desirous of obtaining approval from the State Commissioner of Health for the use which it contemplates making thereof, subject to whatever reasonable restrictions said Commissioner may impose thereon; and

WHEREAS, a certain United States Atomic Energy Commission Survey is annexed hereto and marked Exhibit "1", showing certain radiation hazards on the aforementioned lands proposed to be acquired by and transferred to said Town of Lewiston; and

WHEREAS, said lands are also shown upon that certain map entitled "Site Plan, Atomic Energy Commission Sewage Treatment Plant", hereto annexed and marked Exhibit "2"; and

WHEREAS, the said lands proposed to be acquired by and transferred to said Town of Lewiston are more particularly described as follows:

All that tract or parcel of land, being part of Lot 21, Township 14, Range 9 of the Holland Land Purchase in the Town of Lewiston, County of Niagara and State of New York, and part of Lot 13, Township 15, Range 9 of the Holland Land Purchase in the Town of Porter, County of Niagara and State of New York, more particularly bounded and described as follows: Beginning at a point, said point being the southwesterly corner of a tract of land transferred by the United States of America to the Fort Conti Corporation on July 23, 1966, said point also being located northeast of the

intersection of "N" Street and Lutts Road, being 98.6 feet northerly from the center line of "N" Street and 100 feet easterly of the center line of Lutts Road; thence N 89°19'59" W, crossing Lutts Road, a distance of 807.1 feet more or less to a point of intersection with the existing fence on the western boundary of the Government owned land; thence as follows: N 0°50'52" W a distance of 1,136.5 feet more or less, and N 47°38'42" E a distance of 64.5 feet more or less; then S 89°19'59" E along a line parallel to and 100 feet south of the center line of "M" Street a distance of 790.0 feet more or less to a point 100 feet east of the center line of Lutts Road; thence S 0°40'01" E, parallel to the center line of Lutts Road, a distance of 1,180.0 feet more or less to the point of beginning; containing 22.47 acres, more or less.

NOW, BY VIRTUE OF THE AUTHORITY VESTED IN ME by the Public Health Law, the rules and regulations promulgated pursuant thereto and the State Sanitary Code,

IT IS HEREBY ORDERED:

I. THAT in the event that the Town of Lewiston aforesaid shall, as proposed, acquire the said lands hereinbefore more particularly described, they shall not be used for residential purposes, schools, hospitals or permanent occupancy, except that any such use existing at the time of the issuance of this Order shall be and the same hereby is allowed to continue and to be maintained, provided, however, that such existing use shall not be expanded or broadened from and after the time of the issuance of this Order.

II. THAT the aforesaid lands may, however, otherwise be used for commercial and industrial purposes.

III. THAT any deliberate or intentional movement, displacement or excavation, by whatever means, of the soil of said lands is hereby prohibited unless otherwise expressly permitted after the submission to and approval by the Commissioner of Health, or his authorized representative, of acceptable plans therefor, except that any official agency having jurisdiction or responsibility whether State or Federal, shall not be subject to such prohibition.

IV. THAT no procedures for decontamination of said lands shall be undertaken by other than an official agency having jurisdiction or responsibility, either State or Federal, or its agents, servants or employees, unless application for approval of acceptable plans therefor shall first have been made to and such plans approved by the Commissioner of Health or his authorized representative.

V. THAT before the Town of Lewiston, County of Niagara, after acquisition by it, shall make any sale, transfer, lease or conveyance of said lands, it shall give to the Commissioner of Health, or his authorized representative, not less than five (5) days prior written notice of such proposed sale, transfer, lease or conveyance.

VI. THAT the aforesaid restrictions shall commence upon the acquisition by or transfer, by deed or otherwise, of the aforesaid lands to the Town of Lewiston, County of Niagara, and shall continue in full force and effect until such time as the State Commissioner of Health, or his authorized representative, shall determine that radioactive emissions from said lands have been reduced to levels he deems acceptably safe and that, irrespective of any procedures for decontamination of said lands which may be undertaken by any official agency, whether State or Federal, the Commissioner of Health, or his authorized representative, may require further decontamination procedures to be undertaken for the purpose of achieving levels of radioactivity deemed acceptably safe by him, or his authorized representative, before termination of the aforesaid restrictions.

VII. THAT the Town of Lewiston aforesaid shall provide the State Commissioner of Health with a copy of any deed or other instrument transferring or conveying the title or the possession and control of said lands to it, within five (5) days thereof.

DATED: Albany, New York
June 31, 1974

[redacted]
Commissioner of Health
[redacted]

Deputy Commissioner

TO: TOWN CLERK
Town of Lewiston
Niagara County
New York

MEMORANDUM OF AGREEMENT
BETWEEN

THE UNITED STATES ARMY CORPS OF ENGINEERS
AND
THE NEW YORK STATE HISTORIC PRESERVATION OFFICE

REGARDING
THE MITIGATION OF PUBLIC SAFETY HAZARDS
AT THE FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
WASTEWATER TREATMENT PLANT (WWTP)

WHEREAS, pursuant to the National Historic Preservation Act of 1966 (NHPA), and other federal and state laws and regulations, the United States Army Corps of Engineers (Corps) is responsible for managing historic properties in a manner that emphasizes preservation and to avoid, minimize or mitigate the impact of undertakings that might adversely affect historic resources listed on, or eligible for listing on, the National Register of Historic Places; and

WHEREAS, the site of the Lake Ontario Ordnance Works (LOOW) has been determined eligible by the New York State Historic Preservation Office (SHPO) for listing in the National Register of Historic Places; and

WHEREAS, the Corps and the SHPO (collectively, the Parties) agree that Wastewater Treatment Plant (WWTP) currently poses a public safety hazard and corrective action is necessary to eliminate the hazards and remove residual contamination at the site; and

WHEREAS, it has been determined that options to avoid or minimize the effects of this undertaking have been reviewed and determined to not be viable; and

WHEREAS, SHPO, in consultation with the Corps and other involved agencies, has identified measures to mitigate the adverse effect caused by the implementation of public safety measures at the WWTP.

NOW, THEREFORE, in accordance with Section 106 of the National Historic Preservation Act, the Corps and the SHPO agree that the undertaking shall proceed in accordance with the stipulations below.

STIPULATIONS

The Corps will ensure that the implementation of public safety measures at the WWTP will proceed in compliance with following stipulations:

I. RECORDATION OF HISTORIC STRUCTURES

In consultation with the SHPO, the Corps shall document the WWTP and its site through a photographic documentation and accompanying narrative as follows:

a. Digital photographs describing the site and structures at high resolution printed on acid-free paper will be prepared. A CD of the photographs will be prepared.

b. Original and historic drawings will be replicated and/or digitized as part of the documentation.

c. A historic narrative pertaining to the history of the structure to illustrate the historic, engineering and architectural significance of the complex. The narrative will provide an appropriate historic context for the structures.

d. An inventory of historic documentation and records will be provided indicating the title of original document and its location. Digital copies of the documents will be provided.

f. Two copies of the report are required: one copy of the report will be submitted to the SHPO for forwarding to the State Archives (which will include the archival photographs) and one copy of the report will be submitted to an appropriate local repository (library or historical society).

II. REVIEW PROCESS

The Corps shall consult with the SHPO as the photographic documentation and historic narrative for the Project is advanced, including providing the SHPO with drawings and other appropriate materials.

a. SHPO will have 15 business days in which to comment on the proposed photographic documentation and historic narrative.

b. If the Corps and SHPO cannot agree to appropriate treatments with regard to the design, the ACHP will be requested to review and provide final comments to resolve any disagreement.

IV. OTHER

a. Amendments: If any of the terms of this Agreement cannot be met, or the design or scope of the project changes, the Corps will immediately request the consulting parties to consider an amendment or addendum to the Agreement. Such an amendment; or addendum, shall be executed in accordance with 36 CFR 800.13.

b. Any signatory to this Agreement may request that it be amended. If any signatory determines that an amendment must be made, that party shall immediately consult with the other parties to develop the amendment to the Agreement. 36 CFR 800.5 (c) shall govern the execution of any such amendment.

c. Termination of the Agreement will be governed by 36 CFR 800.5 (c): "If any signatory determines that the terms of a memorandum of agreement cannot be carried out, the signatories shall consult to seek amendment of the agreement. If the agreement is not amended, any signatory may terminate it. The Agency Official shall either execute a memorandum of agreement with signatories under paragraph (c) (1) of this section or request the comments of the Advisory Council on Historic Preservation (Council) under Section 800.7 (a)."

d. The Corps will be responsible for informing its independent contractors, employees, agent, and assigns of their responsibility to comply with this Memorandum of Agreement (MOA), including all stipulations, while acting as Corps' agent with respect to the activities covered by this MOA.

e. The Council and the SHPO may monitor activities carried out pursuant to the Agreement, and the Council will review such activities if so requested. The Corps will cooperate with the Council and the SHPO in carrying out their monitoring and review responsibilities. In the event an on-site visit is required, at least 48-hour notification will be given to the Corps, and SHPO and/or Council representatives shall complete a required health and safety briefing.

f. In the event the Corps does not carry out the terms of this Agreement during the commenting process, it shall not take or sanction any action or make any irreversible commitment that would result in an adverse effect to a National Register-listed or eligible property, or that would foreclose the Council's consideration of modifications or alternatives that could avoid or mitigate the adverse effect.

V. EFFECT OF AGREEMENT

Execution of this Memorandum of Agreement and carrying out its Stipulations evidences that the Corps has satisfied its Section 106 responsibilities for public safety hazard mitigation and demolition work at the former LOOW WWTP.

SIGNATORY PARTIES

_____(date)_____
[redacted]
New York State Historic Preservation Officer

_____(date)_____
[redacted]
Lieutenant Colonel, Corps of Engineers
District Engineer

_____(date)_____
[redacted], Supervisor
Town of Lewiston

Appendix E
Cost Estimates for Alternative 2, Alternative 4 and Alternative 6

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Alternative 2

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WASTEWATER TREATMENT PLANT at the

FORMER LAKE ONTARIO ORDNANCE WORKS SITE

Remedial Alternative 2 – Capping of Contaminated Sludge/Sediment

Current Working Estimate of Construction Costs (FY14)

Basis of Cost Estimate R2a

The capping alternative involves covering the contaminated sludge/sediment in the Acid Neutralization Building / Dilution Sump to minimize the potential for human contact with the COCs. Solidifying agents would be added to increase the strength of the sludge/sediment to withstand the cap load. Water in the structures would be removed beforehand to meet the required liquid-to-solid ratio for solidification. Self-compacting fill would be placed over the strengthened sludge. A six-inch concrete cap would be placed over the fill. The structures and underground lines would remain. Contaminants would also remain in the solidified mass at levels that would not allow unlimited use and unrestricted exposure. Land Use Controls, Long Term Monitoring (30-year) and five-year reviews would be required.

HTRW REMEDIAL ACTION (CONSTRUCT) (WBS 331XX)

Mobilization and Preparatory Work (WBS 331XX01)

This item includes the following activities:

- Mobilization of Construction Equipment and Facilities
- Submittals / Implementation Plans
- Setup / Construct Temporary Facilities

Mobilization of Construction Equipment and Facilities - This activity includes the transport, initial assembly and setup of construction equipment prior to project startup. Work associated with mobilization will include preparation of equipment for transport, equipment transportation and setup, drivers and equipment operators.

Submittals / Implementation Plans - This activity includes the work incurred prior to, and during, remedial action for obtaining all necessary plans. The plans included are:

- Accident Prevention Plan (APP) / Site Safety and Health Plan (SSHP)
- Water Management Plan

- Construction Quality Control Plan
- Material Handling / Transportation / Disposal Plan
- Sampling and Analysis Plan
- Site Operations Plan
- Solidification Treatability Study
- Radiation Protection Program
- Backfill and Restoration Plan

Each of these plans will be prepared by competent project technical personnel and subject matter experts. A draft of each plan will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final plans.

Setup / Construct Temporary Facilities - This activity includes procurement, setup, and construction of office trailers, storage areas, access roads, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for Construction Equipment / Vehicles
- Lunch / Break Trailer (Craft Labor)
- Portable Toilets
- Aggregate Surfacing (site haul road)
- Project Signs
- Erosion Control

The overall estimated duration for Mobilization and Preparatory Work (WBS 331XX01) is 39 weeks.

<u>Monitoring, Sampling, Testing, and Analysis (WBS 331XX02)</u>

This item includes the following activities:

- Meteorological Monitoring
- Radiation Monitoring
- Air Monitoring and Sampling
- Monitoring Wells
- Sampling Liquid Waste
- Sampling Soil and Sediment
- Laboratory Chemical Analysis

- Radioactive Waste Analysis
- Geotechnical Testing
- Sampling Demolition Debris for Disposal Characterization

Meteorological Monitoring - This activity includes the procurement, setup, testing, and operation of a meteorological station on the project site. These activities will be performed from site mobilization through completion of site demobilization.

Radiation Monitoring - This activity includes the following radiological control (RADCON) crews performing the indicated radiological monitoring activities:

RADCON Crew	Monitoring Activity
RADCON Crew - Baseline	Establish Radiological Controls / Initial Baseline Surveys / Periodic Survey of Site Haul Roads
RADCON Crew - Excavation	Demolition
	Solidification
RADCON Crew - Incoming / Outgoing	Outgoing Waste Packages
	Incoming Construction Equipment
	Outgoing Construction Equipment

The composition of the RADCON Crews is as follows:

RADCON Crew	Personnel	Equipment
Baseline	(1) Senior Radiation Tech, (1) Radiation Technician, (0.2) Certified Health Physicist	(1) Ludlum 2221, (1) Ludlum 2360, (1) Ludlum 19, (1) Ludlum 43-10-1, (1) Ludlum 44-10, (2) Ludlum 44-7, (1) Trimble GPS
Excavation	(1) Senior Radiation Tech, (1/2) Radiation Technician	(1) Ludlum 2221, (1) Ludlum 177-61, (1) Bicron Micro Rem Meter, (2) Ludlum 44-7, (1) B2/5 FIDLER Probe, (3) F&J LV-1 Low Volume
Incoming / Outgoing	(2) Radiation Technicians	(2) Ludlum 2221, (1) Ludlum 177-61, (1) Ludlum 44-9 Pancake G-M

In all instances were a RADCON crew is supporting another activity (e.g., demolition, solidification, etc.) the duration of the RADCON crew activity is dependent on the duration of the activity being supported.

Air Monitoring and Sampling - This activity includes installation and operation of an assumed four (4) real-time perimeter dust monitors around the project perimeter This activity also includes installation and operation of an assumed one (1) portable sampler to collect air

samples at various locations on the project site. Operation of these air monitors consists of monthly retrieval of the air filters and analysis for gross alpha / beta. These activities will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of Demobilization.

Monitoring Wells – This activity includes decommissioning of one (1) monitoring well to a depth of 25 ft in the vicinity of the Acid Neutralization Building. This well is assumed to be in the way of remedial activities. This activity also includes installation of two (2) monitoring wells in the vicinity of the Acid Neutralization Building / Dilution Sump. These monitoring wells will be used for monitoring the long term performance of this alternative.

Sampling Liquid Waste – This activity includes retrieval of samples of existing water, construction water and precipitation from WWTP structures and lines for disposal characterization. This will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of demobilization.

Sampling Soil and Sediment - This activity includes retrieval of sludge/sediment samples from WWTP structures and lines for performance of the solidification treatability study. This activity also includes retrieval of solidified sludge/sediment samples for verification analysis.

Laboratory Chemical Analysis - This activity includes the following:

- Existing Water From WWTP Structure – Disposal characterization analysis for:
    - Volatile organic compounds
    - Semi-volatile organic compounds
    - PCBs
- WWTP Structure Demolition Debris – Disposal Characterization Analysis for:
    - Semi-volatile organic compounds
    - PCBs
    - TCLP Volatile organic compounds
    - TCLP Pesticides
    - TCLP Metals
- Existing Sludge/Sediment From WWTP Structures – Treatability Study Analysis by Static Leaching Test for:
    - PCBs

- Solidified Sludge/Sediment From WWTP Structure – Verification Analysis by Static Leaching Test for:
    - PCBs

The duration of these chemical analysis activities is dependent on the duration of the remedial action activities that the analytical activity is supporting.

Radioactive Waste Analysis - This activity includes laboratory radiological analysis of samples from the following:

- Monthly composite of the filters from each air monitoring location will be sent to an off-site laboratory for analysis gross alpha and beta.
- Existing Water From WWTP Structure – Disposal characterization analysis for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Existing Sludge/Sediment From WWTP Structure – Treatability Study Analysis by Static Leaching Test:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Solidified Sludge/Sediment From WWTP Structure – Verification Analysis by Static Leaching Test for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- WWTP Structure Demolition Debris – Disposal Characterization Analysis for:
    - Pu-238, Pu-239/240

- Ra-226, Ra-228
- Th-228, Th-230, Th-232, Th-234
- U-234, U-235, U-238
- Pb-210, Pb-212, Pb-214

The duration of these analytical activities is dependent on the duration of the construction activities that the analytical activity is supporting.

Geotechnical Testing - This activity includes the following:

- Strength:
    - Sludge/sediment from WWTP structure – Treatability Study
    - Solidified sludge/sediment from WWTP structure - Verification

The duration of these geotechnical testing activities is dependent on the duration of the construction activities that the testing activity is supporting.

The overall estimated duration for Monitoring, Sampling, Testing and Analysis (WBS 331XX02) is 29 weeks.

<u>Sitework (WBS 331XX03)</u>

This item includes clearing a work area 20-feet wide around the perimeter of the Acid Neutralization Building / Dilution Sump. This item also includes demolition of approximately 200 feet of existing chain link fence for access to the project site. The overall estimated duration for Sitework (WBS 331XX03) is one (1) week.

<u>Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09)</u>

This item includes transfer to temporary storage of existing pumpable liquids from the Acid Neutralization Building /Dilution Sump. The overall estimated duration for Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09) is nine (9) weeks.

<u>Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10)</u>

This item includes demolition and loading of the following WWTP Structures:

- Acid Neutralization Building Top Slab (Floor El. 317.50)
- Acid Neutralization Building Intermediate Slab (Floor El. 304.50)
- Misc. C&D Material in Acid Neutralization Building

The overall estimated duration for Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10) is four (4) weeks.

Stabilization / Fixation / Encapsulation (WBS 331XX15)

This item includes solidification by reagent (Portland cement) addition and mixing of sludge / sediment in the Acid Neutralization Building / Dilution Sump. The overall estimated duration for Stabilization / Fixation / Encapsulation (WBS 331XX15) is one (1) week.

Disposal (Commercial) (WBS 331XX19)

This item includes the following activities:

- Loading Demolition Debris for Disposal
- Hauling Demolition Debris for Disposal
- Hauling Water from WWTP Structure
- Disposal Fees and Taxes

Loading Demolition Debris for Disposal – Assume that a crew consisting of one (1) 1.25 CY Front End Wheel Loader, one (1) Equipment Operator, and one (1) Laborer utilized ½ time will load demolition debris from the Acid Neutralization Building / Dilution Sump into intermodal or dump containers at an average rate of 20 CY/hour.

Hauling Demolition Debris for Disposal - Assume demolition debris will be hauled to a permitted disposal facility that can accept LAMW, assumed to be located in the western U.S., approximately 2,500 miles from the project site, in intermodal containers via truck. Assume empty intermodal containers will be returned to the project site via truck. Costs ($ / CWT) for transportation of loaded and empty containers are from the MII Cost Book. Assume that unloading costs are included in unit prices for disposal.

Hauling Water from WWTP Structures and Lines – Assume that 100% of the existing water from the WWTP structure will be hauled to a permitted waste treatment/disposal facility for disposal as Low Activity Radioactive Waste. Process Water Hauling Fee is from the MII Cost Book. Assume that unloading costs are included in the unit prices for disposal.

Disposal Fees and Taxes – Assume that the composition of materials to be disposed is:

- 333,840 Gallons Water: Low Activity Radioactive Waste - Water
- 346 LCY Demolition Debris: Low Activity Mixed Waste - Debris

Unit price for Radioactive Process Water is from the MII Cost Book. Unit prices for Low Activity Radioactive Waste – Soil and Low Activity Radioactive Waste – Debris disposal are from a

current USACE contract with a permitted disposal facility that can accept LAMW. The overall estimated duration for Disposal (Commercial) (WBS 331XX19) is five (5) weeks.

Site Restoration (WBS 331XX20)

This item includes placement of a self-leveling flowable fill material into the following WWTP structures:

- Acid Neutralization Building / Dilution Sump (following sludge / sediment stabilization)
- Collection Tank (to plug line going to Acid Neutralization Building / Dilution Sump)
- Manholes K, L, M (to plug lines going to Acid Neutralization Building / Dilution Sump)

This item also includes construction of a 6-inch thick, reinforced concrete cap on the Acid Neutralization Building / Dilution Sump following sludge / sediment stabilization and self-leveling flowable fill material placement.

This item also includes installation of approximately 200 feet of chain link fence which was removed at the project start to provide access to the project site.

The overall estimated duration for Site Restoration (WBS 331XX20) is eight (8) weeks.

Demobilization (331XX21)

This item includes the following activities:

- Removal of Temporary Facilities
- Final Decontamination
- Demobilization of Construction Equipment and Facilities
- Submittals

Removal of Temporary Facilities – This activity includes demobilization and dismantling of office trailers, storage, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for construction Equipment / Vehicles
- Lunch / Break Trailer
- Portable Toilets
- Project Signs
- Erosion Control

Final Decontamination – Portable water storage tanks will be decontaminated and verified to meet free-release criteria. Small equipment that is impractical to satisfactorily decontaminate will be processed and disposed as LLRW debris. All construction equipment will be decontaminated until acceptable post-decon analysis for free release from the site is achieved. The Equipment Decontamination Pad will be loaded and packaged for transportation and disposal.

Demobilization of Construction Equipment and Facilities - This activity includes the disassembly, takedown, and transport of construction equipment at the conclusion of project activities. Work associated with demobilization will include preparation of equipment for transport, equipment transportation, drivers and equipment operators.

Submittals – This activity includes preparation of a Construction Documentation Report which will include, at a minimum, all final reports, punch lists, project acceptance, final QA/QC reports and As-Built Drawings. The Construction Documentation Report will be prepared by competent project technical personnel and subject matter experts. A draft of the report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

The overall estimated duration for Demobilization (WBS 331XX21) is 18 weeks.

<u>General Requirements (331XX22)</u>

This item includes the following activities:

- Supervision and Management
- Engineering, Surveying, and Quality Control
- First Aid, Fire Protection, and Traffic Control
- Health & Safety
- Temporary Construction Facilities – Ownership
- Temporary Construction Facilities – Operation
- Project Utilities

Supervision and Management – Assume the following personnel, and associated vehicles, travel and per diem:

- Program Manager (5% time, i.e. 2 hrs/wk., located at home office)
- Project Manager (50% time, i.e., 20 hours/week)
- General Superintendent (On-site full time, 1 trip home/month, per diem, vehicle)

Engineering, Surveying, and Quality Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Civil Engineer (50% time, i.e., 20 hours/week, 7 site visits during dewatering, demolition and solidification)
- Surveyors (On-site ¼ time, i.e., 10 hours/week; local hire/subcontractor)
- Quality Control Manager (On-site full time, 1 trip home/mo., per diem, vehicle)

First Aid, Fire Protection, and Traffic Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Water Truck w/ Driver (On-site full time, local hire)

Health & Safety - Assume the following personnel, and associated vehicles, travel and per diem:

- Safety & Health Manager (CIH) (½ time, i.e. 20 hrs/mo., 2-day trip to site every month)
- Radiation Safety Officer (On-site full time, 1 trip home/mo., per diem, vehicle)
- Assistant Radiation Safety Officer (On-site 1/2 time, i.e., 20 hours/week, 1 trip home/8 weeks, per diem, vehicle)
- Site Safety & Health Officer (On-site full time, 1 trip home/mo., per diem, vehicle)

Health & Safety also includes the following:

- Health and Safety Training - Includes DOE 10 CFR 835 Training (8 hours)
- Health and Safety Medical Exams – Includes Entry Physical, Exit Physical,
- Personal Protective Equipment (PPE) – Level D, Level C, Level B PPE as required by site conditions.

Temporary Construction Facilities – Ownership – Assume monthly rental expenses for the following:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Lunch / Break Trailer
- Portable Toilets

Temporary Construction Facilities Operation – Assume the following monthly / annual operating expenses:

- Janitors and Cleaning Services – Clean office trailers on a weekly basis
- Haul Road Maintenance

Project Utilities - Assume the following monthly project site utility expenses:

- Telephone
- Electricity
- Water
- Internet

The overall estimated duration for General Requirements (WBS 331XX22) is 25 weeks.

SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT (WBS 333XX)

USACE Labor & Contracts (WBS 331XX01)

This item includes USACE labor and contracts for supervision, administration and construction management during the implementation of the remedial action, from start of Mobilization and Preparatory Work to completion of Demobilization. The estimated level of effort for this item (i.e., 20% of Construction Cost) was provided by CELRB-TD-EE [redacted]). The overall estimated duration for Supervision & Administration (S&A) Construction Management (WBS 333XX) is 72 weeks.

HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES (WBS 34XXX)

FISCAL / FINANCIAL CLOSEOOUT ACTIVITIES (WBS 341XX)

USACE Labor & Contracts (WBS 341XX01)

This item includes USACE labor and contracts for post remedial action closeout activities. The estimated level of effort for this item (i.e., 5% of Construction Costs) was provided by CELRB-TD-EE [redacted]). The overall estimated duration for Fiscal / Financial Closeout Activities (WBS 341XX) is 104 weeks.

HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION) (WBS 342XX)

It is assumed that post-remediation program consisting of environmental monitoring will be implemented for a period of thirty (30) years after this alternative is implemented.

Monitoring, Sampling, Testing, and Analysis (WBS 342XX02)

This item includes the following activities:

- Monitoring Wells
- Sampling Surface Water / Groundwater / Liquid Waste
- Laboratory Chemical Analysis

- Annual Site Inspection

Monitoring Wells - This item includes an allowance of $500 / year for repairs to the monitoring wells.

Sampling Surface Water / Groundwater / Liquid Waste - This activity includes continued quarterly sampling of an estimated four (4) groundwater wells on the project site for off-site chemical laboratory analysis.

Laboratory Chemical Analysis – This activity includes continued groundwater chemical analysis for PCBs.

Annual Site Inspection – This activity includes an annual inspection of the project site. It is assumed that this inspection will be performed by a Project Engineer and a Construction Inspector.

The overall estimated duration for Monitoring, Sampling, Testing, and Analysis (WBS 342XX02) is 30 years.

<u>General Requirements (WBS 342XX22)</u>

This item includes the following activities:

- Supervision and Management
- Five-Year Reviews
- Site Closeout Report

Supervision and Management – Assume that a Project Manager will work on the project an average of 10 hours per month during the 30-year Long Term Monitoring (LTM) period following completion of remedial construction.

Five-Year Review – This activity includes performance by competent project technical personnel of a five-year review process in Years 5, 10, 15, 20, 25 and 30 following completion of remedial construction. The five-year review process will address the following components:

- Community involvement and notification
- Document review
- Data review and analysis
- Site inspection
- Interviews
- Protectiveness determination

A draft of the five-year review findings report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

Site Closeout Report - This activity includes preparation of a Site Closeout Report in Year 30 following completion of remedial construction by competent project technical personnel and subject matter experts. A draft of the report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

The overall estimated duration for General Requirements (WBS 342XX22) is 30 years.

Contractor Assignment and Mark-ups

Assume that a Prime Contractor will self-perform all work except health physics, monitoring well installation and CERCLA Five-Year Reviews. Assume that health physics will be performed by a Health Physics Subcontractor, and monitoring well installation will be performed by a well drilling subcontractor. CERCLA Five-Year Reviews will be performed by and Architect – Engineer (A/E) firm.

Assume that reasonable mark-ups for the Prime Contractor are: Home Office Overhead 15%, Profit 8%, and Bond 1.0%.

Assume that reasonable mark-ups for the Health Physics Subcontractor are: Home Office Overhead 15% and Profit 8%.

Assume that reasonable mark-ups for the Well Drilling Subcontractor are: Home Office Overhead 15% and Profit 10%.

Assume that reasonable mark-ups for the CERCLA Five-Year Review A/E firm are: Home Office Overhead / G&A 55% and Profit 10%.

Sales Tax

An 8.00% New York (Niagara County) Sales Tax is applied to materials.

Escalation

Because this CWE will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Present Value Analysis

Remedial action projects typically involve construction costs that are expended at the beginning of a project (capital costs) and costs in subsequent years (operation and maintenance and periodic costs). Present value (PV) analysis is a method to evaluate expenditures which occur over different periods of time. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single value, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed. PV analysis uses a discount rate and period of analysis to calculate the PV of each expenditure.

Discount Rate

A discount rate is the difference between interest and inflation rates. When inflation is neglected, the discount rate is simply an interest rate, and is used to account for the time value of money. A dollar is worth more today than in the future because, if invested today, the dollar would earn interest. The choice of a discount rate is important because the selected rate directly impacts the present value of a cost estimate, which is then used in making a remedy selection decision.

Based on guidance provided by Huntsville Center – Programs & Planning Branch (28Mar13 email, [redacted]l to [redacted] Subject: Request Direction on Interest / Discount Rates for Present Value Calculations of O&M Costs on FUSRAP Projects) the "Consumer Price Index, All Urban Consumers, U.S. city average, for All Items" average annual percentage change from 1913 to present was selected because "For a government project, particularly an O&M exercise, your discount rate need only control for the long term tendency of costs of labor and materials to rise over time. In other words, the discount rate and the inflation rate should be about equal. The inflation statistic with the longest period of actual data collection is the Bureau of Labor Statistic's Consumer Price Index (CPI) with approximately 100 years worth of data points. While the CPI is not construction specific its long life has an advantage. Theoretically you could argue that use of this statistic account for all events affecting inflation with a probability of occurring in the next 100 years (the wars, the recessions, depressions, etc.) and you need only worry about those events which occur at frequency of less than once every 100 years (nuclear war, global pandemics, global warming and other unknowns and unknowable unknowns)." The average annual percentage change from 1913 to present for this index was calculated to be 3.33%.

Present Value

The present value of a single periodic future payment is calculated using the following equation:

$$PV = \frac{x_t}{(1+i)^t}$$

Where:

PV = Present value
x_t = Payment in year t (t = 0 for present or base year)
i = Discount factor
t = Number of years following construction that expenditure occur

The PV of a series of equal annual future payments such as annual Long Term Monitoring payments is calculated using the following equation:

$$PV = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

Where:

PV = Present value
x_t = Payment in year t (t = 0 for present or base year)
i = Discount factor
t = Number of years following construction that expenditure occur

MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate report, a Miscellaneous Owner Cost mark-up titled "Present Value" was applied to the annual cost elements to result in a Project Cost that accurately depicts the Present Value of the annual cost elements over the 30 year Long Term Monitoring period. For *i* = 3.33%, the numerical value used for this mark-up in the MII cost estimate is 1779.01.

For the CERCLA Five-Year Reviews, the present value for each of six (6) five-year reviews was calculated as above. MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate, an Owner Cost mark-up titled "Present Value" was applied to the Five-Year Review cost element over the 30 year Long Term Monitoring period. For *i* = 3.33%, the numerical value used for this mark-up in the MII cost estimate is 251.6. This value was used so that the resulting MII Long Term Monitoring Project Costs accurately reflect the present value calculation.

The present value of the preparation cost of the Site Closeout Report in Year 30 was calculated as above. MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate, a Miscellaneous Owner Cost mark-up titled "Present Value" was applied to the preparation cost of the Site Closeout Report in Year 30. For *i* = 3.33%, the

numerical value used for this mark-up in the MII cost estimate is -62.57**.** This value was used so that the resulting MII Long Term Monitoring Project Costs accurately reflect the present value calculation.

Project Schedule

Based on estimated durations of the project WBS items and assumed predecessor / successor relationships between the items, a draft project schedule was prepared. This schedule is based on mobilizing to the project site and working until project completion. No allowance has been made in the schedule or the CWE for interim demobilization / remobilization, seasonal project shut-down, or facility winterization. Based on these assumptions, the estimated overall project construction duration is 72 weeks. Please see Figure 1 for the project schedule.

It is assumed that post–remediation Long Term Monitoring activities will continue for thirty (30) calendar years following completion of construction activities.

LOOW FS Alt 2 Capping of Contaminated Sludge/Sediment CWE FY13 MII 4-2B3 (Rev2)

The capping alternative involves covering contaminated sludge/sediment in the acid neutralization building and dilution sump/weir to minimize the potential for human contact with the COCs. Solidifying reagents would be added to increase the strength of the sludge/sediment in order to withstand the cap load. Water in the structure would be removed beforehand to meet the required liquid-to-solid ratio for the solidifying reagents. A six inch concrete cap would be placed over the strengthened sludge/sediment. The structures and underground pipes would remain. Contaminants would also remain in the sludge/sediment at levels that would not allow UU/UE. LUCs, LTM, and five-year reviews would be required.

Estimated by	CELRB-TD-DE
Designed by	CELRB-TD-FE
Prepared by	[redacted]
Preparation Date	4/30/2014
Effective Date of Pricing	4/30/2014
Estimated Construction Time	504 Days

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Description	Quantity	UOM	ContractCost	ProjectCost
Project Cost			**5,491,531**	**7,716,575**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**4,977,886**	**4,977,886**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**4,148,238**	**4,148,238**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**416,589**	**416,589**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**169,533**	**169,533**
331XX03 Site Work	**1.00**	**EA**	**5,528**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**245,193**	**245,193**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**128,563**	**128,563**
331XX15 Stabilization / Fixation / Encapsulation	**1.00**	**EA**	**18,674**	**18,674**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**1,071,366**	**1,071,366**
331XX20 Site Restoration	**1.00**	**EA**	**474,513**	**474,513**
331XX21 Demobilization	**1.00**	**EA**	**137,573**	**137,573**
331XX22 General Requirements	**1.00**	**EA**	**1,480,704**	**1,480,704**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**829,648**	**829,648**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**829,648**	**829,648**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**513,645**	**2,738,689**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**207,412**	**207,412**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**207,412**	**207,412**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.00**	**EA**	**306,233**	**2,531,277**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**91,105**	**1,711,867**
342XX22 General Requirements	**1.00**	**EA**	**215,129**	**819,410**

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost
Project Indirect Summary			**4,490,065**	**98,016**	**3,551,021**	**532,653**	**326,694**	**44,104**	**5,491,531**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**4,093,571**	**42,974**	**3,306,897**	**496,035**	**304,235**	**41,072**	**4,977,886**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**3,263,923**	**42,974**	**3,306,897**	**496,035**	**304,235**	**41,072**	**4,148,238**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**327,787**	**4,309**	**332,097**	**49,815**	**30,553**	**4,125**	**416,589**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**121,234**	**13,914**	**135,148**	**20,272**	**12,434**	**1,679**	**169,533**
331XX03 Site Work	**1.00**	**EA**	**4,407**	**0**	**4,407**	**661**	**405**	**55**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**195,463**	**0**	**195,463**	**29,320**	**17,983**	**2,428**	**245,193**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**102,488**	**0**	**102,488**	**15,373**	**9,429**	**1,273**	**128,563**
331XX15 Stabilization / Fixation / Encapsulation	**1.00**	**EA**	**14,887**	**0**	**14,887**	**2,233**	**1,370**	**185**	**18,674**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**854,073**	**0**	**854,073**	**128,111**	**78,575**	**10,608**	**1,071,366**
331XX20 Site Restoration	**1.00**	**EA**	**378,273**	**0**	**378,273**	**56,741**	**34,801**	**4,698**	**474,513**
331XX21 Demobilization	**1.00**	**EA**	**109,671**	**0**	**109,671**	**16,451**	**10,090**	**1,362**	**137,573**
331XX22 General Requirements	**1.00**	**EA**	**1,155,639**	**24,750**	**1,180,390**	**177,058**	**108,596**	**14,660**	**1,480,704**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**829,648**	**0**	**0**	**0**	**0**	**0**	**829,648**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**829,648**	**0**	**0**	**0**	**0**	**0**	**829,648**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**396,494**	**55,042**	**244,124**	**36,619**	**22,459**	**3,032**	**513,645**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**207,412**	**0**	**0**	**0**	**0**	**0**	**207,412**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**207,412**	**0**	**0**	**0**	**0**	**0**	**207,412**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.00**	**EA**	**189,082**	**55,042**	**244,124**	**36,619**	**22,459**	**3,032**	**306,233**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**72,627**	**0**	**72,627**	**10,894**	**6,682**	**902**	**91,105**
342XX22 General Requirements	**1.00**	**EA**	**116,455**	**55,042**	**171,497**	**25,724**	**15,778**	**2,130**	**215,129**

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectCost
Project Direct Summary			**2,185,158**	**282,161**	**549,961**	**1,472,785**	**4,490,065**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.0**	**EA**	**1,877,895**	**282,161**	**530,953**	**1,402,563**	**4,093,571**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.0**	**EA**	**1,048,247**	**282,161**	**530,953**	**1,402,563**	**3,263,923**
331XX01 Mobilization and Preparatory Work	**1.0**	**EA**	**188,899**	**14,377**	**72,026**	**52,486**	**327,787**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.0**	**EA**	**30,060**	**7,143**	**13,894**	**70,137**	**121,234**
331XX03 Site Work	**1.0**	**EA**	**3,470**	**937**	**0**	**0**	**4,407**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.0**	**EA**	**79,974**	**75,309**	**0**	**40,180**	**195,463**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.0**	**EA**	**65,283**	**37,205**	**0**	**0**	**102,488**
331XX15 Stabilization / Fixation / Encapsulation	**1.0**	**EA**	**1,335**	**3,616**	**9,936**	**0**	**14,887**
331XX19 Disposal (Commercial)	**1.0**	**EA**	**1,732**	**559**	**0**	**851,782**	**854,073**
331XX20 Site Restoration	**1.0**	**EA**	**128,547**	**39,947**	**209,780**	**0**	**378,273**
331XX21 Demobilization	**1.0**	**EA**	**79,080**	**10,724**	**6,214**	**13,653**	**109,671**
331XX22 General Requirements	**1.0**	**EA**	**469,867**	**92,345**	**219,102**	**374,325**	**1,155,639**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.0**	**EA**	**829,648**	**0**	**0**	**0**	**829,648**
333XX01 USACE Labor & Contracts	**1.0**	**EA**	**829,648**	**0**	**0**	**0**	**829,648**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**307,264**	**0**	**19,008**	**70,222**	**396,494**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**207,412**	**0**	**0**	**0**	**207,412**
341XX01 USACE Labor & Contracts	**1.0**	**EA**	**207,412**	**0**	**0**	**0**	**207,412**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.0**	**EA**	**99,852**	**0**	**19,008**	**70,222**	**189,082**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.0**	**EA**	**2,405**	**0**	**0**	**70,222**	**72,627**
342XX22 General Requirements	**1.0**	**EA**	**97,447**	**0**	**19,008**	**0**	**116,455**

LOOW WWTP FS
Cost Estimate for Alternative 2 - Capping

WBS	Description	Duration	Direct Cost			Notes
331XX	**HTRW Construction Activities**	**72 WK**	**$ 3,141,105**			
01	Mob & Prep Work	39 WK	$ 327,787			
01	Mob Const Equip & Facilities		$ 21,788			
01	Transport Vehicles			$ 3,084		
02	Drivers			$ 2,461		
07	Const Equipment			$ 440		
08	Equip Operators			$ 852		
09	Initial Assembly & Setup			$ 11,750		
01	Assemble Mixer to Hydraulic Excavator				$ 4,250	Assemble mixer to hydraulic excavator, 4-person crew, 8 hrs
03	Set-up Training				$ 7,500	
90	Transport Cost for Mixers & Pressure Feeders			$ 3,200		
03	Submittals/Plans		$ 189,948			
08	APP/SSHP			$ 22,429		
12	Water Management Plan			$ 15,825		
14	CQC Plan			$ 17,784		
15	Waste Handling/Transportation/Disposal			$ 12,827		
22	Sampling & Analysis Plan			$ 29,786		
24	Site Operations Plan			$ 28,318		
30	Other Technology Plans			$ 30,000		Solidification Treatability Study
90	Radiation Protection Plan			$ 17,807		
93	Backfill & Restoration Plan			$ 15,172		
04	Setup/Construct Temp Facilities		$ 116,052			
01	Office Trailers			$ 9,285		
01	Contractor Trailer				$ 9,285	Double wide, (2) 50' x 10'
02	Storage Facilities			$ 1,172		
04	Decon Facilities for Personnel			$ 14,255		
05	Decon Facilities for Equipment			$ 20,592		20' x 50'
01	Grading				$ 3,926	
02	Geosynthetics				$ 1,134	40 mil HDPE
03	Aggregate				$ 999	1' thick
05	Bituminous				$ 4,005	8-in thick layer, 20' x 40'
--	Decon Equipment				$ 10,528	Pressure washer, decon fluids, misc supplies, & poly sheeting
07	Lunch Break Trailer			$ 8,662		50' x 20'
10	Toilets			$ 443		
23	Aggregate Surfacing			$ 27,669		Haul road maintenance, 1' thick gravel, 1,000 LF
28	Signs			$ 1,380		
30	Erosion Control			$ 32,595		Silt fence, 3,500 LF
02	Monitoring, Sampling, Testing, Analysis	29 WK	$ 110,828			
01	Meteorological Monitoring	25 WK	$ 7,316			
01	Met Station			$ 7,316		
02	Rad Monitoring	25 WK	$ 21,977			
90	Establish Rad Controls, Initial Baseline Surveys			$ 4,110		40 hr RADCON Crew [Sr Rad Tech (1), Rad Tech (1), CHP (0.2), 6 instruments & GPS]
91	Monitoring During Site Work			$ 10,588		
---	Demolition				$ 9,966	
---	Solidification				$ 623	
94	Outgoing Waste Monitoring			$ 624		RADCON Crew [2 Rad Techs]
95	Incoming Construction Equipment Monitoring			$ 3,327		
95	Outgoing Construction Equipment Monitoring			$ 3,327		
03	Air Monitoring & Sampling	25 WK	$ 41,756			
01	Real Time			$ 36,690		4 stations @ perimeter
90	Portable Sampler			$ 5,066		1 portable sampler
04	Monitoring Wells	2 WK	$ 7,800			
	Decommissioning			$ 567		Decommission 1 well
	Installation			$ 7,234		Install 2 wells, nominal 25 ft depth each
05	Sampling - SW, GW, & Liquid Waste	13 WK	$ 1,750			
03	Liquid Waste			$ 270		20 samples
05	Sample Shipping & Handling			$ 1,480		
03	Liquid Waste				$ 1,480	20 samples
06	Sampling - Soil & Sediment	15 WK	$ 227			
03	Sludge/Sediment (WWTP structures)			$ 81		6 samples
---	Sludge/Sediment Sampling for Treatability Study				$ 54	4 samples
---	Sludge/Sediment Sampling for Verification Analysis				$ 27	2 samples
04	Shipping & Handling			$ 146		
09	Lab Chemical Analysis	29 WK	$ 9,697			
02	Water Quality & Wastewater (disposal characterization)			$ 7,807		
01	WWTP Water				$ 7,807	
05	Haz Waste (RCRA) Analysis			$ 853		Demolition debris
07	Soil & Sediment			$ 1,037		
10	Lab Rad Analysis	29 WK	$ 20,049			
---	Air			$ 2,203		Misc, gross alpha & beta, gas flow proportional counting
---	Liquid			$ 13,461		Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
---	Disposal Characterization				$ 13,461	
05	Soil/Sediment, Treatability Study			$ 3,758		Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
06	Misc (Disposal Characterization)			$ 626		Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
11	Geotechnical	18 WK	$ 195			

LOOW WWTP FS
Cost Estimate for Alternative 2 - Capping

WBS	Description	Duration	Direct Cost				Notes
---	Strength			$ 195			
90	Sampling & Shipping Demo Debris	4 WK	$ 62				Disposal Characterization
03	Site Work	1 WK	$ 4,407				
02	Clearing and Grubbing		$ 3,483				1 Ac area
09	Liquid/Sed/Sludge Collection & Containment	9 WKS	$ 195,463				Cost is per gallon basis
06	Pumping/Draining/Collection		$ 195,463				
01	WWTP Water			$ 195,463			333,840 gal
10	Misc Demo & Removal	4 WK	$ 102,488				Cost is per CY basis
03	Structure Removal		$ 102,448				
02	Demolition			$ 102,448			
15	Stabilization/Solidification	1 WK	$ 14,887				
03	In-Situ Pozzolan Process		$ 14,887				
19	Disposal	5 WK	$ 854,073				
21	Transportation to TSDF		$ 52,642				
01	Loading/Hauling/Unloading			$ 42,626			
--	Loading				$ 2,291		346 CY
--	Hauling				$ 40,335		692 Tons
02	Pumping/Hauling of Liquid			$ 10,015			
--	WWTP Water				$ 10,015		333,840 gal
22	Disposal Fees & Taxes		$ 801,432				
01	LARW Disposal			$ 747,802			
--	Water				$ 747,802		333,840 gal
02	LAMW Disposal			$ 53,630			
--	Demolition Debris				$ 53,630		346 CY
20	Site Restoration	8 WK	$ 265,861				
01	Earthwork		$ 237,094				
03	Backfill			$ 237,094			1,840 CY flowable fill placed above solidified sediment and in empty structures
03	Permanent Features		$ 28,767				
02	Structures (Concrete Cap)			$ 12,800			51' x 42' x 0.5' (acid neutralization bldg) & 34' x 14' x 0.5' (dilution sump & weir)
90	Perimeter Fence			$ 15,967			Replacement of 200 LF fence removed at start of the project
21	Demobilization	18 WK	$ 109,671				
01	Removal of Temp Facilities		$ 27,360				
01	Office Trailers			$ 2,090			
01	Contractor's Trailer				$ 2,090		
02	Storage Facilities			$ 1,172			
04	Decon Facilities, Personnel			$ 14,524			
05	Decon Facilities, Equipment			$ 2,192			
07	Lunch/Break Trailer			$ 2,590			
10	Toilets			$ 443			
16	Truck Scales			$ 1,640			
30	Erosion Control			$ 2,710			
03	Final Decontamination		$ 21,806				
01	Storage Tanks			$ 11,672			Decon of two 20,000 storage tanks, 40 hrs total
02	Construction Equipment			$ 10,134			
04	Demobilization of Construction Equip & Facilities		$ 14,288				
01	Transport Vehicles			$ 3,084			Demob of 12 loads of construction equipment @ 8 hrs/load = 96 hrs
02	Drivers			$ 2,461			As above
07	Construction Equipment			$ 440			As above
08	Equipment Operators			$ 852			12 loads x 2 hrs/load = 24 hrs
09	Final Disassembly & Takedown			$ 4,250			
01	Disassemble Mixer				$ 4,250		
90	Transport Cost for Mixers & Pressure Feeders			$ 3,200			
06	Submittals		$ 46,217				
05	Const Documentation Report			$ 46,217			
22	General Requirements	25 WK	$ 1,155,639				
01	Supervision and Management		$ 148,121				
01	Program Manager			$ 3,822			2 hrs/wk; no travel
02	Project Manager			$ 38,649			20 hrs/wk; located off-site, no travel
03	General Superintendent			$ 66,061			40 hrs/wk; located on-site
11	Vehicles			$ 12,109			
--	General Superintendent				$ 12,109		
12	Travel & Per Diem			$ 27,480			
01	Travel				$ 3,000		
03	General Superintendent					$ 3,000	
02	Per Diem				$ 24,480		
03	General Superintendent					$ 24,480	
04	Engineering, Surveying, & QC		$ 204,533				
02	Civil Engineer			$ 29,283			20 hrs/wk; located at home office, site visit every 4 wks (26 WK/4 WK-visit = 7 visits)
10	Surveyors			$ 22,259			10 hrs/wk; 2 person crew
22	Surveying Equipment & Supplies			$ 2,203			
25	QC Manager			$ 55,573			40 hrs/wk; located on-site
28	Vehicles			$ 10,702			
---	Civil Engineer				$ 1,539		7 site visits @ 3 days each
---	QC Manager				$ 9,163		
29	Travel & Per Diem			$ 84,514			

LOOW WWTP FS
Cost Estimate for Alternative 2 - Capping

WBS	Description	Duration	Direct Cost					Notes
01	Travel					$ 11,500		
---	Civil Engineer						$ 3,500	7 site visits @ 3 days each
25	QC Manager						$ 8,000	
02	Per Diem					$ 73,104		
---	Civil Engineer						$ 3,472	7 site visits @ 3 days each
25	QC Manager						$ 69,542	
06	First Aid, Fire Protection, Traffic Control, & Security		$ 98,270					
10	Water Truck			$ 98,270				Operated 40 hrs/wk for 25 WK
07	Health & Safety		$ 622,675					
01	CIH (Safety & Health Manager)			$ 2,935				2 hrs/wk; located at home office, no site visits
02	Asst Rad Safety Officer			$ 23,456				20 hrs/wk; located on-site
03	Rad Safety Officer			$ 78,819				40 hrs/wk; located on-site
07	Site Safety & Health Officer			$ 61,838				40 hrs/wk; located on-site
14	Health & Safety Training (HTW & Rad)			$ 19,339				
02	DOE 10 CFR 835 Training					$ 19,339		
15	Medical Exams			$ 106,565				
01	Entry Exams					$ 53,283		4 hrs per worker + $800/ea
02	Exit Exams					$ 53,283		4 hrs per worker + $800/ea
16	PPE			$ 239,859				
01	Monitoring, Sampling, Testing & Analysis (Rad)					$ 12,069		Includes baseline survey, demolition, solidification, & outgoing waste surveys
02	Liquid, Sed/Sludge Collection					$ 61,438		
03	Demolition & Removal					$ 48,907		
04	Solidification					$ 897		
05	Disposal					$ 1,194		
06	Demobilization					$ 916		
01	Final Decontamination						$ 916	
---	General Requirements					$ 114,436		PPE for supervision & mgmt personnel (Gen Superintendent, Surveyors, Civil Engineer, QC Mgr, Truck Driver, RSO, Asst RSO, & SSHO)
24	Vehicles			$ 24,218				Vehicles for S&H Manager, Safety Officer, Asst Rad Officer, & Rad Officer
25	Travel & Per DIem			$ 65,647				Travel & Per Diem for Asst RSO, RSO, & SSHO
01	Travel					$ 7,336		Travel, staff as above
02	Per Diem					$ 58,311		Per Diem, staff as above
08	Temp Facilities (Ownership)		$ 59,832					
01	Trailers & Facilities			$ 3,567				Trailers: Contractor Office, HP, Storage, Toilets, Decon, Lunch Break, & Gov't
03	Warehouse & Storage Facilities			$ 1,154				
08	Portable Toilets			$ 2,555				
11	Decon Facilities			$ 48,990				
14	Break Trailer & Facilities			$ 3,567				
09	Temp Facilities (Operation)		$ 5,995					Trailer cleaning & road maintenance
04	Janitorial Services			$ 952				
12	Haul Rd Maintenance			$ 5,043				
10	Utilities		$ 16,212					Phone, electric, water, & Internet
01	Phone			$ 4,988				
02	Electric			$ 7,483				
04	Water			$ 1,871				
90	Internet			$ 1,871				
333XX	**USACE Supervision & Administration, Const Management**	**72 WK**	**$ 810,481**					
34XXX	**USACE HTRW Post Const & Financial Closeout**		**$ 327,882**					
341XX	Fiscal/Financial Closeout Activities		$ 202,620					
01	Labor & Contracts			$ 202,620				
342XX	HTRW Operation & Maintenance	30 YR	$ 125,262					Includes LTM, five-year reviews, and site closeout activities
02	Monitoring, Sampling, Testing, & Analysis	30 YR		$ 8,807				
04	Monitoring Wells				$ 500			Converted to PW cost using I = 3.33%
05	GW Sampling				$ 579			As above
09	Lab Analysis - Chemical				$ 4,240			As above
90	Site Inspection				$ 3,488			As above
22	General Requirements	30 YR		$ 116,455				
01	Supervision & Management				$ 9,276			As above
02	Project Manager					$ 9,276		As above
90	Five-Year Reviews				$ 78,073			As above
---	Site Close-out Report				$ 29,106			As above

Total Direct Cost Estimate	**$ 4,279,468**		
Subcontractor Markup	$ 96,339		
Overhead, Prime Contractor	$ 504,406		
Profit, Prime Contractor	$ 309,369	Capital	$ 5,106,085
Bond	$ 41,765		
Present Value Cost	$ 800,831	O&M	$ 926,093
Total Estimate	**$ 6,032,178**		

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Alternative 4

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WASTEWATER TREATMENT PLANT at the

FORMER LAKE ONTARIO ORDNANCE WORKS SITE

Remedial Alternative 4 – Sludge-Sediment-Water Removal & Off-site Disposal

Current Working Estimate of Construction Costs (FY14)

Basis of Cost Estimate

This alternative includes the removal of sludge, sediment and water from within the Acid Neutralization Building and Dilution Sump. The structures would not be removed.

The sludge, sediment and water will be removed by pumping and/or excavation and then dewatered. Following dewatering, the solids will be temporarily staged, sampled, analyzed for disposal characterization, and transported to a permitted TSDF. Some additional pretreatment may be necessary to meet land disposal restrictions. The water will be temporarily staged on-site in tanks, sampled, analyzed and appropriately discharged. The sludge/sediment will be temporary staged on-site, dewatered, sampled, analyzed and transported off-site to a permitted TSDF.

Disposal characterization will be required under the land disposal restrictions. At a minimum, testing will be performed to determine RCRA characteristics, PCB concentrations, radionuclide concentrations, and compliance with TSDF requirements.

This alternative will not include post-remedy LUCs, LTM, and five-year reviews.

HTRW REMEDIAL ACTION (CONSTRUCT) (WBS 331XX)

Mobilization and Preparatory Work (WBS 331XX01)

This item includes the following activities:

- Mobilization of Construction Equipment and Facilities
- Submittals / Implementation Plans
- Setup / Construct Temporary Facilities

Mobilization of Construction Equipment and Facilities - This activity includes the transport, initial assembly and setup of construction equipment prior to project startup. Work associated with mobilization will include preparation of equipment for transport, equipment transportation and setup, drivers and equipment operators.

Submittals / Implementation Plans - This activity includes the work incurred prior to, and during, remedial action for obtaining all necessary plans. The plans included are:

- Accident Prevention Plan (APP) / Site Safety and Health Plan (SSHP)
- Water Management Plan
- Construction Quality Control Plan
- Material Handling / Transportation / Disposal Plan
- Sampling and Analysis Plan
- Site Operations Plan
- Radiation Protection Program
- Backfill and Restoration Plan

Each of these plans will be prepared by competent project technical personnel and subject matter experts. A draft of each plan will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final plans.

Setup / Construct Temporary Facilities - This activity includes procurement, setup, and construction of office trailers, storage areas, access roads, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for Construction Equipment / Vehicles
- Lunch / Break Trailer (Craft Labor)
- Portable Toilets
- Aggregate Surfacing (site haul road)
- Project Signs
- Erosion Control

The overall estimated duration for Mobilization and Preparatory Work (WBS 331XX01) is 39 weeks.

<u>Monitoring, Sampling, Testing, and Analysis (WBS 331XX02)</u>

This item includes the following activities:

- Meteorological Monitoring
- Radiation Monitoring
- Air Monitoring and Sampling

- Sampling Liquid Waste
- Sampling Soil and Sediment
- Laboratory Chemical Analysis
- Radioactive Waste Analysis
- Sampling Demolition Debris for Disposal Characterization

Meteorological Monitoring - This activity includes the procurement, setup, testing, and operation of a meteorological station on the project site. These activities will be performed from site mobilization through completion of site demobilization.

Radiation Monitoring - This activity includes the following radiological control (RADCON) crews performing the indicated radiological monitoring activities:

RADCON Crew	Monitoring Activity
RADCON Crew - Baseline	Establish Radiological Controls / Initial Baseline Surveys / Periodic Survey of Site Haul Roads
RADCON Crew - Excavation	Demolition
	Decontamination
RADCON Crew - Incoming / Outgoing	Outgoing Waste Packages
	Incoming Construction Equipment
	Outgoing Construction Equipment

The composition of the RADCON Crews is as follows:

RADCON Crew	Personnel	Equipment
Baseline	(1) Senior Radiation Tech, (1) Radiation Technician, (0.2) Certified Health Physicist	(1) Ludlum 2221, (1) Ludlum 2360, (1) Ludlum 19, (1) Ludlum 43-10-1, (1) Ludlum 44-10, (2) Ludlum 44-7, (1) Trimble GPS
Excavation	(1) Senior Radiation Tech, (1/2) Radiation Technician	(1) Ludlum 2221, (1) Ludlum 177-61, (1) Bicron Micro Rem Meter, (2) Ludlum 44-7, (1) B2/5 FIDLER Probe, (3) F&J LV-1 Low Volume
Incoming / Outgoing	(2) Radiation Technicians	(2) Ludlum 2221, (1) Ludlum 177-61, (1) Ludlum 44-9 Pancake G-M

In all instances were a RADCON crew is supporting another activity (e.g., demolition, solidification, etc.) the duration of the RADCON crew activity is dependent on the duration of the activity being supported.

Air Monitoring and Sampling - This activity includes installation and operation of an assumed four (4) real-time perimeter dust monitors around the project perimeter This activity also includes installation and operation of an assumed one (1) portable sampler to collect air samples at various locations on the project site. Operation of these air monitors consists of monthly retrieval of the air filters and analysis for gross alpha / beta. These activities will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of Demobilization.

Sampling Liquid Waste – This activity includes retrieval of samples of existing water, construction water and precipitation from the Acid Neutralization Building and Dilution Sump for disposal characterization. This will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of demobilization.

Sampling Soil and Sediment - This activity includes retrieval of sludge/sediment samples from the Acid Neutralization Building and Dilution Sump for disposal characterization analysis.

Laboratory Chemical Analysis - This activity includes the following:

- Existing Water From Acid Neutralization Building and Dilution Sump – Disposal characterization analysis for:
    - Volatile organic compounds
    - Semi-volatile organic compounds
    - PCBs
- Acid Neutralization Building Demolition Debris – Disposal Characterization Analysis for:
    - Semi-volatile organic compounds
    - PCBs
    - TCLP Volatile organic compounds
    - TCLP Pesticides
    - TCLP Metals
- Existing Sludge/Sediment From Acid Neutralization Building and Dilution Sump – Disposal Characterization Analysis for:
    - Semi-volatile organic compounds
    - PCBs
    - Volatile organic compounds
    - Pesticides
    - Metals

The duration of these chemical analysis activities is dependent on the duration of the remedial action activities that the analytical activity is supporting.

Radioactive Waste Analysis - This activity includes laboratory radiological analysis of samples from the following:

- Monthly composite of the filters from each air monitoring location will be sent to an off-site laboratory for analysis gross alpha and beta.
- Existing Water From Acid Neutralization Building / Dilution Sump – Disposal characterization analysis for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Existing Sludge/Sediment From Acid Neutralization Building / Dilution Sump – Disposal characterization analysis for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Acid Neutralization Building / Dilution Sump Demolition Debris – Disposal Characterization Analysis for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214

The duration of these analytical activities is dependent on the duration of the construction activities that the analytical activity is supporting.

The overall estimated duration for Monitoring, Sampling, Testing and Analysis (WBS 331XX02) is 36 weeks.

Sitework (WBS 331XX03)

This item includes clearing a work area 20-feet wide around the perimeter of the Acid Neutralization Building / Dilution Sump. This item also includes demolition of approximately 200 feet of existing chain link fence for access to the project site. The overall estimated duration for Sitework (WBS 331XX03) is one (1) week.

Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09)

This item includes transfer to temporary storage of existing pumpable liquids from the Acid Neutralization Building / Dilution Sump. This item also includes amending the sludge in the Acid Neutralization Building / Dilution Sump with a drying agent, excavating the amended sludge, and loading it into lined, sealed containers. The overall estimated duration for Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09) is 16 weeks.

Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10)

This item includes demolition and loading of the following WWTP Structures:

- Acid Neutralization Building Top Slab (Floor El. 317.50)
- Acid Neutralization Building Intermediate Slab (Floor El. 304.50)
- Misc. C&D Material in Acid Neutralization Building

This item also includes decontamination of the interior wall and floor surfaces of the Acid Neutralization Building / Dilution Sump by power washing. The overall estimated duration for Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10) is 13 weeks.

Disposal (Commercial) (WBS 331XX19)

This item includes the following activities:

- Loading Demolition Debris for Disposal
- Hauling Demolition Debris for Disposal
- Hauling Amended Sludge for Disposal
- Hauling Water from WWTP Structure
- Disposal Fees and Taxes

Loading Demolition Debris for Disposal – Assume that a crew consisting of one (1) 1.25 CY Front End Wheel Loader, one (1) Equipment Operator, and one (1) Laborer utilized ½ time will load

demolition debris from the Acid Neutralization Building / Dilution Sump into intermodal or dump containers at an average rate of 20 CY/hour.

Hauling Demolition Debris for Disposal - Assume demolition debris will be hauled to a permitted disposal facility that can accept LAMW-SNM, assumed to be located in the western U.S., approximately 2,500 miles from the project site, in intermodal containers via truck. Assume empty intermodal containers will be returned to the project site via truck. Costs ($ / CWT) for transportation of loaded and empty containers are from the MII Cost Book. Assume that unloading costs are included in unit prices for disposal.

Hauling Amended Sludge for Disposal - Assume amended sludge will be hauled to a permitted disposal facility that can accept LAMW-SNM, assumed to be located in the western U.S., approximately 2,500 miles from the project site, in intermodal containers via truck. Assume empty intermodal containers will be returned to the project site via truck. Costs ($ / CWT) for transportation of loaded and empty containers are from the MII Cost Book. Assume that unloading costs are included in unit prices for disposal.

Hauling Water from WWTP Structures and Lines – Assume that 100% of the existing water from the WWTP structure will be hauled to a permitted waste treatment/disposal facility for disposal as Low Activity Radioactive Waste. Process Water Hauling Fee is from the MII Cost Book. Assume that unloading costs are included in the unit prices for disposal.

Disposal Fees and Taxes – Assume that the composition of materials to be disposed is:

- 333,840 Gallons Water: Low Activity Radioactive Waste – Water
- 221 CY Amended Sludge: Low Activity Radioactive Waste – Containerized waste
- 346 LCY Demolition Debris: Low Activity Mixed Waste - Debris

Unit price for Radioactive Process Water is from the MII Cost Book. Unit prices for Low Activity Radioactive Waste – Containerized waste, and Low Activity Radioactive Waste – Debris disposal are from a current USACE contract with a permitted disposal facility that can accept LAMW-SNM. The overall estimated duration for Disposal (Commercial) (WBS 331XX19) is five (5) weeks.

<u>Site Restoration (WBS 331XX20)</u>

This item includes placement of a self-leveling flowable fill material into the following WWTP structures:

- Acid Neutralization Building / Dilution Sump (following sludge / sediment stabilization)
- Collection Tank (to plug line going to Acid Neutralization Building / Dilution Sump)

- Manholes K, L, M (to plug lines going to Acid Neutralization Building / Dilution Sump)

This item also includes installation of approximately 200 feet of chain link fence which was removed at the project start to provide access to the project site.

The overall estimated duration for Site Restoration (WBS 331XX20) is six (6) weeks.

Demobilization (331XX21)

This item includes the following activities:

- Removal of Temporary Facilities
- Final Decontamination
- Demobilization of Construction Equipment and Facilities
- Submittals

Removal of Temporary Facilities – This activity includes demobilization and dismantling of office trailers, storage, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for construction Equipment / Vehicles
- Lunch / Break Trailer
- Portable Toilets
- Project Signs
- Erosion Control

Final Decontamination – Portable water storage tanks will be decontaminated and verified to meet free-release criteria. Small equipment that is impractical to satisfactorily decontaminate will be processed and disposed as LLRW debris. All construction equipment will be decontaminated until acceptable post-decon analysis for free release from the site is achieved. The Equipment Decontamination Pad will be loaded and packaged for transportation and disposal.

Demobilization of Construction Equipment and Facilities - This activity includes the disassembly, takedown, and transport of construction equipment at the conclusion of project activities. Work associated with demobilization will include preparation of equipment for transport, equipment transportation, drivers and equipment operators.

Submittals – This activity includes preparation of a Construction Documentation Report which will include, at a minimum, all final reports, punch lists, project acceptance, final QA/QC reports and As-Built Drawings. The Construction Documentation Report will be prepared by competent project technical personnel and subject matter experts. A draft of the report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

The overall estimated duration for Demobilization (WBS 331XX21) is 16 weeks.

General Requirements (331XX22)

This item includes the following activities:

- Supervision and Management
- Engineering, Surveying, and Quality Control
- First Aid, Fire Protection, and Traffic Control
- Health & Safety
- Temporary Construction Facilities – Ownership
- Temporary Construction Facilities – Operation
- Project Utilities

Supervision and Management – Assume the following personnel, and associated vehicles, travel and per diem:

- Program Manager (5% time, i.e. 2 hrs/wk., located at home office)
- Project Manager (50% time, i.e., 20 hours/week)
- General Superintendent (On-site full time, 1 trip home/month, per diem, vehicle)

Engineering, Surveying, and Quality Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Civil Engineer (50% time, i.e., 20 hours/week, 7 site visits during dewatering, demolition and decontamination)
- Surveyors (On-site ¼ time, i.e., 10 hours/week; local hire/subcontractor)
- Quality Control Manager (On-site full time, 1 trip home/mo., per diem, vehicle)

First Aid, Fire Protection, and Traffic Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Water Truck w/ Driver (On-site full time, local hire)

Health & Safety - Assume the following personnel, and associated vehicles, travel and per diem:

- Safety & Health Manager (CIH) (½ time, i.e. 20 hrs/mo., 2-day trip to site every month)
- Radiation Safety Officer (On-site full time, 1 trip home/mo., per diem, vehicle)
- Assistant Radiation Safety Officer (On-site 1/2 time, i.e., 20 hours/week, 1 trip home/8 weeks, per diem, vehicle)
- Site Safety & Health Officer (On-site full time, 1 trip home/mo., per diem, vehicle)

Health & Safety also includes the following:

- Health and Safety Training - Includes DOE 10 CFR 835 Training (8 hours)
- Health and Safety Medical Exams – Includes Entry Physical, Exit Physical,
- Personal Protective Equipment (PPE) – Level D, Level C, Level B PPE as required by site conditions.

Temporary Construction Facilities – Ownership – Assume monthly rental expenses for the following:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Lunch / Break Trailer
- Portable Toilets

Temporary Construction Facilities Operation – Assume the following monthly / annual operating expenses:

- Janitors and Cleaning Services – Clean office trailers on a weekly basis
- Haul Road Maintenance

Project Utilities - Assume the following monthly project site utility expenses:

- Telephone
- Electricity
- Water
- Internet

The overall estimated duration for General Requirements (WBS 331XX22) is 32 weeks.

<u>SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT (WBS 333XX)</u>

<u>USACE Labor & Contracts (WBS 331XX01)</u>

This item includes USACE labor and contracts for supervision, administration and construction management during the implementation of the remedial action, from start of Mobilization and Preparatory Work to completion of Demobilization. The estimated level of effort for this item (i.e., 20% of Construction Cost) was provided by CELRB-TD-EE [redacted]). The overall estimated duration for Supervision & Administration (S&A) Construction Management (WBS 333XX) is 75 weeks.

HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES (WBS 34XXX)

FISCAL / FINANCIAL CLOSEOOUT ACTIVITIES (WBS 341XX)

USACE Labor & Contracts (WBS 341XX01)

This item includes USACE labor and contracts for post remedial action closeout activities. The estimated level of effort for this item (i.e., 5% of Construction Costs) was provided by CELRB-TD-EE ([redacted]). The overall estimated duration for Fiscal / Financial Closeout Activities (WBS 341XX) is 104 weeks.

Contractor Assignment and Mark-ups

Assume that a Prime Contractor will self-perform all work except health physics, monitoring well installation and CERCLA Five-Year Reviews. Assume that health physics will be performed by a Health Physics Subcontractor, and monitoring well installation will be performed by a well drilling subcontractor. CERCLA Five-Year Reviews will be performed by and Architect – Engineer (A/E) firm.

Assume that reasonable mark-ups for the Prime Contractor are: Home Office Overhead 15%, Profit 8%, and Bond 1.0%.

Assume that reasonable mark-ups for the Health Physics Subcontractor are: Home Office Overhead 15% and Profit 8%.

Assume that reasonable mark-ups for the Well Drilling Subcontractor are: Home Office Overhead 15% and Profit 10%.

Assume that reasonable mark-ups for the CERCLA Five-Year Review A/E firm are: Home Office Overhead / G&A 55% and Profit 10%.

Sales Tax

An 8.00% New York (Niagara County) Sales Tax is applied to materials.

Escalation

Because this CWE will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Project Schedule

Based on estimated durations of the project WBS items and assumed predecessor / successor relationships between the items, a draft project schedule was prepared. This schedule is based on mobilizing to the project site and working until project completion. No allowance has been made in the schedule or the CWE for interim demobilization / remobilization, seasonal project shut-down, or facility winterization. Based on these assumptions, the estimated overall project construction duration is 75 weeks. Please see Figure 1 for the project schedule.

Figures

FIGURE 1

Lake Ontario Ordnance Works Site
Remedial Alternative #4 - Removal of Sludge/Sediment and Water with Off-site Disposal
Remedial Action Construction Schedule

WBS	Description	Duration
331XX	HTRW REMEDIAL ACTION (CONSTRUCT)	75 Weeks
331XX01	Mobilization and Preparatory Work	39 Weeks
331XX0101	Mobilization of Construction Equipment and Facilities	3 Weeks
331XX0103	Submittals / Implementation Plans	35 Weeks
331XX0104	Setup / Construct Temporary Facilities	4 Weeks
331XX02	Monitoring, Sampling, Testing, and Analysis	36 Weeks
331XX0201	Meteorological Monitoring	32 Weeks
331XX0202	Radiation Monitoring	32 Weeks
331XX0203	Air Monitoring and Sampling	32 Weeks
331XX0205	Sampling Surface Water / Ground Water / Liquid Waste	32 Weeks
331XX0206	Sampling Soil and Sediment	3 Weeks
331XX0209	Laboratory Chemical Analysis	36 Weeks
331XX0210	Radioactive Waste Analysis	36 Weeks
331XX0290	Sampling Demolition Debris for Disposal Characterization	6 Weeks
331XX03	Site Work	1 Week
331XX0301	Demolition (Fence)	1 Week
331XX0302	Clearing and Grubbing	1 Week
331XX09	Liquids / Sediments / Sludges Collection and Containment	16 Weeks
331XX0906	Pumping / Draining / Collection	16 Weeks
331XX10	Drums / Tanks / Structures / Miscellaneous Demolition and Removal	13 Weeks
331XX1003	Structure Removal (Demolition & Decontamination)	13 Weeks
331XX19	Disposal (Commercial)	5 Weeks
331XX1921	Transportation to Storage / Disposal Facility	3 Weeks
331XX1922	Disposal Fees and Taxes	3 Weeks
331XX20	Site Restoration	6 Weeks
331XX2001	Earthwork (Backfill)	6 Weeks
331XX2003	Permanent Features (Fence)	1 Week
331XX21	Demobilization	16 Weeks
331XX2101	Removal of Temporary Facilities	4 Weeks
331XX2103	Final Decontamination	2 Weeks
331XX2104	Demobilization of Construction Equipment and Facilities	3 Weeks
331XX2106	Submittals	16 Weeks
331XX22	General Requirements	32 Weeks
331XX2201	Supervision and Management	32 Weeks
331XX2204	Engineering, Surveying, and Quality Control	32 Weeks
331XX2206	First Aid, Fire Protection, Traffic Control, and Security	32 Weeks
331XX2207	Health & Safety	32 Weeks
331XX2208	Temporary Construction Facilities - Ownership	32 Weeks
331XX2209	Temporary Construction Facilities - Operation	32 Weeks
331XX2210	Project Utilities	32 Weeks
333XX	SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MGT	75 Weeks
333XX01	USACE Labor & Contracts	75 Weeks

LOOW FS Alt 4 Sludge / Sediment / Water Removal & Off-site Disposal CWE FY14 MII 4-2B3

This alternative includes the removal of sludge/sediment and water within the Acid Neutralization Building / Dilution Sump The structures will not be removed. The sludge/sediment and water will be removed by pumping and/or excavation and then dewatered. Following dewatering, the solids would be temporarily staged, sampled and analyzed for disposal characterization, and transported to a permitted TSDF. The water would be temporarily staged on-site in tanks and appropriately discharged.

Estimated by	CELRB-TD-DE
Designed by	CELRB-TD-FE
Prepared by	[redacted]
Preparation Date	5/1/2014
Effective Date of Pricing	5/1/2014
Estimated Construction Time	525 Days

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Description	Quantity	UOM	ContractCost	ProjectCost
Project Cost			**5,922,793**	**5,922,793**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**5,685,881**	**5,685,881**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**4,738,234**	**4,738,234**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**333,390**	**333,390**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**452,356**	**452,356**
331XX03 Site Work	**1.00**	**EA**	**5,528**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**272,840**	**272,840**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**189,711**	**189,711**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**1,172,478**	**1,172,478**
331XX20 Site Restoration	**1.00**	**EA**	**362,622**	**362,622**
331XX21 Demobilization	**1.00**	**EA**	**130,089**	**130,089**
331XX22 General Requirements	**1.00**	**EA**	**1,819,220**	**1,819,220**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**947,647**	**947,647**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**947,647**	**947,647**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**236,912**	**236,912**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**236,912**	**236,912**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**236,912**	**236,912**

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost
Project Indirect Summary			**4,897,794**	**63,995**	**3,777,231**	**566,585**	**347,505**	**46,913**	**5,922,793**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**4,660,882**	**63,995**	**3,777,231**	**566,585**	**347,505**	**46,913**	**5,685,881**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**3,713,235**	**63,995**	**3,777,231**	**566,585**	**347,505**	**46,913**	**4,738,234**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**265,772**	**0**	**265,772**	**39,866**	**24,451**	**3,301**	**333,390**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**328,295**	**32,315**	**360,610**	**54,092**	**33,176**	**4,479**	**452,356**
331XX03 Site Work	**1.00**	**EA**	**4,407**	**0**	**4,407**	**661**	**405**	**55**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**217,503**	**0**	**217,503**	**32,625**	**20,010**	**2,701**	**272,840**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**151,234**	**0**	**151,234**	**22,685**	**13,914**	**1,878**	**189,711**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**934,677**	**0**	**934,677**	**140,202**	**85,990**	**11,609**	**1,172,478**
331XX20 Site Restoration	**1.00**	**EA**	**289,076**	**0**	**289,076**	**43,361**	**26,595**	**3,590**	**362,622**
331XX21 Demobilization	**1.00**	**EA**	**103,704**	**0**	**103,704**	**15,556**	**9,541**	**1,288**	**130,089**
331XX22 General Requirements	**1.00**	**EA**	**1,418,567**	**31,681**	**1,450,248**	**217,537**	**133,423**	**18,012**	**1,819,220**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**947,647**	**0**	**0**	**0**	**0**	**0**	**947,647**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**947,647**	**0**	**0**	**0**	**0**	**0**	**947,647**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**236,912**	**0**	**0**	**0**	**0**	**0**	**236,912**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**236,912**	**0**	**0**	**0**	**0**	**0**	**236,912**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**236,912**	**0**	**0**	**0**	**0**	**0**	**236,912**

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectCost
Project Direct Summary			**2,314,963**	**301,222**	**598,617**	**1,682,992**	**4,897,794**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.0**	**EA**	**2,078,051**	**301,222**	**598,617**	**1,682,992**	**4,660,882**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.0**	**EA**	**1,130,404**	**301,222**	**598,617**	**1,682,992**	**3,713,235**
331XX01 Mobilization and Preparatory Work	**1.0**	**EA**	**169,878**	**12,752**	**71,357**	**11,786**	**265,772**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.0**	**EA**	**33,604**	**3,549**	**33,927**	**257,216**	**328,295**
331XX03 Site Work	**1.0**	**EA**	**3,470**	**937**	**0**	**0**	**4,407**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.0**	**EA**	**90,427**	**81,801**	**5,095**	**40,180**	**217,503**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.0**	**EA**	**98,452**	**52,782**	**0**	**0**	**151,234**
331XX19 Disposal (Commercial)	**1.0**	**EA**	**1,732**	**559**	**0**	**932,386**	**934,677**
331XX20 Site Restoration	**1.0**	**EA**	**65,725**	**20,800**	**202,551**	**0**	**289,076**
331XX21 Demobilization	**1.0**	**EA**	**77,196**	**9,841**	**6,214**	**10,453**	**103,704**
331XX22 General Requirements	**1.0**	**EA**	**589,921**	**118,201**	**279,473**	**430,972**	**1,418,567**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.0**	**EA**	**947,647**	**0**	**0**	**0**	**947,647**
333XX01 USACE Labor & Contracts	**1.0**	**EA**	**947,647**	**0**	**0**	**0**	**947,647**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**236,912**	**0**	**0**	**0**	**236,912**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**236,912**	**0**	**0**	**0**	**236,912**
341XX01 USACE Labor & Contracts	**1.0**	**EA**	**236,912**	**0**	**0**	**0**	**236,912**

LOOW WWTP FS

Cost Estimate for Alternative 4 - Removal of Sludge/Sediment and Water with Off-site Disposal

WBS	Description	Duration	Direct Cost			Notes
331XX	**HTRW Construction Activities**	**75 WK**	**$ 3,713,235**			
01	Mob & Prep Work	39 WK	$ 265,772			
01	Mob Const Equip & Facilities	3 WK	$ 7,579			
01	Transport Vehicles			$ 3,084		
02	Drivers			$ 2,461		
07	Const Equipment			$ 1,182		
08	Equip Operators			$ 1,705		
03	Submittals/Plans	35 WK	$ 142,141			
08	APP/SSHP			$ 22,429		
12	Water Management Plan			$ 15,825		
14	CQC Plan			$ 17,784		
15	Waste Handling/Transportation/Disposal			$ 12,827		
22	Sampling & Analysis Plan			$ 29,786		
24	Site Operations Plan			$ 28,318		
90	Radiation Protection Plan			$ 17,807		
93	Backfill & Restoration Plan			$ 15,172		
04	Setup/Construct Temp Facilities	4 WK	$ 116,052			
01	Office Trailers			$ 9,285		
01	Contractor Trailer				$ 9,285	Double wide, (2) 50' x 10'
02	Storage Facilities			$ 1,172		
04	Decon Facilities for Personnel			$ 14,255		
05	Decon Facilities for Equipment			$ 20,592		
01	Grading				$ 3,926	
02	Geosynthetics				$ 1,134	40 mil HDPE
03	Aggregate				$ 999	
--	Bituminous				$ 4,005	8-in thick layer, 20' x 40'
--	Decon Equipment				$ 10,528	pressure washer, decon fluids, misc supplies, & poly sheeting
07	Lunch Break Trailer			$ 8,662		50' x 10'
10	Toilets			$ 443		
16	Truck Scales			$ 32,788		
23	Aggregate Surfacing			$ 27,669		Haul road maintenance, 1' thick gravel, 1,000 LF
28	Signs			$ 1,380		
30	Erosion Control			$ 32,595		Silt fence, 3,500 LF
02	Monitoring, Sampling, Testing, Analysis	36 WK	$ 328,295			
01	Meteorological Monitoring	32 WK	$ 7,316			
01	Met Station			$ 7,316		
02	Radiation Monitoring	32 WK	$ 31,319			
90	Establish Controls / Initial Baseline Surveys			$ 4,110		RADCON Crew [Sr Rad Tech (1), Rad Tech (1), CHP (0.2), 5 instruments & GPS]
91	Excavation Monitoring			$ 19,931		RADCON Crew above will support the excavation crew
94	Outgoing Waste Packages			$ 624		RADCON Crew [2 Rad Techs], 9 hrs
95	Incoming Construction Equipment Monitoring			$ 3,327		RADCON Crew; 48 hrs
95	Outgoing Construction Equipment Monitoring			$ 3,327		RADCON Crew; 48 hrs
03	Air Monitoring & Sampling	32 WK	$ 55,675			
01	Real Time			$ 48,920		4 particulate stations
90	Portable Sampler			$ 6,755		1 portable particulate sampler
05	Sampling - SW, GW, & Liquid Waste	32 WK	$ 1,750			
	Sampling			$ 270		20 samples
05	Sample Shipping & Handling			$ 1,480		
06	Sampling - Soil & Sediment	3 WK	$ 946			
03	Sludge/Sediment			$ 337		25 samples
04	Shipping & Handling			$ 609		
08	Sampling Radioactive Contaminated Media		$ 4,402			85 samples
09	Laboratory Chemical Analysis	36 WK	$ 124,600			
02	Water Quality & Wastewater (disposal characterization)			$ 7,807		VOCs, SVOCs, & PCBs
05	C&D Materials (disposal characterization)			$ 1,705		RCRA Characteristics; TCLP VOCs, SVOCs, Pest/PCBs, & Metals; & PCBs
07	Soil & Sediment (disposal characterization)			$ 42,625		RCRA Characteristics; TCLP VOCs, SVOCs, Pest/PCBs, & Metals; & PCBs
10	Laboratory Radiological Analysis	36 WK	$ 102,213			
02	Air			$ 2,938		Gross Alpha & Beta
03	Liquid			$ 13,461		20 samples; Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
05	Sediment/Soil			$ 31,319		25 samples; Alpha Spec (Pu, Ra, Th, U), Gross Alpha, Gas Flow Prop (Sr-90, Pb-210)
--	Sediment (pre-treatment)				$ 15,660	
06	Misc (C&D material)			$ 54,495		Alpha Spec (Pu, Ra, Th, U), Gross Alpha, Gas Flow Prop (Sr-90, Pb-210)
--	Disposal Characterization				$ 1,253	2 samples
--	Surface Wipes, Interior Walls & Floor				$ 53,242	85 samples
90	Sampling C&D Material & Sample Shipping	6 WK		$ 76		2 samples
03	Site Work	1 WK	$ 4,407			
01	Demolition		$ 924			Fence
02	Clearing and Grubbing		$ 3,483			20 ft wide area around Acid Neutralization Bldg/Dilution Sump
09	Liquid/Sed/Sludge Collection & Containment	16 WK	$ 217,503			
06	Pumping/Draining/Collection		$ 217,503			333,840 gal

LOOW WWTP FS

Cost Estimate for Alternative 4 - Removal of Sludge/Sediment and Water with Off-site Disposal

WBS	Description	Duration	Direct Cost				Notes
331XX	**HTRW Construction Activities**	**75 WK**	**$ 3,713,235**				
01	Pumping WWTP Water			$ 195,463			
03	Collection (remove sed/sludge from WWTP structures)			$ 22,040			210 CY sludge
10	Demolition and Removal	13 WK	$ 151,234				346 CY
03	Structure Removal			$ 151,234			
02	Demolition			$ 102,488			
01	Decontamination			$ 48,746			
19	Disposal	5 WK	$ 934,677				
21	Transportation to TSDF	3 WK		$ 68,272			
01	Loading/Hauling/Unloading			$ 58,256			
--	Loading Demolition Debris				$ 2,291		84 CY
--	Hauling Demolition Debris				$ 40,335		692 Tons
--	Hauling Amended Sludge				$ 15,630		141 Tons
02	Pumping/Hauling of Liquid/Sed/Sludge			$ 10,015			
--	Hauling WWTP Water				$ 10,015		333,840 gal
22	Disposal Fees & Taxes			$ 866,406			
91	LARW Disposal			$ 812,776			
--	Water				$ 747,802		333,840 gal
	Amended Sludge				$ 64,974		221 CY
02	LAMW Disposal			$ 53,630			
--	Demolition Debris				$ 53,630		346 CY
20	Site Restoration	6 WK	$ 289,076				
01	Earthwork	6 WK		$ 273,109			
03	Backfill			$ 273,109			Plugging lines and structures
03	Permanent Features	1 WK		$ 15,967			
90	Perimeter Fence			$ 15,967			Replace fence around Acid Neutralization Bldg/Dilution Sump
21	Demobilization	16 WK	$ 103,704				
01	Removal of Temporary Facilities	4 WK		$ 27,360			
01	Office Trailers			$ 2,090			
02	Storage Facilities			$ 1,172			
04	Decon Facilities, Personnel			$ 14,524			
05	Decon Facilities, Equipment			$ 2,192			
07	Lunch/Break Trailer			$ 2,590			
10	Toilets			$ 443			
16	Truck Scales			$ 1,640			
30	Erosion Control			$ 2,710			
03	Final Decontamination	2 WK		$ 22,548			
01	Storage Tanks			$ 11,672			Decon of two 20,000 storage tanks, 40 hrs total
02	Construction Equipment			$ 10,876			
04	Demobilization of Construction Equip & Facilities	3 WK		$ 7,579			
01	Transport Vehicles			$ 3,084			Demob of 6 loads of construction equipment @ 8 hrs/load = 48 hrs
02	Drivers			$ 2,461			
07	Construction Equipment			$ 1,182			
08	Equipment Operators			$ 852			6 loads x 2 hrs/load = 12 hrs
06	Submittals	16 WK		$ 46,217			
05	Const Documentation Report			$ 46,217			
22	General Requirements	32 WK	$ 1,418,567				
01	Supervision and Management	32 WK		$ 189,450			
01	Program Manager			$ 4,893			2 hrs/wk; no site visits
02	Project Manager			$ 49,470			20 hrs/wk; travel to site 2 times during construction
03	General Superintendent			$ 84,558			40 hrs/wk; located on-site
11	Vehicles			$ 15,499			
--	General Superintendent				$ 15,499		
12	Travel & Per Diem			$ 35,030			
01	Travel				$ 3,695		
03	General Superintendent					$ 3,695	
02	Per Diem				$ 31,335		
03	General Superintendent					$ 31,335	
04	Engineering, Surveying, & QC	32 WK		$ 237,708			
02	Civil Engineer			$ 37,482			20 hrs/wk; located at home office
10	Surveyors			$ 28,491			10 hrs/wk; 2 person crew
22	Surveying Equipment & Supplies			$ 2,819			
25	QC Manager			$ 71,133			Located on-site; 40 hrs/wk for 71 WK
28	Vehicles			$ 13,267			
---	Civil Engineer				$ 1,539		21 days
---	QC Manager				$ 11,728		32 WK
29	Travel & Per Diem			$ 84,514			
01	Travel				$ 11,500		
---	Civil Engineer					$ 3,500	7 trips
25	QC Manager					$ 8,000	Travel home 1/4.33 wks for 71 WK

LOOW WWTP FS

Cost Estimate for Alternative 4 - Removal of Sludge/Sediment and Water with Off-site Disposal

WBS	Description	Duration	Direct Cost					Notes
331XX	**HTRW Construction Activities**	**75 WK**	**$ 3,713,235**					
02	Per Diem					$ 73,014		
---	Civil Engineer						$ 3,472	7 trips; 2 days travel & M&IE, 3 days lodging each trip
25	QC Manager						$ 69,542	On-site full time
06	First Aid, Fire Protection, Traffic Control, & Securuty	32 WK		$ 125,786				
10	Water Truck				$ 125,786			40 hrs/wk for 32 WK
07	Health & Safety	32 WK		$ 760,613				
01	CIH (Safety & Health Manager)				$ 3,757			2 hrs/wk; located @ home office, no site visits
02	Asst Rad Safety Officer				$ 30,023			20 hrs/wk; located on-site, trip home every 8 wks
03	Rad Safety Officer				$ 100,888			40 hrs/wk; located on-site, trip home every month
07	Site Safety & Health Officer				$ 79,153			40 hrs/wk; located on-site, trip home every month
14	Health & Safety Training (HTW & Rad)				$ 19,339			
02	DOE 10 CFR 835 Training					$ 19,339		
15	Medical Exams				$ 106,565			
01	Entry Exams					$ 53,283		4 hrs per worker + $800/ea
02	Exit Exams					$ 53,283		4 hrs per worker + $800/ea
16	PPE				$ 305,861			
01	Monitoring, Sampling, Testing & Analysis (Rad)					$ 22,421		
02	Collection & Containment of Liquids & Sediment					$ 61,438		
03	Removal of Tanks & C&D Materials					$ 73,413		
05	Disposal					$ 1,194		
06	Demobilization					$ 916		
--	General Requirements				$ 146,479			PPE for spervision & management personnel (General Superintendent, Surveyors, QC Manager, RAD Techs, truck drivers, H&S personnel)
24	Vehicles				$ 30,998			Vehicles for SS&H staff
25	Travel & Per DIem				$ 84,028			Travel & Per Diem for S&H Manager, Safety Officer, Asst Rad Officer, & Rad Officer
01	Travel					$ 9,390		Staff as above
02	Per Diem					$ 74,638		Staff as above
08	Temp Facilities (Ownership)	32 WK		$ 76,584				
01	Trailers & Facilities				$ 4,565			Trailers: Contractor Office, HP, Storage, Toilets, Decon, Lunch Break, & Gov't
03	Warehouse & Storage Facilities				$ 1,477			
08	Portable Toilets				$ 3,270			
11	Decon Facilities				$ 62,707			
14	Break Trailer & Facilities				$ 4,565			
09	Temp Facilities (Operation)	32 WK		$ 7,674				
04	Janitorial Svcs				$ 1,218			
12	Haul Rd Maintenance				$ 6,456			
10	Utilities	32 WK		$ 20,752				
01	Phone				$ 6,385			
02	Electric				$ 9,578			
04	Water				$ 2,394			
90	Internet				$ 2,394			
333XX	**USACE Supervision & Administration, Const Management**	**75 WK**	**$ 947,647**					20% of construction cost
34XXX	**USACE HTRW Post Const & Financial Closeout**	**72 WK**	**$ 236,912**					5% of construction cost
01	Labor & Contracts			$ 236,912				

Total (Direct Cost) Estimate	**$ 4,897,794**		
Subcontractor Markup	$ 63,995		
Overhead, Prime Contractor	$ 566,585		
Profit, Prime Contractor	$ 347,505	Capital	$ 5,922,792
Bond	$ 46,913		
Total Estimate	**$ 5,922,792**	O&M	$ -

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Alternative 6

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WASTEWATER TREATMENT PLANT at the

FORMER LAKE ONTARIO ORDNANCE WORKS SITE

Remedial Alternative 6 – In-situ Solidification

Current Working Estimate of Construction Costs (FY14)

Basis of Cost Estimate R3

The in-situ solidification alternative involves immobilizing the contaminated sludge/sediment and potentially contaminated construction materials in the Acid Neutralization Building / Dilution Sump to minimize the potential for human contact with the COCs. Solidification would mix the contaminated materials with inorganic cementious/pozzolanic reagents to transform them into a durable, solid, low hydraulic conductivity material. Water in the structures would be removed prior to solidification in order to meet a prescribed liquid-to-solid ratio for solidifying reagents. Self-compacting fill would be placed over the strengthened sludge. The structures and underground lines would remain. Contaminants would also remain in the solidified mass at levels that would not allow unlimited use and unrestricted exposure. Land Use Controls, Long Term Monitoring (30-year) and five-year reviews would be required.

HTRW REMEDIAL ACTION (CONSTRUCT) (WBS 331XX)

Mobilization and Preparatory Work (WBS 331XX01)

This item includes the following activities:

- Mobilization of Construction Equipment and Facilities
- Submittals / Implementation Plans
- Setup / Construct Temporary Facilities

Mobilization of Construction Equipment and Facilities - This activity includes the transport, initial assembly and setup of construction equipment prior to project startup. Work associated with mobilization will include preparation of equipment for transport, equipment transportation and setup, drivers and equipment operators.

Submittals / Implementation Plans - This activity includes the work incurred prior to, and during, remedial action for obtaining all necessary plans. The plans included are:

- Accident Prevention Plan (APP) / Site Safety and Health Plan (SSHP)

- Water Management Plan
- Construction Quality Control Plan
- Material Handling / Transportation / Disposal Plan
- Sampling and Analysis Plan
- Site Operations Plan
- Solidification Treatability Study
- Radiation Protection Program
- Backfill and Restoration Plan

Each of these plans will be prepared by competent project technical personnel and subject matter experts. A draft of each plan will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final plans.

Setup / Construct Temporary Facilities - This activity includes procurement, setup, and construction of office trailers, storage areas, access roads, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for Construction Equipment / Vehicles
- Lunch / Break Trailer (Craft Labor)
- Portable Toilets
- Aggregate Surfacing (site haul road)
- Project Signs
- Erosion Control

The overall estimated duration for Mobilization and Preparatory Work (WBS 331XX01) is 39 weeks.

<u>Monitoring, Sampling, Testing, and Analysis (WBS 331XX02)</u>

This item includes the following activities:

- Meteorological Monitoring
- Radiation Monitoring
- Air Monitoring and Sampling
- Monitoring Wells
- Sampling Liquid Waste
- Sampling Soil and Sediment

- Laboratory Chemical Analysis
- Radioactive Waste Analysis
- Geotechnical Testing
- Sampling Demolition Debris for Disposal Characterization

Meteorological Monitoring - This activity includes the procurement, setup, testing, and operation of a meteorological station on the project site. These activities will be performed from site mobilization through completion of site demobilization.

Radiation Monitoring - This activity includes the following radiological control (RADCON) crews performing the indicated radiological monitoring activities:

RADCON Crew	Monitoring Activity
RADCON Crew - Baseline	Establish Radiological Controls / Initial Baseline Surveys / Periodic Survey of Site Haul Roads
RADCON Crew - Excavation	Demolition
	Solidification
RADCON Crew - Incoming / Outgoing	Outgoing Waste Packages
	Incoming Construction Equipment
	Outgoing Construction Equipment

The composition of the RADCON Crews is as follows:

RADCON Crew	Personnel	Equipment
Baseline	(1) Senior Radiation Tech, (1) Radiation Technician, (0.2) Certified Health Physicist	(1) Ludlum 2221, (1) Ludlum 2360, (1) Ludlum 19, (1) Ludlum 43-10-1, (1) Ludlum 44-10, (2) Ludlum 44-7, (1) Trimble GPS
Excavation	(1) Senior Radiation Tech, (1/2) Radiation Technician	(1) Ludlum 2221, (1) Ludlum 177-61, (1) Bicron Micro Rem Meter, (2) Ludlum 44-7, (1) B2/5 FIDLER Probe, (3) F&J LV-1 Low Volume
Incoming / Outgoing	(2) Radiation Technicians	(2) Ludlum 2221, (1) Ludlum 177-61, (1) Ludlum 44-9 Pancake G-M

In all instances were a RADCON crew is supporting another activity (e.g., demolition, solidification, etc.) the duration of the RADCON crew activity is dependent on the duration of the activity being supported.

Air Monitoring and Sampling - This activity includes installation and operation of an assumed four (4) real-time perimeter dust monitors around the project perimeter This activity also

includes installation and operation of an assumed one (1) portable sampler to collect air samples at various locations on the project site. Operation of these air monitors consists of monthly retrieval of the air filters and analysis for gross alpha / beta. These activities will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of Demobilization.

Monitoring Wells – This activity includes decommissioning of one (1) monitoring well to a depth of 25 ft in the vicinity of the Acid Neutralization Building. This well is assumed to be in the way of remedial activities. This activity also includes installation of two (2) monitoring wells in the vicinity of the Acid Neutralization Building / Dilution Sump. These monitoring wells will be used for monitoring the long term performance of this alternative.

Sampling Liquid Waste – This activity includes retrieval of samples of existing water, construction water and precipitation from WWTP structures and lines for disposal characterization. This will begin at the start of Mobilization and Preparatory Work, and conclude at the completion of demobilization.

Sampling Soil and Sediment - This activity includes retrieval of sludge/sediment samples from WWTP structures and lines for performance of the solidification treatability study. This activity also includes retrieval of solidified sludge/sediment samples for verification analysis.

Laboratory Chemical Analysis - This activity includes the following:

- Existing Water From WWTP Structure – Disposal characterization analysis for:
    - Volatile organic compounds
    - TCLP Semi-volatile organic compounds
    - PCBs
- WWTP Structure Demolition Debris – Disposal Characterization Analysis for:
    - Semi-volatile organic compounds
    - PCBs
    - TCLP Volatile organic compounds
    - TCLP Pesticides
    - TCLP Metals
- Existing Sludge/Sediment From WWTP Structures – Treatability Study Analysis by Static Leaching Test for:
    - PCBs

- Solidified Sludge/Sediment From WWTP Structure – Verification Analysis by Static Leaching Test for:
    - PCBs

The duration of these chemical analysis activities is dependent on the duration of the remedial action activities that the analytical activity is supporting.

Radioactive Waste Analysis - This activity includes laboratory radiological analysis of samples from the following:

- Monthly composite of the filters from each air monitoring location will be sent to an off-site laboratory for analysis gross alpha and beta.
- Existing Water From WWTP Structure – Disposal characterization analysis for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Existing Sludge/Sediment From WWTP Structure – Treatability Study Analysis by Static Leaching Test:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- Solidified Sludge/Sediment From WWTP Structure – Verification Analysis by Static Leaching Test for:
    - Pu-238, Pu-239/240
    - Ra-226, Ra-228
    - Th-228, Th-230, Th-232, Th-234
    - U-234, U-235, U-238
    - Pb-210, Pb-212, Pb-214
- WWTP Structure Demolition Debris – Disposal Characterization Analysis for:
    - Pu-238, Pu-239/240

- Ra-226, Ra-228
- Th-228, Th-230, Th-232, Th-234
- U-234, U-235, U-238
- Pb-210, Pb-212, Pb-214

The duration of these analytical activities is dependent on the duration of the construction activities that the analytical activity is supporting.

Geotechnical Testing - This activity includes the following:

- Strength:
  - Existing sludge/sediment – Treatability Study
  - Solidified sludge/sediment – Verification

- Permeability
  - Existing sludge/sediment – Treatability Study
  - Solidified sludge/sediment – Verification

The duration of these geotechnical testing activities is dependent on the duration of the construction activities that the testing activity is supporting.

The overall estimated duration for Monitoring, Sampling, Testing and Analysis (WBS 331XX02) is 29 weeks.

<u>Sitework (WBS 331XX03)</u>

This item includes clearing a work area 20-feet wide around the perimeter of the Acid Neutralization Building / Dilution Sump. This item also includes demolition of approximately 200 feet of existing chain link fence for access to the project site. The overall estimated duration for Sitework (WBS 331XX03) is one (1) week.

<u>Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09)</u>

This item includes transfer to temporary storage of existing pumpable liquids from the Acid Neutralization Building /Dilution Sump. The overall estimated duration for Liquids / Sediments / Sludges Collection and Containment (WBS 331XX09) is nine (9) weeks.

<u>Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10)</u>

This item includes demolition and loading of the following WWTP Structures:

- Acid Neutralization Building Top Slab (Floor El. 317.50)
- Acid Neutralization Building Intermediate Slab (Floor El. 304.50)

- Misc. C&D Material in Acid Neutralization Building

The overall estimated duration for Drums / Tanks / Structures / Miscellaneous Demolition and Removal (WBS 331XX10) is four (4) weeks.

Stabilization / Fixation / Encapsulation (WBS 331XX15)

This item includes solidification by reagent (Portland cement) addition and mixing of sludge / sediment in the Acid Neutralization Building / Dilution Sump. The overall estimated duration for Stabilization / Fixation / Encapsulation (WBS 331XX15) is one (1) week.

Disposal (Commercial) (WBS 331XX19)

This item includes the following activities:

- Loading Demolition Debris for Disposal
- Hauling Demolition Debris for Disposal
- Hauling Water from WWTP Structure
- Disposal Fees and Taxes

Loading Demolition Debris for Disposal – Assume that a crew consisting of one (1) 1.25 CY Front End Wheel Loader, one (1) Equipment Operator, and one (1) Laborer utilized ½ time will load demolition debris from the Acid Neutralization Building / Dilution Sump into intermodal or dump containers at an average rate of 20 CY/hour.

Hauling Demolition Debris for Disposal - Assume demolition debris will be hauled to a permitted disposal facility that can accept LAMW, assumed to be located in the western U.S., approximately 2,500 miles from the project site, in intermodal containers via truck. Assume empty intermodal containers will be returned to the project site via truck. Costs ($ / CWT) for transportation of loaded and empty containers are from the MII Cost Book. Assume that unloading costs are included in unit prices for disposal.

Hauling Water from WWTP Structures and Lines – Assume that 100% of the existing water from the WWTP structure will be hauled to a permitted waste treatment/disposal facility for disposal as Low Activity Radioactive Waste. Process Water Hauling Fee is from the MII Cost Book. Assume that unloading costs are included in the unit prices for disposal.

Disposal Fees and Taxes – Assume that the composition of materials to be disposed is:

- 333,840 Gallons Water: Low Activity Radioactive Waste - Water
- 346 LCY Demolition Debris: Low Activity Mixed Waste - Debris

Unit price for Radioactive Process Water is from the MII Cost Book. Unit prices for Low Activity Radioactive Waste – Soil and Low Activity Radioactive Waste – Debris disposal are from a current USACE contract with a permitted disposal facility that can accept LAMW. The overall estimated duration for Disposal (Commercial) (WBS 331XX19) is five (5) weeks.

Site Restoration (WBS 331XX20)

This item includes placement of a self-leveling flowable fill material into the following WWTP structures:

- Acid Neutralization Building / Dilution Sump (following sludge / sediment stabilization)
- Collection Tank (to plug line going to Acid Neutralization Building / Dilution Sump)
- Manholes K, L, M (to plug lines going to Acid Neutralization Building / Dilution Sump)

This item also includes installation of approximately 200 feet of chain link fence which was removed at the project start to provide access to the project site.

The overall estimated duration for Site Restoration (WBS 331XX20) is eight (8) weeks.

Demobilization (331XX21)

This item includes the following activities:

- Removal of Temporary Facilities
- Final Decontamination
- Demobilization of Construction Equipment and Facilities
- Submittals

Removal of Temporary Facilities – This activity includes demobilization and dismantling of office trailers, storage, and other temporary facilities. The facilities included are:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Decontamination Facilities for construction Equipment / Vehicles
- Lunch / Break Trailer
- Portable Toilets
- Project Signs
- Erosion Control

Final Decontamination – Portable water storage tanks will be decontaminated and verified to meet free-release criteria. Small equipment that is impractical to satisfactorily decontaminate will be processed and disposed as LLRW debris. All construction equipment will be decontaminated until acceptable post-decon analysis for free release from the site is achieved. The Equipment Decontamination Pad will be loaded and packaged for transportation and disposal.

Demobilization of Construction Equipment and Facilities - This activity includes the disassembly, takedown, and transport of construction equipment at the conclusion of project activities. Work associated with demobilization will include preparation of equipment for transport, equipment transportation, drivers and equipment operators.

Submittals – This activity includes preparation of a Construction Documentation Report which will include, at a minimum, all final reports, punch lists, project acceptance, final QA/QC reports and As-Built Drawings. The Construction Documentation Report will be prepared by competent project technical personnel and subject matter experts. A draft of the report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

The overall estimated duration for Demobilization (WBS 331XX21) is 18 weeks.

<u>General Requirements (331XX22)</u>

This item includes the following activities:

- Supervision and Management
- Engineering, Surveying, and Quality Control
- First Aid, Fire Protection, and Traffic Control
- Health & Safety
- Temporary Construction Facilities – Ownership
- Temporary Construction Facilities – Operation
- Project Utilities

Supervision and Management – Assume the following personnel, and associated vehicles, travel and per diem:

- Program Manager (5% time, i.e. 2 hrs/wk., located at home office)
- Project Manager (50% time, i.e., 20 hours/week)
- General Superintendent (On-site full time, 1 trip home/month, per diem, vehicle)

Engineering, Surveying, and Quality Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Civil Engineer (50% time, i.e., 20 hours/week, 7 site visits during dewatering, demolition and solidification)
- Surveyors (On-site ¼ time, i.e., 10 hours/week; local hire/subcontractor)
- Quality Control Manager (On-site full time, 1 trip home/mo., per diem, vehicle)

First Aid, Fire Protection, and Traffic Control - Assume the following personnel, and associated vehicles, travel and per diem:

- Water Truck w/ Driver (On-site full time, local hire)

Health & Safety - Assume the following personnel, and associated vehicles, travel and per diem:

- Safety & Health Manager (CIH) (½ time, i.e. 20 hrs/mo., 2-day trip to site every month)
- Radiation Safety Officer (On-site full time, 1 trip home/mo., per diem, vehicle)
- Assistant Radiation Safety Officer (On-site 1/2 time, i.e., 20 hours/week, 1 trip home/8 weeks, per diem, vehicle)
- Site Safety & Health Officer (On-site full time, 1 trip home/mo., per diem, vehicle)

Health & Safety also includes the following:

- Health and Safety Training - Includes DOE 10 CFR 835 Training (8 hours)
- Health and Safety Medical Exams – Includes Entry Physical, Exit Physical,
- Personal Protective Equipment (PPE) – Level D, Level C, Level B PPE as required by site conditions.

Temporary Construction Facilities – Ownership – Assume monthly rental expenses for the following:

- Contractor Office Trailer
- Storage Facilities
- Decontamination Facilities for Personnel
- Lunch / Break Trailer
- Portable Toilets

Temporary Construction Facilities Operation – Assume the following monthly / annual operating expenses:

- Janitors and Cleaning Services – Clean office trailers on a weekly basis
- Haul Road Maintenance

Project Utilities - Assume the following monthly project site utility expenses:

- Telephone
- Electricity
- Water
- Internet

The overall estimated duration for General Requirements (WBS 331XX22) is 25 weeks.

SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT (WBS 333XX)

USACE Labor & Contracts (WBS 331XX01)

This item includes USACE labor and contracts for supervision, administration and construction management during the implementation of the remedial action, from start of Mobilization and Preparatory Work to completion of Demobilization. The estimated level of effort for this item (i.e., 20% of Construction Cost) was provided by CELRB-TD-EE ([redacted] The overall estimated duration for Supervision & Administration (S&A) Construction Management (WBS 333XX) is 72 weeks.

HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES (WBS 34XXX)

FISCAL / FINANCIAL CLOSEOOUT ACTIVITIES (WBS 341XX)

USACE Labor & Contracts (WBS 341XX01)

This item includes USACE labor and contracts for post remedial action closeout activities. The estimated level of effort for this item (i.e., 5% of Construction Costs) was provided by CELRB-TD-EE [redacted]). The overall estimated duration for Fiscal / Financial Closeout Activities (WBS 341XX) is 104 weeks.

HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION) (WBS 342XX)

It is assumed that post-remediation program consisting of environmental monitoring will be implemented for a period of thirty (30) years after this alternative is implemented.

Monitoring, Sampling, Testing, and Analysis (WBS 342XX02)

This item includes the following activities:

- Monitoring Wells
- Sampling Surface Water / Groundwater / Liquid Waste
- Laboratory Chemical Analysis

- Annual Site Inspection

Monitoring Wells - This item includes an allowance of $500 / year for repairs to the monitoring wells.

Sampling Surface Water / Groundwater / Liquid Waste - This activity includes continued quarterly sampling of an estimated four (4) groundwater wells on the project site for off-site chemical laboratory analysis.

Laboratory Chemical Analysis – This activity includes continued groundwater chemical analysis for PCBs.

Annual Site Inspection – This activity includes an annual inspection of the project site. It is assumed that this inspection will be performed by a Project Engineer and a Construction Inspector.

The overall estimated duration for Monitoring, Sampling, Testing, and Analysis (WBS 342XX02) is 30 years.

<u>General Requirements (WBS 342XX22)</u>

This item includes the following activities:

- Supervision and Management
- Five-Year Reviews
- Site Closeout Report

Supervision and Management – Assume that a Project Manager will work on the project an average of 10 hours per month during the 30-year Long Term Monitoring (LTM) period following completion of remedial construction.

Five-Year Review – This activity includes performance by competent project technical personnel of a five-year review process in Years 5, 10, 15, 20, 25 and 30 following completion of remedial construction. The five-year review process will address the following components:

- Community involvement and notification
- Document review
- Data review and analysis
- Site inspection
- Interviews
- Protectiveness determination

A draft of the five-year review findings report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

Site Closeout Report - This activity includes preparation of a Site Closeout Report in Year 30 following completion of remedial construction by competent project technical personnel and subject matter experts. A draft of the report will undergo an internal independent technical review prior to submittal to the USACE. Responses to USACE (and other government agencies) review comments will be formulated and incorporated into the final report.

The overall estimated duration for General Requirements (WBS 342XX22) is 30 years.

Contractor Assignment and Mark-ups

Assume that a Prime Contractor will self-perform all work except health physics, monitoring well installation and CERCLA Five-Year Reviews. Assume that health physics will be performed by a Health Physics Subcontractor, and monitoring well installation will be performed by a well drilling subcontractor. CERCLA Five-Year Reviews will be performed by and Architect – Engineer (A/E) firm.

Assume that reasonable mark-ups for the Prime Contractor are: Home Office Overhead 15%, Profit 8%, and Bond 1.0%.

Assume that reasonable mark-ups for the Health Physics Subcontractor are: Home Office Overhead 15% and Profit 8%.

Assume that reasonable mark-ups for the Well Drilling Subcontractor are: Home Office Overhead 15% and Profit 10%.

Assume that reasonable mark-ups for the CERCLA Five-Year Review A/E firm are: Home Office Overhead / G&A 55% and Profit 10%.

Sales Tax

An 8.00% New York (Niagara County) Sales Tax is applied to materials.

Escalation

Because this CWE will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Present Value Analysis

Remedial action projects typically involve construction costs that are expended at the beginning of a project (capital costs) and costs in subsequent years (operation and maintenance and periodic costs). Present value (PV) analysis is a method to evaluate expenditures which occur over different periods of time. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single value, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed. PV analysis uses a discount rate and period of analysis to calculate the PV of each expenditure.

Discount Rate

A discount rate is the difference between interest and inflation rates. When inflation is neglected, the discount rate is simply an interest rate, and is used to account for the time value of money. A dollar is worth more today than in the future because, if invested today, the dollar would earn interest. The choice of a discount rate is important because the selected rate directly impacts the present value of a cost estimate, which is then used in making a remedy selection decision.

Based on guidance provided by Huntsville Center – Programs & Planning Branch (28Mar13 email, [redacted] to [redacted]; Subject: Request Direction on Interest / Discount Rates for Present Value Calculations of O&M Costs on FUSRAP Projects) the "Consumer Price Index, All Urban Consumers, U.S. city average, for All Items" average annual percentage change from 1913 to present was selected because "For a government project, particularly an O&M exercise, your discount rate need only control for the long term tendency of costs of labor and materials to rise over time. In other words, the discount rate and the inflation rate should be about equal. The inflation statistic with the longest period of actual data collection is the Bureau of Labor Statistic's Consumer Price Index (CPI) with approximately 100 years worth of data points. While the CPI is not construction specific its long life has an advantage. Theoretically you could argue that use of this statistic account for all events affecting inflation with a probability of occurring in the next 100 years (the wars, the recessions, depressions, etc.) and you need only worry about those events which occur at frequency of less than once every 100 years (nuclear war, global pandemics, global warming and other unknowns and unknowable unknowns)." The average annual percentage change from 1913 to present for this index was calculated to be 3.33%.

Present Value

The present value of a single periodic future payment is calculated using the following equation:

$$PV = \frac{x_t}{(1+i)^t}$$

Where:

PV = Present value
x_t = Payment in year t (t = 0 for present or base year)
i = Discount factor
t = Number of years following construction that expenditure occur

The PV of a series of equal annual future payments such as annual Long Term Monitoring payments is calculated using the following equation:

$$PV = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

Where:

PV = Present value
x_t = Payment in year t (t = 0 for present or base year)
i = Discount factor
t = Number of years following construction that expenditure occur

MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate report, a Miscellaneous Owner Cost mark-up titled "Present Value" was applied to the annual cost elements to result in a Project Cost that accurately depicts the Present Value of the annual cost elements over the 30 year Long Term Monitoring period. For *i* = 3.33%, the numerical value used for this mark-up in the MII cost estimate is 1779.01.

For the CERCLA Five-Year Reviews, the present value for each of six (6) five-year reviews was calculated as above. MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate, an Owner Cost mark-up titled "Present Value" was applied to the Five-Year Review cost element over the 30 year Long Term Monitoring period. For *i* = 3.33%, the numerical value used for this mark-up in the MII cost estimate is 251.6. This value was used so that the resulting MII Long Term Monitoring Project Costs accurately reflect the present value calculation.

The present value of the preparation cost of the Site Closeout Report in Year 30 was calculated as above. MII does not support present value calculations. Therefore, for presentation purposes in the MII cost estimate, a Miscellaneous Owner Cost mark-up titled "Present Value" was applied to the preparation cost of the Site Closeout Report in Year 30. For *i* = 3.33%, the numerical value used for this mark-up in the MII cost estimate is -62.57**.** This value was used so

that the resulting MII Long Term Monitoring Project Costs accurately reflect the present value calculation.

Project Schedule

Based on estimated durations of the project WBS items and assumed predecessor / successor relationships between the items, a draft project schedule was prepared. This schedule is based on mobilizing to the project site and working until project completion. No allowance has been made in the schedule or the CWE for interim demobilization / remobilization, seasonal project shut-down, or facility winterization. Based on these assumptions, the estimated overall project construction duration is 72 weeks. Please see Figure 1 for the project schedule.

It is assumed that post–remediation Long Term Monitoring activities will continue for thirty (30) calendar years following completion of construction activities.

Figures

FIGURE 1

Lake Ontario Ordnance Works Site
Remedial Alternative 6 - In-situ Solidification
Remedial Action Construction Schedule R3

WBS	Description	Duration
331XX	HTRW REMEDIAL ACTION (CONSTRUCT)	72 Weeks
331XX01	Mobilization and Preparatory Work	39 Weeks
331XX0101	Mobilization of Construction Equipment and Facilities	3 Weeks
331XX0103	Submittals / Implementation Plans	35 Weeks
331XX0104	Setup / Construct Temporary Facilities	4 Weeks
331XX02	Monitoring, Sampling, Testing, and Analysis	29 Weeks
331XX0201	Meteorological Monitoring	25 Weeks
331XX0202	Radiation Monitoring	25 Weeks
331XX0203	Air Monitoring and Sampling	25 Weeks
331XX0204	Monitoring Wells	2 Weeks
331XX0205	Sampling Surface Water / Ground Water / Liquid Waste	13 Weeks
331XX0206	Sampling Soil and Sediment	15 Weeks
331XX0209	Laboratory Chemical Analysis	29 Weeks
331XX0210	Radioactive Waste Analysis	29 Weeks
331XX0211	Geotechnical Testing	18 Weeks
331XX0290	Sampling Demolition Debris for Disposal Characterization	4 Weeks
331XX03	Site Work	1 Week
331XX0301	Demolition (Fence)	1 Week
331XX0302	Clearing and Grubbing	1 Week
331XX09	Liquids / Sediments / Sludges Collection and Containment	9 Weeks
331XX0906	Pumping / Draining / Collection	9 Weeks
331XX10	Drums / Tanks / Structures / Miscellaneous Demolition and Removal	4 Weeks
331XX1003	Structure Removal	4 Weeks
331XX15	Stabilization / Fixation / Encapsulation	1 Week
331XX1503	In-Situ Pozzolan Process (Lime / Portland Cement)	1 Week
331XX19	Disposal (Commercial)	5 Weeks
331XX1921	Transportation to Storage / Disposal Facility	3 Weeks
331XX1922	Disposal Fees and Taxes	3 Weeks
331XX20	Site Restoration	6 Weeks
331XX2001	Earthwork (Backfill)	6 Weeks
331XX2003	Permanent Features (Fence)	1 Week
331XX21	Demobilization	18 Weeks
331XX2101	Removal of Temporary Facilities	4 Weeks
331XX2103	Final Decontamination	2 Weeks
331XX2104	Demobilization of Construction Equipment and Facilities	3 Weeks
331XX2106	Submittals	16 Weeks
331XX22	General Requirements	25 Weeks
331XX2201	Supervision and Management	25 Weeks
331XX2204	Engineering, Surveying, and Quality Control	25 Weeks
331XX2206	First Aid, Fire Protection, Traffic Control, and Security	25 Weeks
331XX2207	Health & Safety	25 Weeks
331XX2208	Temporary Construction Facilities - Ownership	25 Weeks
331XX2209	Temporary Construction Facilities - Operation	25 Weeks
331XX2210	Project Utilities	25 Weeks
333XX	SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MGT	72 Weeks
333XX01	USACE Labor & Contracts	72 Weeks

LOOW FS Alt 6 In-situ Solidification CWE FY14 MII 4-2B3 (Rev3)

The in situ solidification alternative involves immobilizing contaminated sludge/sediment and potentially contaminated construction materials. Solidification would mix the contaminated materials with inorganic cementitious/pozzolanic reagents to transform them onto a durable, solid, low hydraulic conductivity material. Water within the structures would be removed prior to solidification in order to meet a prescribed liquid-to-solid ratio for the solidifying reagents. The structures would remain. Contaminants would also remain in the solidified mass at levels that would not allow UU/UE. LUCs, LTM and five-year reviews would be required.

The column titled "OwnerMarkup" on the Project Cost summary includes the necesary adjustment to the corresponding Contract Cost to reflect the Present Value of the time-valued stream of estimated costs.

Estimated by	CELRB-TD-DE
Designed by	CELRB-TD-FE
Prepared by	[redacted]
Preparation Date	5/9/2014
Effective Date of Pricing	5/9/2014
Estimated Construction Time	504 Days

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Description	Quantity	UOM	ContractCost	OwnerMarkup	ProjectCost
Project Cost			**5,210,483**	**800,831**	**6,011,314**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**4,784,934**	**0**	**4,784,934**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**3,987,445**	**0**	**3,987,445**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**416,589**	**0**	**416,589**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**158,203**	**0**	**158,203**
331XX03 Site Work	**1.00**	**EA**	**5,528**	**0**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**245,193**	**0**	**245,193**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**128,563**	**0**	**128,563**
331XX15 Stabilization / Fixation / Encapsulation	**1.00**	**EA**	**18,674**	**0**	**18,674**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**1,071,366**	**0**	**1,071,366**
331XX20 Site Restoration	**1.00**	**EA**	**325,050**	**0**	**325,050**
331XX21 Demobilization	**1.00**	**EA**	**137,573**	**0**	**137,573**
331XX22 General Requirements	**1.00**	**EA**	**1,480,704**	**0**	**1,480,704**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**797,489**	**0**	**797,489**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**797,489**	**0**	**797,489**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**425,549**	**800,831**	**1,226,380**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**199,372**	**0**	**199,372**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**199,372**	**0**	**199,372**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.00**	**EA**	**226,177**	**800,831**	**1,027,008**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**11,048**	**196,549**	**207,598**
342XX22 General Requirements	**1.00**	**EA**	**215,129**	**604,281**	**819,410**

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost
Project Indirect Summary			**4,259,542**	**96,339**	**3,359,020**	**503,853**	**309,030**	**41,719**	**5,210,483**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.00**	**EA**	**3,934,908**	**41,297**	**3,178,716**	**476,807**	**292,442**	**39,480**	**4,784,934**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.00**	**EA**	**3,137,419**	**41,297**	**3,178,716**	**476,807**	**292,442**	**39,480**	**3,987,445**
331XX01 Mobilization and Preparatory Work	**1.00**	**EA**	**327,787**	**4,309**	**332,097**	**49,815**	**30,553**	**4,125**	**416,589**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**113,879**	**12,237**	**126,117**	**18,917**	**11,603**	**1,566**	**158,203**
331XX03 Site Work	**1.00**	**EA**	**4,407**	**0**	**4,407**	**661**	**405**	**55**	**5,528**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.00**	**EA**	**195,463**	**0**	**195,463**	**29,320**	**17,983**	**2,428**	**245,193**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.00**	**EA**	**102,488**	**0**	**102,488**	**15,373**	**9,429**	**1,273**	**128,563**
331XX15 Stabilization / Fixation / Encapsulation	**1.00**	**EA**	**14,887**	**0**	**14,887**	**2,233**	**1,370**	**185**	**18,674**
331XX19 Disposal (Commercial)	**1.00**	**EA**	**854,073**	**0**	**854,073**	**128,111**	**78,575**	**10,608**	**1,071,366**
331XX20 Site Restoration	**1.00**	**EA**	**259,124**	**0**	**259,124**	**38,869**	**23,839**	**3,218**	**325,050**
331XX21 Demobilization	**1.00**	**EA**	**109,671**	**0**	**109,671**	**16,451**	**10,090**	**1,362**	**137,573**
331XX22 General Requirements	**1.00**	**EA**	**1,155,639**	**24,750**	**1,180,390**	**177,058**	**108,596**	**14,660**	**1,480,704**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.00**	**EA**	**797,489**	**0**	**0**	**0**	**0**	**0**	**797,489**
333XX01 USACE Labor & Contracts	**1.00**	**EA**	**797,489**	**0**	**0**	**0**	**0**	**0**	**797,489**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**324,634**	**55,042**	**180,304**	**27,046**	**16,588**	**2,239**	**425,549**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.00**	**EA**	**199,372**	**0**	**0**	**0**	**0**	**0**	**199,372**
341XX01 USACE Labor & Contracts	**1.00**	**EA**	**199,372**	**0**	**0**	**0**	**0**	**0**	**199,372**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.00**	**EA**	**125,262**	**55,042**	**180,304**	**27,046**	**16,588**	**2,239**	**226,177**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.00**	**EA**	**8,807**	**0**	**8,807**	**1,321**	**810**	**109**	**11,048**
342XX22 General Requirements	**1.00**	**EA**	**116,455**	**55,042**	**171,497**	**25,724**	**15,778**	**2,130**	**215,129**

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectCost
Project Direct Summary			**2,072,563**	**258,392**	**520,649**	**1,407,938**	**4,259,542**
33XXX HTRW CONSTRUCTION ACTIVITIES	**1.0**	**EA**	**1,773,339**	**258,392**	**501,641**	**1,401,535**	**3,934,908**
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)	**1.0**	**EA**	**975,850**	**258,392**	**501,641**	**1,401,535**	**3,137,419**
331XX01 Mobilization and Preparatory Work	**1.0**	**EA**	**188,899**	**14,377**	**72,026**	**52,486**	**327,787**
331XX02 Monitoring, Sampling, Testing, and Analysis	**1.0**	**EA**	**27,201**	**4,683**	**12,886**	**69,110**	**113,879**
331XX03 Site Work	**1.0**	**EA**	**3,470**	**937**	**0**	**0**	**4,407**
331XX09 Liquids / Sediments / Sludges Collection and Containment	**1.0**	**EA**	**79,974**	**75,309**	**0**	**40,180**	**195,463**
331XX10 Drums / Tanks / Structures / Miscellaneous Demolition and Removal	**1.0**	**EA**	**65,283**	**37,205**	**0**	**0**	**102,488**
331XX15 Stabilization / Fixation / Encapsulation	**1.0**	**EA**	**1,335**	**3,616**	**9,936**	**0**	**14,887**
331XX19 Disposal (Commercial)	**1.0**	**EA**	**1,732**	**559**	**0**	**851,782**	**854,073**
331XX20 Site Restoration	**1.0**	**EA**	**59,009**	**18,639**	**181,477**	**0**	**259,124**
331XX21 Demobilization	**1.0**	**EA**	**79,080**	**10,724**	**6,214**	**13,653**	**109,671**
331XX22 General Requirements	**1.0**	**EA**	**469,867**	**92,345**	**219,102**	**374,325**	**1,155,639**
333XX SUPERVISION & ADMINISTRATION (S&A) CONSTRUCTION MANAGEMENT	**1.0**	**EA**	**797,489**	**0**	**0**	**0**	**797,489**
333XX01 USACE Labor & Contracts	**1.0**	**EA**	**797,489**	**0**	**0**	**0**	**797,489**
34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**299,224**	**0**	**19,008**	**6,403**	**324,634**
341XX FISCAL / FINANCIAL CLOSEOUT ACTIVITIES	**1.0**	**EA**	**199,372**	**0**	**0**	**0**	**199,372**
341XX01 USACE Labor & Contracts	**1.0**	**EA**	**199,372**	**0**	**0**	**0**	**199,372**
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)	**1.0**	**EA**	**99,852**	**0**	**19,008**	**6,403**	**125,262**
342XX02 Monitoring, Sampling, Testing, and Analysis	**1.0**	**EA**	**2,405**	**0**	**0**	**6,403**	**8,807**
342XX22 General Requirements	**1.0**	**EA**	**97,447**	**0**	**19,008**	**0**	**116,455**

LOOW WWTP FS
Cost Estimate for Alternative 6 - In Situ Solidification

WBS	Description	Duration	Direct Cost			Notes
331XX	**HTRW Construction Activities**	**72 WK**	**$ 3,137,419**			
01	Mob & Prep Work	39 WK	$ 327,787			
01	Mob Const Equip & Facilities	3 WK	$ 21,788			
01	Transport Vehicles			$ 3,084		
02	Drivers			$ 2,461		
07	Const Equipment			$ 440		
08	Equip Operators			$ 852		
09	Initial Assembly & Setup			$ 11,750		
01	Assemble Mixer to Hydraulic Excavator				$ 4,250	assemble mixer to hydraulic excavator, 4-person crew, 8 hrs
03	Set-up Training				$ 7,500	
90	Transport Cost for Mixers & Pressure Feeders			$ 3,200		
03	Submittals/Plans	35 WK	$ 189,948			
08	APP/SSHP			$ 22,429		
12	Water Management Plan			$ 15,825		
14	CQC Plan			$ 17,784		
15	Waste Handling/Transportation/Disposal			$ 12,827		
22	Sampling & Analysis Plan			$ 29,786		
24	Site Operations Plan			$ 28,318		
30	Other Technology Plans			$ 30,000		Solidification Treatability Study Plan
90	Radiation Protection Plan			$ 17,807		
93	Backfill & Restoration Plan			$ 15,172		
04	Setup/Construct Temp Facilities	4 WK	$ 116,052			
01	Office Trailers			$ 9,285		
01	Contractor Trailer				$ 9,285	Double wide, (2) 50' x 10'
02	Storage Facilities			$ 1,172		
04	Decon Facilities for Personnel			$ 14,255		
05	Decon Facilities for Equipment			$ 20,592		20' x 50'
01	Grading				$ 3,926	
02	Geosynthetics				$ 1,134	40 mil HDPE
03	Aggregate Layer				$ 999	1' thick
--	Bituminous Layer				$ 4,005	8-in thick layer, 20' x 40'
--	Decon Equipment				$ 10,528	pressure washer, decon fluids, misc supplies, & poly sheeting
07	Lunch Break Trailer			$ 8,662		50' x 10'
10	Toilets			$ 443		
23	Aggregate Surfacing			$ 27,669		Haul road maintenance, 1' thick gravel, 1,000 LF
28	Signs			$ 1,380		
30	Erosion Control			$ 32,595		Silt fence, 3,500 LF
02	Monitoring, Sampling, Testing, Analysis	29 WK	$ 113,879			
01	Meteorological Monitoring	25 WK	$ 7,316			As above
01	Met Station			$ 7,316		As above
02	Rad Monitoring	25 WK	$ 21,977			
90	Establish Rad Controls, Initial Baseline Surveys			$ 4,110		40 hr RADCON Crew [Sr Rad Tech (1), Rad Tech (1), CHP (0.2), 6 instruments & GPS]
91	Monitoring During Demolition & Solidification			$ 10,588		
---	Demolition				$ 9,966	
---	Solidification				$ 623	
94	Outgoing Waste Monitoring			$ 624		RADCON Crew [2 Rad Techs]
95	Incoming Construction Equipment Monitoring			$ 3,327		RADCON Crew; 96 hrs, same as Rev 0
95	Outgoing Construction Equipment Monitoring			$ 3,327		RADCON Crew; 96 hrs, same as Rev 0
03	Air Monitoring & Sampling	25 WK	$ 41,756			
01	Real Time			$ 36,690		4 stations @ perimeter
02	Portable Sampler			$ 5,066		1 portable sampler
04	Monitoring Wells	2 WK	$ 7,800			
--	Well Decommissioning			$ 567		1 well
--	Well Installation			$ 7,234		2 wells
05	Sampling - SW, GW, & Liquid Waste	13 WK	$ 1,750			
03	Liquid Waste			$ 270		20 samples
05	Sample Shipping & Handling			$ 1,480		
06	Sampling - Sludge & Sediment	15 WK	$ 227			
03	Sludge/Sediment (WWTP structures)			$ 81		6 samples
---	Sludge/Sediment Sampling for Treatability Study				$ 54	4 samples
---	Sludge/Sediment Sampling for Verification Analysis				$ 27	2 samples
04	Shipping & Handling			$ 146		
09	Lab Chemical Analysis	29 WK	$ 9,697			
02	Water Quality & Wastewater (disposal characterization)			$ 7,807		
01	WWTP Water				$ 7,807	
05	Haz Waste (RCRA) Analysis			$ 853		Demolition debris
07	Sludge & Sediment			$ 1,037		Treatability Study analysis (TCLP PCBs)
10	Lab Rad Analysis	29 WK	$ 20,049			
---	Air			$ 2,203		Misc, gross alpha & beta, gas flow proportional counting
---	Liquid			$ 13,461		Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
---	Disposal Characterization				$ 13,461	
05	Sludge/Sediment, Treatability Study			$ 3,758		24 samples; Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)
06	Misc (Disposal Characterization)			$ 626		3 samples; Alpha Spec (Pu, Ra, Th, U), Gross Alpha & Beta, Gas Flow Prop (Sr-90, Pb-210)

LOOW WWTP FS
Cost Estimate for Alternative 6 - In Situ Solidification

WBS	Description	Duration	Direct Cost				Notes
11	Geotechnical Testing	18 WK	$ 3,246				
90	Sampling & Shipping Demolition Debris	4 WK	$ 62				Disposal Characterization
03	Site Work	1 WK	$ 4,407				
01	Demolition		$ 924				Fence, ~200 ft.
02	Clearing and Grubbing		$ 3,483				20 ft wide area around Acid Neutralization Bldg & Dilution Sump
09	Liquid/Sed/Sludge Collection & Containment	9 WK	$ 195,463				333,840 gal
06	Pumping/Draining/Collection		$ 195,463				
01	Acid Neutralization Bldg & Dilution Sump Water			$ 195,463			
10	Demolition & Removal	4 WK	$ 102,488				346 CY
03	Structure Removal		$ 102,488				
02	Demolition			$ 102,488			
15	Stabilization/Solidification	1 WK	$ 14,887				210 CY
03	In-Situ Pozzolan Process		$ 14,887				
19	Disposal	5 WK	$ 854,073				
21	Transportation to TSDF	3 WK	$ 52,642				
01	Loading/Hauling/Unloading			$ 42,626			
--	Loading				$ 2,291		346 CY
--	Hauling				$ 40,335		692 Tons
02	Pumping/Hauling of Liquid	3 WK		$ 10,015			
--	Acid Neutralization Bldg & Dilution Sump Water				$ 10,015		333,840 gal
22	Disposal Fees & Taxes		$ 801,432				
01	LARW Disposal			$ 747,802			
--	Water				$ 747,802		333,840 gal
02	LAMW Disposal			$ 53,630			
--	Demolition Debris				$ 53,630		346 CY
20	Site Restoration	6 WK	$ 259,124				
01	Earthwork		$ 243,157				
03	Backfill			$ 243,157			1,890 CY, flowable fill placed above solidified sediment
03	Permanent Features		$ 15,967				Perimeter fence
21	Demobilization	18 WK	$ 109,671				
01	Removal of Temp Facilities	4 WK	$ 27,360				
01	Office Trailers			$ 2,090			
01	Contractor's Trailer				$ 2,090		
02	Storage Facilities			$ 1,172			
04	Decon Facilities, Personnel			$ 14,524			
05	Decon Facilities, Equipment			$ 2,192			
07	Lunch/Break Trailer			$ 2,590			
10	Toilets			$ 443			
16	Truck Scales			$ 1,640			
30	Erosion Control			$ 2,710			
03	Final Decontamination	2 WK	$ 21,806				
01	Storage Tanks			$ 11,672			Decon of two 20,000 storage tanks, 40 hrs total
02	Construction Equipment			$ 10,134			Decon of 4 pieces of construction equipment, 32 hrs total (8 hrs/piece)
04	Demobilization of Construction Equip & Facilities	3 WK	$ 14,288				
01	Transport Vehicles			$ 3,084			Demob of 6 loads of construction equipment @ 8 hrs/load = 48 hrs
02	Drivers			$ 2,461			As above
07	Construction Equipment			$ 440			As above
08	Equipment Operators			$ 852			6 loads x 2 hrs/load = 12 hrs
09	Final Disassembly & Takedown			$ 4,250			
01	Disassemble Mixer				$ 4,250		
90	Transport Cost for Mixers & Pressure Feeders			$ 3,200			
06	Submittals	16 WK	$ 46,217				
05	Const Documentation Report			$ 46,217			
22	General Requirements	25 WK	$ 1,155,639				
01	Supervision and Management		$ 148,121				
01	Program Manager			$ 3,822			2 hrs/wk; no travel
02	Project Manager			$ 38,649			20 hrs/wk; located off-site, no travel
03	General Superintendent			$ 66,061			40 hrs/wk; located on-site
11	Vehicles			$ 12,109			
12	Travel & Per Diem			$ 27,480			
01	Travel				$ 3,000		
02	Per Diem				$ 24,480		
04	Engineering, Surveying, & QC		$ 204,533				
02	Civil Engineer			$ 29,283			20 hrs/wk; located at home office, site visit every 4 wks (26 WK/4 WK-visit = 7 visits)
10	Surveyors			$ 22,259			10 hrs/wk; 2 person crew
22	Surveying Equipment & Supplies			$ 2,203			
25	QC Manager			$ 55,573			40 hrs/wk; located on-site
28	Vehicles			$ 10,702			
---	Civil Engineer				$ 1,539		7 site visits @ 3 days each
---	QC Manager				$ 9,163		
29	Travel & Per Diem			$ 84,514			
01	Travel				$ 11,500		
---	Civil Engineer					$ 3,500	As above

LOOW WWTP FS
Cost Estimate for Alternative 6 - In Situ Solidification

WBS	Description	Duration	Direct Cost					Notes
25	QC Manager						$ 8,000	
02	Per Diem					$ 73,104		
---	Civil Engineer						$ 3,472	As above
25	QC Manager						$ 69,542	
06	First Aid, Fire Protection, Traffic Control, & Security		$ 98,270					
10	Water Truck			$ 98,270				
07	Health & Safety		$ 622,675					
01	CIH (Safety & Health Manager)			$ 2,935				2 hrs/wk; located at home office, no site visits
02	Asst Rad Safety Officer			$ 23,456				20 hrs/wk; located on-site
03	Rad Safety Officer			$ 78,819				40 hrs/wk; located on-site
07	Site Safety & Health Officer			$ 61,838				As above
14	Health & Safety Training (HTW & Rad)			$ 19,339				
02	DOE 10 CFR 835 Training					$ 19,339		
15	Medical Exams			$ 106,565				
01	Entry Exams					$ 53,283		4 hrs/worker + $800 direct cost
02	Exit Exams					$ 53,283		As above
16	PPE			$ 239,859				
01	Monitoring, Sampling, Testing & Analysis (Rad)					$ 12,069		Includes baseline survey, demolition, solidification, & outgoing waste surveys
02	Liquid, Sed/Sludge Collection					$ 61,438		
03	Demolition & Removal					$ 48,907		
04	Solidification					$ 897		
05	Disposal					$ 1,194		
06	Demobilization					$ 916		
01	Final Decontamination						$ 916	
---	General Requirements					$ 114,436		PPE for supervision & mgmt personnel (Gen Superintendent, Surveyors, Civil Engineer, QC Mgr, Truck Driver, RSO, Asst RSO, & SSHO)
24	Vehicles			$ 24,218				Vehicles for S&H Manager, Safety Officer, Asst Rad Officer, & Rad Officer
25	Travel & Per DIem			$ 65,647				Travel & Per Diem for Asst RSO, RSO, & SSHO
01	Travel					$ 7,336		Travel, staff as above
02	Per Diem					$ 58,311		Per Diem, staff as above
08	Temp Facilities (Ownership)		$ 59,832					
01	Trailers & Facilities			$ 3,567				Trailers: Contractor Office, HP, Storage, Toilets, Decon, Lunch Break, & Gov't
03	Warehouse & Storage Facilities			$ 1,154				
08	Portable Toilets			$ 2,555				
11	Decon Facilities			$ 48,990				
14	Break Trailer & Facilities			$ 3,567				
09	Temp Facilities (Operation)		$ 5,995					Trailer cleaning & road maintenance
04	Janitorial Services			$ 952				
12	Haul Rd Maintenance			$ 5,043				
10	Utilities		$ 16,212					Phone, electric, water, & Internet
01	Phone			$ 4,988				
02	Electric			$ 7,483				
04	Water			$ 1,871				
90	Internet			$ 1,871				
333XX	**USACE Supervision & Administration, Const Management**	**72 WK**	**$ 797,489**					
34XXX	**USACE HTRW Post Const & Financial Closeout**	**72 WK**	**$ 324,634**					
341XX	Fiscal/Financial Closeout Activities		$ 199,372					
01	Labor & Contracts			$ 199,372				
342XX	HTRW Operation & Maintenance		$ 125,262					Includes LTM, five-year reviews, and site closeout activities
02	Monitoring, Sampling, Testing, & Analysis			$ 8,807				
04	Monitoring Well Repair				$ 500			
05	GW Sampling				$ 579			
09	Lab Analysis - Chemical				$ 4,240			
90	Site Inspection				$ 3,488			
22	General Requirements			$ 116,455				
01	Supervision & Management				$ 9,276			
02	Project Manager					$ 9,276		
90	Five-Year Reviews				$ 78,073			
---	Site Close-out Report				$ 29,106			

Total Direct Cost Estimate	**$ 4,259,542**		
Subcontractor Markup	$ 96,339		
Overhead, Prime Contractor	$ 503,395		
Profit, Prime Contractor	$ 308,749	O&M	$ 926,094
Bond	$ 41,681		
Present Value Cost	$ 800,832	Capital	$ 5,085,220
Total Estimate	**$ 6,011,314**		