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Region 2 RAC2
Remedial Action Contract

Remedial Action Annual Progress Report - Year 1

Old Roosevelt Field Contaminated Groundwater Area Superfund Site

Remedial Action

Garden City, New York

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CDM Smith

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Section 1

Introduction

This Annual Remedial Action (RA) Progress Report presents a summary of operations and monitoring activities at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (the Site) during the first year of operation, defined as the period between January 1, 2012 and December 31, 2012. This report also presents groundwater monitoring results and an evaluation of the effectiveness of the existing groundwater extraction, treatment, and recharge system, which was constructed to hydraulically control and remediate the contaminated groundwater plume. This report is preceded by Quarterly RA Progress Reports for the first three quarters of 2012, and includes the data presented therein along with the data collected during operations in the fourth quarter of 2011.

This report was prepared by CDM Federal Programs Corporation (CDM Smith) pursuant to Subtask 9.3 of the Work Plan for the Environmental Protection Agency (EPA) Remedial Action Contract 2 (RAC2), Region 2, Work Assignment 023-RARA-02PE. CDM Smith performed the quarterly groundwater-monitoring program in accordance with the approved Quality Assurance Project Plan (QAPP) (CDM Smith 2010). Operation, maintenance, and process sampling of the groundwater treatment system was performed by CDM Smith's RA subcontractor, Arrowhead Contracting, Inc. (Arrowhead), under CDM Smith's direction.

1.1 Background

The Site is comprised of an area of groundwater contamination spanning across several properties within the Village of Garden City, in central Nassau County, New York. Figure 1-1 shows the general location of the site in Nassau County on Long Island, New York. Figure 1-2 shows the layout of the site and key features. The Site is located on the eastern side of Clinton Road, south of the intersection with Old Country Road. It includes a thin strip of open space along Clinton Road (known as Hazelhurst Park) and Roosevelt Field Mall (a large retail shopping mall with a number of restaurants, and a movie theater). Several office buildings share parking spaces with the shopping mall. Village of Garden City water supply wells GWP-10 and GWP-11 and two storm water recharge basins are located in the immediate vicinity of the Site. The Pembrook recharge basin, to the east of the Garden City pumping station, is situated on property owned by the mall. The recharge basin to the south is Nassau County recharge basin #124. Storm water is directed into the recharge basins to recharge the underlying aquifer system.

The Site was used for aviation activities from 1911 to 1951 by the United States (U.S.) military and commercial aviation companies. The Site was known as "Hempstead Plains Field" until 1918 when the U.S. Army changed the name to "Roosevelt Field." The aviation facilities were closed in 1951 and redevelopment was planned. The Village of Garden City installed supply wells GWP-10 and GWP-11 in 1952, at what had been the southwest corner of the former airfield. These two wells were put into service in 1953. Over the following years, several other supply wells and cooling water wells were installed and operated at the former Roosevelt Field. The Roosevelt Field Shopping Center was constructed at the Site and opened in 1957. In the late 1970s and early 1980s investigations conducted by Nassau County found the contaminants trichloroethene (TCE) and tetrachloroethene (PCE) in water supply wells GWP-10 and GWP-11. High levels of contamination also were found in cooling water wells used by businesses at the Site. The Site was listed on the Superfund National Priority List on May 11, 2000.

From June 2005 to December 2006, under the EPA RAC2 contract, CDM Smith performed a remedial investigation (RI) at the Site (CDM Smith 2007a) to investigate the extent of groundwater contamination and to characterize the site geology and hydrogeology. The Site related contaminants of concern (COCs) were identified during the RI, including TCE, PCE, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE), and carbon tetrachloride.

A Feasibility Study was subsequently carried out by CDM Smith (CDM Smith 2007b). On September 28, 2007, a Record of Decision (ROD) was issued for the Site calling for the following (EPA 2007):

- Extraction of contaminated groundwater followed by ex-situ treatment and discharge of treated water to a nearby recharge basin
- Installation of vapor mitigation systems at commercial buildings (if necessary)
- Evaluation of the wellhead treatment at two Garden City supply wells
- Implementation of institutional controls
- Development of a site management plan
- Long-term monitoring
- Five-year reviews

The ROD specified the cleanup criteria for each of the five Site related COCs (TCE, PCE, cis-1,2-DCE, 1,1-DCE, and carbon tetrachloride) as 5 micrograms per liter (µg/L).

In September 2009, CDM Smith completed the Remedial Design (RD) consisting of a groundwater extraction and ex-situ treatment system to achieve hydraulic control of the volatile organic compound (VOC) source area and remediate the plume (CDM Smith 2009). The RA was completed in December 2011 including installation of three extraction wells, construction of a water treatment plant, and a discharge outfall to recharge basin 124 (Figure 1-2). Operations and maintenance (O&M) of the remedy is ongoing. The remedy is subject to a State Pollutant Discharge Elimination System for Remediation Discharges to Groundwater (SPDES-DGW) permit equivalent (PEQ), which conveys to EPA the applicable provisions of the Water Pollution Control Act and New York State Department of Environmental Conservation (NYSDEC) regulations.

1.2 Purpose

This Annual RA Progress Report is presented in support of the following objectives:

- Confirm achievement of remedial system performance requirements, as specified in the RA subcontract documents (i.e., specifications, drawings, approved RA subcontractor submittals)

- Provide data for assessing RA progress and to support decisions regarding treatment system O&M and optimization
- Confirm compliance with the NYSDEC SPDES-DGW PEQ requirements which are included in Appendix A

The content of this Annual Progress Report has been organized as follows:

- **Section 1** – An introduction to the Site and Site remedies
- **Sections 2 and 3** – A summary of Site operations, monitoring activities, resulting monitoring data, capture zone analysis and groundwater mounding estimate
- **Section 4** – An assessment of the effectiveness of the treatment and control systems, including descriptions of specific problems that have occurred, other challenges, and recommendations to resolve identified problems during the first twelve months of remedial operations
- **Section 5** – A summary of relevant literature references

Section 2

Summary of Site Operations

2.1 Groundwater Extraction

The groundwater extraction system consists of three extraction wells, EW-1S, EW-1I, and EW-1D, located in a cluster on the western border of the property at 300 Garden City Plaza, as shown on Figures 1-2 and 2-1. These extraction wells were installed with the objective of achieving hydraulic control and capture of the contaminated groundwater plume at the Site. Screened intervals for extraction wells EW-1S, EW-1I, and EW-1D are -123 to -183 feet above mean sea level (msl) (210 to 270 feet below ground surface [bgs]), -193 to -253 feet msl (280 to 340 feet bgs), and -262 to -322 feet msl (350 to 410 feet bgs), respectively. Design pumping rates for extraction wells EW-1S, EW-1I, and EW-1D are 60 gallons per minute (gpm), 60 gpm, and 80 gpm, respectively. Site operations, including groundwater extraction, began on January 1, 2012 after completion of the Initial Testing Program (ITP).

All effluent from the extraction well is treated by air stripping and discharged to storm water recharge basin #124. Tables 2-1, 2-2, and 2-3 present the daily, monthly, and quarterly extraction rates for the reporting period, respectively. A graph of daily average extraction well flow rates during 2012 is shown in Figure 2-2.

The daily gallons extracted, flow rate, and pump operation data collected during 2012 were used to compute average, annual flow rates of 58 gallons per minute for extraction wells EW-1S and EW-1I and a flow rate of 109 gpm for extraction well EW-1D (Table 2-1). These calculations are shown at the bottom of Table 2-1. It should be noted that extraction well EW-1D was taken offline on March 13, 2012 due to an observed decrease in flow rate, and remained offline for maintenance until June 6, 2012. Extraction well EW-1I was taken offline on June 1, 2012, also due to an observed decrease in flow rate, and remained offline until September 26, 2012. Furthermore, extraction well EW-1S was taken offline on September 26, 2013 and remained offline until the arrival of a replacement mechanical part on October 16, 2013. A detailed discussion of causes of the downtime for extraction wells EW-1D, EW-1I and EW-1S is provided in Section 4.5. An evaluation of extraction well specific capacity over time is presented in Section 4.3 of this report.

2.2 Treatment Plant

The treatment plant is designed to remove VOCs from the influent groundwater. It includes an influent tank, duplex bag filtration system to remove suspended solids, air stripper to remove VOCs, and chemical metering system for pH adjustment prior to discharge. The treatment plant is capable of continuously treating up to 250 gpm. O&M of the treatment plant and recharge basin is conducted by Arrowhead.

During 2012, the process treatment system was shut down for about 14 days due to maintenance issues. In addition, in October and November 2012, the system was shut down for about 14 days due to Hurricane Sandy and the severe winter storm that followed a week later. During 2012, the system achieved an uptime of 89.6 percent. This is just below the 90 percent minimum system uptime performance requirement of the contract specifications. A detailed discussion of system downtime is provided in Section 4.5.

2.3 Recharge Basin

The treated effluent from the air stripper is pumped into an existing storm sewer structure located along Clinton Road via an underground 4-inch high-density polyethylene effluent pipe (Figure 1-2). The effluent and storm water are conveyed by the storm sewer structure southward to Nassau County recharge basin #124. The recharge basin is located approximately 800 feet south of the treatment facility (Figure 1-2). The recharge basin's dimensions are approximately 400-feet by 400-feet by 10-feet deep.

Monthly and quarterly discharge estimates to the recharge basin are presented Tables 2-2 and 2-3, respectively.

Section 3

Summary of Monitoring Activities

3.1 Process Water Influent and Effluent Sampling

The influent to and effluent from the treatment plant were sampled during Year 1 (2012) in accordance with the requirements of the SPDES-DGW PEQ issued by NYSDEC on June 2, 2010. A copy of the SPDES-DGW PEQ is included in Appendix A. Sampling fréquencies for the individual extraction wells (EW-1S, EW-1I, and EW-1D), combined influent, and effluent are summarized in Table 3-1 for each analysis performed.

Samples were collected for the following analyses:

- Target Compound List VOCs using EPA Method 524.2
- Oil and Grease using EPA Method 1664A
- Target Analyte List metals using EPA Method 200.7
- Total suspended solids using Standard Methods 2540D
- Total dissolved solids using Standard Methods 2540C
- Nitrate + nitrite (as N) using EPA Method 353.2
- Mercury using EPA Method 245.1
- Cyanide using EPA Method 335.4

All process samples collected in 2012, including quality assurance/quality control (QA/QC) samples, were analyzed and validated by the EPA Region 2 Division of Environmental Science and Assessment (DESA) laboratory, with the exception of those collected in September 2012. In September 2012, the VOC analyses were performed by CLP Laboratories (Shealy Environmental Services, Inc., metals and mercury analyses were performed by Test America Laboratories, Inc.,) and all other analyses were performed by DESA. September 2012 samples were validated by DESA or EPA's subcontractor.

Oil & Grease samples were collected for combined influent during February, March, May, and June of 2012. Oil & Grease was not detected in any combined influent samples, and monitoring was discontinued for the remainder of 2012.

Process Water Influent

Process system influent sample results for Year 1 (Y1) are compared to the ROD cleanup criteria in Tables 3-2 and 3-3. All influent samples exhibited concentrations greater than the ROD groundwater cleanup criteria of 5 µg/L for TCE and PCE. Additionally, with the exception of the sample collected from extraction well EW-1S on September 11, 2012, all influent samples exhibited concentrations greater than the ROD groundwater cleanup criteria of 5 µg/L for cis-1,2-DCE. Carbon tetrachloride and 1,1-DCE were not detected above the ROD groundwater cleanup criteria (5 µg/L for each compound) in any influent samples.

TCE and PCE exhibited the highest concentrations of all VOCs throughout the first year of operation. TCE concentrations ranged from 60 µg/L (extraction well EW-1D) to 300 µg/L (extraction well EW-1S), and PCE concentrations ranged from 7.1 µg/L (extraction well EW-1S) to 400 µg/L (extraction well EW-1I). The compound cis-1,2-DCE was reported at concentrations ranging from 4.7 µg/L (extraction well EW-1S) to 11 µg/L (extraction well EW-1I).

At this time, a sufficient quantity of analytical data has not been collected to establish contaminant concentration trends. An evaluation will be conducted after the completion of additional sampling.

Process Water Effluent

Process system effluent sample results for Y1 are compared to the PEQ criteria in Tables 3-4 and 3-5. Y1 effluent samples did not exhibit concentrations greater than the PEQ criteria for any of the parameters listed in the SPDES-DGW PEQ.

TCE was detected above the detection limit of 0.5 µg/L in 12 of the 24 process water effluent samples collected during 2012. The maximum concentration of TCE detected was 3.5 µg/L in a sample collected on August 22, 2012. PCE was detected above the detection limit of 0.5 µg/L in 7 of the 24 samples collected during 2012. The maximum concentration of PCE detected was 2 µg/L in a sample collected on August 22, 2012. Copper, iron, zinc, nitrite + nitrate (as Nitrogen), and total dissolved solids were all detected in at least one monthly effluent sample collected during 2012 but all concentrations were below PEQ criteria.

In May 2012, effluent TCE and PCE concentrations began to gradually rise. In early September 2012, the treatment system was inspected to determine the cause of the rise in VOC effluent concentrations. It was determined that clogging of the screen on the blower air intake was restricting airflow into the air stripper thereby reducing VOC removal efficiency. The screen was replaced and reduced VOC effluent concentrations were observed in the effluent samples collected thereafter; PCE and TCE were not detected above the detection limit (0.5 µg/L) during Y1Q4 effluent sampling.

pH Monitoring

The pH of the effluent was monitored continuously during the reporting period to ensure that it was within the PEQ range of 6.5 to 8.5 standard units (SU). Effluent pH was within the PEQ-required range through the entire first year of operation, with a minimum pH of 6.57 SU, and a maximum pH of 7.96 SU. A trend chart presenting the continuous pH effluent readings is provided as Figure 3-1. Readings of pH collected at the time of process sample collection are presented in Tables 3-2 and 3-4. Manual readings indicated that nearly all combined influent samples were below 6.5 SU. Air stripping raised the pH of process water but the effluent was still within the permit limit so no chemical addition was required prior to discharge as discussed in Section 4.4.

3.2 Air Monitoring

In accordance with NYSDEC regulation 6 NYCRR Subpart 201-3.3 air strippers at a Superfund site are considered trivial activities and the owner and operator of such trivial activities are exempt from obtaining an NYSDEC air pollution control State Facility permit. However, the owner and/or operator of an exempt source is required to certify that it is properly operated and must maintain on-site records. Therefore, the discharge of toxic air pollutants, such as PCE and TCE, needs to meet the regulatory requirements specified in the NYSDEC Air Toxics Program.

Based on modeling performed during design of the treatment system and sampling of effluent during treatment system startup, it has been determined that VOC concentrations in the air stripper effluent are far below applicable short-term or annual guidance concentrations. During the reporting period, photoionization detector (PID) readings were collected from the air stripper effluent stack on a weekly basis to monitor VOC emissions. PID measurements are reported in the monthly O&M Reports, provided as Appendix B.

Monthly samples of discharge air were collected during Y1 from the air stripper effluent stack to confirm that the emission rate was in compliance with the State criterion for total VOCs of 25 tons/year. Samples were analyzed for VOCs in accordance with EPA Method TO-15. Sample results indicated that emission rates ranged from 0.1 tons/year, in November 28, 2012, to 0.25 tons/year, in July 25, 2012, which is well below the State criterion of 25 tons/year. Air sampling results are provided in Arrowhead's O&M Reports, included as Appendix B.

3.3 Water Level Measurements and Seasonal Fluctuations

Quarterly synoptic water level measurements were collected on April 4, July 18, September 26, and December 13, 2012 and summarized in Table 3-6. The multiport well elevation and pressure data used to calculate water level elevations at each port is included in Appendix C.

Each synoptic round included multi-port wells SVP-2, SVP-3, SVP-4, SVP-5, SVP-9, SVP-10, and SVP-11. Measurements were performed in ports 1 through 10 at each of these wells except for multiport well SVP-3 where only ports 1 through 7 were measured. During the Year 1 Quarter 2 (Y1Q2) and Year 1 Quarter 4 (Y1Q4) quarterly synoptic rounds, groundwater elevations were also collected from port 9 at wells SVP-1 and port 5 at wells SVP-6, SVP-7 and SVP-8. Additional water level measurements were collected from monitoring wells MW-1S and MW-1I during the Year 1 Quarter 1 (Y1Q1) quarterly synoptic round and from MS-1S, MW-1I, MW-2S, MW-2I, MW-3S, and MW-3I during the remaining three quarterly synoptic rounds. Furthermore, the water level measurements were collected from monitoring well GWX-10019, during the Y1Q1, Y1Q2 and Y1Q4 quarterly synoptic rounds, and from monitoring well at GWX-10020 during the Y1Q4 quarterly synoptic round. During the Year 1 Quarter 3 (Y1Q3) synoptic round, water level measurements at the conventional wells were taken on September 27, 2012, a day after the water level was measured in the multi-port wells. Figure 2-1 shows the locations of the monitoring wells were water levels were collected.

The December 13, 2012 synoptic round of water level measurements were used to prepare potentiometric surface maps for the shallow, intermediate, and deep zones underlying the site. The shallow zone corresponds to the screened interval of extraction well EW-1S (-123 to -183 feet msl; 210

to 270 feet bgs). The intermediate zone corresponds to the screened interval of extraction well EW-1I (-193 to -253 feet msl (280 to 340 feet bgs). The deep zone corresponds to the screened interval of extraction well EW-1D (-262 to -322 feet msl; 350 to 410 feet bgs). To break the water level elevation data into shallow, intermediate, and deep zones the screen elevation of each well and port was compared to the screen elevations of the extraction wells. If the well or port screen elevation fell within 10 feet of an extraction well screen elevation then the water level elevation data were grouped into that zone. The synoptic water level data and zone assignments are included in Appendix C. The continuous water level observations collected from extraction wells EW-1S and EW-1D on December 13, 2012, and well efficiency calculations were used to estimate the water level elevations immediately adjacent to each extraction wells. These estimates were used in the potentiometric surface maps (the pumping level is normally significantly lower that the water level elevation in the aquifer immediately adjacent to the well). Water level elevation data were not available for extraction well EW-1I due to a malfunction of the transducer in this well.

The potentiometric surfaces for December 13, 2012 in the shallow, intermediate, and deep zones are shown in Figure 3-2. All three surfaces show that the regional groundwater flow is from the north to the south. Potentiometric surfaces prepared using water level elevation data collected during pre-remedial operations also indicated groundwater flows from north to south across the site. During 2012 the three extraction wells have been operating and, while the regional flow is still southward, all three surfaces clearly show the influence of the extraction wells where the potentiometric contours loop to the north in response to pumping. The influence of pumping from municipal wells GWP-10 and GWP-11 is most evident in the shallow and intermediate surfaces. In all three surfaces, the water level elevation data from multiport well SVP-5 is higher than adjacent water level elevation data, which results in a closed contour around this point in the shallow and intermediate surfaces. This is probably due to the influence of pumping from the extraction wells and the developing capture zone. Comparison of the water level elevation data in each zone shows that the vertical gradient is downward.

During Y1 continuous water level measurements were recorded by transducers in monitoring wells GWX-10019, GWX-10020, MW-1S, MW-1I, MW-2S, MW-2I, MW-3S, MW-3I; from multiport wells SVP-5, port 2 and SVP-10, port 2; and from the extraction wells EW-1S and EW-1D. Precipitation data from the weather station at the Garden City municipal well field at that site was not available for 2012 so data from the station in Floral Park, New York was used (Station ID GHCND:US1NYNS0007 FLORAL PARK 0.4 W NY US). Floral Park is located about 5-miles to the west of Garden City. The water level and precipitation data are presented in Figure 3-3. In this figure, the water level elevation data were grouped and plotted on separate Y-axes to make the data easier to review and compare. The data were organized into the following groups: extraction wells, SVP port data, monitoring wells inside the projected capture zone (GWX-10019, GWX-10020, MW-1S, and MW-1I), and monitoring wells outside the projected capture zone (MW-2S, MW-2I, MW-3S, and MW-3I).

Review of the water level elevation graphs shows that, over a period of days, water levels at the site are influenced by pumping from extraction well GWP-10, pumping from the extraction wells, and precipitation events. Over a period of months, a downward trend in all water levels was observed from late 2011 to early May 2012 when a series of precipitation events began and the downward trend abated. From July 2012 through early 2013 water levels were steady.

Review of the water level elevation graphs shows that water levels in the extraction wells and all monitoring and multiport wells were strongly influenced by pumping at municipal well GWP-10 Municipal well GWP-10 cycles on and off several times per day in response to demand and causes the high frequency up and down fluctuation in water levels in the extraction and observation wells. The relatively short periods when this well is not operating, such as the third and fourth week of February 2011, are characterized by steady water levels. The degree of influence is a function of proximity to municipal well GWP-10 and elevation. The extraction wells and SVP ports show the most influence because they are screened in the same elevation range and are relatively close to municipal well GWP-10 (Figure 2-1). The monitoring wells show less influence because they are screened at higher elevations and are further from municipal well GWP-10 (Figure 2-1). When the extraction wells are operating, they pump at a constant rate but when they shut down the water level in the extraction well spikes up. Examples of this are seen throughout the extraction well water level elevation data (see the period around April 1, 2012 for several examples). Extraction well shutdown also causes water levels to rise in some of the observation wells over the short term. A clear example of this is observed in the second week of April 2012 when extraction well EW-1D shutdown and the water level in multiport well SVP-5, port 2, which is close by, also spiked upward. The water levels in monitoring well MW-1S and MW-2S also rose slightly in response to this extraction well shutdown.

The response of water levels at the site to precipitation events is evident over the short term and long term. A clear example of the short-term response to precipitation is seen in the third week of April 2012 when about 60 millimeters (mm) of precipitation fell over a one-day period. Water levels in the extraction wells and all monitoring wells rose in the range of 1 to 2 feet within 24 hours following this event. This response may have been relatively large because it was preceded by a relatively dry period. A series of precipitation events followed over the next month and caused series of responses giving the water level elevation data in the monitoring wells from the period from late May to early July 2012 a saw tooth appearance. Over a period of months, a downward trend in all water levels was observed from late 2011 to early May 2012 when a series of precipitation events began and the downward trend abated. From July 2012 through early 2013 water levels were steady.

3.4 Groundwater Modelling and Capture Zone Analysis

The Y1 groundwater capture zones were evaluated using both observed groundwater head data and the existing numerical groundwater model, which was first developed for the Feasibility Study (FS) in 2007. Using the groundwater model allows CDM Smith to account for variations in operational conditions (pumping rates) since start-up and simulate the cumulative area captured. The groundwater model was updated to include more recent pumping and recharge data, which have been obtained since the previous calibration effort. The model has been extended through December 2012 and simulated head was compared with observed head collected from site wells between September 2011 and December 2012. Modifications to the model have been made as a result of the extended calibration simulation. The refined model was used to simulate 1-year capture zones for the site extraction wells under 2012 conditions.

3.4.1 Groundwater Model Updates and Verification

The Old Roosevelt Field groundwater model was previously calibrated to measured groundwater head data collected onsite in April and July 2006 and was initially used to evaluate various alternatives for the FS. The development of the groundwater model was documented in a technical memorandum dated August 13, 2007 (CDM Smith 2007c), which also serves as Appendix A of the FS.

An aquifer test conducted in 2010 was used to verify the groundwater model and adjustments in model properties were made accordingly (CDM Smith 2011a). Model calibration was not verified with additional synoptic groundwater head data since data on post-2009 water supply pumping was not yet available at the time and water supply pumping from nearby supply wells could influence head at the site. Rather, the model was verified during the aquifer test simulation by comparing head changes at various wells/ports in response to pumping the extraction well system.

During the spring of 2012, the Old Roosevelt Field (ORF) groundwater model was used for preliminary evaluations for the location and extraction rate of a set of extraction wells to capture contamination that has migrated south of Garden City municipal wells GWP-10 and GWP-11. As part of that effort, model discretization was enhanced through the incorporation of 5 additional levels and more than 3,700 nodes (CDM Smith 2012a).

Groundwater head data have been collected at a number of multi-port and conventional monitoring wells throughout 2012 and have been used for model verification. However, prior to verifying the groundwater model to 2012 conditions, the model had to be updated through 2012 by incorporating additional water supply pumping data and recharge.

3.4.1.1 Water Supply Data

Because the Old Roosevelt Field site has numerous groundwater supply wells located within the immediate vicinity, incorporating water supply pumping from these surrounding wells is critical. As there are more than 40 individual water suppliers within Nassau County, monthly water supply pumping data was historically provided for all water purveyors by Nassau County Department of Public Works (NCDPW). However, at this time the latest year that NCDPW has data for is 2010. Additional data have recently been collected from the NYSDEC. Monthly pumping data for the following providers have been provided and incorporated into the model:

- Garden City: 2011-2012
- Roosevelt Field: 2011-2012
- Uniondale: 2011-2012
- Westbury: 2011-2012
- Old Westbury: 2011-2012
- Carle Place: 2011-2012
- Hempstead: 2011

- Mineola: 2011

The suppliers listed above are the closest to the project site (see Figure 3-4) and pumpage from these suppliers would have the greatest impact on groundwater head distribution within the study area. Data from all purveyors for 2011 and 2012 are not yet available from NYSDEC. Data from Hempstead and Mineola were not available from NYSDEC or NCDPW for 2012. Data for 2012 were approximated based on the average change between pumping in 2011 and 2012 from the other water purveyors.

Pumping for other Nassau County water suppliers was approximated for 2011 and 2012 based on the average change in Garden City pumping. Therefore, it is assumed that the pumping patterns at other purveyors are similar to those at Garden City. For example, Garden City pumping was approximately 5.2 percent lower in 2011 than in 2010. So, to approximate the 2011 pumping at other water purveyors, the 2010 pumping was reduced by 5.2 percent. Similarly, Garden City pumping was 5.7 percent lower in 2012 than in 2010. Therefore, 2010 pumping at other purveyors was reduced by 5.7 percent to approximate 2012 pumping. Ultimately, all actual pumping data should be incorporated into the model when it becomes available.

Pumping data from the Purex facility, operated by NCDPW, was not incorporated since the full pumping dataset was not available at the time these simulations were conducted. However, based on communications with NCDPW, the Purex facility had minimal pumping in 2012. In fact, the facility has not been operational since April 10, 2012 and the only pumping that occurred in 2012 prior to that date was within the offsite plume at rates between 65-75 gpm (well 383D on Figure 3-4). Therefore, pumping from the Purex facility is not anticipated to impact hydraulic conditions at and upgradient of the extraction wells in 2012. During operation, all Purex facility treatment system effluent was discharged to County recharge basin No. 540, located between Oak St. and Grove St.

In addition, pumping from the cooling well located at 585 Stewart Avenue was also not incorporated (well N-8068 on Figure 3-4). From a hydraulic perspective, it is likely that the cooling well would yield a negligible net loss of water, as water was returned to the aquifer through diffusion wells (Eckhardt and Pearsall 1989; NYSDEC 2009). The reported average daily flow rate for N-8068 is approximately 100 gpm and the well normally operates from May through October (NCDPW, personal communication, 8/24/12). However, the location and construction details of the diffusion wells are not known at this time. Regardless, the cooling well is not anticipated to have a significant hydraulic impact on the extraction wells because the water is re-injected and it is located approximately 1,900 feet to the southeast of the extraction wells, which is both down and cross-gradient.

Based on prior modeling efforts and conversations with the project team, it is assumed that the cooling wells within the shopping mall property as specified by USGS (Eckhardt and Pearsall 1989; wells N-5507, N-5725, N-6045, N-6949, N-8050, N-8458, N-9310, N-9311), are no longer operational and have not been for the model simulation period.

3.4.1.2 Recharge

Precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Mineola station (located at the Garden City well field) through 2011 were obtained and used to calculate recharge into the model since 2008. At the time of the data request, precipitation data were only available through

2011 at the Mineola station. It is not known if this weather station was in operation during 2012 or if the data are not yet available for public release. For 2012, precipitation data collected at the nearby Floral Park station were utilized (see Section 3.3). Precipitation data collected at the Floral Park weather station was also substituted for April and July of 2011, as data for those months were missing from the Mineola data set. Recharge as a function of rainfall was increased from previous model simulations to improve the agreement of simulated heads with observed heads at the site wells.

3.4.1.3 Groundwater Model Calibration/Verification Simulations

Transient groundwater flow simulations were conducted between January 1995 through December 2012 using average monthly water supply pumpage and recharge. Time steps varied from 3 months, between 1995 and 2003, to one month from January 2003 to December 2011. Time steps were reduced to 10 days for 2012 to account for fluctuations in groundwater pumping at extraction wells EW-1S, EW-1I, and EW-1D. Treated effluent from the extraction system was simulated to recharge at the Nassau County owned recharge basin 124 immediately south of the Garden City wells.

Simulated and observed head is shown at various wells on Figure 3-5 and Appendix D. As shown on the figure, the model simulated head is generally consistent with observed head. It is important to note, however, that the groundwater head measured at onsite wells is significantly influenced by water supply pumpage, particularly from the two Garden City municipal wells.

Figure 3-6 shows the simulated versus observed head in port 2 at SVP-10, where a pressure transducer is installed. In general, the simulated head is within the range of observed head as measured by the pressure transducer. However, as shown on Figure 3-6, measured head at port 2 fluctuates on any given day. Fluctuations have reached 5.8 feet and average approximately 3 feet throughout the day. This is primarily due to the operational patterns of the Garden City municipal wells, but also to the operation of the extraction wells located immediately adjacent to multiport well SVP-10. Hourly and daily variations in pumping and head are not accounted for in the model because the model currently uses a monthly average pumping rate for water supply wells. The head variations are somewhat dampened at shallower ports and wells (away from the zone of significant municipal well pumping). Since short term pumping changes have a lesser influence in the more shallow portions of the Magothy and upper glacial aquifer, the simulation results tend to better match observed head in intermediate and shallow ports (see Figure 3-6 and Appendix D).

Sensitivity simulations indicate that the model is more sensitive to recharge than to the hydraulic properties of the Magothy. Increasing the transmissivity of the Magothy aquifer by as much as 100 percent had relatively little impact on simulated head as compared to recharge. During calibration simulations, recharge was increased throughout the model domain compared with previous model simulations. While this improved model calibration at the site, the model simulated head is higher than observed at the southern USGS groundwater well in the upper glacial aquifer as well as the shallow Magothy USGS monitoring well to the north of the site, which suggests that too much recharge was added to these areas (Figure 3-7). Further refinements to recharge are recommended for future model simulations, especially in the Old Roosevelt Field shopping mall area. Although almost entirely impervious, the Old Roosevelt Field shopping mall area recharges much of the stormwater runoff into catch basins which are open to the underlying aquifer (Eckhardt and Pearsall 1989). As per Eckhardt and Pearsall (1989), "Most of Roosevelt Field is paved and impervious; thus, natural recharge of the underlying ground-water system is limited to small grassy areas around the perimeter of the shopping center. Storm drains receive runoff from some of the impervious areas and route it to recharge basins; storm drains in paved parking areas are open to the underlying deposits, which allows direct infiltration. When a storm drain's infiltration capacity is exceeded, overflow conduits carry the excess runoff to local recharge basins. The sporadic recharge from precipitation causes short-term rises of the water table..."

The drainage of the shopping mall and other adjacent areas of impervious cover are currently not well understood. It is recommended that recharge basin and catch basin drainage areas at the shopping mall and adjacent impervious areas be determined and the model recharge updated accordingly.

3.4.2 Simulated Capture Zones to Extraction Wells

Simulated 1-year hydraulic capture zones corresponding to 2012 conditions were developed for the shallow, intermediate, and deep pumping zones, corresponding to the three extraction wells. The transient groundwater flow field for 2012 (10 day time steps) was read into DYNTRACK. In contrast, previous capture zones in prior memoranda are 15 year capture zones under steady-state conditions.

Particles were released on January 1, 2012 and allowed to migrate throughout the year, following the simulated 2012 groundwater flow field. Particles were released at elevations corresponding to the mid-point of the well screens to EW-1S (-153 feet msl), EW-1I (-223 feet msl) and EW-1D (-292 feet msl). The starting positions of particles that were captured by the extraction wells at some point throughout the year represent the 1-year capture zone. The simulated capture zone for 2012 is shown on Figure 3-8. Note that the capture zone for EW-1D is somewhat disconnected due to the period from late March 2012 until late May 2012 during which the well was not pumping.

Simulated pumping rates (based on average monthly rates) at Garden City municipal wells GWP-10 and GWP-11 are approximately 40 percent higher for 2012 than the average pumping data previously used for long-term average conditions (average 2003 through 2007). Previous simulations assign 387.1 gpm to well GWP-10 (N-03934) and 417.8 gpm to well GWP-11 (N-03935). In 2012, well GWP-10 pumped an average of 147 gpm while well GWP-11 pumped an average of 983 gpm. Together, both wells pumped an average of more than 1500 gpm during July and August 2012. Well GWP-11 pumped more than twice the previously simulated rate resulting in a significant cone of depression at depth (see Figure 3-8).

3.4.3 Summary

The Old Roosevelt Field groundwater model was updated through 2012 and used to simulate the 1-year hydraulic capture zones for the three extraction well system throughout the year. The model updates included incorporation of all Nassau County pumpage data through 2010 and for nearby water purveyors through 2011 and 2012. For wells where pumping data were not available during 2011-2012 flow rates were estimated based on pumping patterns at the Garden City municipal wells. Precipitation data through 2012 were also incorporated as an update to model recharge. Model recharge as a function of rainfall was increased to improve calibration at the site. Hydraulic model properties were not changed from those that were previously updated from the aquifer test groundwater model simulation.

If possible, all pumping data through 2012 should be collected and incorporated into the model. The model is sensitive to recharge and recharge patterns should be re-visited in future model updates. Should precipitation data for the Mineola weather station become available for 2012 consideration should be given to using that data in place of the data from Floral Park in the next update to the model.

Pumping from the Purex facility should be incorporated if the facility is reactivated in the future. In addition, pumping from the cooling well located at 585 Stewart Avenue should be incorporated as well when data become available. Although significant impact to the existing extraction wells is not anticipated, depending on the nature of the diffusion wells, it is possible that the cooling well may influence the eastern extent of the capture zone of the southern extraction well system.

The updated groundwater model should be used to re-evaluate the design and pumping rates for the southern extraction wells prior to final design.

3.5 Quarterly and Annual Groundwater Sampling

During each quarterly groundwater sampling event samples were collected from ports 2 through 7 at multiport well SVP-4, from ports 1 through 7 at multiport well SVP-10, and from monitoring wells GWX-10019, MW-1S, and MW-1I. In addition, the December 2012 groundwater sampling event included the collection of annual groundwater samples from ports 1 through 9 at multiport well SVP-2, ports 2 through 5 at multiport well SVP-3, ports 1, 8 and 9 at multiport well SVP-4, ports 1 through 9 at multiport well SVP-5, ports 1-9 at multiport well SVP-9, ports 8 through 9 at multiport well SVP-10, ports 1 through 9 at multiport well SVP-11, and well GWX-10020. The location of each well is shown on Figure 2-1. All groundwater samples were sent to the EPA DESA laboratory for VOC analysis with the exception of the Y1Q3 samples, which were analyzed by the Shealy Environmental Services, Inc. laboratory. All VOC analysis was performed using EPA Method 524.2. Analytical results for Y1Q1 are presented in Table 3-7, for Y1Q2 are presented in Table 3-8, for Y1Q3 are presented in Table 3-9, and for Y1Q4 are presented in Table 3-10. In each table the exceedances of the ROD cleanup criteria are highlighted. Water quality parameters including pH, dissolved oxygen, oxidation-reduction potential, specific conductivity, temperature, and turbidity were recorded during groundwater sampling. Water quality parameter data at the time of sampling are presented for each quarterly even, respectively, in Tables 3-11A, B, C, and D. The quarterly sampling results for PCE and TCE at each monitoring and multiport well are presented in a box map in Figure 3-9.

Concentrations above the ROD cleanup criteria were observed at all quarterly monitoring locations at least once during 2012. Among the annual monitoring locations sampled in December 2012, concentrations were below ROD cleanup criteria at monitoring well GWX-10020, at port 9 of multiport well SVP-10, at port 9 of multiport well SVP-4, at ports 4 and 5 of multiport well SVP-3, at ports 1 and 3 of multiport well SVP-9, at ports 8 and 9 of multiport well SVP-11, and at ports 3, 6, 7, 8 and 9 of multiport well SVP-5. TCE and PCE were the most frequently detected compounds and exhibited the highest concentrations. A summary of exceedances of the ROD cleanup criteria at each well is provided below:

- **GWX-10019** – Monitoring well GWX-10019 is a Nassau County monitoring well located west of the Garden City Plaza office complex and is screened from -137.5 to -142.5 feet msl (223 to 228 feet bgs) (Figure 2-1). TCE exceeded its cleanup criterion during all four quarterly sampling rounds at concentrations ranging from 20 µg/L (Y1Q3) to 72 µg/L (Y1Q4). Cis-1,2-DCE exceeded its cleanup criterion during three of the four sampling rounds at concentrations ranging from 7 µg/L (Y1Q1) to 36 µg/L (Y1Q3). PCE exceeded its cleanup criterion during the Y1Q1 sampling event only, at a concentration of 7.6 µg/L.

- **MW-1S and MW-1I** – Monitoring wells MW-1S and MW-1I are located in a cluster east of 400 Garden City Plaza (Figure 2-1). Monitoring well MW-1S is screened from -148.75 to -158.75 feet msl (235 to 245 feet bgs), and monitoring well MW-1I well is screened from -218.5 to -228.5 feet msl (305 to 315 feet bgs). At monitoring well MW-1S, TCE was detected during the Y1Q3 and Y1Q4 sampling rounds only, at concentrations of 150 µg/L and 140 µg/L, respectively. These detections are above the cleanup criterion for TCE. At monitoring well MW-1I, TCE, PCE, and cis-1,2-DCE exceeded their criteria during all four sampling rounds with the exception of PCE during the Y1Q4 sampling round. TCE concentrations ranged from 110 µg/L (Y1Q4) to 350 µg/L (Y1Q1) and cis-1,2-DCE concentrations ranged from 15 µg/L (Y1Q4) to 27 µg/L (Y1Q2). The three PCE detections above the cleanup criterion ranged in concentration from 17 µg/L (Y1Q2) to 20 µg/L (Y1Q3).

- **SVP-2** – Multiport well SVP-2 is located south of 100 Ring Road (Figure 2-1). Annual groundwater samples were collected from ports 1 through 9 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE was detected above the ROD criterion in all 9 ports, at concentrations ranging from 14 µg/L (port 7) to 35 µg/L (port 5). PCE exceeded its cleanup criterion in 4 of the 9 ports, at concentrations ranging from 5.3 µg/L (port 5) to 6.5 µg/L (port 3). Cis-1,2-DCE exceeded its cleanup criterion in 2 of the 9 ports, at concentrations ranging from 5.5 µg/L (port 5) to 6.3 µg/L (port 4).

- **SVP-3** – Multiport well SVP-3 is located east of 200 Garden City Plaza (Figure 2-1). Annual groundwater samples were collected from ports 2 through 5 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE exceeded its ROD criterion in ports 2 and 3 at concentrations of 26 µg/L and 6.2 µg/L, respectively.

- **SVP-4** – Multiport well SVP-4 is located west of 200 Garden City Plaza. Samples were collected from ports 2 through 7 during all four quarterly sampling rounds and also from ports 1, 8, and 9 during the December 2012 sampling round (Figure 2-1). Port elevations are shown on Table 3-6. PCE exceeded its criterion in all ports during all sampling rounds, with the exception of the annual sample collected from port 9. Concentrations ranged from 9.5 µg/L (port 8, Y1Q4) to 130 µg/L (port 4, Y1Q1). TCE also exceeded its criterion in all ports during all sampling rounds, with the exception of the annual sample collected from port 9. TCE concentrations ranged from 7.6 µg/L (port 2, Y1Q2) to 50 µg/L (ports 6 and 7, Y1Q2).

- **SVP-5** – Multiport well SVP-5 is located immediately south of the Garden City Plaza office complex, approximately 400 feet east of SVP-10 (Figure 2-1). Annual groundwater samples were collected from ports 1 through 9 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE exceeded its ROD cleanup criterion in 4 of the 9 ports, at concentrations ranging from 5.1 µg/L (ports 4 and 5) to 49 µg/L (port 2).

- **SVP-9** – Multiport well SVP-9 is located west of 100 Ring Road (Figure 2-1). Annual groundwater samples were collected from ports 1 through 9 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE concentrations exceeded cleanup criterion in ports 6 through 9 at concentrations ranging from 10 µg/L (port 9) to 330 µg/L (port 8). PCE concentrations exceeded their cleanup criterion in ports 4 through 9 at concentrations ranging from 5.3 µg/L (ports 7 and 9) to 21 µg/L (port 5). Cis-1,2-DCE was detected at concentrations exceeding its ROD cleanup criterion in port 6 (26 µg/L) and port 8 (5.6 µg/L). 1,1-DCE exceeded cleanup criterion in port 2 only, at a concentration of 6.4 µg/L.

- **SVP-10** – Multiport well SVP-10 is located on the west side of the Garden City Plaza office complex (near existing well GWX-10019 and the three extraction wells) (Figure 2-1). Samples were collected from ports 1 through 7 during all four quarterly sampling rounds and from ports 8 and 9 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE exceeded the ROD cleanup criterion in ports 1 through 5 and port 7 during all four sampling rounds, and exceeded criterion in port 6 during the Y1Q4 sampling only. TCE also exceeded the criterion in port 8 during the annual sampling round. Concentrations exceeding ROD criterion ranged from 6.1 µg/L (port 6, Y1Q4) to 700 µg/L (port 2, Y1Q3). PCE exceeded its criterion in ports 2 through 5 during all four sampling rounds, with concentrations ranging from 21 µg/L (port 2, Y1Q3) to 430 µg/L (port 3, Y1Q3). Cis-1,2-DCE exceeded its criterion in ports 1 through 5 during all four sampling rounds and in port 7 during the Y1Q1 and Y1Q2 sampling rounds only. Concentrations ranged from 6.3 µg/L (port 7, Y1Q2) to 67 µg/L (port 2, Y1Q1). 1,1-Dichloroethene exceeded the ROD cleanup criterion in port 3 during three of the four quarterly sampling rounds, at concentrations ranging from 7.7 µg/L (Y1Q3) to 16 µg/L (Y1Q4).

- **SVP-11** – Multiport well SVP-11 is located north of Stewart Elementary School and was the southernmost location sampled during Y1 monitoring (Figure 2-1). Annual groundwater samples were collected from ports 1 through 9 during the December 2012 sampling round. Port elevations are shown on Table 3-6. TCE concentrations exceeded their cleanup criterion in ports 1 through 7 at concentrations ranging from 10 µg/L (port 7) to 290 µg/L (port 1). PCE was detected above its cleanup criterion in 4 of the 9 ports, at concentrations ranging from 7.6 µg/L (port 6) to 28 µg/L (port 2). Cis-1,2-DCE concentrations exceeded ROD cleanup criterion in 4 of the 9 ports as well, at concentrations ranging from 5.4 µg/L (port 5) to 64 µg/L (port 1).

At this time, a sufficient quantity of analytical data has not been collected for evaluation of contaminant concentration trends. In general, contaminant concentrations in monitoring wells GWX-10019, MW-1I, and SVP-4 were consistent throughout Y1 and comparable to baseline sampling. However, at monitoring wells MW-1S and SVP-10 significant fluctuations in contaminant concentrations were observed:

- **MW-1S** – The baseline sampling results for TCE, PCE, and cis-1,2-DCE were, respectively, 340 µg/L, 2.3 µg/L and 5.7 µg/L. No VOCs were detected in the Y1Q1 or Y1Q2 samples. During Y1Q3 and Y1Q4, TCE and PCE concentrations returned to levels comparable to the baseline sampling results (140 µg/L for TCE and 1.2 µg/L for PCE during Y1Q4).

- **SVP-10** - Between Y1Q1 and Y1Q3 TCE concentrations increased from 22 µg/L to 310 µg/L in port 4 and from 69 µg/L to 350 µg/L in port 5. During Y1Q4 sampling, the TCE concentration in port 4 dropped back to 29 µg/L, whereas the port 5 concentration remained relatively steady at 320 µg/L. Furthermore, TCE was detected above the ROD criterion in port 6 for the first time (6.1 µg/L). During the baseline RA sampling PCE concentrations at ports 4 and 5 were 12 µg/L and 4.1 µg/L, respectively. After the onset of remedial operations, PCE concentrations in ports 4 and 5 spiked to 390 µg/L and 350 µg/L in Y1Q1, respectively. Since this time, PCE concentrations in port 4 dropped to 120 µg/L in Y1Q3 before increasing again to 360 µg/L during Y1Q4 sampling. PCE concentrations in port 5 displayed a similar pattern but rose to only 70 µg/L during Y1Q4 sampling, considerably lower than the concentration observed during the post-startup spike. PCE concentrations in port 3 displayed a nearly opposite pattern during Y1 monitoring; a decrease from 230 µg/L to 87 µg/L was observed between baseline and Y1Q1 sampling, followed by an increase to 430 µg/L during Y1Q2 sampling. The PCE concentration in port 3 decreased to 140 µg/L during the Y1Q4 sampling round.

3.6 Quality Assurance/Quality Control

Process, groundwater, and QA/QC samples collected during Y1 were validated by the DESA laboratory or EPA's validation subcontractors. CDM Smith completed Data Quality Assessments for quarterly process and groundwater sample data to determine whether they meet the quality objectives and user requirements outlined in the Old Roosevelt Field Final QAPP (CDM Smith 2010). The Data Quality Assessments are attached in Appendix E. All data from Y1 are considered usable with the data validation qualifiers added. None of the results were rejected. QA/QC samples collected during the Y1 sampling activities included trip blanks, field blanks, and field duplicates.

Groundwater treatment process samples were collected by Arrowhead. Trip blanks were collected at a minimum frequency of one per shipment of samples for VOC analysis and were analyzed for VOCs. The trip blank results associated with groundwater treatment process samples are included in Table 3-12. Field blanks were not collected in association with the groundwater treatment process samples because samples were collected directly from the sample ports. Duplicate groundwater samples are required at a minimum frequency of five percent for process sample collection; field duplicates were collected for samples CI-120113 (EW-2-120113), CI-120731 (EW-2-120731) and EW-1D-121212 (EW-2-121212).

Quarterly and annual groundwater samples were collected by CDM Smith. Trip blanks were collected at a minimum frequency of one per shipment and field blanks were collected at a minimum frequency of one per decontamination event during the Y1 groundwater sampling events. Trip blanks and field blanks were analyzed for VOCs. The results from the analysis of trip blanks and field blanks collected during quarterly sampling are included in Table 3-13. Duplicate groundwater samples were collected at a minimum frequency of five percent; as a result, a single duplicate sample was collected during each of the first three quarterly sampling rounds from multiport well SVP-4, port 5, and given the sample name "SVP-104-5". The annual sampling round in December 2012 was more extensive, and as a result duplicate samples were also collected from multiport well SVP-10, port 6, and multiport well SVP 11, port 9, and identified, respectively, as "SVP-110-6" and "SVP-111-9". The field duplicate sample results are included within the quarterly groundwater sampling results (Tables 3-7, 3-8, 3-9, and 3-10).

The process trip blank sample collected on September 11, 2012 exhibited a low estimated detection of chloromethane (0.27J µg/L), and the process trip blank sample on September 26, 2012 exhibited low estimated detections of chloromethane (0.19J µg/L) and TCE (0.084J µg/L). Several associated sample results were qualified as non-detect during data validation due to possible field contamination. The groundwater trip and field blanks collected on December 11, 2012 exhibited detections of acetone (5.7 µg/L and 5.1 µg/L, respectively). Acetone was not detected in the associated field samples and is believed to be a laboratory contaminant. No VOCs were detected in any other trip or field blank samples during Y1 process and groundwater sampling.

Section 4

Effectiveness of Treatment and Control Systems

4.1 Hydraulic Control of Plume

To assess the hydraulic control of the plume after 1 year of extraction well operation the PCE and TCE baseline plumes were compared to the plumes based on Y1Q4 sampling results (December 2012). Plume maps were prepared for the shallow, intermediate, and deep zones using the baseline data, collected in September 2011, and the Y1Q4 sample results collected in December 2012. Sample results were selected from the same wells in each zone which were used to prepare the potentiometric surface maps as discussed in Section 3.3. The PCE and TCE sample results and their zone assignments are included in Appendix F. Review of the plume maps and capture zones shows that the 100 µg/L isoconcentration contour for TCE and PCE in December 2012 is within each capture zone which indicates that hydraulic control of the plume has been achieved per the treatment system design.

The shallow plume maps are presented in Figure 4-1 and show that, while the plume shapes are similar between the two sampling events, the 5 µg/L TCE contour has pinched in on the east side of the plume and is west of well SVP-5, port 6 in the December 2012 plume map where it was east of this location in the September 2011 plume. The shallow zone capture zone computed in the model is overlain on the potentiometric surface and plume in the December 2012 plume map. The observed water level elevation contours, prepared using the December 13, 2012 water level elevation data, are consistent with the capture zone calculated over all of 2012. The computed capture zone extends about 430 feet north/northeast from the extraction wells and is about 500 feet wide at its widest point.

The intermediate plume maps are presented in Figure 4-2 and show that, while the plume shapes are similar between the two sampling events, the 5 µg/L PCE contour has pinched in on the east side of the plume due to the decrease in PCE concentration at well MW-1I between the September 2011 and December 2012 sampling events. The other significant difference is that the concentration of PCE increased significantly in samples from multiport well SVP-4, port 4 and multiport well SVP-10, port 4. The intermediate zone capture zone computed in the model is overlain on the potentiometric surface and plume in the December 2012 plume map. The observed water level elevation contours, prepared using the December 13, 2012 water level elevation data, are consistent with the capture zone calculated over all of 2012. The computed capture zone extends about 750 feet north/northeast from the extraction wells and is about 450 feet wide at its widest point. This is consistent with the higher flow rate from the intermediate extraction well as compared to the shallow extraction well.

The deep plume maps are presented in Figure 4-3 and show that, while the plume shapes are similar between the two sampling events, the 200 µg/L PCE contour shown in September 2011 is not present in the December 2012 plume map due to the decrease in PCE concentration at multiport well SVP-10, port 3. The deep zone capture zone computed in the model is overlain on the potentiometric surface and plume in the December 2012 plume map. The observed water level elevation contours, prepared using the December 13, 2012 water level elevation data, are consistent with the capture zone calculated over all of 2012. The computed capture zone extends about 800 feet north/northeast from the extraction wells and is about 570 feet wide at its widest point.

4.2 Groundwater Recharge

Treated groundwater from the extraction well system is discharged to Nassau County Recharge Basin 124 south of the Garden City municipal well field. Water discharged to the basin has been recharging the groundwater system during all of Y1 with no problem.

4.3 Specific Capacity

The performance of the extraction wells during Y1 was assessed by determining their specific capacity and comparing these values to values obtained during the Sustained Yield Test (CDM Smith 2011b). The baseline specific capacity values computed using sustained yield test data and step test data for extraction wells EW-1S, EW-1I, and EW-1D are listed in Table 4-1. The values for extraction well EW-1S ranged from 17 to 24 gpm/foot of drawdown (gpm/ft). The values for extraction well EW-1I ranged from 24 to 31 gpm/ft. The values for extraction well EW-1D ranged from 24 to 28 gpm/ft.

To calculate specific capacity, and to try to estimate well efficiency at the end of Y1, the continuous water level elevation data collected using transducers from the following locations were reviewed: extraction wells EW-1S and EW-1D (the transducer in extraction well EW-1I was not working), monitoring wells GWX-10019, MW-1S, and MW-2S, and multiport well SVP-5, port 2 and multiport well SVP-10, port 2. Specifically, the data were reviewed to identify periods when the extraction wells were shutdown long enough to allow water levels in the extraction wells and observation wells to recover and when municipal well GPW-10 was not pumping. Two periods were identified: September 13, 2012 and December 13, 2012. When the extraction wells started pumping again the drawdown in the extraction wells and observation wells was noted. Graphs used to determine drawdown are included in Appendix G.

The 2012 extraction well drawdown data and flow rates were used to calculate new specific capacity values which are listed in Table 4-1. The values calculated from extraction well EW-1S were 18 and 22 gpm/ft and are in the same range as the values calculated in September 2010 using data collected during the sustained yield test. The values calculated from extraction well EW-1D were 27 and 34 gpm/ft of drawdown and are also in the same range as the values calculated in September 2010 using data collected during the sustained yield test. These results indicate that the specific capacity of extraction wells EW-1S and EW-1D has not decreased over the period of Y1.

The drawdown and well location data were evaluated to see if they could be used to calculate well efficiency using the distance drawdown method presented in Driscoll (1986). Using this method the well efficiency of extraction well EW-1S was 52 percent using the sustained yield test data collected in September 2010, 51 percent using the data collected on September 3, 2012, and 49 percent using the data collected on December 13, 2012. The well efficiency of EW-1D was 71 percent using the sustained yield test data collected in September 2010, 134 percent using the data collected on September 3, 2012, and 135 percent using the data collected on December 13, 2012. The results of these calculations are not considered reliable. The calculated well efficiency for extraction well EW-1S seems low in light of the high productivity of the well and relatively little drawdown observed during pumping. The calculated well efficiencies of extraction well EW-1D which are greater than 100 percent are not realistic. The reason that the well efficiency calculations are not realistic is probably because the monitoring wells with available data are not well placed laterally or vertically, with respect to the extraction well screens, to provide sufficient data to use in the distance drawdown method for calculating well efficiency. The specific capacity data provide a more reliable way to evaluate well performance.

The data presented in this report indicate that the extraction wells are performing as designed and that rehabilitation is not necessary at this time. CDM Smith recommends that water levels be monitored continuously in the extraction well and observation wells listed above and that the data be reviewed every year to determine if the specific capacity has decreased. As more data on specific capacity are collected it will be possible to estimate when well rehabilitation will need to be performed.

4.4 Treatment Operations

The information presented in this Annual RA Progress Report shows that the treatment system is operating as designed. Effluent concentrations of all analytes were below effluent discharge criteria in all monthly samples in accordance with the SPDES-DGW PEQ requirements. Full-scale operations during the first year of operation demonstrate that the recharge basin has sufficient capacity to recharge the treated effluent at the current flow rate.

During the first year of operation, the process system was non-operational for a total of approximately 38 days. Fourteen of these days were due to planned shutdowns implemented before Hurricane Sandy and a subsequent winter storm to prevent voltage spikes from harming the system as power was restored to the area. The system was operational 89.7 percent of the time during Y1. This calculation includes the planned downtime caused by the hurricane and the winter storm and thus does not fully represent the performance of the system.

Planned shutdowns were scheduled throughout Y1 to perform various maintenance activities, including routine replacement of filter elements in the bag filter housings BF-1 and BF-2. Furthermore, shutdowns were required to investigate reduced flow rates in extraction wells EW-1S, EW-1I and EW-1D and to attempt repairs. Extraction well downtime is discussed in greater detail in Section 4.5.

Several unplanned shutdowns occurred throughout Y1. Many were caused by electrical faults of the variable frequency drives (VFDs) for transfer pumps P-1 and P-2. VFD electrical faults are discussed in detail in Section 4.5.1. On two occasions the plant was shut down due to level alarms; on July 2nd the level switch in the building sump became stuck and resulted in a high-high alarm, and on August 15th heavy rainfall flooded Clinton Road and caused a high level alarm in the storm sewer. In both cases the issue was remedied and the plant was restarted with no further issue. During the first month of operation there was system downtime caused by malfunctioning communication equipment. These issues are described in greater detail in the Y1Q2 Quarterly Progress Report (CDM Smith 2012b), and all were remedied by the end of the first month.

During Y1, treatment plant effluent pH was within the PEQ range of 6.5 to 8.5 SU without the need for adjustment using a caustic injection system installed as part of the RD. This system was installed because pH levels in samples collected from the extraction wells during pre-design work were below the discharge criteria. However, operational data indicate that the pH of the water increases as a result of air stripping, an anticipated result, and that this is sufficient to meet the PEQ discharge requirements. Continuous pH monitoring was performed to ensure that the treatment plant effluent remained within the PEQ range. The caustic system was set to automatically operate if needed. Continuous pH monitoring results are discussed in Section 3.1.

4.5 Specific Problems Incurred and Recommended Solutions

4.5.1 VFD Faults

During Y1, the plant experienced multiple shutdowns due to electrical faults of the VFDs for transfer pumps P-1 and P-2. Variations in service voltage supplied by the Long Island Power Authority resulted in the VFD faults. Faults occurred primarily during periods of peak electrical demand (early afternoon). Faults are automatically triggered at the VFDs to prevent damage to the units. These faults require a reset from the local VFD panel prior to restarting the plant. The operator cannot access the VFD panel via remote communication and must be at the plant to perform a system restart.

During Y1Q2, Arrowhead investigated a solution to the problem with the VFD manufacturer (Allen-Bradley) (CDM Smith 2012b). Several VFD settings were modified and the common mode jumper was removed from each drive. Neither change resulted in elimination of VFD faults. Allen-Bradley recommended the installation of a 3 percent impedance input line reactor for each drive. Impedance input line reactors need to be sized for each VFD, and the VFDs will be replaced as a part of Southern Plume RA construction.

4.5.2 Extraction Well EW-1D

On March 13th, extraction well EW-1D was removed from service to investigate a reduced flow rate observed by the plant operators during routine inspection. Inspection of threaded connections for the pitless adapter and the first several sections of riser pipe revealed damaged threads on the fittings and pipe. Following this discovery, the decision was made to remove all well pump components for inspection. During removal of the items, a threaded coupling failed causing the pump, motor, and remaining riser pipe to fall to the bottom of the well. Attempts to remove the piping and pump were not successful. On March 20th, a camera inspection of the well was completed to determine the best method for removal of the pipe and pump unit. Work to remove the pump was scheduled to be completed following fabrication of a tool to remove the items. On April 20th, Arrowhead subcontractor R&L Drilling attempted to remove the drop pipe and pump from extraction well EW-1D. The electrical service cable was successfully removed, but the remaining portion of pump riser piping could not be removed.

On May 3rd, R&L Drilling remobilized to the site with drilling equipment and successfully removed the broken drop pipe and pump from well. Following removal, inspection of the damaged equipment revealed that the pump and motor had separated, likely as a result of falling in the well during previous attempts to remove equipment. The motor was lost at the bottom of the well and the pump was damaged beyond repair. Inspection of the drop pipe indicated several sections with defective threads, which required replacement by the material supplier. The replacement pump and motor assembly were installed and extraction well EW-1D was returned to service on June 7th.

On December 9th, Arrowhead noticed that extraction well EW-1D was not running. The extraction logs show that it had been idle since December 6th. There were no alarms to explain the pause in operation, and the pump was restarted without incident. Extraction well EW-1D operated properly with no observed reductions in flow rate through the rest of Y1.

4.5.3 Extraction Well EW-1I

Based on the manufacturing defects observed at extraction well EW-1D and discussed in Section 4.2.2, extraction well EW-1I was taken offline on June 5th to inspect for evidence of similar defects. Servicing included pump removal and inspection of the drop pipe and all fittings. Several drop pipe couplings were replaced with reuse of all other equipment and material. Installation of the pump was completed on June 6th and the well was tested to confirm that the design flow rate of 60 gpm was restored. The well was unable to meet the 60 gpm rate, exhibiting a maximum output of 27 gpm.

On June 20th, R&L Drilling mobilized to the site to troubleshoot the problems with extraction well EW-1I, and confirmed that the pump was wired properly. On June 28th, JK Electric was onsite to inspect extraction well EW-1I for faulty electrical connections or amperage values outside those anticipated for the size of motor in use (5 horsepower). No electrical problems were identified.

On July 17th, Arrowhead performed a dead-head pressure test in the well vaults of extraction wells EW-1I and EW-1S to determine the cause of the low flow conditions from extraction well EW-1I. The test indicated that the problem was not related to an influent pipe line leak and was likely within the well vault piping or submersible well pump.

On September 26th, 2012, Arrowhead inspected the y-strainer in the well vault at extraction well EW-1I to assess blockage that might result in the lack of flow. Arrowhead found a large build-up of iron in the screen which was determined to be the reason for the lack of flow from the well. The screen was cleaned using DPA (dry penetrating agent) solution and the pump was returned to service. In the process of removing the screen, the plug for the y-strainer was damaged. Arrowhead took the plug out of the extraction well EW-1S y-strainer to use in extraction well EW-1I until a replacement part arrived. Extraction well EW-1I operated properly with no observed reductions in flow rate through the rest of Y1.

4.5.4 Extraction Well EW-1S

As described in the previous section, extraction well EW-1S was taken offline on September 26th, 2012 so that the plug for its y-strainer could be used in extraction well EW-1I after the extraction well EW-1I y-strainer plug was damaged. Extraction well EW-1S remained offline until the replacement plug was installed on October 16th.

4.6 Contaminant Removal Estimate

From January 1, 2012 to December 31, 2012, an estimated 193.5 pounds of contaminants have been removed through operation of the groundwater extraction and treatment system. Table 4-2 provides a monthly summary of estimated contaminant removal. Monthly removal estimates were relatively consistent throughout Y1, with the greatest estimated masses in February and March 2012. Table 4-3 provides a summary of the estimated amount of each contaminant removed since system startup. The primary contaminants removed have been TCE and PCE, totaling an estimated 86.5 pounds and 72 pounds, which together comprise 82 percent of the total contaminant mass removed. The analysis shows that the COCs (TCE, PCE, cis-1,2-DCE, carbon tetrachloride and 1,1-DCE) account for approximately 85 percent of the total mass removed between January 1, 2012 and December 31, 2012. Figure 4-4 graphically illustrates the proportions of contaminants estimated to have been removed through groundwater extraction from January 1, 2012 through December 31, 2012.

The estimated mass values were calculated as follows: an average concentration for each contaminant (reported in Tables 4-2 and 4-3) was determined using the two influent concentrations taken during each month. When a duplicate sample was collected alongside the combined influent sample, the average of the parent and duplicate sample results were used as the concentration for that sampling date. The monthly average concentration for each contaminant was then multiplied by the monthly total of extracted water for the given month, which was taken from the flow meter totalizer readings. After unit conversions, the resulting product is the mass removed for each contaminant. Only contaminants detected at concentrations greater than 1 µg/L in more than half the samples were included in the estimate.

4.7 Conclusions and Recomendations

This Annual RA Progress Report presents a summary of operations and monitoring activities at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (the Site) during the first year of operation, defined as the period between January 1, 2012 and December 31, 2012. Based on the results of these operations the following conclusions and recommendations are presented:

- The 100 µg/L isoconcentration contour for TCE and PCE, as defined by the December 2012 sampling results, is within the shallow, intermediate, and deep capture zones indicating that hydraulic control of the plume has been achieved per the treatment system design.
- From January 1, 2012 to December 31, 2012, an estimated 193.5 pounds of contaminants have been removed through operation of the groundwater extraction and treatment system. The primary contaminants removed have been TCE and PCE, totaling an estimated 86.5 pounds and 72 pounds, which together comprise 82 percent of the total contaminant mass removed.
- The specific capacity of the extraction wells calculated using data from September and December 2012 indicate that their performance has not decreased since they were installed in 2010 and that rehabilitation is not necessary at this time.
- CDM Smith recommends that water levels be monitored continuously in the extraction well and observation wells discussed above and that the data be reviewed every year to determine if the specific capacity has decreased.

Section 5
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