Carroll Town Landfill Site
Village of Frewsburg
Town of Carroll
Chautauqua County, New York

Final Construction Completion Report

Well No. 5 Groundwater Treatment System

NYSDEC Site Number: 9-07-017

May 2015

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Environmental Remediation
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Prepared by:

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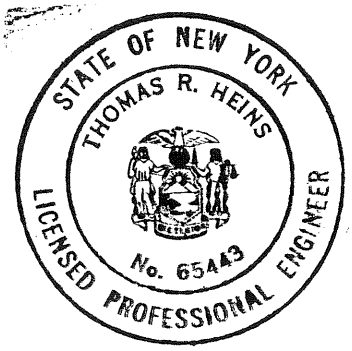
ENGINEER'S CONSTRUCTION CERTIFICATION

I, Thomas R. Heins, certify that I am currently a New York State-registered professional engineer. I had primary, direct responsibility for the implementation of the subject construction program and certify that the Remedial Action of the Carroll Landfill Project (NYSDEC Site Number 09-07-017) Groundwater Treatment System was completed in substantial compliance, as described in this Report, with the approved Remedial Construction Contract Documents entitled *Carroll Town Landfill Site, Site Number 9-07-017, Village of Frewsburg in the Town of Carroll, Chautauqua County, New York,* dated September 2011 and the approved changes.



Signature: _____

Thomas R. Heins, P.E.
Program Director

Date: 5/12/15

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List of Abbreviations and Acronyms

bgs	below ground surface
CAP	Contractor's Application for Payment
CCDOH	Chautauqua County Department of Health
CCR	Construction Completion Report
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CO	Change Order
CPM	Critical Path Method
DER	Division of Environmental Remediation (NYSDEC)
DOR	Daily Observation Report
ECL	Environmental Conservation Law
EC/IC	Engineering Controls/Institutional Controls
EEEPC	Ecology and Environment Engineering, P.C.
FWD	Frewsburg Water District
gal	gallons (U.S.)
gpm	gallons per minute
HASP	Health and Safety Plan
HDPE	High-density polyethylene
HAZWOPER	Hazardous Waste Operations and Emergency Response
HKS	H&K Services, Inc.
IRM	Interim Remedial Measure
KW	kilowatt
LF	linear feet
MBE/DBE	minority-/disadvantaged-owned business enterprise
MGD	million gallons per day
mg/kg	milligrams/kilogram
µg/kg	micrograms per kilogram

List of Abbreviations and Acronyms (cont.)

µg/L	micrograms per liter
NIOSH	National Institute for Occupational Safety and Health
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSERP	New York State Environmental Restoration Program
NYSOSC	New York State Office of State Comptroller
OSHA	Occupational Safety and Health Administration
pdf	personal document file
pH	power of hydrogen
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
psi	pounds per square inch
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RDWP	Remedial Design Work Plan
RFI	Request for Information
RI	Remedial Investigation
ROD	Record of Decision
SPDES	State Pollutant Discharge Elimination System
SSO	Site Safety Officer
SVOC	semi-volatile organic compound
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compound
VRQ	Vendor Responsibility Questionnaire

1 Background and Site Description

This Final Construction Completion Report (CCR) provides information and details on the completion of the remedial construction work performed by H&K Services, Inc., and their subcontractors at the Carroll Town Landfill Site, New York State Department of Environmental Conservation (NYSDEC) Site No. 9-07-017. The selected remedy for the Carroll Town Landfill includes the construction of a landfill cover to minimize infiltration of surface water and subsequent migration of contamination from the landfill waste, and the construction of a treatment system at Well No. 5 to be used as an ex situ treatment system of the groundwater. This will also provide the Frewsburg Water District with an effective supply well that could be used under current conditions. This report includes only the work performed for construction of the treatment system on Public Supply Well No. 5.

1.1 Site Location and Description

The Carroll Town Landfill Site is located in the Village of Frewsburg, Town of Carroll, in Chautauqua County (see Figure 1-1). The site is part of a 305-acre property owned by the Town of Carroll at the end of Wahlgren Road, approximately 1,700 feet north of State Route 62 (also known as Ivory Road). The property is bounded by Conewango Creek to the north and west and State Route 62 to the south and east. The surrounding area includes farmland, wooded areas, wetlands, and private residential properties.

The Frewsburg Water District (FWD) and Town of Carroll Highway Department buildings are located on the property. The approximately 25-acre former landfill is located east of these buildings and consists of an east cell and a west cell. The landfill is mostly vegetated and is accessed via a gravel road off of State Route 62. A portion of the landfill site is currently being used as a public disposal area for brush.

Well No. 5 is located south of the town's highway garage parking lot, near the southern property line. A pump house, a backup generator, and equipment necessary for operation of the pump are also present at this location.

The site is located in the Allegany Plateau physiographic province of New York State and is composed of fill, lacustrine sandy silt and silty clay, glacial outwash sand and gravel, till, and bedrock. The total depth of fill within the landfill ranged

from approximately 2 to10 feet. The top of the fill material was encountered between approximately 1 and 5 feet within each test pit. The sandy silt unit ranges in thickness from 5 feet (southwest) to 10 feet (northeast), and the silty clay unit ranges in thickness from about 3 to 10 feet. The total depth of these units ranges from 7 to 20 feet below ground surface. An outwash of sand and gravel, at a total approximate depth of 45 feet, underlies the sandy silt and silty clay units. The till layer beneath the outwash sand and gravel unit is about 15 feet deep. The weathered shale bedrock was encountered at 76 to 81 feet below ground surface (bgs).

Groundwater was observed between 3 and 9 feet below ground surface. The natural flow of the groundwater is generally northerly toward Conewango Creek. Shallow groundwater was observed to have a flow component to the west-northwest and to the west-southwest. Groundwater in the intermediate zone flows to the southwest. After installation of Well No. 5 in April 2000, it is likely that groundwater flow direction was influenced by pumping activities and migrated to the southwest, causing contamination from the former landfill to be drawn into the pumping well. Well No. 5 is installed at a depth of approximately 80 feet. with a 10-foot screen at the bottom.

1.2 Landfill Operations

The site operated as a municipal landfill from the early 1960s to 1979. A Part 360 Permit for landfill operation expired in 1976. In June 1979, the Town of Carroll filed a permit application to operate a transfer station at the site. Following the issuance of a Consent Order on October 2, 1979, to address several solid waste violations, including failure to provide a complete application for the landfill operation, the town operated the site as a construction and demolition (C&D) debris landfill and transfer station. The western disposal area was closed in 1980.

During a public meeting for the remedial investigation (RI) of the Vac Air Alloys site (NYSDEC Site No. 907016), citizens attending the meeting alleged that Vac Air Alloys disposed of industrial waste at the Carroll Town Landfill. Allegations included citizen's reports of having witnessed drums of waste labeled as "trichloroethene" being disposed of at the landfill. NYSDEC records indicated that Vac Air Alloys disposed of drums containing metal debris and metal turnings. Inspections by NYSDEC indicated the presence of partially buried 55-gallon drums in April 1992 (NYSDEC 2009).

1.3 Remedial History

In May 1998, the NYSDEC listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

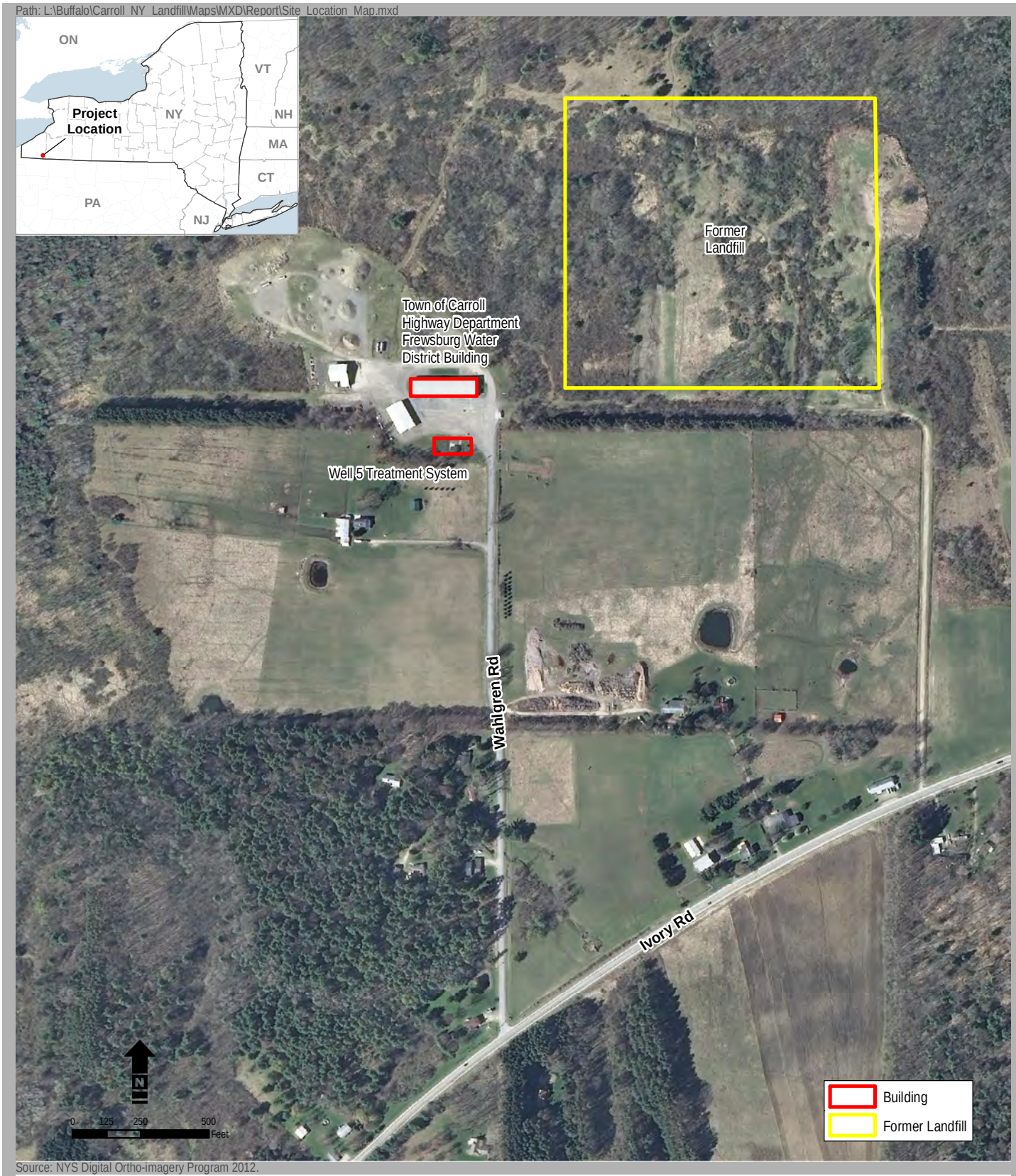

Figure 1-1
Site Location Map
Carroll Well 5
Frewsburg, NY

Between December 1992 and March 1993, Moody and Associates, Inc. (Moody), performed a hydrogeological investigation for the FWD to locate a water supply well. After identifying the Town of Carroll Public Works site, which is adjacent to the landfill, as the probable site for the new water supply well, water quality testing was performed to characterize the aquifer. Groundwater samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), iron, manganese, dissolved solids, hardness, and chloride. At that time, test parameters indicated the water quality was good, except for chloride, which was attributed to runoff from the road salt storage pile and brine storage tank at the Public Works garage.

Subsequent sampling results indicated that VOCs in leachate may have been migrating from the site, which led to classifying the site as a potential hazardous waste disposal site on June 9, 1992. A Preliminary Site Assessment (PSA) was completed in February 1997 by ABB Environmental Services, Inc. (ABB 1997). The resulting determinations of a significant threat lead to the listing of the site as Class 2 site on the Registry of Inactive Hazardous Waste Disposal Sites in May 1998.

1.4 Remedial Investigation

A remedial investigation/feasibility study (RI/FS) was completed by O'Brien & Gere Engineers, Inc., in April 2006 to evaluate the alternatives for addressing the significant threats posed by the site to human health and the environment. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in detail in the RI report (O'Brien & Gere Engineers, Inc. 2006).

To determine whether the landfill waste and groundwater contained contamination at levels of concern, data from the investigation were compared with the following standards, criteria, and guidance (SCGs):

- Groundwater, drinking water, and surface water SCGs, which are based on NYSDEC's Ambient Water Quality Standards and Guidance Values and Part 5 of the New York State Sanitary Code;
- Soil SCGs, which are based on 6 NYCRR Subpart 375-6 – Remedial Program Soil Cleanup Objectives;
- Sediment SCGs, which are based on NYSDEC's *Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1999); and
- Soil vapor SCGs, which are based on the New York State Department of Health's (NYSDOH's) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH 2006).

Based on a comparison of the RI results with the SCGs and an assessment of the potential public health and environmental exposure routes, certain media and

areas of the site required remediation. Additional information regarding sampling performed at the site and comparison of the analytical results with SCGs is provided in the RI report (O'Brien & Gere Engineers, Inc. 2006).

1.4.1 Nature and Extent of Groundwater Contamination

Groundwater samples were collected from 18 wells installed at the site (see Figure 1-2), and one water sample was collected from each of three test pits. One round of groundwater samples was collected in October 2004, and another round of samples was collected in March 2005. A groundwater sampling event also was conducted in August 2008 to assess current groundwater quality after the pumping at Well No. 5 was discontinued in early 2007. The results of 2004 and 2005 sampling indicated that only two monitoring wells had VOC concentrations exceeding the groundwater standards. The highest concentration of VOCs was detected at MW-107S, with 600 micrograms per liter (µg/L) of vinyl chloride (SCG is 2 µg/L) and 69 µg/L of cis-1,2-dichloroethene (SCG is 5 µg/L). The levels of these compounds detected in wells installed around MW107S were very low, indicating that the high concentrations detected in MW107S could be due to localized contamination from past disposal activities and that the contamination is not widespread. These compounds were not detected in soil samples collected from test pits installed adjacent to MW-107S. The same two compounds were detected in MW-102I but at low concentrations that only marginally exceeded the groundwater standards.

The detection of VOCs in samples from the shallow, intermediate, and deep monitoring wells suggests that VOCs have migrated from the landfill. However, based on the groundwater analytical data, VOC concentrations appear to decrease with depth. This suggests that the limited number of detections and low concentrations of VOCs in the intermediate and deep sand and gravel unit are due to biodegradation/natural attenuation of VOCs along the migration pathways.

The analytical data indicates that vinyl chloride and cis-1,2-dichloroethene have migrated from the landfill to Well No. 5. The supply well was installed west of the landfill, and pumping was initiated in 2000. The town installed a sentinel monitoring well (MW-13) approximately 600 feet west of the landfill and 185 feet east of Well No. 5 (see Figure 1-2). This well is sampled periodically to monitor contaminant migration from the landfill towards Well No. 5, before the contaminated groundwater reaches Well No. 5. In June 2005, groundwater samples were collected from MW-13 and Well No. 5 during operation. Vinyl chloride and cis-1,2-dichloroethene were detected in MW-13 at concentrations of 10 µg/L and 15 µg/L, respectively, and in Well No. 5 at concentrations of 0.8 µg/L and 2.4 µg/L, respectively. Although the concentration was less than the drinking water standards, pumping of Well No. 5 was discontinued in early 2007 to ensure that groundwater standards were not exceeded. In May 2007, vinyl chloride and cis-1,2-dichloroethene were detected in MW-13 at 0.6 µg/L and 9.3 µg/L, respectively, and their concentrations were non-detect at Well No. 5. This may indicate that when Well No. 5 was operational contamination was being

F:\Carroll Landfill\GW contours 12-8-14\Sitemap.dwg

N

E 349000
N 757500
E 351000
N

MW-111S
MW-111 I
MW-104
MW-105S
MW-107S
MW-107 I
MW-106S
MW-110 I
MW-110S
MW-103
MW-108 S
MW-108 I
MW-109D
MW-109 I
MW-109S
MW-102
MW-102 I
MW-101
MW-13
SUPPLY WELL #5

FOUNDATION
DEBRIS
DEBRIS
DEBRIS
DEBRIS
DEBRIS

N 756500
N 756000
E 349000
E 351000
N

LEGEND

MONITORING WELL LOCATION

NOTES

1. THIS DRAWING IS A COMBINATION OF CARROL.dwg and ACAD2000-CARROLL LANDFILL.dwg PROVIDED BY THE NYSDEC FROM THE REMEDIAL INVESTIGATION.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF AERIAL MAPPING AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITION EXISTING ON THE DATE OF PHOTOGRAPHY.
3. CONTROL: PROVIDED BY TVGA CONSULTANTS. COORDINATES SHOWN HEREON ARE EXPRESSED IN U.S. SURVEY FEET AND REFERENCED TO THE NORTH AMERICAN DATUM OF 1927 (NAD27) - NEW YORK STATE PLANE GRID. ELEVATIONS SHOWN HEREON ARE EXPRESSED IN FEET AND ARE REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
4. MAPPING COMPILED BY TVGA CONSULTANTS (TVGA) USING PHOTOGRAMMETRIC METHODS. AERIAL PHOTOGRAPHY FLOWN 1 APRIL 2005. THIS MAPPING COMPILED IN ACCORDANCE WITH (NMAS) NATIONAL MAP ACCURACY STANDARDS FOR MAPS AT 1 INCH EQUAL 50 FT. SCALE.

SCALE IN FEET
0 200 400 600

FIGURE 1-2
SITE MAP
CARROLL LANDFILL
FREWSBURG, CHAUTAUQUA COUNTY, NEW YORK

pulled from the area of the landfill to the supply well. Conversely, the results of the groundwater sampling conducted in August 2008 indicated that the contaminant plume was no longer migrating toward the water supply, as evidenced by the decreasing contaminant concentration in MW-13, which may have been due to the termination of pumping at Well No. 5.

Three SVOCs (4-methylphenol, 4-chloro-3-methylphenol, and 4-nitrophenol) were detected in the groundwater sample collected from temporary well TW-TP-02 at concentrations exceeding NYS Class GA groundwater standards. The water collected from the TW-TP-02 location was in contact with the fill materials. SVOCs were not detected at concentrations exceeding the NYS Class GA groundwater standards in the samples collected from the four monitoring wells sampled for SVOCs (MW-102, MW-105S, MW-108I, and MW-109D), suggesting that the migration of SVOCs present within the fill materials to groundwater is limited (O'Brian & Gere 2006).

Arsenic, barium, chromium, iron, lead, and manganese were detected at concentrations exceeding NYS Class GA groundwater standards in groundwater samples collected during the October 2004 and March 2005 sampling events as part of the RI investigation (O'Brian and Gere 2006). Of these contaminants, iron was the only contaminant that was detected consistently (30 of 31 groundwater samples) and at concentrations exceeding groundwater standards. With the exception of iron, these inorganic contaminants were detected only sporadically at concentrations above the groundwater standards, both spatially and temporally. Based on a review of the iron concentrations and the frequency of detection, the detected iron concentrations are likely representative of naturally occurring background groundwater quality conditions.

1.5 Proposed Remedial Action Plans

In 2008, NYSDEC issued the *Proposed Remedial Action Plan* [PRAP] *for the Carroll Town Landfill Site, Town of Carroll, Chautauqua County, New York* (NYSDEC 2008). The PRAP summarized the alternatives considered and discussed the rationale for selecting those alternatives. Following a detailed investigation of the site and an evaluation of the alternatives for remediating the contamination associated with the landfill waste and associated groundwater contamination, Alternative No. 4 (Landfill Cover with Ex Situ Treatment of Groundwater) was selected by NYSDEC and the NYSDOH as the site remedy.

The components of the remedy include consolidation of the two landfill cells followed by construction of a landfill cover to minimize infiltration of surface water and subsequent migration of contamination from the landfill waste. The cover would promote surface water runoff, thereby minimizing the migration of leachate from the landfill waste to the surface drainage ditches. A treatment system would be installed at Well No. 5 to treat the groundwater. This would provide the FWD with an effective supply well that could be used under current conditions.

2 Summary of the Site Remedy

2.1 Record of Decision – Description of the Selected Remedy

Based on the results of the RI for the Carroll Town Landfill Site and the criteria identified for evaluation of alternatives, NYSDEC selected installation of a soil cover at the landfill with consolidation of the cells and construction of a treatment system on Well No. 5 as ex situ treatment. The Record of Decision (ROD) for the Carroll Town Landfill Site was signed on March 31, 2009 (NYSDEC 2009a). The elements of the proposed remedy are described below.

1. A remedial design program will be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.
2. Consolidation of the landfill will be evaluated. The consolidation would include excavating waste from the east cell and its consolidation into the west cell, which will result in a smaller landfill footprint and restore the east cell to usable land. If consolidation of the landfill is not found to be cost effective or practicable, the entire landfill will be covered with a soil cover.
3. A treatment system will be designed and installed at Well No. 5 to comply with drinking water standards. The FWD could use the treated water for public water supply.
4. A soil cover will be constructed over the landfill to limit exposure to contaminated soils and provide contouring to promote runoff of surface water. The cover materials will be further evaluated during design but nominally would consist of 6 inches of topsoil and 18 inches of clean soil material underlain by an indicator (e.g., orange plastic snow fence) to demarcate the cover soil from the subsurface soil. Clean soil will consist of soil that meets the NYSDEC Division of Environmental Remediation's criteria for backfill or local site background. Non-vegetated areas such as roadways are not anticipated at this site, but if they are required, these areas will be covered by a paving system at least 6 inches thick.
5. An institutional control in the form of an environmental easement will be implemented that will require (a) limiting the use and development of the property to commercial or industrial uses; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water unless necessary water quality treatment, as

determined by the NYSDOH, is implemented; and (d) the property owner is to complete and submit to NYSDEC a periodic certification of the institutional and engineering controls.

6. A site management plan will be developed that includes the following institutional and engineering controls: (a) management of the final cover system to restrict excavation below the soil cover's demarcation layer. Excavated soil will be tested, properly handled to protect the health and safety of workers and the nearby community, and properly managed in a manner acceptable to the NYSDEC (b) continued evaluation of the potential for vapor intrusion for any buildings developed on or adjacent to the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater; (d) identification of any use restrictions on the site; (e) provisions for the continued proper operation and maintenance of the groundwater treatment system and other components of the remedy.
7. The property owner will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or other such expert acceptable to the NYSDEC, until NYSDEC notifies the property owner in writing that this certification is no longer needed. This submittal will (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with NYSDEC-approved modifications; (b) allow NYSDEC access to the site; and (c) state that nothing has occurred that will impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the NYSDEC.
8. The soil cover will be maintained periodically. Maintenance will include mowing the cover and repairing any areas of the cover that were damaged or compromised in any way. Since the remedy results in untreated waste remaining at the site, a long-term monitoring program will be instituted. This program will allow the effectiveness of the landfill cover and treatment system to be monitored and will be a component of the long-term management for the site.

As this CCR is only for the work on the construction of the ex situ groundwater treatment system at Well No. 5, all sections of this report going forward pertain to the construction of the groundwater treatment system. A Final Engineering Report (FER) will be provided after the consolidation and construction of the landfill cover is complete.

2.2 General Summary of Work – Groundwater Treatment System

The following is a summary of work for the construction of the groundwater treatment system for Well No. 5, including the following general components:

a. Demolition of the existing pump house piping components;

b. Installation of additional casing on Well No. 5;

c. Construction of a treatment system building;

d. Installation of an air stripper tower;

e. Construction of a clearwell; and

f. Installation of all piping, pumps, valves, monitoring equipment, chemical feed equipment, recirculation system, etc.

2.3 Remedial Action Objectives for Groundwater

Based on the results of the RI, the following remedial action objectives (RAOs) were identified for the groundwater treatment system.

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminants at levels that exceed drinking water standards.

RAOs for Environmental Protection

- Restore the groundwater aquifer, to the extent practicable, to pre-disposal conditions.
- Prevent the discharge of contaminants to surface water.

3 Summary of the Pre-Remedial Activities

3.1 Remedial Design and Contract Documents

The design and construction work for the Carroll Town Landfill – Well No. 5 Groundwater Treatment System project was performed under two work assignments. Ecology and Environment Engineering, P.C. (EEEPC) was issued Work Assignment No. D004442-23 for engineering design of the treatment plant and Work Assignment D007617-09 to provide site services during construction of the project. Construction specifications encompassing the design of the treatment plant were prepared by EEEPC in September 2011 and were included with standard NYSDEC specifications and contract documents as part of the construction contract documents for the site.

Design objectives for the project included the following:

- Treatment of VOC contamination from groundwater via air stripping;
- Design flow of 210 gallons per minute (gpm) with the capacity to increase to 250 gpm as needed. This design flow meets the criteria to contain the contaminated groundwater plume and provide the FWD with sufficient flow to meet demand.
- Additional treatment with hydrochloric acid and chlorine for pH adjustment and chlorine residual; and
- Automated control of system with auto dialer capability.

3.2 Project Bidding Information and Award

A mandatory pre-bid meeting was held by NYSDEC and EEEPC at the project site on October 19, 2011, for the potential bidders to view existing conditions and to discuss the requirements for bidding the project. The requirements included the technical requirements of the contract documents and the administrative protocol to be used during the work. Potential bidders that attended were required to sign an attendance sheet to document their presence at the mandatory meeting. A walk-through of the site and a question-and-answer period were held with those in attendance.

Based on the results of the pre-bid meeting and walkover, an addendum (Addendum No. 1) to the contract documents was issued during the public bidding phase to the plan holders of record on November 3, 2011 (EEEPC 2011). Addendum No. 1 included (a) the pre-bid meeting minutes, (b) the supplementary conditions in Section IX of the contract documents, (c) questions (and answers) received during the pre-bid meeting and by NYSDEC following the pre-bid meeting, (d) changes to the contract documents related to a text addition in specification Section 133419 – Metal Building Systems, and (e) a pre-bid meeting attendee list.

Three bids were received by NYSDEC on November 9, 2011. Appendix A provides a summary of the bids received during the public bid period. The low bidder for the project was H&K Services, Inc. (HKS) of Leon, New York, at $1,359,325.

Following a review of additional post-bid information obtained from HKS, a Notice of Intent to Award letter was issued by NYSDEC to HKS on December 19, 2011. Copies of the agreement for the project were signed by HKS and transmitted to NYSDEC on December 29, 2011. The Department of Audit and Control for the New York State Comptroller approved the agreement on June 15, 2012. The Notice to Proceed date for the Carroll Town Landfill – Groundwater Treatment System project was officially established as June 15, 2012.

EEEPC's initial efforts included a bid summary review and an initial review of HKS's 5-day and 14-day submittal requirements as specified in Section III of the Contract Documents. EEEPC continued to provide construction management services, including construction oversight and daily reporting to NYSDEC, during the construction period. HKS began work at the site on July 25, 2012, and completed work on May 15, 2013. Section 5 below discusses EEEPC's construction management and inspection services for the project.

3.3 Pre-Construction Submittals

Prior to construction, the contractor prepared and submitted a site-specific Health and Safety Plan (HASP); a Quality Assurance/Quality Control (QA/QC) Plan; and a preliminary project schedule. The site-specific HASP was completed in accordance with 29 Code of Federal Regulations (CFR) 1910.120. A site safety officer was designated to ensure compliance with the HASP while personnel were on-site. The site safety officer submitted evidence that all field personnel had current certificates of training. The QA/QC Plan was prepared in accordance with contract documents and identified personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out the contractor's QA/QC responsibilities.

Required details of the construction schedule included showing the sequencing, individual work item durations, and work item completion dates. When

significant schedule changes occurred, the contractor revised and resubmitted an updated schedule to NYSDEC.

NYSDEC reviewed submittals for conformance with the Contract Documents and accepted them, or accepted them with comment, prior to construction.

4 Description of Remedial Actions Performed

4.1 Governing Documents

The Contract Documents under Work Assignment D007617-09, consisted of the NYSDEC standard specifications, technical specifications and contract drawings, which were issued for bids by NYSDEC in September 2011. These documents were based on the ROD issued by NYSDEC in March 2009.

4.2 Project Schedule

Based on Contract Document D007617, Section VI, Article 6, the length of the remediation project from Notice to Proceed until Substantial Completion was established as 150 calendar days, with 20 additional days. The length of the remediation project from Notice to Proceed until Final Completion was established as 175 calendar days, with 20 additional days.

4.3 Contractors and Consultants

The successful low and responsible bidder for the Carroll Town Landfill Site – Groundwater Treatment System project was HKS, of Leon, New York. The company responsible for engineering services during remedial construction was EEEPC, of Lancaster, New York.

4.4 Contractors and Subcontractors

HKS provided a list of subcontractors to be utilized throughout the duration of the project. Major subcontractors (i.e., with costs over $10,000) were required by the contract to submit a Vendor Responsibility Questionnaire (VRQ).

The following subcontractors were utilized during the project. The estimated dollar value of the work performed by each subcontractor is listed in parentheses; the estimate is based on HKS's Contract Schedule of Values breakdown and Change Orders. Subcontractors certified in New York State as minority- or women-owned business enterprises (MBE/WBE) are listed in bold.

- Scanlon Erectors – Hamburg, New York: Erection of metal building system ($71,900)
- Ahlstrom Schaefer – Jamestown, New York: Electrical work ($120,530)

- Armor Fence – WBE, Orchard Park, New York: Supply/install chain link fence and gates ($21,963)
- Nelson Masonry – Jamestown, New York: Concrete masonry ($12,960)
- Empire Concrete – Pittsford, New York: Pre-cast structural concrete ($14,850)
- Moody & Associates – Fairport, New York: Remove existing well pump and install new pump ($13,898)
- Hamburg Overhead Door – Hamburg, New York: Install sectional overhead doors ($5,330)
- SJB Services, Inc. – Hamburg, New York: Specialty engineering service/testing ($1,000)
- VSG Enviromation – Rochester, New York: Process control programming ($140,000)

4.5 Construction Monitoring and Project Plan Submittals

4.5.1 Pre-construction Meeting

On July 3, 2012, a pre-construction meeting was held with representatives from NYSDEC, HKS, the FWD, the Chautauqua County Department of Health, and EEEPC. The meeting was held on-site at the town Highway Department building in Frewsburg, New York. The purpose of the pre-construction meeting was to introduce the project's administrative and field staff and to establish the construction parameters for successful completion of the project. A copy of the pre-construction meeting agenda and meeting minutes for the HKS contract work is provided in Appendix B-1.

Discussions included the general introduction of project staff and responsibilities, review of the contract time and liquidated damages, coordination efforts with local officials, and review of the contract's general and supplementary conditions. Also discussed were individual task schedules, project submittals (work plans and shop drawings), critical items for construction of the treatment system, and field coordination by the prime contractor.

4.5.2 Contractor Plan Submittals

In accordance with the contract document's administrative and technical requirements, HKS submitted project plans and shop drawings. The submission process was recorded by EEEPC.

Project submittal requirements were included in the contract documents, primarily in Bidding Information Requirements (Section III), Standard Specifications (Section X), Supplementary Specifications (Section XI), and Measurement for Payment (Section XII).

The log of the project submissions associated with the contract documents is presented in Appendix C-1. Major project plans and submissions are discussed below.

4.5.2.1 HKS Progress Schedule

HKS submitted, in critical path method (CPM) format, a progress schedule with estimated durations and milestones for major work elements. The submitted schedule followed the requirements of contract documents Section X (Standard Specification, Section 00001 – Progress Schedule). The progress schedule provided details regarding priority, sequencing, and interdependence of activities, as well as the sequence in which the work was to be performed. The schedule also identified how HKS was going to comply with the contract time, named allowances, and the sequences of work indicated or required by the contract documents. The schedule also provided information on how HKS would anticipate foreseeable events that could affect cost, progress, performance, and completion of the work.

The contract documents required regular progress schedule updates, or as necessary, to evaluate the progress and performance of HKS's work. EEEPC requested monthly schedule updates to review progress and to facilitate discussion of tasks and delays at progress meetings. The original progress schedule was submitted by HKS on August 10, 2012. The initial project schedule was accepted by EEEPC (EEEPC Submittal 072.1) on August 21, 2012. Updates to the schedule were provided on a monthly basis as part of the progress meetings. Formal schedule revision submissions were made as needed. The last schedule revision was provided on March 20, 2013. HKS's progress schedule submittal and the schedule revisions submittals are included in the Project Submittal Log provided in Appendix C-1. The initial version is provided in Appendix C-2.

4.5.2.2 Erosion and Sedimentation Control Plan

Pursuant to the requirements of the contract documents, Supplementary Specifications, Section XI – Division 1, Section 015000 (Temporary Facilities and Controls), HKS submitted an Erosion and Sedimentation Control Plan on September 13, 2012. The plan included a description of practices and temporary measures to prevent erosion on the site, including the use of silt fencing and straw bales. The plan also included procedures for inspection, maintenance, and repair of temporary controls. EEEPC reviewed and accepted the second revision of the document (EEEPC Submittal 93.1) on September 24, 2012. The submittal milestones and plan revisions are included in the Project Submittal Log provided in Appendix C-1.

4.5.3 Contractor Post-Construction Project Submittals

Post-construction or closeout submittal requirements for the project were listed in the Supplementary Specifications, Section XI, Division 1, Section 017000 (Execution and Closeout Procedures) of the contract documents. Closeout documents and submittals included a list of administrative and technical

documents to verify the completion of the project in accordance with the technical specification and administrative requirements of the contract documents. HKS submitted the post-construction submittals for EEEPC's review and approval. EEEPC determined whether to reject the post-construction submittals or approve them, with or without conditions. The project closeout submittal list and the revisions for finalization of the project are provided in Appendix C-1.

4.6 Health and Safety Submittals

4.6.1 Health and Safety Plan

Project Standard Specification, Section X – 00003 includes Minimum Requirements for Health and Safety. On August 2, 2012, HKS submitted a site-specific HASP to EEEPC for review as a part of the 5-day and 14-day submittal package requirement of the contract documents. EEEPC's review of the second revision of the HASP (EEEPC Submittal 057) indicated that the contractor had a site-specific plan and that the components were in compliance with the contract document requirements, and the HASP was accepted on August 27, 2012. HKS provided EEEPC with copies of medical surveillance examinations and 40-hour HAZWOPER and refresher training certifications for the individual HKS and subcontracted personnel. The HASP submittal is included in Appendix C-2.

4.7 Contractor Site Mobilization Activities

HKS mobilized to the site on July 25, 2012. HKS mobilization equipment included a backhoe, dump trucks, an equipment trailer, and other equipment necessary to initiate the work. HKS established an operations and equipment staging area and support zone near the eastern side of the site.

4.7.1 Contractor Site Services

HKS provided site services for the duration of the project, including field offices and support areas; temporary utilities; erosion and sediment control; disposal of contractor-generated solid waste; staging/stockpiling and processing areas; survey controls for grades and elevation; and sanitary facilities. HKS mobilized two field office trailers to the site. One trailer contained an office for the contractor and a storage area for equipment; the other trailer was used as an office by the engineer (EEEPC) and as a conference area for project meetings. Both trailers were furnished with office furniture and an all-in-one copier (facsimile, scanning machine, telephone, and internet access).

Potable water service was available at the site in the existing Well No. 5 pump house and at the Highway Department garage north of the project site.

A health and safety meeting was held by HKS once a week during the construction phase of the project. HKS's site safety officer (SSO) was responsible for the day-to-day assessment of potential work hazards and was required to advise HKS and EEEPC personnel of any known or potential health and safety issues.

5 Remedial Program Elements

5.1 Engineering Services during Remedial Construction

5.1.1 Ecology and Environment Engineering, P.C.

EEEPC provided engineering services during the remedial construction under Work Assignment D007617-WA No. 9. EEEPC provided review of the contractor's 5-day and 14-day plans submitted as a part of the evaluation to demonstrate whether the contractor had an understanding of the performance of the project scope of work and compliance with the contract technical specifications. In addition, EEEPC reviewed equipment product data submitted by HKS to demonstrate that the products and materials to be installed on the project were consistent with those specified in the technical specifications. Finally, upon completion of the work, EEEPC provided review of the post-construction documentation that demonstrated the contractor had fulfilled the technical and administrative requirements of the contract documents. A copy of the Project Submittal Log for the work is provided in Appendix C-1.

EEEPC prepared daily observation reports (DORs) during the course of the field work. These DORs were then combined into weekly summary reports that were submitted to the NYSDEC project manager (PM). The DORs documented the construction progress at the site throughout the remedial construction period. Each DOR documented the remedial construction monitoring performed during the day and provided photos of major aspects of the work. Weekly reports submitted to NYSDEC documented work completed during the prior week, any issues encountered, and an update of the project schedule. Copies of the DORs for the work performed by HKS and its subcontractors are provided in Appendix D-1. Copies of the EEEPC weekly summary reports for the work performed by HKS and its subcontractors are provided in Appendix D-2. Project photos taken by EEEPC during the remedial work performed by HKS are provided in Appendix E.

In addition to the DORs, the EEEPC PM and staff communicated with NYSDEC by telephone, generally on a daily basis. EEEPC conducted the progress meetings at the site every week that work was ongoing at the site and provided complete minutes and documentation of each meeting to NYSDEC for record-keeping purposes. Copies of the Progress Meeting Minutes are provided in Appendix B-2.

During the remediation project, EEEPC worked with NYSDEC to manage and resolve requests for further information (RFIs) and, when necessary, provide

clarifications of the contract documents to advance the contractor's understanding of the project. Copies of the RFIs issued during performance of the work and their responses are provided in Appendix F. A summary of the project RFIs is provided in Section 5.4.1 and Table 5-1.

EEEPC issued field orders (FOs) to HKS and its subcontractors when necessary to provide further technical direction to them that did not include any additional cost to the project. These were approved by NYSDEC before being issued to the contractors. Copies of the FOs for the work performed by HKS are provided in Appendix G. A summary of the project FOs is provided in Section 5.4.2 and Table 5-2.

EEEPC developed work change directives (WCDs) for the contractor to describe any additional work not covered by the original scope of work for the project. WCDs were approved by NYSDEC before being issued to the contractor. Once a WCD was executed and completed, the contractor submitted final costs and time for EEEPC's review. Copies of the WCDs are provided in Appendix H. A summary of the project WCDs is provided in Section 5.4.3 and Table 5-3.

If the costs and time for an individual WCD were acceptable, they were included in a final project change order (CO), which was submitted to NYSDEC for approval and then to the New York State Office of the State Comptroller for acceptance and payment of funds. The project COs related to the contract are discussed in greater detail in Sections 6.4. Copies of the COs for the project are provided in Appendix I.

EEEPC reviewed the contractor's completed bid items and quantities in the monthly Contractor Application for Payment (CAP). This review included field confirmation of the project quantities requested in the CAP and review of the contractor's and subcontractors' certified payrolls to provide compliance with the New York State Department of Labor's accepted wage rates for the project. Contractor payments and certified payrolls are discussed in greater detail in Sections 6.4.1 and 6.4.2. Copies of the CAPs are provided in Appendix J.

As part of the final CAP for the project, the contractor was required to submit Waiver of Liens Affidavits. Final Waiver of Liens Affidavits from HKS and their subcontractors are provided in Appendix K.

5.1.2 Watts Architecture and Engineering Services

To support EEEPC, a sub-consultant, Watts Architecture and Engineering (Buffalo, New York), a New York State-certified minority and disadvantaged-owned business enterprise (MBE/DBE), assisted in providing engineering services during construction. Watts performed equipment submittal reviews for electrical work, review and response to RFIs related to electrical work, assisted in preparing FOs and WCDs as they related to electrical work, and performed occasional checks of the electrical installation.

5.2 Project Administration

5.2.1 Progress Meetings

Progress meetings were held weekly at the project site; if needed, the meeting dates were adjusted for the convenience of the primary stakeholders. Attendees typically included representatives of NYSDEC, HKS, the FWD, EEEPC, subcontractors, and other parties to the project, as required. The meetings were held on-site in the engineer's field office during the construction period. EEEPC recorded the minutes of each meeting and distributed copies to the attendees. Comments were received at the next scheduled progress meeting and included in the minutes for that meeting.

A total of 34 progress meetings were held with HKS during the course of the project. Copies of the progress meeting minutes are presented in chronological order in Appendix B-2.

5.2.2 Submittal Reviews

Supplementary Specification, Section XI, Division 1, Section 013000 (Administrative Requirements) provided requirements for the preparation and submittal of the materials, equipment, and methods related to the remedial construction. HKS prepared and submitted project plans and shop drawings in general compliance with these requirements and revised and resubmitted in a timely manner those that were found to be deficient. Submittals were reviewed for general conformance with the contract documents, including the plans and technical specifications. HKS provided a total of 140 submittals for EEEPC review and approval. EEEPC's site representative and PM, with assistance from other staff engineers, reviewed the submittals and either rejected them or approved them, with or without conditions. Copies of the submittals and a Project Submittal Log were maintained by EEEPC throughout the course of the project. The Project Submittal Log is provided in Appendix C-1.

5.3 Contract RFIs, FOs, and WCDs

5.3.1 Requests for Information

RFIs for clarification or interpretation of the contract documents were prepared by HKS. Each RFI was addressed by the party it was directed to and then logged and returned by EEEPC. A total of 58 individual RFIs were submitted to EEEPC, and these are summarized in Table 5-1. Note that RFI 058 was not used. Copies of the RFIs and the responses to them, as well as an RFI Log maintained by EEEPC throughout the course of the project, are presented in Appendix F.

Table 5-1 Carroll Town Landfill Site – Groundwater Treatment System RFI List Summary

RFI Number	Date Received	Description
001	1/5/2012	Additional information for sizing the overhead door for the acid storage room.
002	1/6/2012	Clarification of strength requirements for cast-in-place concrete.
003	1/6/2012	Clarification of elevation of clearwell roof plan.
004	1/10/2012	Contractor requested Corle Building Systems Drwg. FO56329 that was developed during design.
005	1/11/12	Clarification and confirmation on whether communications work is part of contract. Removed spec section 275123.
006	1/17/2012	Clarification of elevations on architectural drawings.
007	1/17/2012	Clarification on size and number of chlorine day tanks.
008	1/19/2012	Clarification on hand/off/auto control of air stripper blower.
009	1/30/2012	Clarification and confirmation of keying system for building.
010	2/2/2012	Clarification of chlorine and acid vapor sensor manufacturers and model numbers.
011	2/6/2012	Clarification of control system drawings and specification.
012	2/29/2012	Clarification of snow loads for New York State.
013	3/6/2012	Contractor asked for option of using 6-inch or 8-inch plank above chemical storage rooms; 6-inch plank was called for in design.
014	3/6/2012	Clarification of dimensions for metal building system.
015	3/5/2012	Clarification of total dynamic head for discharge pumps.
016	3/8/2012	Clarification of support angle installation for FRP grating.
017	4/2/2012	Clarification of clearwell overflow pipe size.
018	4/20/2012	Clarification of level sensors for air stripper tower.
019	5/2/2012	Clarification of distance between air stripper and intake louver.
020	7/16/2012	Clarification of column line 5 and effects of column footings on existing building.
021	7/24/2012	Clarification of location of adsorption fields.
022	7/20/2012	Clarification of tankless hot water heater.
023	7/25/2012	Clarification of trench drain wall between clearwell wall and p-3 pier at column line B4.
024	7/30/2012	Clarification of check valve on underground SPDES discharge line.
025	8/3/2012	Clarification on filling in sump pit in northeast corner of existing building.
026	8/4/2012	Clarification on length of EZ-Flow drainage sections in adsorption cell.
027	8/8/2012	Clarification of rebar in air stripper tower foundation.
028	8/9/2012	Confirmation that wall to be removed in pre-cast existing building is not a loadbearing partition or shear wall.
029	8/9/2012	Verification of trim color for building.
030	8/10/2012	Clarification of clearwell location relative to column 3 and column B.
031	8/10/2012	Clarification of chamfer on top of clearwell.
032	8/14/2012	Approval to change location of reroute of electrical lines.
033	8/15/2012	Confirmation of pipe sleeve elevations through foundation.

Table 5-1 Carroll Town Landfill Site – Groundwater Treatment System RFI List Summary

RFI Number	Date Received	Description
034	8/22/2012	Confirmation of clearwell sump drain line elevation.
035	8/23/2012	Confirmation of bearing surface width on clearwell walls for roof planks.
036	8/31/2012	Confirmation that it is acceptable to install rebar for block wall in foundation by drilling and setting in mortar.
037	9/7/2012	Confirmation of hand operator position for electrically operated valves.
038	9/7/2012	Request for using a ductile iron disk coated with NSF-61 epoxy in lieu of an EPDM-covered stainless steel disk in the electric butterfly valves.
039	9/7/2012	Clarification of changes to be made to existing overhang on east side of building.
040	9/7/2012	Confirmation that using 3-inch binder and 1-inch top in the pavement cut trenches would be acceptable in lieu of 5 inches of concrete.
041	10/5/2012	Request that floor slab in acid room extend over acid pit walls and clarification on what to do for water tightness seal at cold joints.
042	10/5/2012	Clarification on door stops and closers.
043	10/10/2012	Clarification on acid sensor manufacturer and model.
044	10/10/2012	Clarification of penetrations in recirculation tank.
045	10/16/2012	Clarification of ceiling panels above existing roof line.
046	10/22/2012	Request to relocate 4-inch containment pad drain line to westernmost catch basin.
047	10/25/2012	Clarification of location of chlorine and acid vapor sensors and communication capabilities with the system.
048	10/25/2012	Location of lifting beam for distribution pumps.
049	10/29/2012	Clarification of attachment of insulated panels to precast at column line 1.
050	10/31/2012	Clarification of coordinating installation precast planks around Corle building cable stays.
051	11/5/2012	Clarification of exhaust fan ductwork location for PPE room exhaust.
052	11/9/2012	Clarification on installation of gutters on north side of upper building.
053	11/14/2012	Clarification on starters for P1, P2, P3, P5, and P6.
054	11/19/2012	Clarification on where DIP piping is required.
055	12/8/2012	Clarification for mounting chemical injectors in polyvinyl chloride (PVC) pipe.
056	12/14/2012	Clarification on control of exhaust fans, motorized louvers, and dampers.
057	1/16/2013	Clarification of changes made in the field to gas line sizes.
059	1/28/2013	Clarification on pump fault alarm signal for chemical metering pumps.

Note: RFI-058 was skipped in the numbering sequence by HKS.

The responses to the 58 RFIs resulted in four WCDs or COs. Details of the WCDs or COs resulting from the RFIs are discussed in Sections 5.4.3 and 6.4.

5.3.2 Field Orders

A total of six FOs were approved by NYSDEC and issued by EEEPC in response to changes in field conditions that required additional direction. The FOs were issued for no-cost items only. Descriptions of each FO are provided in Table 5-2. Copies of the individual FOs are presented in Appendix G.

Table 5-2 Carroll Town Landfill Site – Groundwater Treatment System Field Order List

Field Order Number	Issue Date	Description
001	4/9/2012	Corrected dimension errors on mechanical and structural drawings and underground electrical lines relocation.
002	4/12/2012	Revision of chemical metering pump model.
003	8/17/2012	Only wall sleeves requiring a water stop ring and link seal will be at the overflow sump drain pipe sleeve, water distribution line pipe sleeve through the east foundation wall, and the pipe sleeve in the spill containment pit wall in the acid storage room.
004	10/15/2012	Removed curb outside of single door on western side of electrical room. Southern door on eastern side will not be used due to building column placement.
005	10/17/2012	Contractor to work with the gas supply company on providing gas service to the building.
006	11/12/2012	Adjusted the slope of the floor in the main process room.

5.3.3 Work Change Directives

A total of 13 WCDs were issued for the project. Each WCD was developed by EEEPC based on changes in conditions or additional activities required at the site to achieve the contract requirements. Each WCD was prepared by EEEPC after discussions with both NYSDEC and the contractor's PM. WCDs were approved by the NYSDEC PM prior to issuance and then implemented by the contractor. The WCDs are summarized in Table 5-3. Copies of the individual WCDs are presented in Appendix H.

Table 5-3 Carroll Town Landfill Site – Summary of WCDs

WCD Number	Date	Topic
001	5/8/2012	Changes were made to the level sensors to be used in the chemical day tanks and the level switches in the air stripper sump tank and recirculation tank. Flow verification sensors were added to the chemical metering pumps.
002	9/10/2012	Changes were made to the design of the footings and piers at column line 5. Changes were made to the electrical power service at the town garage building located northwest of the pump house building. A new set of drawings was issued.

Table 5-3 Carroll Town Landfill Site – Summary of WCDs

WCD Number	Date	Topic
003	8/7/2012	The tankless hot water heater model was changed and electrical requirements for the heater were changed.
004	8/24/2012	Contractor to provide concrete testing.
005	10/25/2012	Contractor to apply plywood sheeting to the west side of the existing building at column line 4.
006	11/13/2012	Contractor directed to provide gutter and downspout on the north side of the upper building. Contractor also directed to paint the block wall construction with filler/primer and finish coat. Finish coat color to be selected by the town. RFI-52 initiated this directive.
007	11/27/2012	Contractor is directed to abandon in place the well at the proposed adsorption field.
008	12/17/2012	Contractor is directed to conduct a plug test of the Well No. 5 well casing to provide physical data as to whether or not the 7.5- or 7.13-inch diameter vertical turbine pump will fit down the well.
009	1/25/2013	Various changes to system components and layout including: MV-11 and flow meter location change on distribution line; relocation of chlorine analyzer on distribution line; change of chlorine day tank from double wall to single wall; acid day tank vent and plumbing at the acid scrubber; placement of level sensors in recirculation tank; change of electrical conduit in chemical rooms from electrical metallic tubing (EMT) to PVC; change locations/added valves; added electrical operation of process room exhaust fan and louver; installation locations for pH sensors; installation components for chlorine analyzer prior to clearwell; installation of sight glass on the air stripper tower; installation of a removal apparatus for the air stripper level switches; installation of drain lines for the vertical turbine pumps; installation of vapor sensor communication with MCP; all chlorine and pH analyzers to read at MCP; removed pressure differential switch at the air stripper tower; removed need for combination starters for the chemical feed pumps; and removed need for combination starter on the acid transfer pump.
010	2/13/2013	Contractor to install photo cell to operate the three exterior lights on the building.
011	3/13/2013	Contractor to install flow meter on the acid transfer line.
012	3/13/2013	Contractor to install pressure reducer on the line to the chlorine analyzer on the distribution pipe; install street elbows on the pipe connections for the level sensors in the stripper tower; install a hose bib in the chlorine room; and cut the ends of pipes in the overflow sump shorter to provide proper air gap, and install screens on the ends.

Table 5-3 Carroll Town Landfill Site – Summary of WCDs

WCD Number	Date	Topic
013	4/15/2013	Contractor directed to complete the following: install bubbler system for well-level measurement; provide calibration kit and gasses for vapor sensors; complete revisions to exterior concrete and fencing; separate blow-off for finished water; install rain hood/sound dampening for blower intake; provide spare Posiflow sensors; install backpressure sustaining valves on chlorine feed lines; install rain hoods for emergency generator intake louver and process room exhaust fan louver; and provide electrical quick disconnects on pH sensors.

All of the WCDs developed for the project resulted in cost change items. The changes in costs for the project are discussed in Section 6.6.2 and Appendix I.

5.4 Changes to the Project Scope

Changes to the project scope of work are discussed in Section 6.4.1. For a detailed list and description of each of the scope revisions, refer to executed Change Order Nos. 1 through 4, which are provided in Appendix I.

5.5 Changes to the Project Schedule

The original contract time was 170 calendar days to achieve substantial completion and 195 calendar days to achieve final completion. With a Notice to Proceed date issued on July 15, 2012, the actual final completion date was then established as December 27, 2012. Due to the late Notice to Proceed date and the need to complete site restoration in spring/summer months, the construction schedule was extended.

Change Order No. 1, which was issued due to the late Notice to Proceed date, added 139 additional calendar days to the project schedule at no increase in contract cost. The addition of these days resulted in a revised substantial completion date of January 22, 2013, and a revised Final Completion date of May 15, 2013. Change Order No. 1 was executed by the New York State Office of the State Comptroller on September 13, 2012.

6 Remedial Performance

6.1 Remedial Actions

6.1.1 Construction of Treatment System

The treatment system building was constructed in substantial compliance with the contract documents. HKS began excavation for the foundations starting with the clearwell and air stripper foundations on August 2, 2012. The clearwell and air stripper foundations were poured first. HKS then began work on the building foundation on August 13, 2012. The building foundation was completed in sections. Concrete testing was performed at each pour, and all concrete passed strength tests required by the contract documents (concrete and compaction testing results are provided in Appendix C-2). The building foundation was completed on October 10, 2012. The air stripper tower was set on October 1, 2012.

HKS's subcontractor, Scanlon Erectors, Inc., began setting the building steel on October 11, 2012. Steel was set starting at the eastern end of the building at column line 5 and working west towards column line 1. HKS's subcontractor, Nelson Masonry, began setting the block walls for the chemical storage and personal protective equipment (PPE) rooms on October 19, 2012. The block rooms were finished on November 1, 2012. Pre-cast concrete planks were set over the clearwell on November 2, 2012, and over the block rooms on November 5, 2012. Scanlon finished placing building steel, wall and roof panels, gutters, and trim on November 16, 2012.

HKS began installing treatment system components on December 4, 2012. The piping was installed in substantial accordance with the contract documents. Pressure and leak testing was performed on the piping. Process and distribution piping was pressure tested at 150 pounds per square inch (psi).

The well pump was installed on January 15 and 16, 2013, by HKS's subcontractor, Moody. The pump and riser were installed along with the level transducer and an additional air tube for water-level measurement of the well. Moody also set the first distribution pump on January 16, 2013. The second distribution pump was installed on February 25, 2013. During testing of the well pump's operation, it was discovered that the pump could not meet the designed flow rate of 210 gpm. The initial well pump's capacity was 175 gpm. A new pump was ordered and installed on July 15, 2014, to achieve the flow rate of 210 gpm.

HKS's electrical subcontractor, Ahlstrom-Schaeffer, finished running all electrical and control wiring in March 2013. The instrumentation was wired back to the control panel in substantial accordance with the contract documents.

6.1.2 Start-up and Testing

HKS's control systems subcontractor, VSG Enviromation, was on-site on March 18, 2013, to install control programming for the treatment system. Programming was completed on April 9, 2013, and the system was put into full AUTO for a five-day demonstration period. Effluent samples of treated water were collected during each day of the demonstration. On April 11, 2013, the plant failed the demonstration period when a chlorine metering pump failed, but the system did not shut down. Programming changes were made, and the system was run in full AUTO for 24 hours on April 16, 2013. Between April 16 and April 30, 2013, more programming changes were made to get the system running properly in full AUTO. After discussions with NYSDEC and NYSDOH, it was decided that to finish the five-day testing period, the plant needed to be run in full AUTO for an additional 48 consecutive hours. The plant was run from May 1 and 2, 2013, in full AUTO, and at the end of this 48-hour period, the system was deemed acceptable, with five full days of running in AUTO complete and all sample results meeting NYSDOH criteria. The analytical results from the start-up testing are provided in Appendix C-2.

6.1.3 Approval of System by CCDOH

After the system testing and demonstration period was over, the Chautauqua County Department of Health (CCDOH) granted a temporary approval of completed works on May 14, 2013, to operate the plant at 150 gpm for three months (ending on August 15, 2013) while the new well pump was ordered and shipped. An extension of this approval was granted on August 12, 2013, and expired on September 30, 2013. On July 15, 2014, the installation of the final pump that met all criteria was completed. For a discussion of the events that occurred from September 30, 2013, until July 15, 2014, see Section 6.5.2.

On June 11, 2014, Paul Snyder of the CCDOH was on-site to observe the treatment system operating at the designed 210 gpm flow rate. Mr. Snyder observed the operation of the system and requested that the FWD perform another round of effluent sampling for bacterial analysis before distributing the water to the public system. The FWD collected the samples the following Thursday (June 12) and brought them directly to the county lab for analyses. All samples passed CCDOH bacteriological standards, and starting Monday, June 16, 2014, the treatment system effluent was discharged into the FWD distribution system. EEEPC informed Mr. Snyder that a new well pump was to be installed sometime in July 2014. He stated that CCDOH would not need to perform another inspection of the system, but that another round of bacterial samples would need to be submitted after the new pump was installed before the system could be run out to distribution following the installation. He also requested that EEEPC

prepare a new certification form and provide a letter identifying the pump changes made and why they were made.

The new pump was installed and functioning at the required maximum flow rate of 250 gpm on July 15, 2014. The FWD collected and submitted bacterial samples on July 17, 2014. Sample results were received the following day with all results meeting the CCDOH bacteriological standards. EEEPC submitted the statement of completed works and letter describing changes to the treatment system on September 15, 2014.

6.2 Project Area Restoration

As specified with the contract documents, the site was to be graded in order to facilitate drainage around the building and then seeded to return the site to prior conditions.

6.2.1 Grading

Final grading of the site was completed in substantial accordance with the contract documents. The site grading included drainage swales on the southern and western sides of the building to facilitate runoff to the paved parking lot and catch basins.

6.2.2 Topsoil and Seeding

Supplemental Specification, Section XI, Section 329200 (Site Restoration) established the requirements for the application of topsoil and seeding for the restoration at the site. Topsoil was placed over disturbed areas that would be seeded. These areas were then seeded and covered with mulched hay.

EEEPC monitored the application of topsoil and the seed mixture with respect to quality, moisture content, and required application rates. Topsoil and mulch deliveries were received and stockpiled at the project site until application could be performed. At final inspection the grass growth was determined to be satisfactory for the site.

6.2.3 Monitoring Well Decommissioning

Two monitoring wells were decommissioned as part of the project: MW-15, located west of the existing pump house, and an unmarked monitoring well found in the area where the adsorption fields were installed. The well decommissioning work was performed by HKS's subcontractor, Moody. The monitoring wells were decommissioned in accordance with NYSDEC Groundwater Monitoring Well Decommissioning Procedures (CP-43) (NYSDEC 2009b) for an overburden well that does not have contamination in the overburden. The decommissioning method was casing pull with grout fill. Documentation of the monitoring well decommissioning is provided in Appendix L.

6.2.4 Demobilization of Equipment and Support Facilities

The contractor demobilized all equipment off-site by May 9, 2013. Office trailers were demobilized in March 2013. Upon demobilization from the site, HKS removed all equipment and materials that were not indicated to be left on-site, removed trash disposal dumpsters, and removed portable sanitary facilities.

6.3 Project Completion

6.3.1 Substantial Completion

Section VIII, Article 13.6, of the General Conditions provided requirements for substantial completion under the terms of the contract. When the contractor "considered all or part of the work ready for its intended use, the contractor shall notify NYSDEC and [the] engineer in writing that the work, or specified part thereof, is substantially complete" and shall "request that the engineer issue a certificate of substantial completion for the work." Within a reasonable time thereafter, not to exceed 30 days, NYSDEC, the engineer, and the contractor "shall make an inspection of the work" to determine the status of completion.

Substantial completion was requested by HKS on May 10, 2013, and EEEPC subsequently scheduled an inspection with representatives of NYSDEC, HKS, the FWD, and EEEPC. The inspection was performed on May 30 and 31, 2013. EEEPC, in conjunction with NYSDEC, prepared a punch-list of remaining work items and an estimate of cost value for final completion on June 19, 2013. While the substantial completion inspection indicated that the field effort was substantially complete, a number of outstanding post-construction critical project submittal items still needed to be provided before final project completion could be granted. In a letter dated July 30, 2013, HKS was informed by NYSDEC that NYSDEC was providing HKS with a certificate of substantial completion as of May 10, 2013. Letters pertaining to substantial completion are provided in Appendix M-1.

6.3.2 Final Completion

Section VIII, Article 13.9, of the General Conditions provided requirements for final completion under the terms of the contract, stating that, "Upon written notice from the contractor that the entire work or an agreed portion thereof is complete, engineer shall make a final inspection with NYSDEC and contractor and will notify the contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to remedy such deficiencies."

In the final contract completion letter dated July 30, 2014, HKS was notified by NYSDEC that the date of final completion was determined to be May 15, 2013, and that HKS could submit a payment request for any remaining costs and for release of retainage associated with the original contract amount. A part of the payment request was the submission of prime and subcontractor certification's payment affidavits. On June 20, 2014, HKS prepared and submitted contractor's application for payment (CAP) No. 11, which requested the release of retention

and final payment of project costs applicable to Change Order No. 4 (executed on June 19, 2014). This CAP requested release of all retention except $1,730.33 for items that were agreed upon by NYSDEC, H&K, and EEEPC as being incomplete.

On September 30, 2014, H&K submitted CAP No. 12 requesting release of the remaining retainage ($1,730.33). This request was denied as these funds were retained to fund the remaining items at the site that were not completed during construction.

Letters pertaining to final completion are included in Appendix M-2.

6.3.3 Record Drawings

On June 4, 2013, H&K submitted red line record drawings to EEEPC. On June 13, 2013, EEEPC reviewed these drawings and returned them to H&K to revise and resubmit. H&K provided EEEPC with the revised drawings on July 3, 2013. After review, EEEPC deemed the drawings still incomplete. After discussions with H&K and NYSDEC, it was decided that H&K would forfeit retainage and EEEPC would complete the record drawings. The final record drawings are provided in Appendix N.

6.4 Changes to the Contract

6.4.1 Changes to the Project Scope and Schedule

Major revisions to the project schedule and scope of work are discussed in the following subsections. Changes to the project schedule were made in Change Order No. 1, which is provided in Appendix I-1. Revisions to the project Scope of Work were made in Change Order Nos. 2 through 4, which are provided in Appendix I-2 through I-4.

6.4.1.1 Changes to the Project Schedule and Change Order No. 1

The original contract time for HKS was 170 calendar days to substantial completion, resulting in a substantial completion date of December 2, 2012. Construction delays in the project schedule were incurred due to the late approval of the contract and the need to wait until spring to complete site restoration.

Change Order No. 1 added 51 additional calendar days to the project schedule, at no increase in Contract cost. With the additional days, the substantial completion date was recalculated to be January 22, 2013, and the final completion date was recalculated to be May 15, 2012. A fully executed copy of Change Order No. 1 is provided in Appendix I-1.

6.4.1.2 Change Order No. 2

Change Order No. 2 was submitted on November 19, 2012, for a total of $27,987 over HKS's original bid. The changed conditions or additional work necessitating this change order are discussed below. A summary of Change Order No. 2 is provided in the following list.

- The emergency generator exhaust stack at the existing pump house building was extended through the new canopy roof.
- The emergency generator intake louver was relocated.
- The footings and pier at column line 5 were adjusted to accommodate the foundation conditions of the existing pump house.
- The routing of the electrical service to the existing town cold storage building was changed based on conditions found at the site.
- The overhang on the east side of the existing pump house was cut back to accommodate new columns for the canopy roof.
- Closures and door stops were furnished at man doors.
- Chlorine and acid vapor sensors were added in the main process room and storage rooms. This change covered the response to RFIs 10 and 43.
- A PVC backwater valve with service extension was installed on the SPDES discharge line.

The project cost, including Change Order No. 2 and the unit quantity adjustments, totaled $1,387,312.00, for a 2% increase over the original contract amount of $1,359,325.00. The revisions to the project scope are documented in executed Change Order No. 2, which is provided in Appendix I-2.

6.4.1.3 Change Order No. 3

Change Order No. 3 was submitted on March 28, 2013, for a total of $39,642 over HKS's original bid. The changed conditions or additional work necessitating this change order are discussed throughout Section 6 of this report. A summary of Change Order No. 3 is provided in the list below.

- The tankless hot water heater model was changed due to the design model no longer being available and the electrical service for the heater was changed.
- The contractor was tasked with concrete testing (rather than EEEPC).
- Plywood sheeting was installed over the exposed end of the existing pump house at column line 4.
- A gutter and downspout was provided for the north face of the upper building.
- The concrete block portion of the building was painted.
- A lift beam was provided above the system distribution pumps.
- The groundwater monitoring well found at the adsorption field location was abandoned in-place.
- An epoxy coating on the PPE room floor and main process room floor was provided.

- Gas piping sizes were revised for the supply lines to the heaters throughout the building. This change covered the response to RFI-57.
- Additional costs for insurance due to late award of project.
- Provided additional contacts in combination starter/disconnects for pumps P-1 through P-5 and control wiring from contacts to MCP to provide the required inputs to the control panel.
- Installed closers and door stops at man doors.
- Tied building downspouts into storm drain system.
- Conducted plug test of Well No. 5 well casing.

The project cost, including Change Order No. 3 and the unit quantity adjustments, totaled $1,426,954.00, for a 3% increase over the original contract amount (including Change Order No. 2) of $1,387, 312.00. The revisions to the project scope are documented in executed Change Order No. 3, which is provided in Appendix I-3.

6.4.1.4 Change Order No. 4

Change Order No. 4 was submitted on October 24, 2013, after completion of the project, for a total of $77,686 over HKS's original bid. The changed conditions or additional work necessitating this change order are discussed throughout Section 6 of this report. A summary of Change Order No. 4 is provided in the list below.

- Changes to controls related to the chemical feed systems and changes to the type of level sensors for the air stripper sump.
- Location change for MV-11, the flow meter, and the chlorine analyzer downstream of the clear well.
- Exchange of chlorine day tanks with the FWD and provision of a containment pallet for the tank.
- Inclusion of unions and quick connects in the acid transfer system.
- Addition of level sensors in the recirculation tank.
- Change from EMT to PVC for electrical conduit in the chemical storage rooms.
- Addition of some hand valves and correction and update of the valve schedule.
- Addition of thermostat control of process room exhaust fan.
- Changes to the way in which the pH sensors are installed in the piping and change to the way in which the chlorine analyzer prior to the clear well is installed in the piping.

- Addition of a site glass on the stripper tower sump and addition of quick connects for the stripper tower level switches.
- Addition of drain lines for the vertical turbine pumps.
- Addition of data input to the master control panel for the chemical vapor sensors, pH sensors, and the chlorine analyzer prior to the clear well.
- Deletion of combination starters for the chemical feed pumps and for the acid transfer pump.
- Addition of a photocell to operate the exterior lighting on the building.
- Addition of a liquid flow meter in the acid transfer line for the hydrochloric acid transfer from the bulk container to the day tank or recirculation tank, and addition of a light switch for the PPE room at the entrance from the process room.
- Additions directed during the testing phase to improve functionality or to meet code.
- Addition of a bubbler system for well-level detection.
- Addition of a calibration kit and gases for the vapor sensors.
- Revision of site sidewalk and fencing.
- Installation of a separate blow-off line for finished water.
- Addition of rain hoods for the emergency generator intake louver and process room exhaust fan louver. Addition of a rain hood/sound dampening for the blower intake.
- Provision of spare Posiflow sensors for chemical feed pumps and installation of backpressure sustaining valves for the chlorine feed lines.
- Addition of quick connects for the pH sensors.
- Provision of mechanical open/closed indicators on the check valves.
- Provision of larger conduit, wiring, and breakers for the larger hot water heater of CO3. In addition, the hot water heater service was changed to PP-1 versus LP-2
- Additional site superintendent time and field office trailer rental beyond the original substantial completion date.
- Reprogram the controls to record chemical day tank level in gallons versus feet below sensor.

The final project cost, including Change Order No. 4 and the unit quantity adjustments, totaled $1,504,640.15, for a 11% increase over the original contract amount (including Change Order Nos. 2 and 3) of $145,315.15. The revisions to the project scope are documented in executed Change Order No. 4, which is provided in Appendix I-4.

6.4.2 Contractor Payments

HKS submitted 12 CAPs during the contract period, including a final release of retention in accordance with the contract documents. EEEPC evaluated the accuracy of each CAP for quantities and percentage of completion of individual bid items in the contract according to Section XII – Measurement for Payment in the contract documents. The individual change order items were reviewed for contractor accuracy prior to inclusion in the CAP. When errors were encountered, the EEEPC discussed them with the contractor to discuss the discrepancy and requested the contractor to revise and resubmit the request. After the CAP was accepted and recommended for payment by EEEPC, each CAP was submitted to NYSDEC for processing. Table 6-1 presents a list of the CAPs submitted by HKS for the project. Copies of the EEEPC-approved CAPs submitted to NYSDEC for approval are provided in Appendix J.

Table 6-1 Carroll Town Landfill Site Groundwater Treatment System – Contractor Applications for Payments

CAP No.	Date Submitted to NYSDEC	Amount
1	8/14/2012	$35,150.00
2	9/4/2012	$161,571.25
3	10/4/2012	$342,641.25
4	11/6/2012	$96,045.00
5	12/6/2012	$114,717.25
6	1/14/2013	$217,569.00
7[1]	2/15/2013	$265,848.24
8[2]	4/16/2013	$36,381.91
9[3]	7/10/2013	$85,682.40
10[4]	9/10/13	$109,242.60
11[5]	6/20/14	$79,426.15
Final[6]	9/30/14	$1,730.33
	Total	**$1,504,640.15**

1 Includes portion of Change Order No. 2.
2 Includes remaining portion of Change Order No. 2.
3 Includes Change Order No. 3.
4 Release of Retention Payment.
5 Change Order No. 4 and remaining retention except funds held back for incomplete work.
6 Release of remaining retention (denied).

6.4.3 Certified Payrolls

For work performed under the Carroll Town Landfill Groundwater Treatment System Contract, NYSDEC required that the contractor and its subcontractors pay at least the prevailing wage and pay or provide the prevailing supplements, including premium rates for overtime pay, as issued by the New York State

Department of Labor. Current wage rates were included in the contract documents under Section XIII.

HKS submitted certified payrolls with each CAP in conformance with prevailing wage rates published in the contract documents. EEEPC reviewed the certified payrolls provided to confirm compliance with the published wage rates before approving each CAP.

A copy of each CAP along with provided certified payroll data is presented in Appendix J.

6.5 Issues and Concerns

6.5.1 Incomplete Items from Punch List

HKS did not complete all punch list items and instead forfeited the associated costs of the items from their retainage in the amount of $1,730.33. EEEPC completed the missing items.

6.5.2 Well Pump Size

After installation of the well pump and subsequent testing, it was found that the total head for the system had been affected by changes in the pipe work during construction and that the pump could not meet the designed flow rate of 210 gpm. The initial well pump's capacity was 175 gpm.

A new well pump was ordered that could meet the design flow rate based on additional design calculations completed by EEEPC. On October 3, 2013, Moody was on-site to remove the installed pump from the well and install the new pump equipment. During the removal process, the pump became stuck on the level transducer. The subcontractor (Moody) was unable to remove the pump with the equipment on hand and recommended that they return at a later date with additional equipment.

On October 7, 2013, Moody was back on-site to attempt to remove the pump from the well. The subcontractor was able to dislodge the pump from the well casing using an air compressor and a specialized attachment to the column pipe, which pumped air into the well to aid in lifting the stuck column pipe.

Due to the difficulty in removing the pump and the amount of iron buildup observed on the removed column pipe, the FWD requested and NYSDEC agreed to investigate the possibility of installing a smaller diameter bowl and column section. EEEPC was tasked with identifying the pump options and corresponding costs. EEEPC identified three options: (i) installing the already acquired 7.5-inch bowl section with 7.5-horsepower (hp) motor; (ii) ordering a new 7.13-inch bowl section to be used with the existing 6-inch column pipe and 7.5 hp motor; or (iii) ordering a new 6-inch bowl section, 4-inch column pipe, and new 10-hp motor. On November 1, 2013, after discussions between NYSDEC, EEEPC, and the

FWD, it was agreed that a new 10-hp well pump with a smaller bowl and smaller column pipe diameter would be ordered, as per the third option above.

On January 13, 2014, Moody installed the new 6-inch-diameter well pump. The pump was run to waste into an on-site storm basin by the FWD overnight, and on January 14, 2014, the pump was run through the treatment system at the 210-gpm design flow rate. The FWD continued to run the system at the 210-gpm flow rate until January 16, 2014. On January 16, the FWD attempted to run the pump at 250-gpm flow rate. The pump was able to achieve only 213 gpm.

On February 3, 2014, Moody was on-site to troubleshoot the capacity issues with the well pump. Moody performed a pump test, and the production rates of the pump were compared with that of the certified test curve. The test showed that above 200 gpm, the pump was underperforming by approximately 20 feet of head. Moody contacted the manufacturer with the pump test results and the manufacturer agreed to provide a new bowl section. The certified test curve for the new bowl section was received on February 19, 2014, and the new bowl section was scheduled for shipment.

The new bowl section was received by Moody on March 4, 2014. Moody was on-site on March 5 and 6, 2014, to remove the existing bowl section and install the new bowl section. After installation, Moody immediately performed a pump test, which showed the pump was underperforming by approximately 20 feet of head at 250 gpm. Moody immediately contacted the manufacturer to discuss the results and available options.

On March 31, 2014, EEEPC contacted Moody to discuss the pump options. The manufacturer (American Marsh) recommended increasing the number of stages of the pump and increasing the motor size. On April 3, 2014, Moody provided EEEPC with new pump bowl section specifications from the manufacturer.

EEEPC, NYSDEC, FWD, and CCDOH discussed whether the system could be approved to operate at the design flow rate of 210 gpm using the current pump and then switch to the new pump when it arrived. The CCDOH's inspection of the system was performed on June 11, 2014. At that time the CCDOH informed the FWD and EEEPC that after the new pump was installed another round of samples would need to be collected for bacterial analysis and that the sample results would have to meet CCDOH bacteriological criteria before water could be pumped to the distribution system. The samples were collected on June 12, 2014, and all samples met the CCDOH criteria. The CCDOH required a letter of explanation as to why the pump changes occurred along with a resubmission of the certificate of completed improvements.

On July 14 and 15, 2014, Moody was on-site to install the new bowl section. Moody finished installing the new bowl section and reconnecting the pump on July 15, 2014. A pump test was performed, and the pump met the design

requirements. At 100% capacity, the pump was able to deliver 268 gpm to the top of the air stripper. Bacterial samples were collected on July 17, 2014, and submitted to the CCDOH for analysis. Sample results were received the following day with all results meeting the CCDOH bacteriological standards.

On September 15, 2014, EEEPC resubmitted the certificate of completed improvements to the CCDOH for the system at 210 gpm, along with the letter of explanation as to the reason for the pump changes. Copies of the sealed certificate and letter are provided Appendix O.

7 References

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