Remedial Investigation/ Feasibility Study

Verona Research Facility
Germany Road
Verona, New York
NYSDEC Site #633046

Interim Remedial Measures Work Plan

Prepared for:

Air Force Research Laboratory
Rome Research Site

150 Electronic Parkway
Rome, New York 13441

August 2014

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Prepared By:

Lu Engineers
ENVIRONMENTAL • TRANSPORTATION • CIVIL

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Verona, New York 13478
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I, Robert Hutteman certify that I am currently a NYS registered professional engineer and that this Interim Remedial Measures Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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1.0 Introduction

Lu Engineers has prepared this Interim Remedial Measures (IRM) Work Plan on behalf of the Air Force Research Laboratory (AFRL), Rome Research Site (RRS), Civil Engineering Branch, Environmental and Occupational Health Office (RIOCV) for approval by the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER). This plan has been prepared in accordance with NYSDEC Department of Environmental Restoration DER-10 "Technical Guidance for Site Investigation and Remediation", and Interim Final guidance for conducting Remedial Investigations and Feasibility Studies (October 1988-Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.3-01).

This work plan is presented to provide a scope of work for the completion of interim remedial measures (IRMs) during the Remedial Investigation / Feasibility Study (RI/FS) of the RRS-owned property at the Verona Research Facility (VRF) (the Site), which is currently underway. As defined within DER-10, an IRM is an action taken to mitigate environmental or human exposures before completion of the remedial investigation and remedial alternative selection. IRMs may include removal of wastes and contaminated materials, and environmental media. The use of a non-emergency IRM is encouraged when a source of contamination or exposure pathway can be effectively addressed prior to completion of the investigation and remedy selection process.

The goal of the IRMs is to remove areas of contamination and environmental conditions considered to have the greatest potential for human exposure and migration. The IRM efforts described in this plan represent the planned remedial actions developed as a result of the findings of the 2013 Environmental Baseline Survey (EBS) and 2013-2014 Remedial Investigation/Feasibility Study (RI/FS) completed at the VRF. The location of the VRF is indicated on Figure 1, Site Location Map. The EBS and RI/FS reports identified eleven areas of concern (AOC) at the Site.

VRF-AOC-01 - Sanitary Sewer System
VRF-AOC-02 - Primary Power System
VRF-AOC-03 - Former Petroleum Storage
VRF-AOC-04 - Former Solvent Disposal
VRF-AOC-05 - Former PCB-Containing Equipment
VRF-AOC-06 - Former ODC-Containing Equipment
VRF-AOC-07 - Waste Disposal Area (WDA)-01 Former Drum Disposal
VRF-AOC-07 - Waste Disposal Area (WDA)-02 Klein Property
VRF-AOC-07 - Waste Disposal Area (WDA)-03 Former Landfill
VRF-AOC-08 - B1233 Investigation and Cleanup
VRF-AOC-09 - Site-wide Groundwater Contamination
VRF-AOC-10 - Site-wide Soil contamination
VRF-AOC-11 - Brandy Brook Sediments

Based on the EBS and RI/FS findings interim at each AOC, Lu Engineers determined that the following nine AOCs require remedial action to attain unrestricted use criteria per 6 NYCRR Part 375:

VRF-AOC-01 - Sanitary Sewer System
VRF-AOC-02 - Primary Power System
VRF-AOC-03 - Former Petroleum Storage
VRF-AOC-05 - Former PCB-Containing Equipment
VRF-AOC-07 - Waste Disposal Area (WDA-03) Former Landfill
VRF-AOC-08 - B1233 Investigation and Cleanup
VRF-AOC-09 - Site-wide Groundwater Contamination
VRF-AOC-10 - Site-wide Soil contamination
VRF-AOC-11 - Brandy Brook Sediments

The remaining AOCs (VRF-AOC-04 – Former Solvent Disposal, VRF-AOC-06 – Former ODC-Containing Equipment and VRF-AOC-07 WDAs 01 and 02) did not require additional investigation or remedial measures and therefore are not included in this work plan.

A summary of the recommended remedy for each AOC is provided below.

- **VRF-AOC-01**: Flush, clean and crush septic tanks and associated contaminated manhole structures as necessary to remove contaminated contents and affected soils; flush and clean associated sewer lines; dispose of waste; in-situ bioremediation for the soils associated with the filter bed media
- **VRF-AOC-02**: Remove and dispose of accessible free-phase oil from system to prevent further spillage
- **VRF-AOC-03**: Remediate petroleum-contaminated soils using in-situ biopiles and accessible free-phase oil; and use ORC or equivalent to address residual contamination
- **VRF-AOC-05**: Remove and dispose of transformer, concrete pad and underlying soil at B1226, B1233, B1245, B1255 and B1266, decontaminate building surfaces at B1287 and B1298 and remove/dispose of surface soils on east side of B1287
- **VRF-AOC-07(WDA-03)**: Remove and dispose of solid wastes, remediate contaminated soils, and dewater as necessary
- **VRF-AOC-08**: Excavate, and dispose of hazardous and non-hazardous soils and dewater
- **VRF-AOC-09**: Complete in-situ bioremediation by remedial agent injection around affected locations
- **VRF-AOC-10**: Complete small-scale soil removals, in-situ biopiles for removal of volatile organic compounds (VOCs) and off-Site disposal for removal of RCRA

metals-contaminated soils at locations where applicable guidance criteria were exceeded

- **VRF-AOC-11**: Complete small-scale sediment removals and off-Site disposal at locations where contaminants were detected above applicable guidance criteria.

The location of each AOC is illustrated on Figures 2 through 8.

Implementation of the work described in this IRM Work Plan will result in mitigation of soil and groundwater impacts at various locations throughout the Site. The findings of the EBS and RI/FS assisted in the determination of appropriate remedial measures necessary to address identified environmental impacts and meet 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs) and 6NYCRR Part 703 Class GA Groundwater Standards including Site-specific cleanup objectives. In addition, contaminated sediments identified at Brandy Brook (VRF-AOC-11), will be remediated such that contaminant concentrations are reduced to comply with “Class A” criteria as defined in the NYSDEC’s 2013 Draft “Screening and Assessment of Contaminated Sediment” guidance document.

1.1 Site Description

The VRF is located at 5586 Germany Road, Verona, New York. The location of the VRF is indicated on the Site Location Map (Figure 1). The Site Plan (Figure 2) provides detail on the Site layout as well as the location of relevant utilities and features. Approximately 494.3 acres are located within the VRF. The VRF was originally 512.5 acres in size. Approximately 18.195 acres of the former Space Command Complex, part of the VRF, has been occupied by the Oneida Indian Nation since 2009. The Space Command Complex is located on the eastern central portion of the VRF and is not included as part of this RI/FS.

The VRF is one of three remote facilities of RRS, associated with the former Griffiss Air Force Base (GAFB), located just east of Rome, New York. The VRF is located 15 miles southwest of the former GAFB (currently utilized as the Griffiss Business and Technology Park (GBTP)), on Germany Road in the Town of Verona, New York, in western Oneida County.

Developed portions of the property are oriented in a northwest-southeast configuration parallel to and bounded by Germany Road. The Site is bounded by Germany Road and residential and agricultural properties to the northeast, east, and southeast. Route 31 and residential and agricultural properties are located to the south to the Site. Open land is located to the north and west of the Site. Brandy Brook flows through the southern portion of the Site. All surrounding properties, with the exception of the Space Command Complex and roadways, are privately owned.

1.2 Site History

The VRF, initially known as the Verona Test Annex, was purchased from three individual owners and six joint ownerships between 1949 and 1970 (nine parcels totaling 512.5 acres) by the Rome Air Development Center (RADC) (later renamed Rome Laboratory and currently is known as RRS) for use as an auxiliary research facility to GAFB, located in Rome, NY. The current property owner is the United States Air Force (USAF).

Prior to construction of the VRF, the land was primarily farmland, undeveloped woods, and grassland. Two farmhouses are known to have existed at the Site. One was located in the grassy field southeast of the Site entrance road and the other was in the wooded area north of the Space Command Complex. In addition, two other structures were also located at the Site, in the vicinity of B1253 and B1261. The remains of these two structures and the farmhouse northwest of the Space Command Complex were observed during the previous inspections.

The majority of development of the VRF occurred between 1951 and 1953. The facility was fully operational from 1954 until 1987 and was used to conduct a broad range of electromagnetic research, experimentation, measurements, and capability evaluations. Hazardous materials were often utilized in past reliability research.

From 1987 to 2000, operations at the Site were minimal, however; in 1990 and 1991 the Space Command Complex, which is comprised of approximately 18.2 acres of land, was constructed on the eastern central portion of the facility and is currently occupied by the Oneida Indian Nation and owned by the Federal Government. Operations at the VRF ceased in October 2000. The USAF does not own the Former Space Command property.

1.3 Previous Site Assessments and Investigations

Lu Engineers has relied upon a large number of reports and data provided by RRS Civil Engineering Branch, Environmental and Occupational Health Office (RIOCV). Environmental sampling, assessment and investigation efforts at the VRF have been conducted by Parsons Engineering Services (Parsons), Sterns and Wheler, LLC, and Lu Engineers as well as RRS itself. Previous environmental work includes, but is not limited to the following:

- Sampling and Analysis Report for Underground Storage Tanks (USTs) at Off-Base Test Annexes by Engineering-Science (ES) in March 1994;
- Base Closure Environmental Assistance Team (BCEAT) Final Report for Griffiss Air Force Base, NY by the USAF in September 1994;
- Phase I PCB Survey conducted in December 1994 by Sterns and Wheler;
- Investigation and Pilot Test completed in September 1995 by Parsons;
- Wetland Study in October 1995 by Geo-Marine, Inc. Engineering;

- Phase I Asbestos Survey in September 1996 by Lu Engineers;
- Phase II PCB Study conducted in December 1996 by Sterns and Wheler;
- PCB sampling at B1239 in 1996 by Lu Engineers;
- Sanitary Sewer Inspection VRF in December 1996 by Sterns and Wheler;
- Review of Verona Test Annex Data from Investigation and Pilot Test conducted in 1996 by Sterns and Wheler;
- Preliminary Site Assessment (PSA) completed in January 1997 by Sterns and Wheler;
- Wetland Delineation in July 1997 by Lu Engineers;
- Phase I Soil Sampling in October 1997 by Sterns and Wheler;
- Phase II PSA completed in December 1997 by Sterns and Wheler;
- Phase I EBS completed in January 1998 by Sterns and Wheler;
- PSA 3rd round of sampling completed in June 1998 by Sterns and Wheler;
- Remedial Construction Documentation Report in August 1998 by Sterns and Wheler;
- Freon Removal from Air Conditioning Units in April 2000;
- UST Removal Program in April-May 2000 by the NYSDEC;
- Asbestos Abatement conducted in 2000;
- Semi-Annual Monitoring Analytical Summary Report completed in January 2001 by Sterns and Wheler;
- Operations, Monitoring and Maintenance (OM&M) Plan in October 2001 by Sterns and Wheler for the Monitored Natural Attenuation (MNA) Program;
- Updated CEBS completed in December 2001 by Sterns and Wheler;
- Natural Attenuation and Monitoring and Bio-remediation ongoing from 2002 to the present. Quarterly reports have been prepared by Lu Engineers;
- Subsurface Characterization Using a Heated Trunkline Membrane Interface Probe (MIP) in 2012 by S2C2, Incorporated contracted by Lu Engineers as part of the 2013 EBS;
- EBS completed in April 2013 (September2013 Final) by Lu Engineers; and
- RI/FS initiated in September 2013 and is ongoing

Additional documents that were found in prior EBS reports include the following:

- NYSDEC Spill Closure Notification for B1225 and B1253 in February 2001.

Previous investigation findings are presented in the September 2013 EBS by Lu Engineers, submitted to NYSDEC and 2014 RI/FS. Refer to the 2014 RI/FS report for a full summary of environmental concerns identified, remedial actions completed, and investigation findings to date.

As previously listed, the findings of the 2013 EBS and 2014 RI/FS identified nine (9) AOCs at the VRF requiring additional investigation and remedial effort to define and mitigate soil and groundwater exceedances to allow Unrestricted Use of the property for future owners and/or users. These nine AOCs were the focus of the RI/FS and are summarized in the following sections.

2.0 Summary of Environmental Conditions

The following sections briefly summarize the findings of the EBS and RI/FS activities conducted to date and provide a detailed analysis of the nature and extent of contaminated media requiring remediation. A more complete description of the current status of the investigation process relative to the VRF can be found in the 2014 RI/FS report provided under separate cover.

2.1 Definition of IRM Areas of Concern

Based on the investigation work completed to date, as well as detailed description and analysis of the nature and extent of Site contamination presented in Sections 2.1 through 2.10, the Site IRM effort has been segregated into nine distinct areas of concern, referred to as VRF-AOC -01 through VRF-AOC-11 (excluding VRF-AOC-04, VRF-AOC-06, and VRF-AOC-07(WDA-01, 02)) in this work plan as follows (see Figures 3 through 8 for respective IRM locations).

VRF-AOC-01 - Sanitary Sewer System
The sanitary sewer system is a suspected source of contamination due to past waste disposal practices. Six (6) intact septic tanks and approximately eleven (11) manhole structures remain on the VRF property and contain liquids and sludge's. Water and sediment samples collected from a portion of the tanks were found to contain elevated levels of solvents (acetone, 2-butanone, benzene, chlorobenzene, 1,4-dichlorobenzene, cis-1,2-Dichloroethene) and heavy metals. Known septic tank locations, sewer lines and a raised bed sewage filtration system are illustrated on the attached Figures 3 through 8.

IRM Action
Based on the contaminants identified within the septic tanks and manholes (additionally presumed to be in the piping network), it is recommended that each impacted septic tank, manhole structure, and associated sewer piping be flushed clean. Septic tanks will be removed, and if additional testing proves it necessary, contaminated soil beneath the tanks will be removed as well. Two minor-scale soil cleanups (by in situ chemical oxidation (ISCO)) have also been recommended relative to the filter bed to address identified VOC contaminants of concern.

Further detail of the planned IRM activities are presented in Section 4.2.1.

VRF-AOC-02: Primary Power System

As previously described, oil has been observed in certain vaults located throughout the Site. Vandalism-caused release of oils from electrical equipment into the system conduits resulted in the presence of oils in the electrical vaults. PCB abatement was completed at the VRF in the 1990s to remove transformer fluids with PCB concentrations exceeding 50 ppm. Transformers were re-filled with non-PCB mineral oil. Therefore, it is inferred that the oil present in underground electrical vaults is mineral oil containing no PCBs or non-hazardous low-level PCBs.

IRM Action

Though it is inferred that the oil present in transformers and/or electrical vaults is mineral oil containing no PCBs or non-hazardous low-level PCBs, this IRM will involve the removal of accessible free-phase oil from the power system by vacuum extraction to prevent further spillage.

Further detail of the planned IRM activities are presented in Section 4.2.2.

VRF-AOC-03: Former Petroleum Storage

Former USTs and ASTs that stored fuel oil for boilers and generators have been identified as potential source areas for petroleum contamination. Underground tanks were historically located on the north side of the laboratory and powerhouse buildings. All tanks have reportedly been removed; however, evidence of petroleum impacts were observed in shallow soils at B1245, B1253, B1277 and B1285 during investigations conducted in 2013 and 2014.

IRM Action

This IRM involves the removal and on-Site treatment of identified petroleum-contaminated soils and groundwater that exhibits free-phase petroleum accessible at the building edge for these areas. Remedial efforts will also include mitigation of inaccessible soils/residual contamination with an ORC or equivalent.

Further detail of the planned IRM activities are presented in Section 4.2.3.

VRF-AOC-04: Former Solvent Disposal

Four areas of solvent-impacted groundwater were identified including: B1233, B1253, BN1219, and B1266. Chlorinated volatile organic compounds (Cs) were detected at these locations in excess of applicable groundwater standards.

IRM Action

It is noted that the planned IRMs associated with B1233 and B1253 are being addressed separately as described in VRF-AOC-08. The planned IRM for the areas associated with BN1219 and B1266 are addressed separately as described in VRF-AOC-09.

Further detail of the planned IRM activities are presented in Section 4.2.4.

VRF-AOC-05: Former PCB-Containing Equipment

Previous sampling has revealed two locations of PCB-containing sludge/residue characterized as hazardous waste and two areas at which surface soil was found to contain PCBs at levels exceeding applicable SCOs.

The floor trench drain in B1233 contains sediments with hazardous waste levels of PCBs (Aroclor 1260). Surface soils near the trench drain discharge pipe at the south corner of B1233 are also impacted by PCBs. Oil residue collected from an exterior electrical switch panel located near B1266 revealed 361 ppm of Aroclor 1260. PBCs were also identified at B1287 within and in soil adjacent to the building. Low-level PCBs were also observed in sludge location on the floor of B1298.

IRM Action

PCB-contaminated sludge and visually stained concrete surfaces exceeding applicable regulatory criteria in B1233 will be remediated by removal prior to the demolition of the building. PCB-contaminated surface soil on the east side of B1233 will be removed during as part of the source area soil removal associated with VRF-AOC-08.

Surface soils on the east side of B1287 containing PCBs exceeding the Unrestricted Use Criteria SCO will be remediated by excavation and disposal. Building surfaces in B1287 on which PCBs were detected above applicable thresholds will be remediated by scarification, as necessary. Sludge located on the floor of B1298 will be mechanically removed for disposal

Further detail of the planned IRM activities are presented in Section 4.2.5.

VRF-AOC-06: Former ODC-Containing Equipment

Based on investigation findings no remedial actions are required as part of this AOC.

VRF-AOC-07 (WDA-03) Former Landfill

Based on investigation findings no remedial actions are required for VRF-AOC-07 (WDA-01) or VRF-AOC-07 (WDA-02). Solid waste materials including but not limited to buried metal, batteries, glass, electronics, plastic and filter bed sand were discovered in the former landfill area (VRF-AOC-07 (WDA-03)). Soil and groundwater contamination likely associated with the buried waste was also detected in this area. Soil contaminants detected include acetone, arsenic, and 2-butanone. Groundwater sampling initially revealed chromium contamination in excess of applicable groundwater standards; however, re-sampling using low-flow methods to mitigate turbidity yielded chromium levels within applicable standards.

IRM Action

Remedial actions at the former landfill will include the removal of all known and accessible solid waste and contaminated soils by excavation and disposal. Remedial activities will also include construction of a biopile to address the VOC-contaminated soil, and excavation dewatering to allow for effective removal of solid waste materials.

Further detail of the planned IRM activities are presented in Section 4.2.6.

VRF-AOC-08: B1233 Investigation and Cleanup

The primary contaminants of concern in subsurface soils at B1233 are acetone, chlorobenzene, dichlorobenzene, perchloroethene (PCE), pesticides, and PCBs. Primary contaminants of concern in groundwater include chlorobenzene, dichlorobenzene, and trichlorobenzene. The vertical and aerial extent of VOC contamination at B1233 has been generally delineated through installation of 15 Membrane Interface Probe (MIP) points as presented in the September 2013 EBS Report.

The floor trench drain in B1233 contains sediments with hazardous waste levels of PCBs. These materials will be remediated as part of IRM VRF-AOC-05 as described in Sections 2.11 and 4.25. Surface soils near the trench drain discharge pipe at the south corner of B1233 are also impacted by PCBs, as shown on Figure 4.

IRM Action

This IRM involves the excavation and disposal of impacted soils, and dewatering, and on-Site treatment of groundwater. Sheet piling will be installed around the perimeter of the soil removal area prior to excavation. Soils previously delineated as meeting unrestricted use criteria will be staged separately for use as clean backfill. To prevent any potential off-Site migration, all staged soils will be staged on and covered with polyethylene sheeting at the conclusion of each workday, prior to off-Site disposal or on-Site backfill. Standard confirmatory sampling will be conducted following soil removal. Dewatered groundwater will be stored in frac tanks on-Site, sampled for waste characterization parameters, treated and discharged on-Site.

Further detail of the planned IRM activities are presented in Section 4.2.7.

<u>VRF-AOC-09: Site-Wide Groundwater Contamination</u>

Groundwater contamination was detected in several locations across the Site, at concentrations exceeding NYSDEC Part 703.5 Class GA groundwater standards at VRF-AOC-03, VRF-AOC-07(WDA-03), and VRF-AOC-08.

<u>IRM Action</u>

Activities relative to groundwater contamination will be conducted as described by planned IRMs at VRF-AOC-03, VRF-AOC-07 (WDA-03), and VRF-AOC-08. Generally, groundwater contamination will be remediated by means of in-situ chemical oxidation.

Further detail of the planned IRM activities relative to Site-wide groundwater remediation are presented in Sections 4.2.3, 4.2.6, 4.2.7, and 4.2.8.

<u>VRF-AOC-10: Site-Wide Soil Contamination</u>

Acetone and 2-butanone were detected above the applicable Site-specific cleanup criteria of 100 ppb in subsurface soils throughout the Site, as described in the RI/FS report.

<u>IRM Action</u>

Planned IRMs for these areas will include in-situ chemical oxidation and confirmatory sampling. Standard confirmatory sampling will be conducted per NYSDEC DER-10. All other known soil contamination will be remediated as IRMs as described in Section 2.1 and 4.0 for VRF-AOC-01(filter bed), AOC-VRF-03, VRF-AOC-05, VRF-AOC-07(WDA-03), and VRF-AOC-08.

<u>VRF-AOC-11: Brandy Brook Sediments</u>

Pesticides, metals and acetone were detected in excess of applicable regulatory criteria at three sample locations: BB-SED-01, BB-SED-02, and BB-SED-03.

<u>IRM Action</u>

Small-scale sediment removal and disposal will occur at the three locations where contaminants were detected in excess of applicable regulatory criteria and sediment guidance values (BB-SED-01, BB-SED-02, and BB-SED-03 sample locations). A subsequent Stream Restoration Plan will be implemented accordingly, if determined to be necessary, and provided to all project stakeholders.

2.2 Standards, Criteria, and Guidance

Standards, criteria, and guidance (SCG) values to be employed during the IRMs include Unrestricted Use SCOs referenced in the NYSDEC document titled "*6 NYCRR Part 375, Environmental Remediation Programs*" dated December 14, 2006. In addition, site-specific cleanup criteria for soil and groundwater for the VOCs acetone and 2-butanone (basically indistinguishable by gas chromatography) as agreed upon with the NYSDEC. It is noted that the site specific VOC criteria were established based on the presence of elevated concentrations of acetone and 2-butanone in areas of the Site with no known history of waste disposal. These criteria were also established based on the fact that acetone and 2-butanone occur naturally in the environment as a result of plant and animal decomposition. SCG values have also been considered with respect to NYSDEC's 2013 draft sediment guidance. Table 1 provides a list of SCGs specific to target contaminants to be remediated relative to each AOC exhibiting soil and/or groundwater contamination.

TABLE 1 - SCGs for each AOC

IRM	Contaminant(s)		SCO Concentration		Sediment Concentration		Water/GW Concentration		Other
VRF-AOC-01	1,4-Dichlorobenzene	Unrestricted Use	1.8 ppm			NYSDEC GW Standards	3 ug/l		NA
	2-Butanone	Unrestricted Use	0.12 ppm				NA		NA
	Acetone	Unrestricted Use	0.1* ppm			NYSDEC GW Standards	50 ug/l		NA
	Aroclor	Unrestricted Use	0.1 ppm				NA		NA
	Arsenic	Unrestricted Use	13 ppm				NA		NA
	Barium	Unrestricted Use	350 ppm				NA		NA
	Benzene	Unrestricted Use	0.06 ppm			NYSDEC GW Standards	1 ug/l		NA
	Cadmium	Unrestricted Use	2.5 ppm				NA		NA
	Chlorobenzene	Unrestricted Use	1.1 ppm			NYSDEC GW Standards	5 ug/l		NA
	Chromium	Unrestricted Use	30 ppm				NA		NA
	cis-1,2-Dichloroethene	Unrestricted Use	0.25 ppm				NA		NA
	Dichlorodifluoromethane		NA				NA		NA
	Lead	Unrestricted Use	63 ppm				NA		NA
	Mercury	Unrestricted Use	0.18 ppm				NA		NA
	Silver	Unrestricted Use	2 ppm				NA		NA
VRF-AOC-02	Acetone		0.1*ppm			NYSDEC GW Standards	50 ug/l		NA
	Aroclor		0.1 ppm				NA	Unrestricted Use	0.1 mg/kg (Oil)
VRF-AOC-03	Acetone	Unrestricted Use	0.05 ppm				NA		NA
	Medium Weight PHC	Unrestricted Use	100 ppm				NA		NA
	Heavy Weight PHC	Unrestricted Use	100 ppm				NA		NA
	Mercury	Unrestricted Use	0.18 ppm				NA		NA
VRF-AOC-05	Aroclor	Unrestricted Use	0.1 ppm				NA	Unrestricted Use	0.4 mg/kg (Concrete)
VRF-AOC-04	2-Butanone	Unrestricted Use	0.12 ppm				NA		NA
	Acetone	Unrestricted Use	0.1* ppm				NA		NA
	Arsenic	Unrestricted Use	13 ppm				NA		NA
	Chromium		13 ppm			NYSDEC GW Standards	50 ug/l		NA
VRF-AOC-08	1,2,3-Trichlorobenzene		NA			NYSDEC GW Standards	5 ug/l		NA
	1,2,4-Trichlorobenzene		NA			NYSDEC GW Standards	5 ug/l		NA
	1,2-Dichlorobenzene		NA			NYSDEC GW Standards	3 ug/l		NA
	1,3-Dichlorobenzene		NA			NYSDEC GW Standards	3 ug/l		NA
	1,4-Dichlorobenzene	Unrestricted Use	1.8 ppm			NYSDEC GW Standards	3 ug/l		NA
	4,4,-DDT	Unrestricted Use	0.0033 ppm				NA		NA
	Acetone	Unrestricted Use	0.1* ppm				NA		NA
	Aroclor	Unrestricted Use	0.1 ppm				NA		NA
	Chlorobenzene	Unrestricted Use	1.1 ppm			NYSDEC GW Standards	5 ug/l		NA
	Dieldrin	Unrestricted Use	0.005 ppm				NA		NA
	Endosulfan II	Unrestricted Use	2.4 ppm				NA		NA
	Tetrachloroethene	Unrestricted Use	1.3 ppm				NA		NA
VRF-AOC-09	1,2-Dichloroethane		NA			NYSDEC GW Standards	0.6 ug/l		NA
	Barium		NA			NYSDEC GW Standards	1,000 ug/l		NA
	Cis-1,2-Dichloroethene		NA			NYSDEC GW Standards	5 ug/l		NA
	Vinyl Chloride		NA			NYSDEC GW Standards	2 ug/l		NA
VRF-AOC-10	Acetone	Unrestricted Use	0.1* ppm				NA		NA
	Lead	Unrestricted Use	63 ppm				NA		NA
	Mercury	Unrestricted Use	0.18 ppm				NA		NA
VRF-AOC-11	Acetone	Unrestricted Use	0.05 ppm	Sediment Guidance	NA		NA		NA
	Lead	Unrestricted Use	63 ppm	Sediment Guidance	<36 ppm		NA		NA
	Arsenic	Unrestricted Use	13 ppm	Sediment Guidance	<10 ppm		NA		NA
	Chromium	Unrestricted Use	30 ppm	Sediment Guidance	<43 ppm		NA		NA
	Endosulfan II	Unrestricted Use	2.4 ppm	Sediment Guidance	<1 ppm		NA		NA

3.0 Alternatives Analysis Summary

Remedial goals, objectives, and consideration factors were developed in order to prepare remedial alternatives for consideration. A complete, detailed discussion of remedial alternatives, methods, procedures and associated project costs has been prepared for this project as a Feasibility Study and is included in Lu Engineers' RI/FS Report, dated May 2014. Evaluation criteria have been developed in order to compare the remedial alternatives. The alternatives considered for this Site are intended to address contamination in soil, groundwater, sediment, and concrete, and are presented below.

This section describes the technology types and process options that are appropriate to conditions and the nature and extent of contamination at the Site. As required by regulation 6 NYCRR Part 375-2.8, this analysis will consider one or more alternatives to achieve the Unrestricted Use SCOs in 6 NYCRR Part 375-6.8(a), which are considered to be representative of pre-disposal conditions at the Site. This option would allow any property use including the raising of livestock. The No Action option will be included as a comparison to evaluate other alternatives, although it may not meet the RAOs established for the Site.

After a preliminary screening, the following general response actions have been identified to address soil, sediment, and/or groundwater contamination above SCGs at each AOC.

3.1 VRF-AOC-01- Sanitary Sewer System

<u>No Action</u>
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

<u>Removal and Disposal of Sewer System Sludge, Water and Contaminated Filter Bed Media</u>
This remedial approach will involve flushing and cleaning septic tanks, manholes, and sewer lines. Sludge and water removed from the sewer system will be contained and characterized for disposal. An estimated volume of 45,000 gallons of contaminated water would require treatment prior to discharge on-Site. Septic tanks, lift stations (B1241and B1273), and accessible manholes containing contaminants will be emptied and cleaned.

After cleaning, underlying soils will be accessed through the floor of each subject tank to determine whether additional excavation is necessary. If additional excavation is necessary, the subject tank will be demolished to allow access to affected soils below. Underlying soils will be excavated for off-Site disposal and confirmatory sampling, as necessary. Once favorable laboratory analytical results have been obtained, the tank debris, imported fill and/or clean material from elsewhere on the Site will be used to backfill each subject septic tank.

Approximately 100 CY of potentially hazardous sediment/sludge may be generated during this process. Sewer piping would remain in-place. Approximately 1,000 CY of contaminated filter bed media would be remediated by in-situ bioremediation or chemical oxidation via direct injection of remedial media.

3.2 VRF-AOC-02- Primary Power System

No Action
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

Removal and Disposal of Free-Phase Oil
Remove accessible free-phase oil from electrical vaults, manholes, and conduit to prevent future spillage. This includes a minimum of 9,000 feet of 4-inch diameter electrical conduit and 29 manholes. Recovered mineral oil/water mixture would be transported off-Site for disposal.

3.3 VRF-AOC-03- Former Petroleum Storage

No Action:
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

Removal and On-Site Treatment of Petroleum-Impacted Soils:
This option includes excavation of petroleum-impacted soils along the building edge at each of the former tank locations (see Figures 3 through 6) to a depth of up to 10 feet below grade. An estimated total quantity of 1,200 CY of non-hazardous petroleum-contaminated soil would be excavated and staged in “biopiles” located at each subject building to remediate the soils through aerobic bioremediation. Each biopile will be staged on and covered with polyethylene sheeting for the duration of the aerobic bioremediation process to protect the neighboring properties and prevent any potential off-Site migration. Dewatering by vac truck will be necessary during excavation. An estimated 55,000 gallons of groundwater removed from the petroleum-impacted areas would be transferred to a frac tank(s) to allow separation of free-phase oil. Any oil would be suctioned off the top of the groundwater and disposed of prior to discharge on-Site.

Confirmatory soil samples will be collected to demonstrate effective removal of impacted soil. Excavated areas will be backfilled with remediated soil once the aerobic bioremediation process has been completed as indicated by confirmatory sampling of staged soils. Soil additives, such as Oxygen Releasing Compound (ORC), will be applied prior to backfilling to address residual petroleum contamination beneath the buildings.

<u>In-Situ Enhanced Bioremediation:</u>
The in-situ treatment alternative would involve injection of ORC, nutrients, or other product, to accelerate natural biodegradation processes in the subsurface. ORC (or other product) would be injected into the source areas using Geoprobe tooling. Injection points could also be installed through the building slabs to address contamination beneath the buildings. The effectiveness of this method will require confirmatory sampling of soils after completion of the remedial program via direct-push methods. A pilot test would be performed to determine the number of injection points and volume of ORC to be injected at each former tank location.

Additional soil sampling would be necessary to evaluate long-term effectiveness of the in-situ treatment.

3.4 VRF-AOC-05- Former PCB-Containing Equipment

<u>No Action:</u>
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

<u>Removal and Disposal of Impacted Soil and Equipment:</u>
The transformer at B1226 will be removed, drained of oil, and recycled as scrap metal. A concrete pad and approximately 10 CY of impacted surface soil surrounding the transformer will be removed to a depth of approximately 5 feet below grade and sent for off-Site disposal as non-hazardous waste at an approved landfill. Approximately 5 CY of PCB impacted soil will also be removed and disposed of off-site from a location immediately adjacent to B1287.

PCB-impacted concrete and sludge at B1226, B1233, B1245, B1255, B1266, B1287, and B1298 will also be cleaned and resultant wastes disposed of for off-site as non-hazardous PCB-containing waste. PCB-contaminated building surfaces in B1287 will be decontaminated by scarification or other methods.

Approximately 5 CY of PCB-impacted surface soil located east of B1287 (see Figure 7) will be removed to a depth of 2 to 3 feet below grade for off-Site disposal as non-hazardous waste at an approved landfill. This area of impacted surface soil has been delineated during the RI; therefore, only a bottom confirmatory soil sample will be collected to demonstrate effective removal.

3.5 VRF-AOC-07- WDA-03 Former Landfill

No Action:
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

Full Removal and Disposal of Solid Wastes and Dewatering:
This alternative involves excavation and off-Site disposal of all solid waste within the footprint of the former landfill area, as shown on Figure 3. Assuming an average depth of 4.5 feet, the estimated volume of unpermitted solid waste in the landfill is 7,200 CY. Soil within the landfill excavation would be segregated, stockpiled, and characterized for disposal or reuse on-Site. The excavation will be dewatered, treating the water via settling to remove suspended solids, and discharging the groundwater on-Site. An estimated volume of 450,000 gallons would be pumped into frac tanks for settling and discharged on-Site. The excavated area would not be backfilled but instead, returned to original wetland conditions.

Limited Removal and Disposal of Solid Wastes:
This remedial option would involve a more limited removal of solid waste and metal contaminated soil. Approximately 1,200 CY of soils contaminated with acetone and 2-butanone only (as indicated by analytical testing) will be remediated by means of on-Site treatment by aerobic bioremediation (biopile). An estimated 300 CY (25% of landfill footprint) of arsenic- contaminated soil, scrap metal, plastic, and other solid waste identified by the geophysical survey and test pit investigation would be removed for disposal at a permitted landfill. Wastes and soils would be segregated, stockpiled, and characterized for disposal or re-use on-Site. Approximately 100,000 gallons of groundwater would be dewatered from excavated areas, settled in frac tanks to remove suspended solids, and discharged on-Site. Excavated areas would be backfilled with clean, imported material.

3.6 VRF-AOC-08- B1233 Investigation and Cleanup

No Action:
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

Excavation and Disposal of Contaminated Soil with Dewatering:
This option for B1233 contamination would involve installation of sheet piling surrounding the contaminated area (see Figure 4), and excavation of approximately

4,500 CY of soil to a depth of up to 14 feet below grade. Removal areas would be based on a GIS model created using results from the RI. The excavation would require dewatering to reach the desired removal depth. Contaminated soils would be segregated, staged on-Site, and characterized for disposal at an approved landfill or on-Site reuse as backfill. An estimated volume of 1,500 CY soil will be sent for off-Site disposal as non-hazardous waste. To prevent any potential for off-Site migration, all staged soils will be staged on and covered with polyethylene sheeting at the conclusion of each workday prior to off-Site disposal or on-Site backfill. To facilitate excavation, approximately 235,000 gallons of groundwater would be pumped into frac tanks, treated, and discharged on-Site. Confirmatory soil samples would be collected to demonstrate effective removal of contaminated soil. The excavated area would be backfilled with approved, imported material.

It is assumed that approximately five (5) new groundwater monitoring wells would be installed within the source area to evaluate post-removal groundwater concentrations.

<u>In-Situ Bioremediation:</u>
Soil and groundwater contamination would be addressed by injection of Organix Green Liquid (OGL), or similar product, to accelerate natural breakdown of contaminants in the subsurface. OGL is an organic acid rich liquid material derived from a carefully controlled vermiculture process. This material has been used successfully at the VRF to remediate residual concentrations of dissolved phase trichloroethylene and its daughter products at B-1253 and B1255. The OGL additive would be injected into the contaminated zone using Geoprobe tooling. Post-injection groundwater monitoring would be performed to evaluate long-term effectiveness of the in-situ treatment. Multiple injections may be required to meet groundwater standards. This approach is not considered viable for source area or non-aqueous phase remedial applications.

3.7 VRF-AOC-09- Site-wide Groundwater Contamination

<u>No Action:</u>
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

<u>In-Situ Chemical Oxidation:</u>
In-situ chemical oxidation (ISCO) is a treatment technology that introduces chemical oxidizing reagents (e.g., permanganate, peroxide, persulfate) to react with VOCs and form less toxic or non-toxic compounds. This is a proven remedial approach for chlorinated solvents in groundwater. The oxidizing compound would be injected into the contaminated zone using Geoprobe tooling. Post-injection groundwater monitoring would be performed to evaluate long-term effectiveness of the in-situ treatment.

Multiple injections may be necessary to achieve complete chemical destruction of contaminants.

An ISCO pilot study was previously conducted at B1233 in 2008 to address chlorinated VOCs in groundwater. The ISCO injections proved to be ineffective at reducing contaminant levels; however, the injection points were not located within the newly defined source area. It is uncertain whether ISCO would be effective if applied within the source area.

<u>In-Situ Bioremediation:</u>
The in-situ treatment alternative would involve injection of OGL, or similar product(s), to accelerate natural breakdown of chlorinated solvents in groundwater at B1266 and BN1219. The OGL additive would be injected into the contaminated zone using Geoprobe tooling. As described in Section 3.6, this material has been used to successfully attain groundwater cleanup goals at the VRF. Post-injection groundwater monitoring would be performed to evaluate long-term effectiveness of the in-situ treatment. Multiple injections may be required to meet groundwater standards.

3.8 VRF-AOC-10- Site-wide Soil Contamination

<u>No Action:</u>
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

<u>Excavation and Disposal of Contaminated Soil:</u>
Contaminated soils would be disposed as non-hazardous waste at an approved landfill. Confirmatory soil samples will be collected to demonstrate effective removal of contaminated soil. The excavated areas would be backfilled with approved, imported material. An estimated 20 CY of mercury and lead impacted soils surrounding the dilapidated septic tanks at TP-83 and TP-93 would be excavated and disposed off-Site at a permitted landfill. Additional sampling will determine if soils surrounding other remaining septic tanks require removal and disposal. This option would also involve excavation and off-Site disposal of approximately 100 CY of soil from isolated areas of acetone and metals contamination across the Site.

Due to the limited and sporadic occurrence of acetone contamination in subsurface soil at locations within the VRF, this is the only remedial alternative evaluated to address isolated acetone exceedances in soil.

<u>In-Situ Chemical Oxidation:</u>
An ISCO compound would be injected into the contaminated zone using Geoprobe tooling. Post-injection soil sampling would be performed to evaluate long-term

effectiveness of the in-situ treatment. Multiple injections may be necessary to achieve complete chemical destruction of contaminants.

As part of this process an estimated 20 CY of mercury and lead impacted soils surrounding septic tanks at TP-83 and TP-93 will be excavated and disposed off-Site at a permitted landfill. Additional sampling will determine if soils surrounding other remaining septic tanks require removal and disposal.

3.9 VRF-AOC-11- Brandy Brook Sediment

No Action:
The No Action alternative is included as a baseline to evaluate other alternatives. This alternative proposes no remedial work. The Site condition would remain virtually as is and future use would not be limited via institutional controls.

Excavation and Disposal of Contaminated Sediments:
This option would involve dredging of approximately 10 CY of sediments from Brandy Brook at each location: BB-SED-01, BB-SED-02, and BB-SED-03. Dredged material would be placed in lined roll-off dumpsters for off-Site disposal as non-hazardous waste at a permitted landfill.

4.0 Scope of Work

The primary goals of the IRM are to address areas of contamination and environmental conditions considered to have the greatest potential for human exposure and migration and to meet both NYSDEC Part 375-6.8(a) Unrestricted Use SCOs, "Class A" criteria as defined in the NYSDEC's 2013 Draft "Screening and Assessment of Contaminated Sediment" guidance document, NYSDEC Site-specific cleanup objectives and NYSDEC Part 703.5 Class GA groundwater standards. IRMs will include: removal and disposal of soils and groundwater that are collectively impacted with contaminants of concern including VOCs, SVOCs, PCBs, petroleum, pesticides, metals, and concrete transformer slabs at specific source areas as previously described. Site soils that are proposed for re-use as backfill of excavations will first be tested in accordance with Table 5.4(e)10 of DER-10, as necessary. As previously described, IRM actions will be completed in nine distinct areas of concern, as follows.

- VRF-AOC-01 - Sanitary Sewer System
- VRF-AOC-02 - Primary Power System
- VRF-AOC-03 - Former Petroleum Storage
- VRF-AOC-05 - Former PCB-Containing Equipment
- VRF-AOC-07 - Waste Disposal Area (WDA)-03 Former Landfill
- VRF-AOC-08 - B1233 Investigation and Cleanup
- VRF-AOC-09 - Site-wide Groundwater Contamination
- VRF-AOC-10 - Site-wide Soil Contamination
- VRF-AOC-11 - Brandy Brook Sediments

4.1 Site Preparation and Control

A utility stakeout for identification and clearance of Site utilities will be completed prior to commencement of intrusive work.

Planned IRM work will require Site controls to ensure the safety of Site workers and the public. Access to the Site will be limited to staff, workers, and pertinent agencies involved with the project only. The public will not be permitted to enter the Site. All equipment, materials and/or vehicles that will be used on-Site will be inspected prior to being permitted on-Site to ensure that they are not contaminated (i.e., free of accumulations of non-hazardous, hazardous substances, and petroleum products). Equipment, materials and/or vehicles that arrive at the Site contaminated and not decontaminated from the previous job, will not be permitted to enter the Site.

IRM activities are to be contained within the Site boundaries. Figures 3 through 8 indicate the location of each IRM area and other significant existing Site features. Planned staging, transportation and support areas are located such that movement of heavily contaminated waste materials across the Site will be limited to the extent necessary to allow excavation and safe and efficient access to each work area.

GPS will be used to locate IRMs and IRM-related features. The extent of each IRM area will be marked using marking paint and other methods prior to initiation of IRM activities. Likewise, areas of the Site to be used for staging, parking, decontamination and related activities will be marked.

<u>Vapor/Odor Management</u>

Lu Engineers will conduct continuous air monitoring of worker breathing zone air and perimeter air monitoring during excavation activities. Where applicable, VOCs in worker's breathing zone air will be monitored with a PID during activities that have the potential to disturb contaminated material to aid in determining if vapor suppression is necessary. Readings will be recorded on log sheets and/or the Site logbook.

In accordance with the Health and Safety Plan (HASP), vapor suppression will be implemented if PID readings of greater than 25 ppm above background at breathing zone, sustained for greater than 5 minutes, are observed. Vapor suppression will also be implemented if nuisance odors are detected at the Site perimeter. If nuisance odors are identified at the Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected.

<u>Traffic Control and Trucking Routes</u>

Trucks will be prohibited from stopping and idling outside the project Site. Queuing of trucks will be performed on-Site in order to minimize off-Site disturbance; therefore, a traffic control plan is not necessary. Diesel-fueled trucks will be prohibited from idling for more than 5 minutes, in accordance with 6 NYCRR Subpart 217-3.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during Site remediation. Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-Site soil tracking.

If possible, off-Site trucking routes will not include transport through residential areas or past sensitive Sites, and is the most direct route to major highways.

<u>Emergency Procedures</u>

Emergency contact information, emergency egress routes, directions to the local Hospital, and other emergency procedures are provided in the HASP (Appendix B).

<u>Decontamination Procedures</u>

As part of the contractor's mobilization activities, a decontamination (decon) area for trucks, equipment, and personnel will be constructed at appropriate areas the Site to prevent tracking of contaminated residuals from the Site, as necessary.

To eliminate tracking of contaminated soils, the drivers will follow designated truck routes to contain traffic within a limited area. Efforts will be made to minimize any accumulation of impacted materials outside the excavation and staging areas, and these areas will be addressed to the satisfaction of the Field Team Leader.

During truck loading activities, polyethylene sheeting or tarps may be used as necessary to prevent unnecessary tracking of wastes through the Site and during transport.

Decontamination will be performed in accordance with NYSDEC-approved procedures. Sampling methods and equipment have been chosen to minimize decontamination requirements and prevent the possibility of cross-contamination.

Prior to exiting the Site, transport vehicles will be decontaminated via dry methods or washing, if deemed necessary. Heavy equipment involved in the excavation of soil/fill on-Site will be decontaminated by washing after each IRM area has been completed and prior to the start of backfilling activities if the equipment is covered with contaminated material. It should be noted that, if possible, clean areas/corridors that either eliminate or minimize any decontamination washing will be utilized. Efforts will be made to unload, use and load transport equipment in a manner that prevents contact of the vehicles with impacted materials. Adherence to these procedures will help to ensure that decontamination will not be necessary.

4.2 IRM Implementation and Sequencing

As described in Section 3.0, the selected alternatives include excavation and disposal of contaminated soils, including dewatering and disposal of contaminated groundwater as necessary. Selected alternatives also include excavation and disposal of surface soils, sediments, and concrete.

The Site preparation and control measures described in Section 4.1 will be implemented prior to completing IRM excavations.

The components of the selected remedial alternative are intended to assist in remediating IRM Areas to meet Unrestricted Use SCOs. The following sections define the specific remedial work associated with each IRM Area.

Tentative Fiscal Year 2014 Schedule

WEEK / Remedial Task	1	2	3	4	5	6
Mobilization						
VRF-AOC-01 Sanitary Sewer System						
VRF-AOC-02 Primary Power System						
VRF-AOC-03 Former Petroleum Storage [1]						
VRF-AOC-05 Former PCB Containing Equipment						
VRF-AOC-07 Former Landfill [1]						
VRF-AOC-08 B1233 Investigation and Cleanup [2]						
VRF-AOC-09 Site-Wide Groundwater Contamination [3]						
VRF-AOC-10 Site-Wide Soil Contamination						
VRF-AOC-11 Brandy Brook Sediments						

NOTES:
1. Periodic (monthly) monitoring will be conducted on biopiles using PID and laboratory analysis on soils. Inferred biopile deconstruction and backfill Spring 2015.
2. Work will be completed during 2015 fiscal year. Schedule has not yet been determined.
3. Indicated time frame includes first injection of remedial agent. Second injection of remedial agent will be completed eight weeks after first application. Re-sampling of groundwater will be conducted quarterly following first remedial agent injection.

Sequencing of IRM work is subject to change pending weather and Site conditions during the project.

4.2.1 VRF-AOC-01 - Sanitary Sewer System

The sanitary sewer system is a suspected source of contamination due to past waste disposal practices. Six (6) known and intact septic tanks and eleven (11) manholes remain on the VRF property. Water and sediment/sludge samples collected from several of the tanks contain elevated levels of solvents and heavy metals. Known septic tank locations, manhole structures and sewer lines are shown on Figures 3 through 7. Water collected from Manhole-3 (MH-3, Figure 6) located east of B1266 contained elevated levels of dichlorodifluoromethane (Freon), arsenic, and chromium.

The raised bed sand filter system is also a suspected source of contamination. As previously described, elevated concentrations of VOCs were detected in a subsurface sample (B1243-S13) at a depth of 7.5-8 feet, as shown on Figure 4. Acetone was also detected above the Site-specific SCO in underlying native silt and clay at a depth of 10 feet below grade. No groundwater contaminants were detected in the mini-well (B1243-W05) sampled within the filter bed or in TPW-82 located down-gradient of the B1226 septic tank. The bulk of the remedial effort associated with this IRM is anticipated to focus on the remaining septic tanks as indicated in Table 2.

Table 2 - Septic Tanks Requiring IRM Effort

Septic Tank	Tank Size	Contaminants of Concern	
		Aqueous	Non Aqueous
TP-93	N/A		Lead Mercury
B1226	750 gal	Chlorobenzene Benzene 1,4-Dichlorobenaene	Chlorobenzene Benzene 1,4-Dichlorobenzene Cadmium Chromium Mercury
B1231	790 gal	N/A	Acetone Arsenic Cadmium Lead Mercury Silver
B1250	4350 gal	Acetone Benzene Chlorobenzene 1,4-Dichlorobenzene	Aroclor
B1269	790 gal	Arsenic	
B1277	790 gal	cis-1,2-Dichlorobenzene	
B1285	790 gal	N/A	Chlorobenzene 2-Butanone Acetone Benzene Arsenic Barium Cadmium Lead
B1241 Lift Station	N/A	N/A	Arsenic Acetone

4.2.1.1 Sewer System Cleaning, Septic Tank Removal and Sampling

Based on the contaminants identified within the septic tanks and associated manholes to date, it is recommended that each impacted septic tank (B1226, B1231, B1241, B1250, B1277, B1285), manhole structure (MH-3), and affected sewer system piping be flushed clean and dewatered. A sewer-jetting truck (or equivalent) will be used to decontaminate the entire sanitary sewer system.

The sewer system piping network consists of up to 7,320 linear feet and sections will be isolated as it is cleaned to ensure effective cleaning of the entire system. Isolation of each section of piping between septic tank and manhole structures will ensure proper recovery of the waste contents within the piping network. The piping network will be decontaminated concurrently with the septic tanks and manhole structures. A 1996 sanitary sewer inspection (Sterns and Wheler) indicated that mortar decay, weathering cracks, and root intrusions were present in several manholes and piping sections resulting in infiltration during storm events or periods of high groundwater. Due to this historic study, cleaning fluid (water) volumes will be measured upon injection into each section of sewer piping as well as at the collection end points. If a notable loss of cleaning fluid is visually observed, or day lighting is noted at the ground surface, the area around the pipe will be carefully excavated to identify the general area of the fracture. If a significant loss of cleaning fluid is visually observed around the general area of the fracture, a water sample may be collected for characterization, and excess water may be pumped into a frac tanks located on-Site if deemed necessary by AFRL and NYDEC.

The waste water and sludge/sediment generated through cleaning of the sewer system will be transferred to frac tanks located on-Site, in which suspended sediment will settle out. It is assumed that approximately 100 cubic yards (CY) of sediment/sludge will be removed from the septic system, handled and disposed of as hazardous waste. The total volume of waste water that will be generated, including existing sewer system water and cleaning fluids, is estimated at 45,000 gallons. The waste water will be sampled for characterization purposes, filtered on-Site and likely discharged on-Site. A temporary NYSDEC-issued discharge permit will be acquired as necessary. Clean water will be used during the sewer system cleaning process, obtained from the Town of Verona highway garage located two (2) miles north of the Site on Germany Road.

It is noted that the portions of the sanitary sewer piping network are constructed of asbestos-concrete which is an asbestos containing material (ACM). The pipe material will likely be assumed positive for asbestos. An appropriately trained and licensed asbestos abatement contractor will be required to properly sever the ACM piping at septic tank and manhole structures prior to any disturbance of ACM, if necessary. Notifications of the abatement project will be made as appropriate. Lu Engineers has licensed asbestos inspectors and designers on staff to sample and assist with this work, as necessary.

Care will be taken to avoid disturbance of suspected or assumed ACM during the project. If ACM disturbance is determined to be necessary, each subject septic tank and manhole structure will be crushed in place and backfilled with native soil and/or imported clean backfill.

It is assumed that approximately 1,000 CY of soil will be remediated using ISCO or similar methods within with the filter bed where acetone was detected above the Site-specific SCO at TP-12. A direct-push Geoprobe® drill rig will be mobilized to the Site to perform the injection of a remedial agent solution (OGL or equivalent). Remedial solution will be introduced into the previously identified target depths through a series of approximately 20 grid-based injection points around each of the two exceedances on the filter bed. The grid-based approach at each location will be based on an assumed 10-foot spacing interval. Lu Engineers recommends a total of 3 injection events at each location. The quantity of remedial solution injected per event will be based on what has been proven effective by grid-based injection elsewhere on-Site. Post-remedial soil sampling by direct-push methods will be conducted.

Small-scale remediation of soils associated with elevated levels of acetone detected during test pitting at septic tank locations including TP-38, TP-45, TP-48, TP-66, and TP-75 will be conducted as part of VRF-AOC-10 as described in Section 4.2.9.

4.2.1.2 Confirmatory Soil Sampling

With respect to the filter bed where in-situ remediation is planned, the initial confirmatory soil sampling event will be completed six weeks after the final (third) remedial agent injection event. A total of two confirmatory sampling events are anticipated with the second event following six weeks after the first. If no target analytes are detected at concentrations exceeding applicable SCOs, confirmatory soil sampling will be considered complete. If target analytes are found to exceed applicable SCOs, additional remedial effort and confirmatory sampling will be considered based on consultation with AFRL and NYSDEC at that time.

Immediately following soil remediation by excavation within AOC-01 and elsewhere, confirmatory soil samples will be collected, as necessary, per the requirements of NYSDEC DER-10. Excavations will be left open pending laboratory analytical results. If sample results are above Unrestricted Use SCOs, additional soil will be removed from the identified area of the excavation and re-sampled until favorable results are achieved. Soil removal will continue until favorable sample results are achieved. The Quality Assurance Project Plan (QAPP) (Appendix A) provides detailed descriptions of the applicable sampling protocols, planned analytical requirements and numbers of samples anticipated for each subject AOC. Analytical results will be evaluated with respect to applicable regulatory and guidance criteria as previously defined herein.

4.2.2 VRF-AOC-02: Primary Power System

Oil has been observed in certain vaults including, but not limited to those adjacent to B1233, B1239, B1247, B1255, B1263, B1287, and 1298. It is inferred that oil entered the primary power system through conduits connecting the vaults to building interiors housing electrical equipment. Vandalism apparently caused the release of oils from various electrical equipment into the conduits, resulting in the presence of oil in the electrical vaults.

PCB abatement was completed at the VRF in the 1990s to remove transformer fluids with PCB concentrations exceeding 50 ppm. Transformers were re-filled with non-PCB mineral oil. Therefore, it is inferred that the oil present in underground electrical vaults is mineral oil containing no PCBs or non-hazardous low-level PCBs.

4.2.2.1 Oil Removal and Disposal

Though it is inferred that the oil present in transformers and/or electrical vaults is mineral oil containing no PCBs or non-hazardous low-levels PCBs, this IRM will involve the removal of remaining and accessible free-phase oil from the power system by vacuum extraction methods to prevent potential future spillage. Once removed, the oil will likely be disposed of off-Site at the Industrial Oil Tank Service Corp. in Oriskany, New York as non-PCB containing waste oil. Confirmatory sampling for AOC-02 will be limited to wipe sampling on equipment to be disposed of in order to verify that no PCB residues are present.

4.2.3 VRF-AOC-03: Former Petroleum Storage

Former USTs and ASTs that stored fuel oil for boilers and generators have been identified as potential source areas for petroleum contamination. Underground tanks were historically located on the north side of the laboratory and powerhouse buildings. All tanks have reportedly been removed; however, evidence of petroleum impacts were observed in shallow soils at each location.

Sample locations and results exceeding SCOs are shown on Figures 3 through 8. The following is a summary of the EBS and RI/FS analytical results:

- No VOCs were detected above Unrestricted Use SCOs, except for acetone (286 ug/kg or 0.286 ppm) in TP-59 at B1263.
- Medium and heavy weight petroleum hydrocarbons (PHC) were detected above Unrestricted Use SCOs at twelve (12) locations:
    - TP-11 at B1245 (Figure 4)
    - TP-52 at B1247 (Figure 4)
    - TP-64 at B1250 (Figure 5)
    - TP-10 at B1253 (Figure 5)
    - TP-54 and TP-56 at B1255 (Figure 5)

  - TP-57 and TP-59 at B1263 (Figure 5)
  - TP-74 at B1277 (Figure 7)
  - TP-73 and TP-72 at B1279 (Figure 7)
  - TP-81 at B1285 (Figure 7)

- Free-phase oil was observed at each former tank location. Elevated PID readings were observed to a maximum of 236 ppm at a depth of 3 to 4 feet below grade. Petroleum impacts were observed at depths generally ranging from 2 to 7 feet below grade.
- Metals detected in the areas sampled for petroleum will not affect soil [profiling for disposal purposes and will be disposed of as non-hazardous petroleum contaminated soil. Groundwater may also require off Site disposal, but profiling this waste will not require segregation or special disposal considerations for the levels of RCRA metals detected.

4.2.3.1 Soil, Groundwater and Free-Phase Oil Removal

This IRM involves the removal of identified petroleum-contaminated soils on the north side of each laboratory building at the former petroleum storage tank locations and immediately adjacent to each powerhouse building, including B1247, B1255, B1263, B1279 and B1287, as indicated on Figures 3 through 7. Soil will be removed by excavation and disposed of off-Site. The soil removals and closure will be conducted in accordance with NYSDEC DER-10. It is estimated that soil in the former tank locations will be removed to a depth of approximately 10 feet for a total volume of approximately 1,140 CY. It is estimated that approximately 5 CY will be removed from each impacted area around the previously mentioned power house buildings for a total volume of approximately 45 CY.

The estimated combined total volume of soil to be excavated and remediated is approximately 1,200 CY. This material along with straw and organic soil amendment(s) as described below will be used to construct a biopile at each of the seven impacted buildings. Soils will be screened during all excavation activity with a MiniRAE 3000 (or equivalent) PID to assess subsurface petroleum impacts and conduct air monitoring per the procedures outlined in the HASP.

During the excavation and biopile construction process, dewatering will be conducted by a vacuum truck to assist in managing saturated soils and remove free-phase oil observed during EBS and RI activities. Water removed from the excavations will be transferred into a series of frac tanks, as necessary. Once dewatering has been completed and all water is contained within the frac tanks, free-phase oil will be removed with a vacuum truck and sent off-Site to Industrial Oil Tank Service Corp. in Oriskany, New York for disposal. The staged water will then be sampled as necessary, treated on-Site (if necessary) and discharged to the Site. It is estimated that approximately 55,000 gallons of water will be removed and containerized during the dewatering process.

Sub-slab piping can potentially act as migration pathways for contaminants to follow. If any such piping is encountered, it will be investigated for evidence of suspect contamination and removed during the soil removal phase.

If applicable, decontamination wastes will be disposed of in accordance with applicable regulations and protocols.

Following the excavation and dewatering activities, Lu Engineers recommends that remedial efforts include amending inaccessible soils and residual contamination with ORC or an equivalent.

A biopile will be constructed at each of the seven subject locations to accomplish aerobic bioremediation of the contaminated soils. Biopiles will be constructed on a double layer of six-mil polyethylene sheeting. Soils will be amended with straw and organic material and mixed during placement. Perforated piping will be installed horizontally through the center of each pile and vented to the atmosphere. It is noted that no NYSDEC-listed hazardous air pollutants (HAPs) were identified during sampling of environmental media associated with this AOC and no emissions of HAPs are anticipated. Piles will be covered with polyethylene sheeting as needed to protect it from adverse weather conditions. Small berms will be installed around each pile using uncontaminated soil to mitigate runoff/runon.

Each soil pile will be sampled periodically (once every two months during the growing season) to determine whether remediation has been completed. It is assumed that remediation will be completed within one (1) year of installation.

The excavation will remain open while bioremediation progresses. Once favorable analytical results are observed, the biopile will be used as backfill and waste materials (sheeting/piping) will be disposed of off-Site.

4.2.3.2 Confirmatory Sampling

Upon removal of the contaminated soil to the extent possible, the former tank pits and powerhouse excavations will be observed for physical evidence of residual contamination and the sidewalls and excavation floor will be screened with a PID. Prior to backfilling, post-excavation confirmatory soil samples will be collected in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A).

4.2.3.3 Backfill

NYSDEC-approved imported clean backfill material will be installed and compacted to fill the voids left by contaminated soil removal. Excavated soil that is proposed for re-use as backfill in the excavation will first be tested in accordance with Table 5.4(e)10 of DER-10.

4.2.4 VRF-AOC-04: Former Solvent Disposal

Based on investigation findings no remedial actions are required as part of this AOC. Contamination identified in association with former solvent disposal is being handled under the provisions outlined in VRF-AOC-08 and VRF-AOC-09.

4.2.5 VRF-AOC-05: Former PCB-Containing Equipment

The VRF has a well-documented history of PCB-containing equipment and evidence of spillage of transformer oil is present in several areas of the Site. Previous sampling has revealed two locations of PCB-containing sludge/residue characterized as hazardous waste and two areas at which surface soil was found to contain PCBs at levels exceeding applicable SCOs.

The floor trench drain in B1233 contains sediments with hazardous waste levels of PCBs (Aroclor 1260). Surface soils near the trench drain discharge pipe at the south corner of B1233 are also impacted by PCBs. Oil residue collected from an exterior electrical switch panel located near B1266 revealed 361 ppm of Aroclor 1260.

4.2.5.1 Concrete Decontamination and Limited Soil Removal

Remedial activities associated with this AOC include work at B1226, B1233, B1235, B1255, B1266, B1287 and B1298. This IRM involves concrete and soil removal, and limited decontamination of PCB-containing concrete and building surfaces.

<u>B1226:</u> The existing transformer located east of B1226 will be removed from its concrete slab. The concrete slab will be removed and broken into manageable pieces for off-Site disposal. The bedding material beneath the slab and subsurface soil will be removed to an assumed depth of approximately 5 feet below grade. The estimated volume of soil to be removed from this location is approximately 10 CY.

Following soil removal confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). The excavation will be backfilled using NYSDEC-approved clean imported backfill material.

<u>B1233:</u> Following building demolition, the concrete slab will be removed and broken into manageable pieces for off-Site disposal. The bedding material beneath the slab and subsurface soil will be removed to an assumed depth of approximately 5 feet below

grade. The estimated volume of soil to be removed from this location is approximately 10 CY.

Following soil removal confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). The excavation will be backfilled using NYSDEC-approved clean imported backfill material. Surface soils on the east side of B1233 were found to contain PCBs exceeding the Unrestricted Use Criteria SCO. Impacted surface soils at B1233 will be remediated by excavation and disposal as part of the source area removal described under VRF-AOC-08. Due to the PCB concentrations detected during sampling it is likely that the affected soils at B1233 will be considered hazardous waste.

B1245: Affected portions of the concrete slab will be removed and broken into manageable pieces for off-site disposal. The bedding material beneath the slab and subsurface soil will be removed to an assumed depth of approximately 5 feet below grade. The estimated volume of soil to be removed from this location is approximately 10 CY.

Following soil removal confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). The excavation will be backfilled using NYSDEC-approved clean imported backfill material.

B1255: Affected portions of the concrete slab will be removed and broken into manageable pieces for off-Site disposal. The bedding material beneath the slab and subsurface soil will be removed to an assumed depth of approximately 5 feet below grade. The estimated volume of soil to be removed from this location is approximately 10 CY.

Following soil removal confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). The excavation will be backfilled using NYSDEC-approved clean imported backfill material.

B1266: Affected portions of the concrete slab will be removed and broken into manageable pieces for off-Site disposal. The bedding material beneath the slab and subsurface soil will be removed to an assumed depth of approximately 5 feet below grade. The estimated volume of soil to be removed from this location is approximately 10 CY.

Following soil removal confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). The excavation will be backfilled using NYSDEC-approved clean imported backfill material.

B1287: The stained PCB-containing concrete floor slab and impacted building surfaces will be decontaminated. Decontamination methods may include scarification, chemical application/extraction or by other remedial technologies. Waste associated with the decontamination process will be disposed of per applicable regulations. Confirmatory concrete sampling will be conducted as necessary to ensure effective remediation.

Surface soils on the east side of B1287 were found to contain PCBs exceeding the Unrestricted Use Criteria SCO. Impacted surface soils at B1287 will be remediated by excavation and disposal. It is estimated that 5 CY of surface soil will be removed and disposed of according to applicable regulations. Confirmatory surface soil sampling will be conducted as deemed necessary.

B1298: The concrete slab will be cleaned and material containerized for disposal off-Site. The estimated volume of waste to be removed from this location is approximately 2 CY.

Following soil removal confirmatory soil samples will be collected from the concrete surface in accordance with NYSDEC protocols in DER-10 Section 5.4(b). Samples will be collected and analyzed as specified in the QAPP (Appendix A).

4.2.6 VRF-AOC-07 (WDA-03) Former Landfill

As previously described and based on investigation findings no remedial actions are required for VRF-AOC-07 (WDA-01) or VRF-AOC-07 (WDA-02). Solid waste materials generally including but not limited to buried metal, batteries, glass, electronics, plastic, drums, fiberglass and filter bed sand were discovered in the former landfill area (VRF-AOC-07 (WDA-03)). Soil and groundwater contamination likely associated with the buried waste was also detected in this area. Soil contaminants detected above applicable SCOs include acetone, arsenic, and 2-butanone. Chromium was the only groundwater contaminant detected above the Class GA groundwater standard. However, subsequent testing has indicated that no groundwater exceedances for chromium are present.

4.2.6.1 Soil and Groundwater Removal and Disposal

Remedial actions at the former landfill will include the removal of all known solid waste and arsenic-contaminated soils by excavation and off-Site disposal. All identified fill and buried solid waste materials will be excavated to an average depth of 5 feet below grade throughout the entire footprint of the landfill area, as illustrated on Figure 3. This is the approximate maximum depth at which waste materials were identified. It is estimated that 300 CY of solid waste and arsenic-contaminated soils will be removed from the landfill and disposed of off-Site. Soils will be segregated based on analytical results and

PID screening. Soils contaminated with VOCs only will be segregated for on-Site bioremediation as described below.

During and after the soil removal process, confirmatory soil samples will be collected from excavation sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.5(c). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). For soils indicating elevated levels of acetone and/or 2-butanone, biopile(s) will be constructed.

A biopile will be constructed to accomplish aerobic bioremediation of VOC-contaminated soils. The biopile will be constructed on a double layer of six-mil polyethylene sheeting. Soils will be amended with straw and organic material and mixed during placement. Perforated piping will be installed horizontally through the center of each pile and vented to the atmosphere. The pile will be covered with polyethylene sheeting as needed to protect it from adverse weather conditions. A low berm will be installed around the pile using uncontaminated soil to mitigate run-off/run-on.

The soil pile will be sampled periodically to determine whether remediation has been completed. It is assumed that remediation will be completed within one (1) year of installation.

The excavation will remain open while bioremediation progresses. Once favorable analytical results are observed, the biopile will be used as backfill and waste materials (sheeting/piping) will be disposed of off-Site.

Once removed and characterized, arsenic-contaminated soil and solid waste will be hauled off-Site and disposed of at an appropriately licensed waste disposal facility.

The excavation will be dewatered by a vacuum truck during soil removal as necessary to allow for effective removal of the fill and solid waste materials. Dewatered groundwater will be pumped into frac tanks in which the solids will be allowed to settle. Once the majority of solids have settled out the water will be transferred into a series of frac tanks for staging prior to treatment as necessary. The water will then be treated on-Site, sampled as necessary and discharged to the ground surface. Prior to discharge, Lu Engineers will secure any appropriate NYSDEC-required discharge permit(s).

If chromium exceedances in groundwater are indicated, remedial activities may also include in-situ groundwater treatment (i.e. molasses) and quarterly groundwater monitoring for one year following the waste removal. Lu Engineers recommends the application of a 5% solution of food-grade molasses (or equivalent) into the open excavations prior to re-grading to reduce hexavalent chromium to its insoluble trivalent state. The need to apply molasses will be determined during the excavation process as indicated by waste water sampling results and will be considered if exceedances of Class GA standards for chromium are identified.

2-inch diameter backfill monitoring wells will be installed using an excavator following the soil removal to an approximate depth of 6 feet below grade to replace the wells removed with the waste and to provide access to groundwater for application of remedial agents, as necessary.

It is noted that the landfill area may not be completely backfilled following remediation.

4.2.7 VRF-AOC-08: B1233 Investigation and Cleanup

It is anticipated that an addendum to this work plan will be necessary to further specify the details relating to cleanup, confirmatory sampling and related requirements once remediation of the other IRMs discussed herein has been completed. The IRM work planned for AOC-08 will be conducted as a separate effort, distinct from the other IRMs that are likely to begin no earlier than Spring 2015. Comments received from the NYSDEC relating to specific elements of this IRM will be addressed by addendum.

The primary contaminant of concern at B1233 is chlorobenzene in subsurface soil and groundwater. The vertical and aerial extent of VOC contamination at B1233 has been generally delineated through installation of 15 Membrane Interface Probe (MIP) points as presented in the September 2013 EBS Report. Acetone, PCE, pesticides, and PCBs were also detected above Unrestricted Use SCOs in source area soils between 4.5 and 10 feet below grade.

The floor trench drain in B1233 contains sediments with hazardous waste levels of PCBs. Surface soils near the trench drain discharge pipe at the south corner of B1233 are also impacted by PCBs, as shown on Figure 4.

4.2.7.1 PCB Remediation

Following building demolition, the PCB-contaminated concrete slab will be removed as previously described in Section 4.2.5.1. Following concrete building slab removal and off-Site disposal, PCB-contaminated surface soils will be removed in conjunction with the planned soil removal activities as described in the following section.

4.2.7.2 Soil and Groundwater Removal, Disposal and Sampling

Following the demolition of B1233, VOC-contaminated soils identified to date will be remediated by excavation and disposal from the area, as indicated on Figure 4. Planned remedial measures include dewatering of groundwater during the excavation process, as necessary.

Prior to initiating removal of impacted soils, sheet piling will be installed around the perimeter of the soil removal area to ensure excavation sidewall stability. This is partly due to the fact that the groundwater table is very shallow in this portion of the property. Once installed, soil removal by excavation will be initiated. The planned maximum depth of excavation is approximately 14 feet below grade at which a dense glacial till layer will be encountered beneath the affected soils. Excavated soils will be sampled as necessary to properly characterize the soil. Impacted soils will be disposed of off-Site at an approved waste disposal facility per applicable regulations. It is estimated that approximately 1,500 CY of contaminated soil will be removed and disposed of off-Site.

During and after the soil removal process, confirmatory soil samples will be collected from the excavation sidewalls and floor in accordance with the protocols outlined in NYSDEC DER-10 Section 5.5(c). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A).

Dewatering of groundwater within the excavation will be conducted as necessary during the soil removal effort. The water will be pumped into a series of frac tanks in which sediment will be allowed to settle. It is estimated that approximately 235,000 gallons of water will be removed from the excavation and treated on-Site. On-Site water treatment will likely be accomplished by activated carbon filtration prior to discharge on-Site. Sampling of water will be conducted as required to satisfy the requirements of a temporary NYSDEC discharge permit, as necessary.

4.2.7.3 Excavation Backfilling, Monitoring Well Installations and Post-Remedial Injection

Following the soil and groundwater removal effort and confirmatory sampling the excavation will be backfilled to existing grade. Clean soils removed during the excavation process to access contaminated soils will be sampled and re-used as backfill within the excavation footprint, as appropriate. Clean backfill material from an NYSDEC-approved source will be imported to the Site to complete the backfilling process, as necessary.

Several monitoring wells located within the soil removal area will be removed during soil excavation. Approximately five (5) new 2”-diameter drilled monitoring wells will be installed following the backfilling phase in order to evaluate post-remedial groundwater conditions. Lu Engineers also recommends in-situ injection of the remedial agent OGL (or equivalent) through a grid-based series of approximately 40 injection points. Remedial solution injection will be conducted by use of a geoprobe and injection pump system. It is recommended that three (3) rounds of post-remedial injection be conducted.

4.2.8 VRF-AOC-09: Site-Wide Groundwater Contamination

Groundwater contamination exceeding NYSDEC Part 703.5 Class GA groundwater standards was detected in several locations across the Site, including chromium and chlorinated solvents. Areas that revealed contaminated groundwater include the landfill associated with VRF-AOC-07(WDA-03) (GPW-39, GPW-40, GPW-41), B1233, BN1219, and B1266. Chlorinated solvents detected above groundwater standards at BN1219 and B1266 are addressed in this section. Chromium-contaminated groundwater identified in the landfill may be remediated as outlined in Section 4.2.7.1, VRF-AOC-07(WDA-03), if necessary. CVOCs detected at B1233 will be addressed as outlined in Section 4.2.8.2 under VRF-AOC-08.

Chlorinated solvents, including 1,2-dichloroethane (detected at BN1219-W06), cis-1,2-dichloroethene and vinyl chloride (detected at B1266-W07 & B1266-W12) will be remediated by in-situ injection methods. A direct-push Geoprobe® drill rig will be mobilized to the Site to perform the injection of a remedial agent solution (OGL or equivalent). Remedial solution will be introduced into the water-bearing zone at target depths through a series of approximately 20 grid-based injection points around each of the three (3) affected miniwells. The grid-based approach at each location will be based on an assumed 10-foot spacing interval. Lu Engineers recommends a total of three (3) injection events at each location. The quantity of remedial solution injected per event will be based on what has been proven effective by grid-based injection elsewhere on-Site.

Post-remedial groundwater sampling will be conducted using the existing wells located at the remedial target locations as indicated on Figures 5 and 6. The initial confirmatory groundwater sampling event will be completed six weeks after the final (third) remedial agent injection event. A total of four (4) quarterly groundwater sampling events are anticipated. If no target analytes are detected at concentrations exceeding applicable SCGs, confirmatory soil sampling will be considered complete. If target analytes are found to exceed applicable SCGs after four quarterly monitoring events, additional remedial effort and confirmatory sampling will be considered based on consultation with AFRL and NYSDEC at that time.

4.2.9 VRF-AOC-10: Site-Wide Soil Contamination

Soil contamination identified across the Site at concentrations exceeding applicable SCOs for VOCs will be remediated by in-situ bioremediation and/or ISCO. VOC exceedances were identified at TP-38, TP-45, TP-48, TP-66, TP-71, TP-75, and soil boring B1287-S10 (see Figures 3 through 7). Soil removals will take place at TP-83 where lead was detected above the applicable SCO (Figure 8) and at TP-93 where mercury was detected above the applicable SCO. Soils from these two locations will be remediated by excavation and off-Site disposal. At each location, approximately 10 CY of soil will be removed by excavation.

A direct-push Geoprobe® drill rig will be mobilized to the Site to perform the injection of a remedial agent solution (OGL or equivalent). Remedial solution will be introduced into the previously identified contaminant depth(s) through a series of approximately 20 grid-based injection points around each of the exceedances. The grid-based approach at each location will be based on an assumed 10-foot spacing interval. Lu Engineers recommends a total of three (3) injection events at each location. The quantity of remedial solution injected per event will be based on what has been proven effective by grid-based injection elsewhere on-Site. Post-remedial soil sampling by direct-push methods will be conducted. The frequency of the sampling will be as agreed upon with NYSDEC.

The initial confirmatory soil sampling event will be completed six weeks after the final (third) remedial agent injection event. A total of two confirmatory sampling events are anticipated with the second event following six weeks after the first. If no target analytes are detected at concentrations exceeding applicable SCOs, confirmatory soil sampling will be considered complete. If target analytes are found to exceed applicable SCOs, additional remedial effort and confirmatory sampling will be considered based on consultation with AFRL and NYSDEC at that time.

Following the soil removal process at TP-83 and TP-93, confirmatory soil samples will be collected from each excavation's sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.5(c). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). After confirmatory sampling has been completed, each area will be backfilled with clean backfill material from a NYSDEC-approved source.

4.2.10 VRF-AOC-11: Brandy Brook Sediments

Sediment contamination identified in the bank of Brandy Brook at concentrations exceeding applicable SCOs will be remediated by excavation and off-Site disposal. These areas include previous sample locations BB-SED-01, BB-SED-02 where contaminants endosulfan sulfate, arsenic, chromium and lead were detected above Unrestricted Use SCOs, and at BB-SED-03 where acetone was detected above the Site-specific SCO (see Figures 3 and 4). Soil removals will also take place at TP-83 where lead was detected above the applicable SCO (Figure 8) and at TP-93 where mercury was detected above the applicable SCO.

At each location, approximately 10 CY of soil will be removed by excavation. Soil will be transported off-Site and disposed of at an approved disposal facility. Following the soil removal process, confirmatory soil samples will be collected from each excavation's sidewalls and floor in accordance with NYSDEC protocols in DER-10 Section 5.5(c). Soil samples will be collected and analyzed as specified in the QAPP (Appendix A). After confirmatory sampling has been completed, each area will be backfilled with clean backfill material from a NYSDEC/NYSDOT-approved source. A subsequent Stream

Restoration Plan will be implemented if determined to be necessary and provided to all project stakeholders.

4.3 Characterization, Transportation, and Disposal of Contaminated Soils

Excavated material that will not be re-used as backfill will be characterized to determine disposal options, in accordance with the QAPP (Appendix A). These samples will be analyzed for waste characterization parameters as deemed appropriate and specific to each AOC.

Transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Trucks will be logged, and drivers and their respective time on-Site will be documented to ensure compliance with applicable health and safety requirements and prevailing wage considerations.

The contractor(s) will be responsible for loading, transporting, and disposing of non-hazardous and hazardous contaminated soils, sediment/sludge, concrete, and groundwater generated during the IRM work, as necessary. At the discretion of the field team leader and the AFRL, if soil being loaded contains wet material capable of producing free liquid, truck bed liners will be used. All trucks exiting the Site with contaminated material will be covered with tight-fitting tarps prior to departure and during precipitation events. Tarps will also be required if a loaded truck is to remain on-Site overnight. The contractor(s) is responsible for ensuring that staging of trucks will not interfere with community traffic and that truck idling will be in accordance with applicable local, State, and Federal regulations.

Appropriate shipping documents will be prepared for each waste shipment, for execution by AFRL. Copies of disposal documentation will be maintained and will be available for on-Site review. Documentation from the disposal facility verifying the weight of each shipment will be provided by the contractor as soon as possible.

4.4 Dust and Vapor Monitoring and Mitigation Procedures

Procedures for dust and/or vapor monitoring are presented in the HASP included as Appendix B, and the Community Air Monitoring Plan (CAMP) included as Appendix C.

Continuous perimeter and work zone air monitoring will be conducted during contaminated soil removal and handling activities as necessary using dustraks (or equivalent) and MiniRAE 3000s (or equivalent) to ensure that workers and the public are not exposed to elevated concentrations of dusts and/or VOCs. The air monitoring will be conducted in accordance with a Site-specific CAMP, which is included in Appendix C.

Fugitive dust migration will be visually assessed during all work activities, and reasonable dust suppression techniques (i.e., water spray) will be used during any Site activities that may generate fugitive dust, such as demolition of concrete, as necessary.

4.5 Disposal of Other IRM-Derived Wastes

The following IRM-derived wastes are anticipated for this project in addition to the bulk (soil and groundwater) materials discussed elsewhere:

- Former transformer and/or building concrete slabs and associated bedding material
- Decontamination wastes.

These materials will be characterized and be disposed off-Site in accordance with applicable regulations.

Any drums of material generated as part of the IRM activities will be removed upon completion of the IRM activities and disposed of in accordance with all applicable local, state and federal regulations. All IRM equipment will be decontaminated and removed upon completion of the IRM activities.

4.6 Site Restoration

Once contaminated soils, sediments and solid waste materials have been excavated and post-excavation sampling has been completed and/or as necessitated by conditions observed during excavation, the excavations will be backfilled with clean soil that was previously removed, staged, and covered on-Site, and/or imported backfill material from an NYSDEC-approved source(s) that meets the requirements set forth in DER-10, Section 5.4(e) and Appendix 5. Imported backfill material will be approved by NYSDEC DER prior to being delivered to the Site.

To the extent practicable, backfill will be placed in lifts with the excavator and compacted. Areas impacted by the IRM will be returned to existing conditions with the exception of VRF-AOC-07 which will not be backfilled. Existing grade will be matched at each IRM (with the exception of VRF-AOC-07).

4.7 Installation and Development of Additional Monitoring Wells

The installation of additional monitoring wells is not anticipated at the present time other than the backfill wells specified with respect to VRF-AOC-07. Should additional wells be required, a rotary drill rig will be used to install additional and/or replacement overburden monitoring wells. The actual number of wells and locations are subject to change based on field conditions encountered and input from the AFRL and NYSDEC.

As necessary, additional monitoring wells will be installed utilizing a two-inch inside diameter, Schedule 40 PVC casing and screen materials. A No. 10 slot screen will be attached to a solid PVC riser casing with a PVC cap that will extend from the top of the screened section to approximately the ground surface. The anticipated screen length will be 10 feet. The actual length of the well screen may vary due to the encountered field conditions.

The annulus around the collection sump and well screen will be filled with a washed and graded silica sand pack that will be placed to at least two feet above the top of the screen interval. A minimum two-foot thick bentonite seal will be placed above the sand pack and hydrated with water. Following hydration of the bentonite, the remaining annulus will be filled with cement/bentonite grout consisting of approximately 96% Portland type 1 (or similar) cement to 4% granular bentonite mixture and water. The cement/bentonite grout will be tremied into the well annulus to approximately one foot below grade, as necessary. Wells will be completed with lockable protective steel covers.

<u>Well Development</u>

Monitoring wells will be developed by utilizing either a new dedicated disposable bailer with dedicated cord, and/or a pump and dedicated disposable tubing depending on the field conditions. Monitoring well development can occur a minimum of 48 hours after installation. No fluids will be added to the wells during development without prior approval of the NYSDEC, and well development equipment will be decontaminated prior to development of each well.

The well development procedure is listed below:

- Obtain pre-development static water level and oil/water interface reading for presence of DNAPL using a Heron Model HO1.L oil/water interface probe or similar instrument;
- Calculate water/sediment volume in the well;
- Obtain initial field water quality measurements (e.g., pH, specific conductivity, turbidity, temperature, and PID readings). The pH, specific conductivity, turbidity and temperature readings will be obtained using YSI Quattro Pro water quality meter (or similar equipment);
- Select development method and set up equipment depending on method used;
- Alternate water agitation methods (e.g., moving a bailer or pump tubing up and down inside the screened interval) and water removal methods (e.g., pumping or bailing) in order to suspend and remove solids from the well;
- Obtain field water quality measurements for every two to five gallons of water removed. Record water quantities and rates removed;

- Stop development when the following water quality criteria are met and at least 10 well volumes have been removed;
    - Water is clear and free of sediment and turbidity is less than 50 nephelometric turbidity units (NTUs);
    - pH is ±0.1 standard unit between readings;
    - Specific conductivity is ±3% between readings, and;
    - Temperature is ±10% between readings.
- Obtain post-development water level readings; and
- Document development procedures, measurements, quantities, etc.

Pertinent information for each well will be recorded on well development logs.

5.0 Geographic Information System Database

A GIS database will be used identify, track, and document the IRM activities as they progress. The database will also prove to be an efficient vehicle for location of IRM areas and evaluating data from previous investigations. The scope of work will include incorporating the current geodatabase into an updated spatial database with interactive GIS map.

6.0 QA/QC Protocols

The Engineer is responsible for the project management, coordination and scheduling, subcontracting, and quality assurance/quality control (QA/QC) of IRM activities. General QA/QC procedures, including sample preparation and holding times, are described in the QAPP (Appendix A).

Samples will be obtained, handled and characterized in accordance with NYSDEC Analytical Services Protocol (ASP) methods. Once obtained, samples will be immediately labeled and stored on ice in a cooler. Analytical work will be performed by an appropriately qualified New York State Department of Health (NYSDOH) Environmental Laboratory Approval Plan (ELAP) accredited, Contract Laboratory Protocol (CLP) certified subcontracted laboratory. The subcontracted laboratory will be accredited for the category of parameters analyzed, as outlined in DER-10, Section 2.1. Analytical methods reflect the requirements of the NYSDEC ASP, revised July 2005. Chain-of-custody requirements will be strictly adhered to for designated analyses.

A listing of anticipated samples, analytes, methods, and QA/QC samples to be collected during this project is included in the attached QAPP. The QAPP protocols will not be deviated from except to collect additional RI samples, as deemed necessary by AFRL and

NYSDEC personnel. Data will be provided to the NYSDEC electronically in the required EQuiS database format.

7.0 Health and Safety

A Site-specific HASP has been prepared for this project and is included as Appendix B. The HASP will be reviewed by all employees visiting the Site before starting Site work. Other entities can adopt the protocols set forth in the HASP, or can develop their own HASP which must be submitted to the NYSDEC. Monitoring of the work area and screening of soil and groundwater will be conducted throughout the duration of IRM activities using the following (or equivalent) instrumentation:

- TSI Dustrak, Sidepack or equivalent for particulate monitoring, as necessary
- EntryRAE Multi-Gas Monitor (or equivalent), as necessary
- MiniRAE 3000 PID equipped with a 10.2 eV or 10.6 eV lamp, as necessary.

Air monitoring at the Site will be continuous during ground intrusive activities and during the demolition of building slabs and asphalt pavement. Air monitoring will be periodic during non-intrusive activities.

A written CAMP is provided as Appendix C.

All workers on-Site will have completed the Occupational Health and Safety (OSHA) 40-hour Hazardous Waste Operations (HAZWOPER) training with current refresher courses. A copy of the HASP will be available on-Site at all times during the IRM activities.

Professional personnel entering the Site will have current OSHA HAZWOPER Certifications. Non-professional personnel will maintain OSHA 10-hour Certifications, at a minimum.

8.0 IRM Construction Completion Report

Upon receipt and review of necessary data, an IRM Construction Completion Report will be prepared including:

- A discussion of the IRM work completed;
- Site Plan(s) with locations of IRM activities;
- Extents of soil removal;
- Manifests for off-Site disposal of waste materials;
- Photographs;
- Tabulated post-excavation soil sampling results, including comparison to appropriate NYSDEC SCOs in 6 NYCRR Part 375; and
- Laboratory analytical reports and chain-of-custody forms.

A draft IRM report will be prepared for review. The report will be prepared in accordance with Section 5.8(b)-(d) of DER-10 and identify and list recommended cleanup levels in accordance with SCGs. In addition, the report shall identify applicable Federal and State criteria, advisories and guidances associated with any identified hazardous substances. Hazardous substances to which SCGs have been exceeded or contravened will be identified in the draft IRM report. Upon approval of the draft IRM report by the AFRL, the report will be provided to the NYSDEC.

9.0 Citizen Participation

A Citizen Participation Plan (CPP) has been developed for this project and is available upon request. The components of the CPP will be implemented as they relate to the IRM work.

Figures

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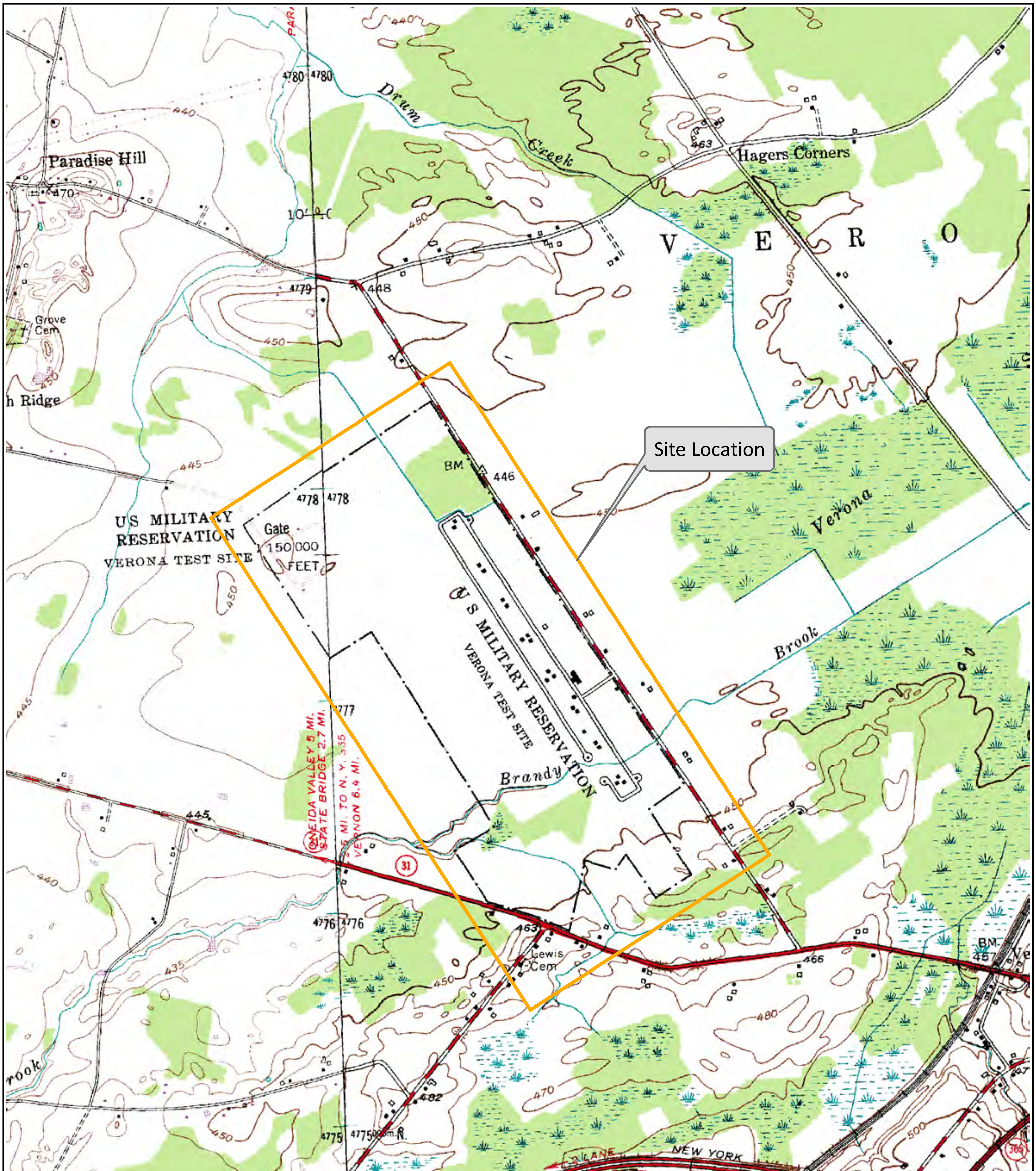
ENVIRONMENTAL • TRANSPORTATION • CIVIL



1:24,000

0	1,000	2,000	4,000

Feet

N

New York Quadrangle Location

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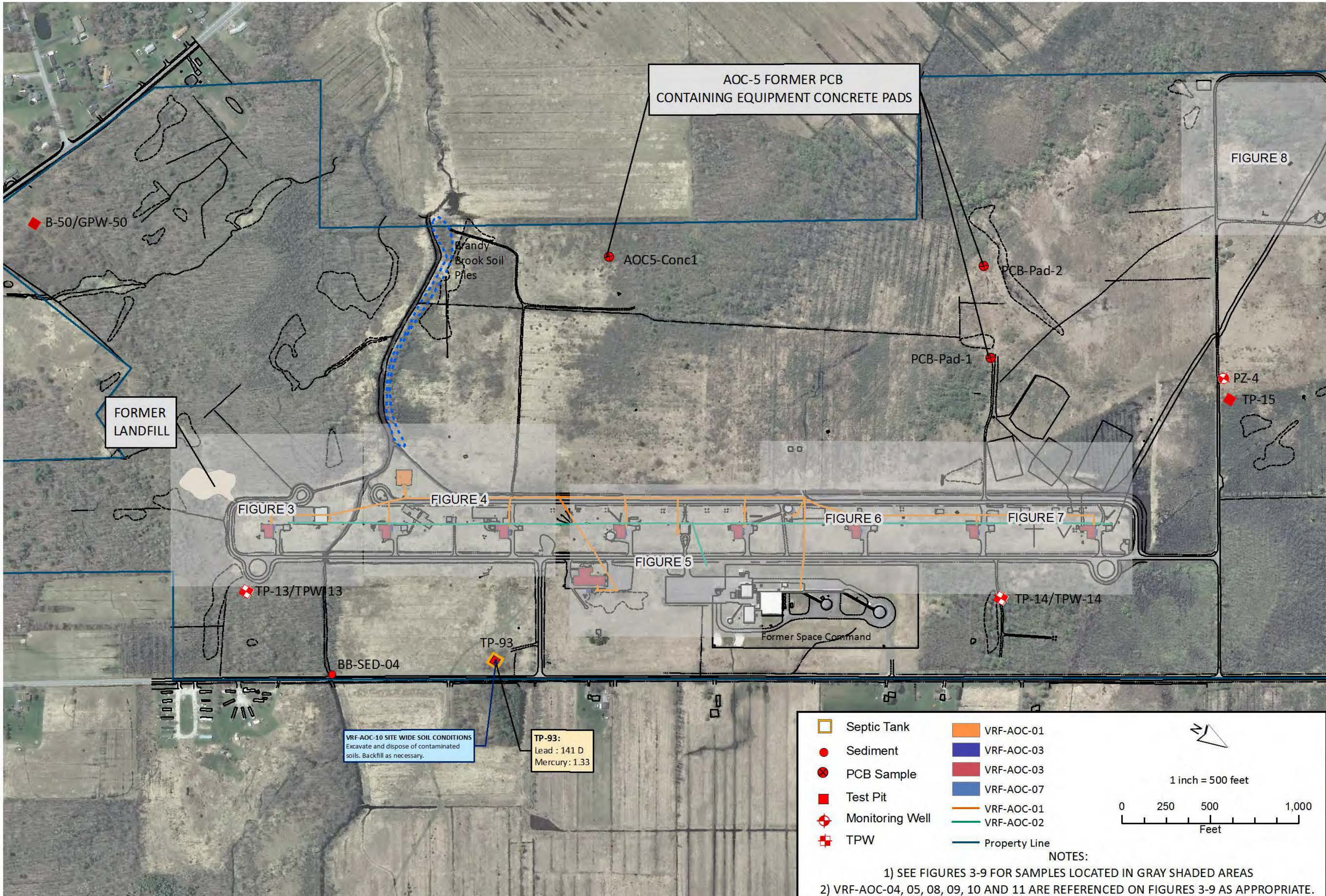
FIGURE 1.1
SITE LOCATION MAP
VERONA RESEARCH FACILITY
VERONA, NY

DATE: MAY 2014
SCALE: 1:24,000
DRAWN/CHECKED: GLA/SMK
DATA SOURCE: USGS Digital Raster Graphic quadrangle 1978



DATE: MAY 2014

SCALE: 1 inch= 500 feet

DRAWN/CHECKED: GLA/SMK

DATA SOURCE:
NYS GIS CLEARINGHOUSE
ORTHOIMAGERY

FIGURE 2
SITE PLAN
VERONA RESEARCH FACILITY IRM WORK PLAN
VERONA, NY

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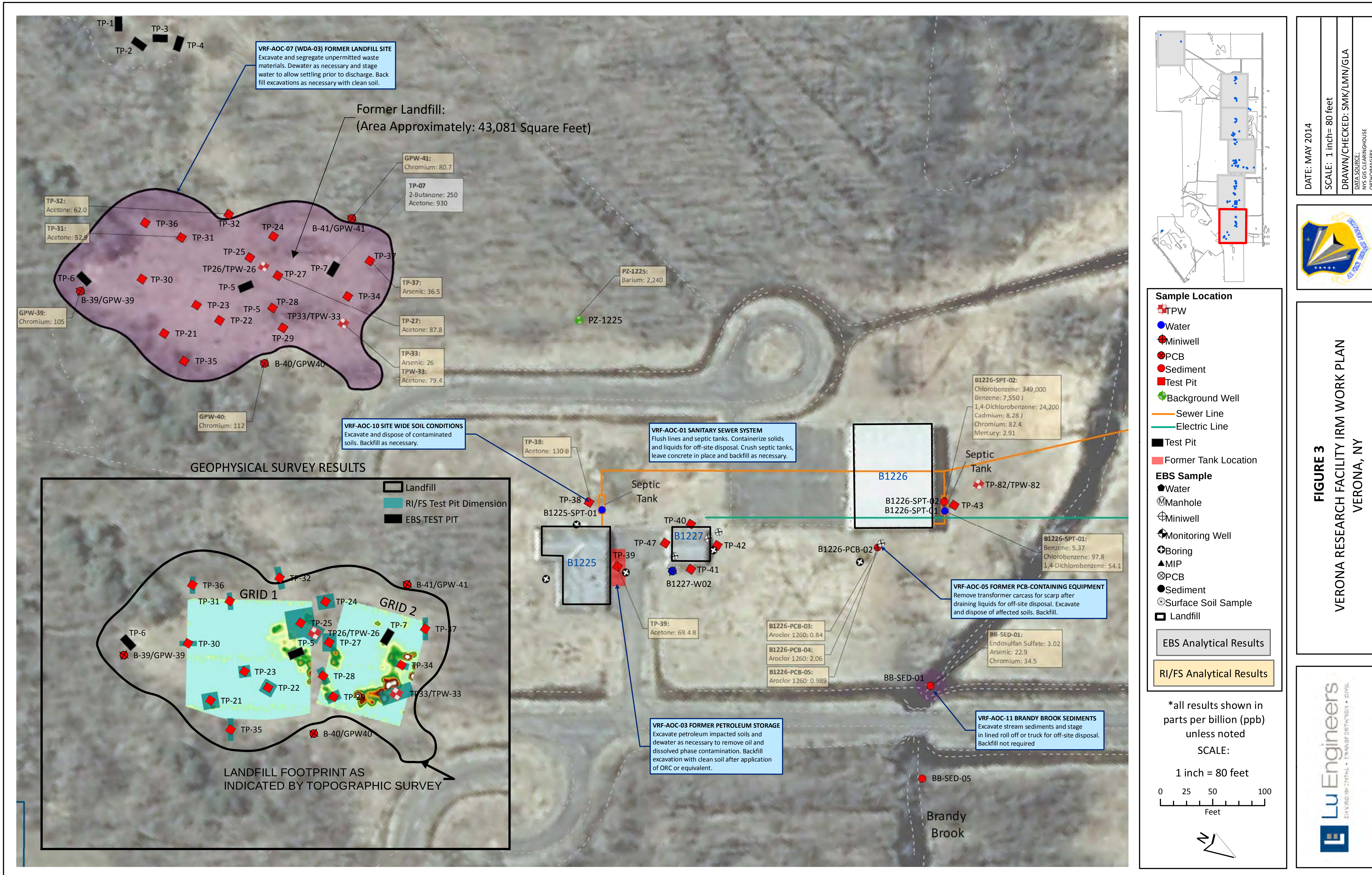
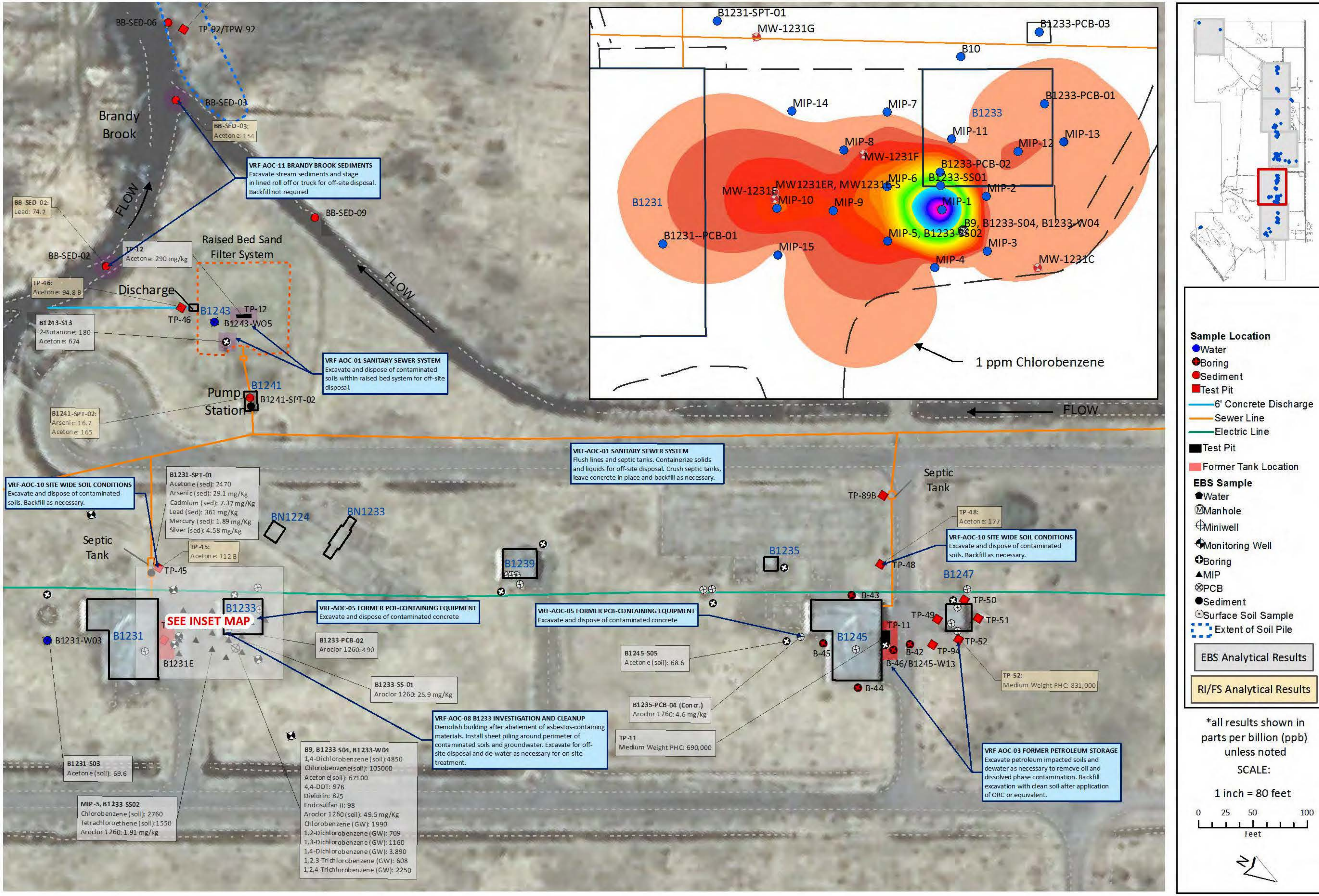


VRF-AOC-07 (WDA-03) FORMER LANDFILL SITE
Excavate and segregate unpermitted waste materials. Dewater as necessary and stage water to allow settling prior to discharge. Back fill excavations as necessary with clean soil.
Former Landfill:
(Area Approximately: 43,081 Square Feet)
GPW-41: Chromium: 80.7
TP-07 2-Butanone: 250 Acetone: 930
TP-32: Acetone: 62.0
TP-31: Acetone: 52.9
GPW-39: Chromium: 105
TP-37: Arsenic: 36.5
TP-27: Acetone: 87.8
TP-33: Arsenic: 26 TPW-33: Acetone: 79.4
GPW-40: Chromium: 112
PZ-1225: Barium: 2,240
PZ-1225
VRF-AOC-10 SITE WIDE SOIL CONDITIONS
Excavate and dispose of contaminated soils. Backfill as necessary.
TP-38: Acetone: 130 B
VRF-AOC-01 SANITARY SEWER SYSTEM
Flush lines and septic tanks. Containerize solids and liquids for off-site disposal. Crush septic tanks, leave concrete in place and backfill as necessary.
B1226-SPT-02: Chlorobenzene: 349,000 Benzene: 7,550 J 1,4-Dichlorobenzene: 24,200 Cadmium: 8.28 J Chromium: 82.4 Mercury: 2.91
B1226-SPT-01: Benzene: 5.37 Chlorobenzene: 97.8 1,4-Dichlorobenzene: 54.1
GEOPHYSICAL SURVEY RESULTS
Landfill
RI/FS Test Pit Dimension
EBS TEST PIT
GRID 1
GRID 2
LANDFILL FOOTPRINT AS INDICATED BY TOPOGRAPHIC SURVEY
Septic Tank
B1225
B1226
B1227
B1225-SPT-01
B1226-SPT-02
B1226-SPT-01
B1227-W02
B1226-PCB-02
TP-39: Acetone: 69.4 B
B1226-PCB-03: Aroclor 1260: 0.84
B1226-PCB-04: Aroclor 1260: 2.06
B1226-PCB-05: Aroclor 1260: 0.989
VRF-AOC-05 FORMER PCB-CONTAINING EQUIPMENT
Remove transformer carcass for scarp after draining liquids for off-site disposal. Excavate and dispose of affected soils. Backfill.
BB-SED-01: Endosulfan Sulfate: 3.02 Arsenic: 22.9 Chromium: 34.5
BB-SED-01
BB-SED-05
VRF-AOC-03 FORMER PETROLEUM STORAGE
Excavate petroleum impacted soils and dewater as necessary to remove oil and dissolved phase contamination. Backfill excavation with clean soil after application of ORC or equivalent.
VRF-AOC-11 BRANDY BROOK SEDIMENTS
Excavate stream sediments and stage in lined roll off or truck for off-site disposal. Backfill not required
Brandy Brook
Sample Location
TPW
Water
Miniwell
PCB
Sediment
Test Pit
Background Well
Sewer Line
Electric Line
Test Pit
Former Tank Location
EBS Sample
Water
Manhole
Miniwell
Monitoring Well
Boring
MIP
PCB
Sediment
Surface Soil Sample
Landfill
EBS Analytical Results
RI/FS Analytical Results
*all results shown in parts per billion (ppb) unless noted
SCALE:
1 inch = 80 feet
0 25 50 100
Feet
DATE: MAY 2014
SCALE: 1 inch= 80 feet
DRAWN/CHECKED: SMK/LMN/GLA
DATA SOURCE: NYS GIS CLEARINGHOUSE ORTHOIMAGERY
FIGURE 3
VERONA RESEARCH FACILITY IRM WORK PLAN
VERONA, NY
Lu Engineers



DATE: MAY 2014
SCALE: 1 inch = 80 feet
DRAWN/CHECKED: SMK/LMN/GLA
DATA SOURCE: NYS GIS CLEARINGHOUSE ORTHOIMAGERY

FIGURE 4
VERONA RESEARCH FACILITY IRM WORK PLAN
VERONA, NY

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