Review Avenue Development Site (RAD) I

LONG ISLAND CITY, QUEENS, NEW YORK

Final Engineering Report

Brownfield Cleanup Program (BCP) Site Number:
#C241089

Prepared by:

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511 Congress Street, Suite 200

Portland, Maine 04112

and

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December 2015

CERTIFICATIONS

I, _Brent C. O'Dell_, am currently a registered professional engineer licensed by the State of New York, I had primary direct responsibility for implementation of the remedial program activities, and I certify that the Remedial Action Work Plan was implemented and that all construction activities were completed in substantial conformance with the Department-approved Remedial Action Work Plan..

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

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

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

I certify that all documents generated in support of this report have been submitted in accordance with the DER's electronic submission protocols and have been accepted by the Department.

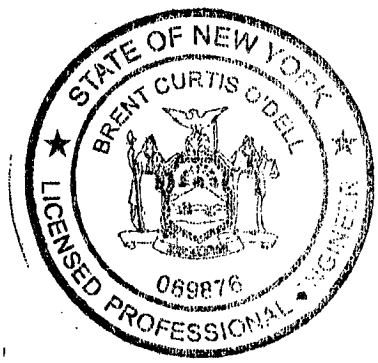
I certify that all data generated in support of this report have been submitted in accordance with the Department's electronic data deliverable and have been accepted by the Department.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Brent C O'Dell, of MACTEC Engineering & Consulting, P.C., am certifying as the Designated Site Representative for the site.

069876 6/7/16

NYS Professional Engineer # Date Signature

Note: include PE stamp



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LIST OF ACRONYMS

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO_2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
LNAPL	Light Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operations and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration

OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAD II	Review Avenue Development II Property
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Soil Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-Slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
SVMS	Soil Vapor Mitigation System
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency

UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program
VER	Vacuum Enhanced Recovery

FINAL ENGINEERING REPORT

1.0 BACKGROUND AND SITE DESCRIPTION

Cresswood Environmental Consultants, LLC (Volunteer) retained Golder Associates, Inc. (Golder) to prepare a Remedial Action Work Plan (RAWP) to satisfy the requirements of the New York State Department of Environmental Conservation (NYSDCEC) for the Review Avenue Development (RAD) I and RAD II properties located on Review Avenue in Long Island City, New York, dated February 9, 2007. The RAWP was prepared in accordance with the DER-10 Technical Guidance for Site Investigation and Remediation (DER-10) (HYSDEC, 2010) and Subpart 375.3 Brownfield Cleanup Program (BCP) Regulations (NYSDEC, 2006a) and submitted in November 2011. Cresswood Environmental Consultants, LLC entered into a Brownfield Cleanup Agreement (BCA) C241089 and dated June 6, 2005, with the NYSDEC to participate in the Brownfield's Cleanup Program for the RAD I and RAD II Sites.

The RAD I Site and the RAD II Site are adjacent to each other and have the same physical setting. The RAD Sites had been investigated concurrently since the early 1980's, but were entered into separate BCA and assigned different BCP numbers. The remedy selected by the NYSDEC for the RAD II Site is in the Record of Decision (ROD) issued by the NYSDEC in February 2007. A Decision Document was issued by the NYSDEC for the RAD I Site and a separate Final Engineering Report (FER) has been provided to address the requirements of that Decision Document. The remainder of this document will focus on the requirements of the Decisions Document for the RAD I Site.

The RAD I Site is identified as Block 312 and Lot 41 on the Long Island City Tax Map. The RAD II Site is separated from the RAD I property by a right of way (located on RAD 1), Preston Street, which runs from Review Avenue to the Long Island Railroad. To the northeast is Review Avenue and the Calvary Cemetery and to the southwest is the Long Island Railroad and the South Capasso property and the Former Peerless Oil property. The boundaries of the RAD I Site are shown on Figure-2.

2.0 SUMMARY OF SITE REMEDY

2.1 Remedial Action Objectives

The remediation goals for the RAD I Site, as stipulated by the RAWP and the December 2015 Decision Document are to eliminate or reduce to the extent practicable:

- The presence of LNAPL as a potential source of soil, groundwater and soil gas contamination;
- Potential further migration of LNAPL that could result in soil, groundwater or soil gas contamination;
- Exposures of persons at or around the site to VOCs or exceedances of the lower explosive level (LEL) in soil vapor;
- The potential for ingestion/direct contact with contaminated soil; and
- The release of contaminants from the urban soil and LNAPL into groundwater that may create exceedances of groundwater quality standards over time.

In addition, the remediation goals for the RAD I Site are to meet to the extent practicable:

- Ambient groundwater quality standards; and
- Standards, Criteria Goals (SCG's) for soil to the extent practicable.

2.1.1 Groundwater

Remedial Action Objectives (RAO's) for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

2.1.2 Soil

RAOs for Public Health Protection

- Prevent ingestion / direct contact with contaminated soil.

- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination

2.1.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from the potential for, soil vapor intrusion into buildings at the Site.

2.2 Description of Selected Remedy

The RAD I Site was remediated in accordance with the remedy selected by the NYSDEC in the Decision Document dated December 2, 2015 and ROD for the RAD II Site, dated February 9, 2007. The factors considered during the selection of the remedy for the RAD I and II Sites are those listed in 6NYCRR 375-1.8.

Portions of the RAD I Site were remediated under an IRM. This included the removal and offsite disposal of four underground storage tanks (USTs), a concrete trench, and a sump in May 2006. Currently, RAD I is paved and contains two buildings (Building 1 and Building 2). The components of the remedy proposed in the draft Decision Document include: the preparation of an Environmental Easement and periodic submittals, which are components addressed in the Site Management Plan (SMP). The remedies selected for the RAD I Site are listed below by media:

LNAPL

The remedy for LNAPL beneath the RAD I Site was recovery using single-phase skimmer pumps and vacuum enhanced (VER) recovery methods at locations where higher viscosity LNAPL is present. A long term monitoring program to monitor the effectiveness of the LNAPL recovery system was implemented.

Soil

The remedy for the soil at the RAD I Site was to re-cover excavation areas using a paving system that was consistent with existing cover and consistent with the development of the RAD I Site. The Site Management Plan identifies restoration requirements of future development activities.

Groundwater

The remedy for groundwater was the establishment of an institutional control that restricts the use of untreated groundwater beneath the RAD I Site as a source of potable water.

Soil Vapor

The results of soil vapor investigations on the RAD I Site did not identify a threat for migration of soil vapor laterally from the limits of the LNAPL beneath the RAD I Site.

Listed below are the primary elements of the selected remedy:

- Operation of a LNAPL recovery system:
- Establishment of an institutional control that restricts the use of untreated groundwater beneath the RAD I Site as a source of potable water;
- The execution and recording of an Environmental Easement to restrict land use and prevent future exposure to any contamination remaining at the RAD I Site;
- Development and implementation of a SMP for long term management of remaining contamination as required by the Environmental Easement, which includes plans for the following: (1) ECs and ICs, (2) monitoring, (3) operation and maintenance, and (4) reporting; and,
- Periodic certification of the ECs and ICs listed above.

3.0 INTERIM REMEDIAL MEASURES; OPERABLE UNITS AND REMEDIAL CONTRACTS

The selected remedy for the RAD I Site was performed in multiple phases to adequately address specific site characteristics.

- In 1982 the NYCDEP and NYSDEC completed an Emergency Removal Action to address immediate risks posed by the site due to the various waste materials left behind in tanks and related structures.
- 1988 through 1990 – investigatory work was conducted
- As a result of the Phase II Investigation, an RI Investigation was initiated to define the nature and extent of contamination (in conjunction with RAD II)
- RI report submitted to NYSDEC in June 2005 (in conjunction with RAD II)
- February 2007 – A Record of Decision was published by the NYSDEC
- In 2008 a VER LNAPL Recovery Pilot Study was completed by Golder Associates, Inc. VER -1 pilot study was conducted on the RAD I property.
- A RAWP was completed in November 2011 by Golder Associates, Inc.
- LNAPL Recovery System Construction and site restoration commenced with well drilling activities during the fall of 2014. In the spring and summer of 2015, the LNAPL recovery system construction the site capping system was constructed. LNAPL recovery system commissioning and implementation, both skimmer and VER systems, occurred in September 2015 by Amec Foster Wheeler.
- A Decision Document for RAD I was approved on December 2, 2015.

4.0 DESCRIPTION OF REMEDIAL ACTIONS PERFORMED

Remedial activities completed at the RAD I Site were conducted in general conformance with the NYSDEC-approved RAWP and ROD. The changes to the proposed remedy are included in the RAD II FER. Changes that took place did not affect the installed remedy on RAD I.

4.1 Governing Documents

4.1.1 Site Specific Health & Safety Plan (HASP)

All remedial work performed under this Remedial Action was in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal Occupational Safety and Health Administration (OSHA).

A Health and Safety Plan (HASP) was complied with for all remedial and invasive work performed at the Site. The HASP used for the RAD I Site is in Appendix G of the SMP.

4.1.2 Quality Assurance Project Plan (QAPP)

The QAPP provided a framework of procedures, functional activities, and organization to be used during the execution of environmental work at the RAD II Site. The procedures and criteria outlined in the QAPP described the level of performance required to achieve the project objectives.

The objectives of the QAPP are as follows:

- Provide a consistent framework for collecting samples and generating analytical data throughout the project;
- Identify detection limit and quality control (QC) goals for analytical methodologies used to generate chemistry data;
- Set forth review procedures used to demonstrate that the analytical systems are achieving project objectives;
- Set forth record-keeping procedures for field activities, sample collection and handling, and analytical data reporting;
- Provide for generation and documentation of data of known and acceptable quality; and,
- Set forth procedures that limit the effect of non-laboratory activities on analytical data.

The QAPP assured the documentation of RAD I Site activities so that field and analytical measurements could be verified. Quality assurance (QA) activities included the use of a management system to produce valid data in support of the program and a system of checks and reports that monitored the attainment of data quality objectives (DQOs). This management system included plans that allowed for the traceability, completeness, and security of field and analytical documents, procedures, and the evaluation of data quality relative to DQOs. QC included specific technical activities performed by field or laboratory personnel to demonstrate that system performance was maintained within established criteria. QC activities were included within this QA system to document precision, accuracy, and comparability of results. The QAPP for the RAD I Site is in Appendix F of the SMP.

4.1.3 Community Air Monitoring Plan (CAMP)

A Community Air Monitoring Plan (CAMP) was prepared for the RAD I Site because there is remaining contamination in soil. The CAMP required real-time monitoring for volatile and semi-volatile organic compounds (VOCs and SVOCs) and particulates (i.e., dust) at the downwind perimeter of the RAD I Site when investigation and remediation activities were in progress. The CAMP was not intended for use in establishing action levels for worker respiratory protection. Rather, its intent was to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and onsite workers not directly involved with invasive activities) from a potential airborne contaminant. The action levels in the CAMP required increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helped to confirm that work activities did not spread contamination off-site through the air.

This generic CAMP will also be sufficient to cover the area of the Site for any future invasive activities. Because of the small size of the Site and the Site's conditions, a separate site-specific CAMP or supplement should not be required.

Reliance on this CAMP will not preclude simple, common-sense measures to keep volatile organic compound (VOC), dust, and odors at a minimum around possible future invasive work areas. The CAMP is in Appendix _L of the SMP.

4.1.4 Community Participation Plan

The purpose of the Citizen Participation Plan (CP Plan) for the Site was to provide information that would promote and facilitate citizen participation as required in the legislation that created the Brownfields Cleanup Program (BCP). Environmental investigations and remediation were conducted on the RAD I Site to characterize and

remove organic constituents identified in the subsurface that were associated with the previous uses of the Site. The objectives of the CP Plan were as follows:

1. Inform the public of planned and/or ongoing actions, the nature of environmental conditions, responses under consideration, and progress;
2. Create opportunities for the public to provide information, opinions and perspectives on the Site's technical decisions;
3. Ensure open communication among the public, the project staff, and state/local decision makers throughout the remedial progress; and
4. Coordinate public outreach efforts within the involved governmental agencies to best serve the public.

Opportunities for public participation were provided when notices announcing investigative and remedial activities were published in the Environmental Notice Bulletin. Opportunities for public participation were provided when Fact Sheets were distributed that discussed the proposed plans for investigation or remediation.

A Site Contact List which included the names of persons required by the BCP is included below and in the SMP. This list will be updated as necessary to include the names of any parties that identify themselves to the Site's owner or NYSDEC as interested in being on the list.

Company	Title	Name	Address	Office Phone	Mobile Phone	Email
Cresswood Environmental	Owner	David Kushner	Paradigm Capital Group 380 Lexington Avenue 2020 New York, New York 10168	212-661-0858	NA	kush@paradigmcf.com
de maximis	de maximis Project Coordinator	Craig Coslett	1550 Pond Road #120 Allentown, PA 18014	610-435-1151	610-360-7539	ccoslett@demaximis.com
MACTEC	MACTEC Program Director	William Weber	511 Congress Street #200 Portland, ME 04101	207-828-3530	207-289-4213	William.Weber@amecfw.com
MACTEC	MACTEC Project Manager, Engineer of Record (EOR)	Brent O'Dell	200 American Metro Blvd #113 Hamilton, NJ 08619	609-631-2915	908-285-1769	Brent.Odell@amecfw.com
MACTE	MACTEC Health and Safety Officer	Cindy Sundquist	511 Congress Street #200 Portland, ME 04101	207-828-3309	207-650-7593	Cynthia.Sundquist@amecfw.com
MACTEC	MACTEC OMM Manager	Kinjal Shah	200 American Metro Blvd #113 Hamilton, NJ 08619	609-689-2829	732-986-7432	Kinjal.Shah@amecfw.com

Company	Title	Name	Address	Office Phone	Mobile Phone	Email
MACTEC	MACTEC OM&M Technical Support	Dan Berkowitz	285 Davidson Avenue, Suite 405 Somerset, New Jersey 08873	732-302-9500	848-702-9743	Daniel.Berkowitz@amecfw.com
MACTEC	MACTEC Engineering Lead	Tim Kessler	200 American Metro Blvd #113 Hamilton, NJ 08619	609-631-2927	215-704-6592	Timothy.Kessler@amecfw.com
MACTEC	MACTEC System OM&M Manager	Vincent Whelan	200 American Metro Blvd #113 Hamilton, NJ 08619	609-689-2832	609-815-6175	Vincent.Whelan@amecfw.com
MACTEC	MACTEC OM&M Senior Technician	Joe Lewandowski	751 Arbor Way #180 Blue Bell, PA 19422	610-341-0491	610-203-3484	Joseph.Lewandowski@amecfw.com
MACTEC	MACTEC OM&M Technician	Dan Berkowitz	285 Davidson Ave #405 Somerset, NJ 08873	732-302-9500	848-702-9743	Daniel.Berkowitz@amecfw.com

A public document repository was also established at which copies of documents and other information pertaining to the investigation and remediation of the Site, including technical data and reports submitted to the NYSDEC have been placed. The information was kept current and included reports, data, maps and other information gathered during the various stages of investigative and remedial activities at the Site. Fact Sheets were also available at the repository. The repository for the Site is listed below:

Queens Borough Public Library
Sunnyside Branch
4306 Greenpoint Avenue
Long Island City, New York 11104
(718) 784-3033
Hours: Monday- 9:00 am - 8:00 pm,
Tuesday 1:00pm – 6:00pm
Wednesday and Friday 10:00am – 6:00pm
Thursday 12:00pm – 8:00pm
Saturday 10:00 – 5:30
Sunday CLOSED

In addition, complete project records are also kept at the following location:

NYSDEC Region 4 Office
625 Broadway
Albany, New York 12233-0001

Telephone: (518) 402-8545
Hours: Monday-Friday 9:00 am – 3:00 pm
By appointment only, contact Brian Davidson, Remediation Manager, 518-402-9790, brian.davidson@dec.ny.gov

4.1.5 Excavation Plan

The NYSDEC was notified at least 15 days prior to the start of any excavation/soil disturbance activity for remediation or development on the RAD I Site, including grading, trenching, and drilling, where potential remaining contamination was expected to be encountered. The initial notification was made to:

Brian Davidson, Remediation Manager, 518-402-9790,
brian.davidson@dec.ny.gov
Regional Hazardous Waste Remediation Engineer
NYSDEC Region 4 Office
625 Broadway
Albany, New York 12233-0001

This notification included the following:

- A detailed remedial design and description of the work to be performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this Excavation Plan;
- A statement that the work will be performed in compliance with this Excavation Plan and 29 Code of Federal Regulations (CFR) 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided for the Site;
- Identification of disposal facilities for potential waste streams; and

- Identification of sources of any anticipated backfill.

4.1.5.1 Soil Screening Methods

Soil screening was performed by a Qualified Environmental Professional (QEP), Professional Engineer or their designated representative, during all remediation and development excavations/soil disturbance activities within known or potentially contaminated material (potential remaining contamination). Soil screening was performed regardless of when the invasive work was done and included all excavation and invasive work performed during remediation, development, utility installation and/or repair in or immediately adjacent to the Site, such as excavations for foundations and utility work. Personnel potentially exposed to contaminated soil were required to have personal protective equipment and the appropriate Hazardous Waste Operations and Emergency Response (HAZWOPER) training under 29 CFR 1910.120.

Soil from drill cuttings, excavation, or grading were segregated based on previous environmental data and screening results 1)soil that requires off-site disposal, 2) soil that requires testing, 3) soil that can be returned to the subsurface, and 4) soil that can be used as cover soil. Soil impacted with LNAPL or from a depth of 15 feet below ground surface (bgs) or greater was segregated and managed as Non-TSCA, Non RCRA Hazardous Petroleum Contaminated Remediation Waste </= 50 mg/kg and disposed off-site at a soil recycling facility. Excess soil obtained from the RAD I Site at a depth < 15 ft or otherwise not visually impacted with saturated LNAPL was reused on-site or shipped off-site as non-hazardous soils for disposal. See waste disposal logs contained in Appendix D.

4.1.5.2 Stockpile Methods

Soil stockpiles were continuously encircled with erosion and sediment controls, such as a berm and/or silt fence. Hay bales and other erosion and sediment controls were used as needed near catch basins, surface waters and other discharge points.

Stockpiles were kept covered at all times with appropriately anchored tarps. Stockpiles were routinely inspected and damaged tarp covers were promptly replaced.

Stockpiles were inspected at a minimum once each week and after every storm event. Results of inspections were recorded in a logbook and maintained at the RAD I Site and available for inspection by the NYSDEC.

4.1.5.3 Materials Excavation and Load Out

During the installation of the LNAPL recovery system, a QEP, Professional Engineer or person under their direct supervision provided oversight of invasive work, the excavation and load-out of all excavated material and drill cuttings which were not re-used on the

RAD I or RAD II sites. Excavation and load out of petroleum impacted soils, and disposal of recovered oil and water waste did occur during an Emergency Removal Action in 1982. A QEP, Professional Engineer or person under their supervision provided oversight of invasive work and the excavation and reuse of on-site soils generated during the installation of the LNAPL recovery system.

The presence of utilities and easements on the RAD I Site were investigated by the QEP or Professional Engineer. It was determined from this investigation what risks or impediments to the planned work under this plan was posed by utilities or easements on the Site.

The QEP, Professional Engineer or designated representative was responsible for ensuring that all excavation equipment was cleaned of residual soils before leaving the RAD I Site until the activities performed under this section are complete.

Locations where vehicles enter or exit the RAD I Site were inspected daily for evidence of off-site soil tracking.

The QEP, Professional Engineer or designated representative was responsible for ensuring that all egress points for truck and equipment transport from the RAD I Site were clean of soil and other materials derived from the Site during intrusive excavation activities.

4.1.5.4 Materials Transport Off-Site

All transport of materials, were performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers were appropriately licensed and trucks properly placarded.

Soil and other material transported by trucks exiting the RAD I Site were secured with the appropriate covers. If loads containing wet soil and other material capable of producing free liquid, truck liners were used.

All trucks were cleaned of residual soils, if needed, prior to leaving the RAD I Site. Truck transport routes were determined once the soil and other excavated material had been classified as to its waste type and the proper disposal facility had been identified. . If transport route approval was needed, all trucks loaded with site materials exited the vicinity of the RAD I Site using only approved truck routes. The routes were the most appropriate route and took into account: (a) limiting transport through residential areas and past sensitive sites; (b) the use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport, and; (g) community input, when necessary.

Trucks were prohibited from stopping and idling in the neighborhood outside the RAD II Site.

Egress points for truck and equipment transport from the RAD I Site were kept clean of soil and other materials during any remediation or development of the Site.

Queuing of trucks was performed onsite in order to minimize off-site disturbance. Off-site queuing was prohibited.

4.1.5.5 Materials Disposal Off-Site

During the installation of the LNAPL recovery system, most excavated soils and drill cuttings removed from the RAD I Site at a depth shallower than 15 feet bgs were reused onsite as backfill for the piping trenches, consolidated in an unpaved area (see section 4.1.5.6) or used as fill material beneath the cap constructed at RAD II. The asphalt cover at RAD II was completed prior to placement of all spoils from RAD I and therefore some soils from shallow excavations was removed from site and disposed of as non-hazardous fill at Cycle Chem's facility in Perryville, PA. All drill cuttings removed via recovery well and monitoring well drilling activities at a depth deeper than 15 feet bgs were characterized and managed as solid waste in accordance with the permit requirements of the disposal facility. LNAPL was separated and recovered from well development water generated during the installation of the LNAPL recovery wells during the fall of 2014 and winter of 2015. The LNAPL was also disposed of off-site by Cycle Chem Corporation during the spring of 2015.

Off-site disposal locations for drill cuttings and shallow trench soils were shipped offsite in 17H open top DOT shippable drums and disposed of by Cycle Chem Corporation's Perryville, PA Operation. Actual disposal quantities and associated documentation is provided in Appendix D. This documentation includes waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

4.1.5.6 Materials Reuse On-Site

Chemical criteria for onsite reuse of soil and other material was approved by NYSDEC. The QEP, Professional Engineer or designated representative ensured that procedures defined for soil and other material reuse were followed and that unacceptable soil and other material did not remain onsite. A portion of the onsite material that was determined to be acceptable for re-use, was utilized as backfill for the LNAPL recovery system under-ground pipe trenches. Another portion of these soils was consolidated in an unpaved area at the southeast corner of the RAD I site prior to the required capping with a 6" asphalt paving system. The balance of excavated soils, which could not be re-used on the RAD I site, due to space/volume constraints and scheduling conflicts, were disposed of offsite as Non-Hazardous Soil by Cycle Chem, Inc. as described in section 4.1.5.5.

4.1.5.7 Cover System Restoration

Since the RAD I Site had an existing cover (asphalt parking are), a new capping system was not a requirement of the ROD, Proposed Decision Document, or the RAWP. As such, upon completion of LNAPL system installation activities, portions of the existing asphalt pavement which were removed or damaged were replaced to meet or exceed the in place pavement system.

4.1.5.8 Backfill from Off-Site Sources

All soil and other material proposed for import onto the RAD I Site was approved by the QEP, Professional Engineer or designated representative and was in compliance with provisions prior to receipt at the RAD I Site.

Soil and other material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites was not imported to the RAD I or RAD II Site.

All imported soil met the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soil that met 'exempt' fill requirements under 6 NYCRR Part 360, but did not meet backfill or cover soil objectives for the RAD I Site, was not be imported onto the Site without prior approval by NYSDEC. Solid waste was not imported onto the RAD I Site.

Trucks entering the RAD I Site with imported soil were securely covered with the appropriate covers. Imported soil was stockpiled separately from excavated soil and other material and covered to prevent dust releases.

4.1.5.9 Stormwater Pollution Prevention

Barriers and hay bale checks were installed in accordance with the Erosion and Sediment Control Plan (ESCP) and inspected once a week as well as after each storm event. The results of inspections were recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs were made immediately.

Accumulated sediments were removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor were repaired immediately with appropriate backfill material.

Manufacturer's recommendations were followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures were observed to ensure that they were operating correctly. Where discharge locations or points were accessible, they were inspected to ascertain whether erosion control measures were effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales were installed around the perimeter of a construction area.

4.1.5.10 Contingency Plan

No previously unidentified contaminant sources were found during remediation or development related construction, excavation activities.

4.1.6 Storm-Water Pollution Prevention Plan (SWPPP)

Amec Foster Wheeler prepared a site specific Erosion and Sediment Control Plan (ESCP) and submitted to the New York State Department of Environmental Conservation (NYSDEC) Region 2 offices on June 18, 2014. The ESCP was submitted for NYSDEC's information and review only as a permit is not required since the site remediation is being performed under the Brownfield Cleanup Program (BCP), however, the substantive requirements of NYSDEC for ESCP permits were followed. No comments were received from NYSDEC Region 2. The erosion and sediment controls for all remedial construction were performed in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control and the site-specific Storm Water Pollution Prevention Plan

4.1.7 Contractors Site Operations Plans (SOPs)

The Remediation Engineer reviewed all plans and submittals for this remedial project (i.e. those listed above plus contractor and subcontractor submittals) and confirmed that they were in compliance with the RAWP. Except as otherwise noted herein. All remedial documents were submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work. The Remediation Engineer oversaw site oversight personnel, reviewed contractor work plans, drawings and specifications and ensured that the site and drilling contractors adhered to the design plans and specifications.

4.2 Remedial Program Elements

4.2.1 Contractors and Consultants

A listing of the contractors who performed work on the RAD I is listed as follows:

- Site Work Contractor – Transit Corp., Yonkers, NY
- Well Drilling and Development – Aquifer Drilling and Testing, Inc., Mineola, NY
- Surveyor – Geod Corporation, Newfoundland, NJ

- Subsurface Survey – Delta Geophysics
- Contaminated Environmental Media Disposal/Recycling Services – Cycle Chem, Inc., Elizabeth, NJ

4.2.2 Site Preparation

Prior to mobilization, a pre-construction meeting was held between Amec Foster Wheeler, de maximis, and the contractor on March 11 2015.. An NYC Building Department PW-1 and building permit was obtained for the sewer connection on RAD I (in conjunction with the RAD II permit). A separate PW-1 and building permit was obtained for the installation of the Above Ground Storage Tanks on RAD II. An air permit to construct was obtained from NYSDEC as required for the discharge of extracted soil vapor following vapor phase treatment. Public subsurface utility notifications and mark-outs were completed as well as the implementation of multiple private subsurface surveys to identify additional known and unknown utilities prior to intrusive activities. Limited areas were cleared and grubbed in advance of intrusive activities. These areas included the south-western portion of the site.

Documentation of agency and non-agency permit approvals are provided under Appendix F.

4.2.3 General Site Controls

The RAD I site is bounded by a fence and 2 gates. The site is manned and guarded 24 hours a day, 7 days per week. The treatment equipment for both the RAD I and RAD II sites is located in a separate 90 ft by 90 ft treatment compound. The treatment compound has been delineated and further secured by additional fencing, within the site perimeter fencing, and serves as the location of the packaged treatment equipment and LNAPL Storage Tanks. Refer to excavation plan described above for additional site control details.

4.2.4 Nuisance Controls

Nuisance controls for dust, odor, and excavation equipment decontamination are described above in the site Excavation Plan.

4.2.5 CAMP Results

Monitoring results indicate that no exceedances of offsite dust concentrations or VOCs have occurred. Action levels, however, were triggered for on-site dust levels and proper water spray controls were implemented to mitigate the issue prior to offsite action level

exceedances occurred. Summary of CAMP implementation and findings are provided in a summary sheet under Appendix D.

4.2.6 Reporting

Daily and Weekly Construction Summaries are prepared by the Site Engineer's Construction Manager and submitted to the PRP Group's Project Manager on a weekly basis. Digital photo logs were updated on a weekly basis and made available to the Project Manager on a monthly basis.

Daily and Weekly Construction Summary reports are provided electronically in Appendix D, digital photo logs are provided electronically in Appendix E

4.3 Contaminated Materials Removal

Contaminated materials removed from the site in drill cuttings from > 15 feet below ground surface generated from recovery well drilling activities. One hundred and three (103) fifty-five (55) gallon drums of drill cuttings were accumulated and disposed of offsite. Approximately 224 Tons of excavated spoils were removed of and disposed of at Cycle Chem Perryville, PA Facility. Waste disposal logs are provided in Appendix D.

4.4 Remedial Performance/Documentation Sampling

Current completed remedial construction activities have not included any remediation of soil and groundwater contamination, end point sampling has not been performed. A LNAPL Recovery System has been installed as described in Section 4.8 as an Engineering Control. The remedial performance of the LNAPL Recovery System will be measured in accordance with the procedures outlined in the OM&M Plan provided with the SMP.

4.5 Imported Backfill

Imported fill was provided from the following offsite sources:

- Virgin 3/8 inch Clean Stone from Evergreen Recycling (used for underground pipe and sleeve bedding);
- Recycled Dense Graded Aggregate from Evergreen Recycling (used for the asphalt pavement system sub-base)
- A table of all sources of imported backfill with quantities for each source is shown in Table 2.
- Analytical results for backfill, in comparison to allowable levels, are provided in Appendix D.

4.6 Contamination Remaining at the Site

4.6.1 LNAPL

Contamination associated with the Site is contained in the LNAPL, which occurs on the groundwater table and the vadose zone throughout much of the Site. The ROD requires that the LNAPL recovery system operate until the remedial action objectives have been achieved or until it is determined that the continued operation of the LNAPL recovery system is technically infeasible or impracticable. During the operation of the LNAPL recovery system, the performance of the system will be evaluated periodically to determine if the remedial objectives of the system have been achieved or if the system has reached asymptotic conditions (i.e. its practical limits) for sustainable and effective recovery of LNAPL. When LNAPL recovery has been terminated, sorbed LNAPL will remain as residual contamination within the soil of the vadose zone.

4.6.2 Groundwater

The Decision Document for the Site requires that the LNAPL recovery system operate until the remedial action objectives have been achieved or until it is determined that the continued operation of the LNAPL recovery system is determined to be technically impracticable. The need for continuing groundwater monitoring after substantial completion of LNAPL recovery will be evaluated during the recovery period. See Section 2.3 of the SMP.

4.6.3 Soil Vapor

The results of soil vapor investigations on the Site did not identify a threat for migration of soil vapor laterally from the limits of the LNAPL. See Section 2.3 of the SMP.

Since contaminated soil and petroleum light non-aqueous phase liquid (LNAPL) remains on the groundwater beneath the site and is a potential source of ongoing soil, groundwater and soil gas contamination after completion of the Remedial Action, Institutional and Engineering Controls are required to protect human health and the environment. These Engineering and Institutional Controls (ECs/ICs) are described in the following sections. Long-term management of these ECs/ICs and residual contamination will be performed under the Site Management Plan (SMP) approved by the NYSDEC.

4.7 Soil Cover [or Cap] System

As outlined in the RAWP a new cap is not required on RAD I as a remedy element. Damage to the existing asphalt pavement during construction of the LNAPL Recovery

System, however, has been repaired/replaced to meet or exceed the thickness of the original pavement system. The depth below ground surface to the top of the LNAPL impacted portion of the subsurface soil is approximately 15 to 20 feet which was confirmed visually during installation of the LNAPL recovery wells. A final environmental easement is referenced in the SMP to address future excavations that might encounter LNAPL impacted soils.

4.8 Other Engineering Controls

Since LNAPL continues to be present at the Site, Engineering Controls (EC) are required to protect human health and the environment. The site Engineering Controls are described in the following subsections.

4.8.1 Vacuum Enhanced Total Fluids LNAPL Recovery System

The installed LNAPL recovery system designed for the higher viscosity LNAPL portion of the site will enhance LNAPL recovery via both hydraulic and pneumatic gradient enhancement. System details have been outlined below as follows:

- ***Vacuum Enhanced Total Fluids LNAPL Recovery System –*** The LNAPL recovery system for the higher viscosity area consists of enhancing product recovery via both hydraulic and pneumatic enhancement a total of 30 Vacuum Enhanced/Total Fluids (VER/TF) Recovery Wells arranged in 7 zones. Ten (10) of the VER/TF Recovery Wells are located on RAD 1 while twenty (20) are located on RAD II. Six zones (labeled TF-1 through TF-6) consist of four (4) recovery wells each (labeled A through D), while the seventh zone (labeled TF-7) consists of six (6) recovery wells labeled A through F). Zones TF-6 and 7 are located on RAD I. Hydraulic and vacuum enhancement is accomplished by installing top loading TF pneumatic pumps in each of the 10 VER/TF RAD I recovery wells as well as by applying a vacuum to the vadose zone via separate vapor extraction lines tied into each recovery well's casing. In addition to routing vapor extraction lines to each well head, compressed air supply lines and groundwater/LNAPL discharge lines have also been routed to each well head as required to power the pneumatic pumps and transport extracted groundwater and LNAPL product from each well back to the treatment facility

in dedicated transport lines from each zone. Each VER/TF Recovery Well zone is specially piped, manifolded and equipped with automatic controls to allow for the enhanced recovery in each zone to be turned ON and OFF or pulsed at any desired frequency and duration. The recovery well system can also be monitored and controlled by the system operator remotely via a cellular modem/ Human Machine Interface (HMI) system. Record drawings provided in Appendix A shows the location of each of the 10 VER/TF Recovery Wells which have been located in the higher viscosity LNAPL portion of the RAD II site.

- ***VER/TF and Skimmer LNAPL Recovery Wells -*** Each recovery well is constructed with 15 feet of 0.020 inch Slot, 4 inch diameter V-Wire continuous slot PVC screen and 4 inch diameter sch 40 PVC casing to a total installed depth of approximately 25 to 30 ft below ground surface. The V-Wire Screen was utilized to improve well efficiency and capture radius of influence. In the VER/TF wells, top of screen elevations were set to provide approximately 5 ft of open screen above groundwater/top of product elevation to allow for substantial pneumatic connectivity to the vadose zone as required to generate adequate vacuum influence.

- ***Skimmer LNAPL Recovery Wells -*** Each recovery well is constructed with 15 feet of 4" diameter standard V-Wire continuous slot PVC screen and 4" sch 40 PVC casing to a total installed depth of approximately 25 to 30 ft below ground surface to maximize efficiency and radius of influence. Top of screen elevations were set to provide approximately 5 ft of open screen above groundwater elevation to allow for adequate vacuum influence to the vadose zone.

- ***Total Fluids Pumps –*** Ten (10) top loading pneumatic total fluids (TF) pumps have been installed at each of the 4" VER/TF RAD I recovery wells. The recovery well heads were modified to accept the pumps as well as the compressed air and liquid discharge lines and the vapor extraction line. The TF pumps are automatic, variable capacity pumps which will maintain pumping

level at the pump's top inlet, thereby allowing for extraction of both LNAPL and groundwater. A flow rate of 1.5 gpm to 3 gpm is anticipated from each well at a total extracted flow rate of up to 25 gpm when 2 zones are active. Compressed air supply piping has also been arranged two (2) separate zone manifolds such that 4 to 6 pumps are supplied by compressed when its supply solenoid control valve is energized as determined by the control system timer or manual operator initiation (local or remote).

- ***Vacuum Enhancement System –*** Vapor extraction piping has been routed to each recovery well such that the recovery wells can also be vacuum enhanced. The vapor extraction piping has also been arranged in 2 separate manifolds such that the vapor extraction flow from each zone manifold serves 4 to 6 wells in each zone. The zone manifold line is connected to a source of vacuum when it's respective Motor Operated Valve (MOV) is opened as determined by the control system timer or manual operator initiation (local or remote). A 30 HP low/medium vacuum blower with a flow rate capability of 750 scfm (@ 5" Hg inlet vac.) has been utilized to apply vacuum at one (1) to two (2) recovery well zones simultaneously. As such, with approximately 5 ft of open screen, a flow rate of up to 44 scfm per well @ 1" Hg casing vacuum can be achieved for a total extracted flow rate of 176 to 440 scfm.

- ***Field Piping –*** Trenching and Piping systems for the VER/TF and Skimmer wells were installed utilizing 1 or more 4" and 6" corrugated HDPE pipe sleeves depending on the pipe trench segment. A Pipe Trench Segment Identification Table provided on the Record Drawings indicates the size, type and quantity of sleeves installed in each segment. The VER/TF associated pipe sleeves also include 4" diameter sch. 40 PVC SVE zone piping which are also listed on the above referenced Table. The 4 inch and 6 inch diameter sleeves are utilized to carry compressed air hose, total fluids discharge hose and skimmer pump product discharge hose. The sleeves allow for future replacement in the event of failure or degradation in the future. The sleeves and SVE zone lines are bedded in 3/8" clean, compacted virgin stone with a minimum of 6 inches of

cover above, below and on each side. The SVE zone lines also have been configured with low point drains, accessible from grade via an 8 inch manhole cover, and also are configured to drain directly into select recovery wells in the event of excessive moisture accumulation in these lines. Suitable excavated soils were used as backfill above the bedding stone to the pavement system subgrade elevation. All compressed air and liquid hose joints are located in recovery well vaults or the hose vaults for ready inspection of pipe integrity. All sleeves carrying total fluids or LNAPL have been installed with a 36 inch minimum burial depth as required for freeze protection. Sleeves with air-lines and 4" SVE zone lines have been installed with a minimum of 24 inch burial depth as required for traffic loading protection. Compressed air hose sizes range ½" ID to 1" ID, while TF and LNAPL lines range from ½" ID to 2" ID. Approximately 2,075 linear feet of pipe trenching has been installed on the RAD II site as required for both the Vacuum Enhanced Total Fluids Recovery System and the Single Phase LNAPL Recovery System described below in Section 4.8.2.

- ***Recovery Well Vaults –*** Recovery well vaults are constructed using 24 inch square and 30 inch square by 24 inch deep steel, open bottom vaults with H-20 traffic rated, hinged and lockable diamond plate steel lids. The vault frames are locked into 12 inch thick concrete pads with an outside dimension of 5 ft X 5 ft and 5-1/2 ft X 5-1/2 ft depending on weather the vault is 24 inch square or 30 inch square, respectively. The concrete pads dissipate traffic wheel loading such that the load applied to the subsurface soils is within the allowable soil bearing capacity.

- ***Phasing Plan -*** The 10 RAD II VER/TF recovery wells will be operated in multiple modes of operation in order to maximize product recovery, minimize energy consumption and to avoid exceeding the limitations of the oil/water separation and groundwater treatment processes. The modes of operation are summarized as follows:

- ***Skimmer Mode –*** skimmer pumps have initially been installed and operated in the VER/TF wells until such time that initial product thicknesses in recovery wells have been reduced from multiple feet to </= 1 ft and/or LNAPL production rate (gallons per day or week) has diminished by >/= 75%.

- ***Hydraulic Enhancement mode –*** Following the skimming or single phase LNAPL recovery mode of operation, pneumatic TF pumps will be installed in the VER/TF wells and set at a pumping level configured for approximately 6" to 12" of piezometric draw-down (or as required to keep total extracted groundwater production </= 25 gpm). This mode of operation will continue until product thicknesses in recovery wells have been reduced from multiple feet to < 1 ft and/or LNAPL production rate (gallons per day or week) has diminished by >/= 75%. As compared to the prior mode of operation.

- ***Vacuum and Hydraulic Enhancement (VER) mode –*** Following operation of the TF pumps without Vacuum enhancement, the vacuum blower will also be operated to achieve approximately 1" Hg casing vacuum at each of the VER wells. Upon further significant diminishment of product thicknesses and LNAPL production rate, additional operational variables can be adjusted, including zone pulsing schedules, piezometric draw down and applied casing vacuum levels as required to maximize LNAPL production rates and minimize energy consumption and operational costs per gallon of LNAPL recovered. Operation will continue until such time that maximum extent practical recovery goals can be achieved as outlined in the approved RAWP.

Procedures for monitoring, operating and maintaining the Vacuum Enhanced Total Fluids LNAPL Recovery System are provided in the Operation Maintenance & Monitoring Manual (OM&M) in Section 4 of the Site Management Plan (SMP). The OM&M Manual also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect on-site ECs.

4.8.2 Single Phase LNAPL Recovery System

The installed Single Phase LNAPL Recovery system is utilized to recover LNAPL from the lower viscosity area of the RAD II site. The system consists of a total of 38 Skimmer Recovery Wells outfitted with pneumatically operated skimmer pumps. 23 Skimmer wells are located on RAD I while 15 skimmer wells are located on RAD II. See Appendix A for the location of each Skimmer Recovery Well (S1A through 1E, S2A through 2D and S-3A through 3E). Each skimmer pump is configured with a specific gravity skimmer intake and a pneumatic cycle timer that controls the pumping rate of each skimmer pump. The specific gravity skimmers are designed to sink in product with a specific gravity of less than approximately < 0.95 and float on water such that they can remove LNAPL down to a thickness of approx. 1/4". The skimmer float has a vertical range of travel of 24" to accommodate fluctuations in groundwater elevation. The skimmer pumps have a maximum rated capacity of up to 160 gallons per day. The operator will adjust the pumping rate of each skimmer pump over time to avoid significantly exceeding the LNAPL recovery yield from each of the skimmer wells. By doing this, the rate of LNAPL recovery will be maximized while avoiding unnecessary pump wear and wasting compressed air and energy.

Procedures for monitoring, operating and maintaining the Single Phase LNAPL Recovery System are provided in the OM&M Manual in Section 4 of the Site Management Plan (SMP). The OM&M Manual also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect on-site ECs.

4.8.3 Packaged SVE and Groundwater Treatment System

The Packaged SVE and Groundwater Treatment System as well as the recovered LNAPL product storage tanks, have been installed in the Northeast Portion of the adjacent RAD II site in a secure 90 ft by 90 ft treatment system compound. The treatment system is built to serve a total of 68 recovery wells located on both the RAD I and RAD II sites. The RAD I site consists of a total of 33 wells, composed of 10 VER/TF wells and 23 Skimmer Wells. The treatment equipment is housed in two (2) steel, 40-foot long, insulated shipping containers (Sea-Boxes) hereafter referred to as Treatment Equipment Enclosures. All equipment was pre-plumbed, wired and inspected at an off-site location. The Treatment Equipment containers were installed on concrete piers and spread footings. Two (2), 6,000 gallon, above ground, secondarily contained storage tanks were installed on a single 8" thick concrete pad. Two (2) Vapor-phase activated carbon and one (1) Vapor-phase Potassium Permanganate filtration unis have been located outside of the treatment equipment enclosures on the asphalt pavement cap system. Equipment is sized based on a vapor flow of up to 750 scfm @ 5" Hg Vac. and an instantaneous liquid flow rate of 25 gpm from 5 to 15 VER/TF recovery wells at a time. A process flow diagram for the

treatment process is presented in Appendix A. The following treatment equipment components have been provided:

- ***SVE Inlet Manifold*** – A seven (7) position manifold serves each of the seven (7) VER/TF Zones (2 zones on RAD I, 5 zones on RAD II). Each position includes: flow meter; manual gate valve, motor operated valve (MOV), vacuum gauge; Schedule 80 PVC Pipe and fittings.
- ***Vapor- Liquid Separator*** - 150 gallon steel vessel with: low (pump on), high (pump off), and high-high (alarm) switches; progressive cavity transfer pump, skid mounted.
- ***Vacuum Blower*** – One, 30 HP skid mounted regenerative blower with inlet filters, dilution valve, silencers, vacuum relief valve, capable of 750 SCFM @ 5”Hg Inlet vacuum.
- ***Heat Exchanger*** – Static Air to Air, 750 scfm, complete with temperature indicator and high temperature switch. Provides approximately 20 deg. Delta Temperature drop of SVE blower discharge air as required for efficient vapor phase treatment.
- ***Vapor Phase Carbon Treatment Vessels*** – Two (2) vessels each containing 2,000 lbs of virgin vapor phase activated carbon for VOC removal. Vessels are complete with 6” inlet and outlet connections and provide 4.5 ft of bed depth and 16 ft2 of cross sectional area.
- ***Vapor Phase Potassium Permanganate Treatment Vessel*** – 2,160 lbs of 6% potassium permanganate impregnated media for Vinyl Chloride removal. Vessel complete with 6” inlet and outlet connections and provides 36 FT3 of media, 2.2 ft of bed depth and 16 ft2 of cross sectional area.
- ***2 Stage Oil/Water Separation System*** – 25 gpm, gravity feed. Stage 1: 500 gallon 304SS pre-separation and equalization tank with rotary skimmer and upstream Biocide Injection; post gross separation emulsion breaking reagent injection; Stage 2: 540 gallon 304SS coalescing pack gravity separator

complete with rotary skimmer, belt skimmer, 120 gallon product storage chamber and 150 gallon effluent tank. Complete with effluent transfer pump level switch controls, and product discharge pump level switch controls.

- ***Effluent Transfer Pump*** – 1-1/2 HP, 30 gpm nominal centrifugal pump w/ 1-1/4" Inlet and 1" outlet connections with SS wetted components and housing.
- ***Product Discharge Pump*** – ½ HP, 4.8 gpm rotary gear pump w/ ¼" Inlet & Outlet connections, with bronze body and gear construction.
- ***Bag Filters*** – 4 6.7 inch diameter X 30 inch deep bag filters with SS housings and 2 inch connections. Complete with eyebolt lids, manifold and interconnects for 2 parallel trains of 2 filters in series, pressure gauges and high pressure alarm switch.
- ***Liquid Phase Carbon Treatment Vessels*** – 2-1,000 lb units, manifold and valves, interconnection hoses, pressure gauges, roof hatch directly over vessels to facilitate carbon change.
- ***Air Compressor*** – Rotary screw 20 HP, 88 cfm @ 125 psig, with integral after-cooler and refrigerated dryer. Complete with local control panel, remote alarm integration with system HMI, particulate filter, coalescing filter, pressure regulator, gauges, automatic condensate drain system, and 3-way solenoid valve for quick pneumatic pump shutdown.
- ***Compressed Air Supply Manifold*** – A Seven (7) position manifold serves each of the seven (7) VER/TF Zones (2 zones on RAD I, 5 zones on RAD II). Each position includes: manual ball valve; pressure gauge; pressure regulator, solenoid valve. Schedule 40 carbon steel pipe and fittings.
- ***Main control panel*** – PLC controlled logic with 16 Inputs & Outputs, color touch screen graphical Human Machine Interface (HMI), remote monitoring and control via wireless modem, email notification alarms.
- ***Electrical*** – NEC Class I, Div 2 Hazardous Location wiring provided in the Groundwater Treatment System and the Soil Vapor Extraction Rooms.

- ***HVAC*** – Electric Unit Heaters and ventilation fans provided in both equipment enclosures complete with thermostat controls.
- ***LNAPL Storage Tanks*** – Two (2) 6,000 gallon, single-wall steel with secondary containment dike, New York City waste-oil labeled. Complete with 90% and 95% high level alarm and overfill prevention system; local mechanical tank gauge, normal and emergency venting system to meet fire code requirements, access stair and platform for vacuum tanker truck hose connection.

Procedures for monitoring, operating and maintaining the Packaged SVE and Groundwater Treatment System are provided in the OM&M Manual in Section 4 of the Site Management Plan (SMP). The OM&M Manual also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect on-site ECs.

4.9 Institutional Controls

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

The environmental easement for the RAD I Site was executed by the Department on May 2, 2015, and filed with the Queens Borough Clerk on October 21, 2015. The County Recording Identifier number for this filing is 2015111000994002. A copy of the easement and proof of filing is provided in Appendix D of the Site Management Plan.

4.10 Deviations from the Remedial Action Work Plan

No significant deviations from the remedies prescribed by the ROD or RAWP have occurred. The general intent for each remedy component as described in the RAWP has been maintained. Engineering details, however, have changed in order to improve upon remedial effectiveness, decrease energy consumption, decrease O&M costs and ensure sewer discharge compliance.

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C – CALCULATIONS

- SVE Zone Pipe Sizing
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