New Cassel/Hicksville Ground Water Contamination Superfund Site
Nassau County, New York

July 2013

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the remedial alternatives considered for an interim remedy to address a portion of the contaminated groundwater downgradient of the New Cassel Industrial Area (NCIA), which comprises Operable Unit 1 (OU1) of the New Cassel/Hicksville Ground Water Contamination Superfund Site (the Site), and it identifies the preferred remedial alternative with the rationale for the preference. This OU1 pertains to only one portion of the Site, and the U.S. Environmental Protection Agency (EPA) anticipates additional remedies will be evaluated in the future for additional OUs at the Site.

This Proposed Plan was developed by EPA, the lead agency for the Site, in consultation with the New York State Department of Environmental Conservation (NYSDEC). EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, also known as Superfund), as amended, and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of the contamination for OU1 at the Site and the remedial alternatives summarized in this Proposed Plan are described in EPA's Supplemental Remedial Investigation (RI) Memorandum, dated July 2013, EPA's OU1 Supplemental Feasibility Study (FS) Memorandum, dated July 2013, NYSDEC's September 2000 RI/FS Report, as well as other documents contained in the Administrative Record for this Site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted.

This Proposed Plan is being provided as a supplement to the above-referenced documents to inform the public of EPA's preferred remedy and to solicit public comments on the remedial alternatives evaluated, including the preferred alternative. The preferred remedial alternative for addressing contaminated groundwater includes a combination of in-well vapor stripping, extraction and on-Site treatment, and use of in-situ chemical treatment such as in-situ chemical oxidation (ISCO). The treated groundwater effluent would be disposed of by discharge to a waste-water treatment or by reinjection to groundwater.

The interim remedy described in this Proposed Plan is the preferred remedial alternative for OU1 at the Site. Changes to the preferred remedial alternative, or a change from the preferred remedial alternative to another remedial alternative may be made if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The final decision regarding the selected interim remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting public comment on all of the alternatives considered in the Proposed Plan and in the detailed analysis section of the EPA's OU1 Supplemental FS Memorandum because EPA may select a remedy other than the preferred alternative in this Proposed Plan.

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
July 26, 2013 – August 26, 2013
EPA will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: August 15, 2013 at 7:00 pm
EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Supplemental FS Memorandum. Oral and written comments will also be accepted at the meeting. The meeting will be held on the second floor of the "Yes We Can" Community Center, 141 Garden Street, Westbury, NY 11590.

COMMUNITY ROLE IN SELECTION PROCESS

EPA relies on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each Superfund site. To this end, EPA's Supplemental RI Memorandum, OU1 Supplemental FS Memorandum, and this Proposed Plan have been made available to the public for a public comment period which begins on July 26, 2013 and concludes on August 26, 2013.

A public meeting will be held during the public comment period at the "Yes We Can" Community Center at 141 Garden Street, Westbury, New York on August 15, 2013 at 7:00 p.m. to present the conclusions of the documents supporting this decision, to elaborate further on the reasons for recommending the preferred remedial alternative, and to receive public comments.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD), the document which formalizes the selection of the remedy.

Written comments on the Proposed Plan should be addressed to:

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INFORMATION REPOSITORIES

Copies of the Proposed Plan and supporting documentation are available at the following information repositories:

Westbury Public Library, Reference Section
445 Jefferson Street
Westbury, NY 11590
Telephone: (516) 333- 0176
Hours of operation:
Monday-Friday: 9:30 am to 9:00 pm
Saturday: 9:30 am to 5:00 pm
Sunday: 1:00 pm to 5:00 pm

USEPA – Region 2
Superfund Records Center
290 Broadway, 18th Floor
New York, NY 10007-1866
(212) 637-4308
Hours: Monday – Friday: 9:00 am to 5:00 pm

SCOPE AND ROLE OF ACTION

The primary objectives of this action are to address the groundwater contamination, reduce the migration of contaminants, and minimize any potential future negative health impacts. This Proposed Plan addresses groundwater contamination in the area immediately downgradient of the NCIA designated as OU1 for the Site. A Site location map is provided as Figure 1.

EPA will be addressing the Site in discrete phases or components known as OUs. An operable unit represents a portion of the site remedy that for technical or administrative purposes can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from Site contamination. EPA anticipates that there will be multiple OUs for the Site, and subsequent Proposed Plans and RODs will address groundwater contamination at other OUs at the Site.

EPA anticipates conducting a separate investigation of a second OU to address groundwater contamination in the far-field area further downgradient of the portion of the plume addressed in this OU1. This would result in a second Proposed Plan and ROD that complements the actions proposed in this Proposed Plan. This interim remedy selected for OU1 is an early action intended to minimize further migration of contaminants while the RI of the far-field area is being conducted. Additional OUs for the Site would include, but may not be limited to, areas of groundwater contamination impacting the Hicksville public supply wells 5-2, 5-3, 4-2, 8-1, 8-3, 9-3 and Hempstead-Levittown 2A. It is anticipated that additional Proposed Plans and RODs will be issued for these OUs. Furthermore, a subsequent remedy for groundwater at the entire Site, including OU1, will be addressed in a future Proposed Plan and ROD.

Individual facilities within the NCIA are considered to be among the sources of groundwater contamination for OU1. Those facilities continue to be addressed under NYSDEC's Superfund program. The on-going State authorized response actions to address source areas at the NCIA facilities are not the focus of this Proposed Plan, although successful completion (*i.e.*, source control or remediation) of the source area(s) at the individual NCIA facilities, under NYSDEC oversight, are essential to the full realization of the objectives of the preferred remedial alternative in this Proposed Plan.

The effectiveness of the remedy in this Proposed Plan requires coordination between actions currently being overseen by NYSDEC under agreements to address contaminant sources at individual facilities within the NCIA and EPA's preferred remedial alternative, as explained in this Proposed Plan. In the event that source control is not successfully implemented pursuant to NYSDEC's on-going enforcement efforts, EPA may elect to evaluate additional options at individual NCIA facilities pursuant to CERCLA to ensure the effectiveness of any remedy selected by EPA for this OU1.

SITE BACKGROUND

Site Description

The Site comprises an area of widespread groundwater contamination within the Towns of Hempstead, North Hempstead, and Oyster Bay, Nassau County, New York. The Site currently is estimated to include approximately 6.5 square miles, characterized by contaminated groundwater that has impacted several public supply wells, including four Town of Hempstead wells (Bowling Green 1 and 2, Roosevelt Field 10 and Levittown 2A), six Hamlet of Hicksville wells (4-2, 5-2, 5-3, 8-1, 8-3 and 9-3), and one Village of Westbury well (11).

The area comprising OU1 includes approximately 211 acres and consists of residential properties, as well as some commercial/light industrial areas. Upgradient of OU1, the NCIA encompasses approximately 170 acres of land. It is bounded by the Long Island Railroad to the north, Frost Street to the east, Old Country Road to the south and Grand Boulevard to the southwest. The NCIA was developed for industrial use during the 1950s through the 1970s and remains densely populated with industrial and commercial properties. Review of Nassau County Department of Health and NYSDEC reports indicates that on-site leach pools and/or dry wells were generally used for disposal of wastewater until sewers were installed in the mid-1980s. Currently, there are an estimated 200 industrial and commercial businesses within the NCIA.

OU1 History

In 1986, as part of a county-wide groundwater investigation, Nassau County Department of Health identified extensive groundwater contamination throughout the NCIA. Groundwater data revealed that contaminants from the NCIA impacted the Bowling Green water supply, which is comprised of two public supply (extraction) wells and is approximately 1,000 feet downgradient of the NCIA[1].

In December of 1990, the Town of Hempstead completed construction of a granulated activated carbon treatment system at the Bowling Green water supply wells to address VOCs that were found in the drinking water. Five years later the treatment system was supplemented with an air stripper. This treatment system is still operating and effective in removing VOCs to below the drinking water standards prior to the distribution of this drinking water to the public. In 1997, NYSDEC installed four early warning wells located upgradient of the Bowling Green water supply wells to monitor contamination in the groundwater upgradient of the two water supply wells. Following the Nassau County Department of Health investigation and the Town of Hempstead's activities, NYSDEC conducted preliminary site assessment activities within the NCIA from 1994 to 1999 to identify the sources of the groundwater contamination. Based on NYSDEC's findings, 17 individual facilities within the NCIA were listed on NYSDEC's Registry of Inactive Hazardous Waste Disposal Sites (more commonly known as New York State Superfund) between May 1995 and September 1999. Investigations have been completed and remedial actions have been selected for the 17 facilities. Of the 17 facilities, five require no further action, one requires further monitoring, and 11 have on-going response actions including continued operation of air sparging and soil vapor extraction systems.

From 1999 to 2000, NYSDEC conducted a remedial investigation and feasibility study of the groundwater contamination downgradient of the NCIA. Based on the investigation, NYSDEC determined that a variety of disposal activities within the NCIA had resulted in the disposal of hazardous wastes, including 1,1,1-trichloroethane (TCA), tetrachloroethylene (PCE), and trichloroethylene (TCE), which are VOCs. Some of these hazardous wastes were released or have migrated from the NCIA to surrounding areas, including the area bordering the NCIA south of Old Country Road and Grand Boulevard. Individual facility descriptions, operational/disposal histories, and remedial histories for facilities within the NCIA can be found in NYSDEC's 2003 record of decision entitled, "New Cassel Industrial Area Sites, Town of North Hempstead, Nassau County, New York, Off-site Groundwater South of the New Cassel Industrial Area Operable Unit No. 3" (note that the term "OU3" is the geographical designation that NYSDEC assigned to a portion of the area that EPA has designated as OU1).

In October 2003, NYSDEC selected a remedy, under its State authorities to address groundwater contamination downgradient of the NCIA. NYSDEC's remedy called for remediation of the upper and deep portion of the aquifer (to a depth of 225 feet below ground surface (bgs)) with in-well vapor stripping/localized vapor treatment. NYSDEC's remedy included a contingency plan to utilize ex-situ extraction and treatment (more commonly known as groundwater pump and treat) if pilot testing determined the selected remedy to be less practical because of

[1] Both of the Bowling Green water supply wells were constructed in 1975 and have a permitted pumping capacity of 1,400 gallons per minute.

engineering or economics reasons.

As part of the remedial design phase, in 2009 and 2011, NYSDEC retained consultants to perform pre-design investigations. The first pre-design investigation, conducted in 2009, determined the Magothy aquifer to be anisotropic[2] and, as a result, concluded that in-well vapor stripping may not be an effective technology for remediating the groundwater. Thereafter, NYSDEC decided that the contingency remedy of ex-situ extraction and treatment of the contaminated groundwater was more appropriate, and a subsequent pre-design investigation for the contingency remedy was completed in December 2011. However, this remedy was never implemented, and during the period when the 2011 pre-design investigation was being completed, NYSDEC requested that EPA list the Site on the National Priorities List (NPL). No further remedial actions were taken by NYSDEC related to what it referred to as the groundwater contamination downgradient of the NCIA. On September 16, 2011, EPA listed the Site on the NPL.

Site Geology

The principal hydrogeologic units underlying the Site are the glacial outwash and morainal deposits known as the Upper Glacial Aquifer (UGA) and the underlying Magothy Formation and Matawan Group (Magothy). Beneath these two units are the clay member and the Lloyd Sand member of the Raritan Formation.

The UGA is estimated to be 40 to 65 feet thick and consists predominantly of coarse-grained sands and gravels. A distinct contact between the UGA and the Magothy units has not been observed in the area. The underlying Magothy formation sediments (estimated to be approximately 600 feet thick) are characterized by sand and silty sand with discontinuous clay and silt layers. Geologic studies in the area have revealed that sediments tend to become finer in size fraction downward in the Magothy formation, except within the basal portion where coarse-grained sands and gravels are prevalent.

Unconfined groundwater is generally found at the Site between 40 and 65 feet bgs, which is near the estimated boundary between the UGA and Magothy aquifers. Groundwater within the UGA and Magothy aquifers flows in a south-southwest flow direction in the area downgradient of the NCIA. Pumping of the Bowling Green supply wells likely influences the groundwater flow direction above their production interval of 463 to 674 feet bgs.

NATURE AND EXTENT OF CONTAMINATION

Results of NYSDEC RI

As mentioned above, from 1999 to 2000, NYSDEC performed its remedial investigation activities' including the collection of three rounds of groundwater samples from a network of 50 solitary and clustered groundwater monitoring wells in the vicinity of the NCIA. Groundwater monitoring wells were installed at various depths that targeted four depth ranges (0 to 64 feet, 65 to 99 feet, 100 to 124 feet and 125 to 200 feet below ground surface). Early warning monitoring wells clusters, located upgradient of the Bowling Green supply wells, were also sampled at depths ranging from 132 to 164 and 504 to 516 feet bgs.

Groundwater samples were analyzed for VOCs by a NYSDEC contract laboratory. During the third round of sampling in January 2000, a subset of samples from 24 of the groundwater monitoring wells were also analyzed for physical and chemical parameters to assist in a monitored natural attenuation (MNA) evaluation. Additionally, 39 groundwater samples were collected from four Hydropunch® borings (GWHP-01 through GWHP-04) in 2000. The location of the monitoring wells and Hydropunch® borings can be found in NYSDEC's September 2000 RI Report for the "New Cassel Industrial Area Off-site Groundwater."

Summary of NYSDEC's RI Results

Major findings documented in NYSDEC's 2000 RI Report for groundwater contamination downgradient of the NCIA are summarized as follows:

- Contaminants of concern (COC) are PCE, TCE, and TCA. Breakdown products of PCE, TCE, TCA and other minor constituents within the VOC category were also present.
- Three groundwater plumes (eastern, central, and western) were identified emanating from the NCIA into the study area downgradient of the NCIA. NYSDEC attributed the source of groundwater contamination to the individual NYSDEC Registry facilities located within the NCIA.
- Contaminant distribution is influenced by local geology and hydrogeology. This includes the effect from the pumping of the Bowling Green supply wells

[2] In an anisotropic aquifer, the hydraulic conductivity (measurement of ease in which water can flow through the aquifer material) is different in the horizontal and vertical direction.

which produces a significant downward vertical gradient (*i.e.* drawing the groundwater deeper and toward it) in the vicinity of the NCIA.
- The presence of some breakdown products suggests that the degree of biodegradation is limited within the area downgradient of the NCIA.
- Sources of groundwater contamination upgradient of the NCIA were not identified. Groundwater samples collected from upgradient well N-10459 did not contain any detectable PCE or TCE, and groundwater samples collected from upgradient well N-10462 contained low concentrations of PCE (8 J[3] and 14 micrograms per liter (µg/L)).

Vapor Intrusion

From 2006 to 2009, NYSDEC also conducted vapor intrusion investigations downgradient of the NCIA. Investigations were conducted in three phases to assess whether VOCs from the NCIA are volatilizing and entering structures in areas surrounding the NCIA.

Phase 1 was conducted in September 2006 and included the collection of soil vapor samples at 38 locations throughout NYSDEC's study area downgradient of the NCIA. At each of 38 locations, one sample was collected approximately six to ten feet above the water table (generally 29 to 45 feet bgs), and one sample was collected at approximately eight feet bgs (the typical depth of a building's foundation).

As a screening evaluation, NYSDEC compared results from the Phase 1 soil vapor sampling to the New York State Department of Health's (NYSDOH) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* dated September 2006, which includes guidelines for indoor air concentrations for PCE and TCE, which are 100 µg/m^3 and 5 µg/m^3, respectively. This comparison provided for the targeting of locations for subsequent phases of the vapor intrusion investigation. Phase 1 results identified PCE concentrations up to 1,086 µg/m^3. TCE was identified at concentrations up to 363 µg/m^3. Based on the results, NYSDEC determined that indoor air sampling should be conducted at W.T. Clarke High School as soil vapor samples within the vicinity identified TCE concentrations above NYSDOH air guidelines.

Phase 2 began in September 2007 and included the collection of six indoor air samples from the basement, and first floor locations, and one outdoor (ambient air) location at the W.T. Clarke High School. Phase 2 results were compared to NYSDOH air guidance values, and concentrations of the identified COCs were below levels of concern. The ambient air sample, which serves as a measurement of background concentrations, had a concentration of TCE at 3.71 µg/m^3. The TCE ambient air result was higher than the indoor air concentrations and therefore, unlikely the result of volatilization of contaminants from contaminated groundwater. The maximum concentration of PCE was 2.28 µg/m^3 from a first floor indoor air sample. Additionally, concentrations of carbon tetrachloride and benzene were identified up to 0.831 µg/m^3 and 1.95 µg/m^3, respectively. While NYSDOH did not have an indoor air guidance value for carbon tetrachloride and benzene, these values do not exceed EPA's upper bound acceptable risk levels for those two substances.

Phase 3 was conducted in March 2009, and included collection of outdoor air, indoor air and/or subslab samples at the W.T. Clarke High School, seven residential properties, and a Town of Hempstead Water Department facility. Phase 3 results at the W.T. Clarke High School did not identify detections in indoor air or subslab samples above levels of concern. Both PCE and TCE were not detected in the indoor air above their reporting limits. TCA was detected in the indoor air up to 1.3 µg/m^3 and, while NYSDOH does not have an indoor air guidance value for this VOC[4], it does not exceed EPA's current risk based screening level of 5,200 µg/m^3. Methylene chloride was detected at concentrations of up to 14 µg/m^3 in the indoor air, however, NYSDOH's air guidance value is 60 µg/m^3. Based on these results, NYSDEC determined that no further action was necessary, which was in accordance with NYSDOH's 2006 Guidance.

Results from Phase 3 sampling at the seven residential properties did not identify detections in the indoor air above levels of concern for COCs. Subslab sampling at six residential properties indicated that the highest concentrations of PCE and TCE were 15 µg/m^3 and 14 µg/m^3, respectively. Based on comparison of these results to NYSDOH's 2006 Guidance, one residence, located approximately 500 feet downgradient from the NCIA was selected for future monitoring.

Phase 3 additionally included vapor intrusion sampling at a Town of Hempstead Water Department facility located at the Bowling Green water supply wells. Chloroform, a

[3] This sample result with a "J" qualifier represents an estimated value.

[4] NYSDOH's 2006 *Guidance for Evaluating Soil Vapor Intrusion in New York State* provides guidance on actions that should be taken to address current and potential exposures related to soil vapor intrusion and can be used to evaluate indoor air data for 1,1,1-TCA in Matrix 2. Currently, there are no NYSDOH air guidance values for sub slab data.

compound for which the NYSDOH does not have a respective air guidance value, was detected in the indoor air at concentrations of 150 μg/m^3 and in the subslab at concentrations of 81,000 μg/m^3. EPA's current risk based industrial indoor air value for chloroform is 0.53 μg/m^3. Other COCs were not detected above levels of concern in the indoor air.

No further actions were taken by NYSDEC subsequent to the completion of the three phases of the vapor intrusion investigations.

Summary of NYSDEC's Pre-Design Investigations

2009 Pre-Design Investigation

After selection of its remedy in 2003, NYSDEC conducted a pre-design investigation in 2009 that included a groundwater quality assessment from existing wells, vertical profile groundwater sampling including temporary monitoring wells (TMW), geologic profiling, soil sampling, and gamma logging. Seven TMWs were advanced to a depth of 285 feet bgs, which is comparable to the depth of the deepest permanent monitoring well locations. At two additional locations, TMWs were installed in the western plume and the central-eastern plume area to a depth of 502 feet bgs. Groundwater samples were collected at 20-foot intervals from the water table (approximately 45 feet bgs) down to 502 feet bgs. These results documented the presence of Site-related VOC contamination at depths up to 502 feet bgs.

Monitored Natural Attenuation Evaluation

The 2009 pre-design investigation evaluated available groundwater monitoring sampling results collected quarterly subsequent to the selection of the State's 2003 remedy, to determine whether the data corresponds with previous conclusions drawn in 2003. Review of the data revealed that the chlorinated VOCs comprise two general suites of parent and degradation or daughter products, ethanes and ethenes. An evaluation of the occurrence and distribution of ethane compounds in the VOC plume suggested that degradation was occurring.

Historically, the parent compound TCA was the primary ethane species constituent detected in wells within the NCIA. However, in wells downgradient of the NCIA, the percentage of TCA decreased relative to the wells within the NCIA while the percentage of 1,1-dichloroethane (DCA) increased relative to the NCIA wells, indicating the degradation of TCA to 1,1-DCA.

However, evaluations were not able to determine whether breakdown of ethene constituents was occurring due to the varying occurrence and distribution of the parent and breakdown ethene compounds between the NCIA and downgradient wells. Historically, the distribution of ethene constituents in the wells located within the NCIA was comprised mainly of breakdown products 1,1-DCE and 1,2-DCE, while wells downgradient of the NCIA contained relatively higher amounts of the parent products PCE and TCE. In addition, significant levels of vinyl chloride were not present, indicating that the ultimate breakdown of the ethene suite is not taking place.

As part of the natural attenuation evaluation, some additional parameters that would be indicative of the biodegradation of chlorinated VOCs were collected from a limited set of monitoring wells. The data did not reveal the presence of ferrous iron, indicating that a reducing environment may not be present at those locations, and total organic carbon was also not detected. The presence of total organic carbon would have indicated a potential energy source for biodegradation. In addition, byproducts of biodegradation (i.e. alkalinity, chlorides, carbon dioxide and methane) were not detected at elevated concentrations. Parameters such as sulfide and hydrogen were not collected during this evaluation.

Based on these factors, significant biodegradation of the VOC plumes does not appear to be occurring within OU1. However, the presence of some breakdown products suggests that the degree of biodegradation is limited within OU1.

Evaluation of Hydogeologic Conditions

Results from NYSDEC's 2009 pre-design investigation indicated that, based on literature data for the Magothy in the vicinity of the area proposed for treatment, anisotropy ratios (*i.e.*, ratio of vertical to horizontal hydraulic conductivity) of approximately 100 are not uncommon. Vertical hydraulic conductivity sampling measurements based on discrete soil sampling of the Magothy revealed higher degrees of anisotropy (*i.e.*, average was 42,700). NYSDEC concluded in its 2009 pre-design investigation that in-well vapor stripping would not be an effective technology for remediating groundwater and recommended use of the contingency remedy of groundwater extraction and treatment.

2011 Pre-Design Investigation

As a result, in 2011, NYSDEC conducted a second pre-design investigation that included the installation of 11 new monitoring wells and two extraction (pumping) wells, a 72-hour aquifer pump test of an extraction well, and a pilot test/treatability study for ex-situ treatment of contaminated groundwater.

Results from NYSDEC's 2011 pre-design investigation, which included sampling from the recently expanded monitoring well network, indicated that impacted area of groundwater had a larger horizontal and vertical extent than previously determined in NYSDEC's 2000 study. The water level monitoring conducted as part of the 72-hour aquifer pump test revealed that the Bowling Green water supply wells strongly influence the water levels in all of monitoring wells located in the Magothy that were monitored during the test. Results from the pump test indicated test extraction wells were relatively high yielding, and NYSDEC determined that a series of high yielding pumping wells would be required to capture known contamination.

Data from the 72-hour aquifer pump test was additionally used to calculate aquifer characteristics, including anisotropic ratios, which were determined to be significantly lower (27 to 100) than the original estimate from the 2009 pre-design investigation. Calculated results for anisotropy were within the published ranges from several United States Geologic Survey studies on Long Island. Based on this information collected, these results are consistent with NYSDEC's initial selection in the remedy selected in 2003.

NYSDEC concluded, based on its 2011 pre-design investigation that the contaminant plumes were stable with localized areas where declining or increasing concentrations trends are observed. Concentrations of PCE/TCE breakdown compounds are relatively low to nondetect compared to the concentrations of PCE and TCE, which indicates that their biodegradation is not progressing at a significant rate within OU1. Concentrations of Site related VOCs in the early warning monitoring wells were below their respective state and federal water quality standards.

EPA's Supplemental RI Memorandum

In 2011, after the Site was added to the NPL, EPA commenced its Supplemental RI which resulted in the Supplemental RI Memorandum, dated May 2013, which summarizes the historical groundwater data, outlines response activities conducted, and provides recommendations for future investigation and remedial activities at the Site. The evaluation of groundwater contamination downgradient of the NCIA, designated as OU1 by EPA, included a review of NYSDEC's September 2000 study, October 2003 remedy, and the 2009 and 2011 Pre-Design Investigation Reports.

Summary of EPA's Supplemental RI Memorandum

Based on an evaluation of groundwater data collected through 2011, EPA determined the current nature and extent of contamination in OU1, as is set forth in the Supplemental RI Memorandum, that three groundwater plumes exist at OU1 (the eastern, central, and western plumes). These plumes are characterized by chlorinated VOCs (CVOCs), primarily PCE and TCE, and are generally oriented in a south-southwest direction, consistent with regional groundwater flow. A downward hydraulic gradient appears to drive the three plumes to greater depths as groundwater moves through the area downgradient of the NCIA. The eastern and western plumes are more extensive laterally than the central plume. The three plumes are depicted on Figure 2 and described in more detail as follows:

- **OU1 Eastern Plume**: The eastern plume is characterized by a generally higher molar fraction[5] of PCE relative to TCE at depths less than approximately 205 feet. In depths greater than approximately 205 feet, a generally higher molar fraction of TCE compared to PCE was observed.

  April 2011 pre-design investigation sampling of monitoring well FSMW-14A revealed PCE and TCE at concentrations of 16,000 µg/L and 1,800 µg/L respectively. Monitoring well FSMW-14A is screened in the Magothy at 119 to 129 feet bgs and was installed in 2004 in association with investigations conducted at a facility located in the NCIA. Past sampling has indicated PCE concentrations up to 75,000 µg/L at FSMW-14A.

- **OU1 Central Plume**: The central plume contains a generally higher molar fraction of TCE and cis-1,2 DCE compared to PCE. Below a depth of approximately 150 feet bgs, PCE and TCE in the central plume appear to be commingled with the western plume.

  Relatively high concentrations of TCA (up to 1,400 µg/L at monitoring well TMW-5) were also detected in the central plume based on data collected in 2008. The presence of TCA in the central plume can be used as a contaminant fingerprint to distinguish between plumes.

[5] The molar fraction is the amount of a CVOC divided by the total amount of total CVOCs. This fraction has been adjusted for molecular weight.

- **OU1 Western Plume**: The western plume has a generally higher molar fraction of TCE compared to PCE.

  The highest concentration of TCE (5,100 µg/L) was detected in 2008, along the western edge of OU1 at monitoring well TMW-2, located within the Magothy at 225 feet bgs. The highest concentration of PCE (3,700 µg/L) was also detected in 2008 and was along the southwestern edge of OU1 at monitoring well TMW-1, located within the Magothy at 225 feet bgs.

  Based on data collected from a TMW, both PCE and TCE do not appear to extend deeper than 450 feet in the western plume downgradient of the NCIA.

RISK SUMMARY

EPA conducted a baseline human health risk assessment (HHRA) for OU1 to estimate current and future effects of contaminants on human health. A baseline HHRA is an analysis of the potential adverse human health effects of releases of hazardous substances from a site in the absence of any actions or controls to mitigate such releases under current and future land and groundwater uses.

A four-step human health risk assessment process was used for assessing Site-related cancer risks and noncancer health hazards. The four-step process is comprised of: Hazard Identification of Chemicals of Potential Concern (COPCs), Exposure Assessment, Toxicity Assessment, and Risk Characterization (see adjoining text box, "What is Risk and How is it Calculated" for more details on the risk assessment process).

The cancer risk and noncancer health hazard estimates in the HHRA are based on current reasonable maximum exposure scenarios and were developed by taking into account various health protective estimates about the frequency and duration of an individual's exposure to chemicals selected as COPCs, as well as the toxicity of these contaminants.

Cancer risks and noncancer health hazard indexes (HIs) are summarized below (please see the adjoining text box for an explanation of these terms).

A screening level ecological risk assessment was not conducted to assess the risk posed to ecological receptors because contaminated groundwater downgradient of the NCIA does not discharge to any

WHAT IS RISK AND HOW IS IT CALCULATED?

Human Health Risk Assessment: A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants in air, water, soil, etc. as identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means an "one-in-ten-thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a threshold (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 or less for a noncancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at a site and are referred to as Chemicals of Concern or COCs in the final remedial decision, or Record of Decision.

surface water bodies within the area described as OU1. Since no groundwater discharges to surface water, exposure pathways are not complete, and ecological receptors are not exposed to contaminants from the Site.

Human Health Risk Assessment

The area encompassing OU1 mainly consists of residential parcels with some retail businesses along Old Country Road. Portions of the W.T. Clarke Middle School and High School are within the southwest corner of OU1. The Bowling Green supply wells, Nassau County Recharge Basin #51, and another smaller Nassau County Department of Public Works-operated recharge basin are located within the area. It is expected that the future land and groundwater use in this area will remain the same.

COPCs were selected by comparing maximum detected concentrations of each analyte in groundwater with available risk-based regional screening levels for tap water. All class A human carcinogens were also evaluated for the quantitative assessment. A total of fifteen VOCs were selected as COPCs for OU1, which are provided in Table 1.

The HHRA evaluated health effects that could result from direct exposure to contaminated groundwater though ingestion of and dermal contact with groundwater and inhalation of vapors during bathing/showering activities. Based on the current zoning and anticipated future use, the HHRA focused on a variety of possible receptors, including site workers and residents (children and adults). Although residents and businesses in the area are currently served by municipal water, groundwater at the Site is designated as a federally designated sole source aquifer, and the State considers it to be a potable water supply; therefore it could be used as such in the future. Consequently, hypothetical exposure to contaminated groundwater at the Site was evaluated quantitatively in the HHRA.

A more detailed discussion of the exposure pathways and estimates of risk can be found in the OU1 *Final Baseline Human Health Risk Assessment* in the information repositories.

Human Health Risk Assessment Summary

Table 1 provides the exposure concentration for COPCs found during EPA's statistical analysis of groundwater sampling data. Table 1 additionally provides the respective and current New York State Water Quality Standards for Class GA (potable drinking water aquifer) and EPA's Safe Drinking Water Act MCL values for comparison.

These exposure concentrations are associated with an excess lifetime cancer risk $3x10^{-3}$ for the future adult and child resident, and $2x10^{-4}$ for the commercial worker. PCE, TCE, vinyl chloride, 1,1-DCA, and 1,1,2,2-tetrachloroethane are the primary contributor to these cancer risk levels. The calculated noncarcinogenic hazard indices (HI) are as follows: future adult resident HI=300, future child resident HI=700, and future commercial worker HI= 20. Both TCE and PCE were the main drivers of noncancer hazards that yielded values greater than 1.

These cancer risks and noncancer hazards indicate that there is significant potential risk to potentially exposed populations from direct exposure to groundwater. For these receptors, exposure to groundwater results in either an excess lifetime cancer risk that exceeds EPA's target risk range of 10^{-4} to 10^{-6} or an HI above the acceptable level of 1, or both.

In 2013, as part of the HHRA, EPA conducted a qualitative vapor intrusion (VI) screening level desktop evaluation to assess potential risk using conservative assumptions. The evaluation indicated the potential for VI risk associated with groundwater contamination at OU1. However, NYSDEC's 2009 vapor intrusion investigation sampled 7 residences, and the results did not indicate the need for installation of vapor intrusion mitigation systems.

The results of the human health risk assessment indicate that the contaminated groundwater presents an unacceptable exposure risk. Based on the results of the RI and the risk assessment, EPA has determined that the actual or threatened releases of hazardous substances from the Site, if not addressed by the preferred remedy or one of the other active measures considered, may present a threat to human health or welfare or the environment. It is EPA's current judgment that the preferred remedial alternative identified in the Proposed Plan is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

Table 1: Exposure Point Concentrations and Respective NYS and EPA Drinking Water Standards for OU1 Groundwater

COPCs	Exposure Point Concentration (EPC)[6] (µg/L)	NYS Water Quality Standards (µg/L)	Federal Safe Drinking Water Act MCL (µg/L)
1,1,1-TCA	432	5	200
1,1,2,2-Tetrachloroethene	23	5	No Standard (NS)
1,1,2- TCA	1.38	1	5
1,1- DCA	302	5	NS
1,1-DCE	392	5	7
1,2-DCA	1.25	0.60	5
Benzene	10	1	5
Bromodichloro-methane	11	NS	NS
Carbon Tetrachloride	2.11	5	5
Chloroform	23.50	7	NS
Cis-1,2-DCE	247	5	70
PCE	3,540	5	5
Trans-1,2,-DCE	18.20	5	100
TCE	388	5	5
Vinyl chloride	11	2	2

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are specific goals to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered guidance, and site-specific risk-based levels.

The following remedial action objectives have been established for OU1:

- Prevent or minimize current and potential future human exposure (via ingestion and dermal contact) to VOCs in groundwater at concentrations in excess of federal and State standards.
- Minimize the potential for further migration of groundwater with VOC contaminant concentrations greater than federal and State standards;
- Restore the impacted aquifer to its most beneficial use as a source of drinking water by reducing contaminant levels to the federal and State standards.

[6] EPC is the concentration of a constituent in groundwater that is reasonably expected to be contacted by an individual over time and universally throughout OU1. The EPC value represents the 95% upper confidence limit of the mean concentration or the maximum detected concentration of the constituent.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA 121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARs, and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to reduce permanently and significantly the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a site. CERCLA 121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA 121(d)(4), 42 U.S.C. §9621(d)(4).

Detailed descriptions of the remedial alternatives considered for addressing groundwater contamination at OU1 can be found in EPA's OU1 Supplemental FS Memorandum. EPA's OU1 Supplemental FS Memorandum updates information previously presented in NYSDEC's Feasibility Study Report for "New Cassel Industrial Area Off-site Groundwater", dated September 2000, and introduces three additional alternatives. Based on evaluations performed by EPA in the development of the OU1 Supplemental FS Memorandum, remedial alternatives developed by NYSDEC in 2000 for its remedy that do not address the entire vertical extent of groundwater contamination were thus not considered satisfactory alternatives and are not included among EPA's alternatives for this remedy.

The duration time for each alternative reflects only the time required to construct the remedy and does not include the time required to design the remedy, actually attain performance standards, negotiate the performance of the remedy with any potentially responsible parties, if possible, or procure contracts for design and construction.

Common Elements

All of the alternatives, with the exception of the no action alternative, include common components. Alternatives 2 through 5 include long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until performance standards are achieved. The long-term monitoring program would include sampling from the two existing, early warning monitoring well clusters and an evaluation of potential impacts to the Bowling Green supply wells. As additional groundwater data become available, EPA would continue to investigate the soil vapor intrusion pathway for OU1 under Alternatives 2 through 5. Vapor mitigation systems would be installed, if warranted.

Alternatives 2, 3, 4, and 5 include institutional controls for groundwater use restrictions until performance standards are achieved and as such a plan would be developed which would specify institutional controls to ensure that the remedy is protective. Existing local requirements that prevent installation of drinking water wells and informational devices to limit exposure to contaminated groundwater would be implemented.

Alternatives 3, 4, and 5, all of which include active remediation, would evaluate the use of in-situ chemical treatments such as ISCO to target areas containing high concentrations (greater than 10,000 µg/L) of total VOCs. ISCO is a process that involves the injection of reactive chemical oxidants into the subsurface for rapid contaminant destruction. Oxidation of organic compounds using ISCO converts contaminants to non-toxic by-products. During the remedial design, a treatability study would be performed to evaluate the use in-situ chemical treatments, such as ISCO, as an element of the selected alternative in a manner that complements and improves the effectiveness of the remedy. In-situ chemical treatment would only be utilized if a determination is made during the remedial design that the application would not adversely affect the public supply wells.

Additionally, because MCLs will take longer than five years to achieve in Alternatives 2 through 5, a review of conditions at the Site will be conducted no less often than once every five years until performance standards are achieved.

Alternative 1: No Action

Capital Cost:	$0
Annual O&M Costs:	$0
Present-Worth Cost:	$0
Duration Time:	Not Applicable

The NCP requires that a "No Action" alternative be developed as a baseline for comparing other remedial alternatives. Under this alternative, there would be no physical remedial actions taken to address contamination. Additionally, this alternative does not include monitoring or institutional controls.

Under this alternative, CERCLA requires that the Site would be reviewed at least once every five years as long as contaminants remain above the levels that allow for unrestricted use and unlimited exposure. If justified by the review, additional response actions may be implemented.

Alternative 2: Monitored Natural Attenuation

Capital Cost:	$ 614,000
Annual O&M Costs:	$ 115,000
Present-Worth Cost:	$ 3,300,000
Duration Time:	6 to 9 months

This remedial alternative relies on monitored natural attenuation to address the groundwater contamination. Natural attenuation is the process by which contaminant concentrations are reduced by various naturally occurring physical, chemical, and biological processes. The main processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. These processes occur naturally, in-situ, and act to decrease the mass or concentration of contaminants in the subsurface. Only non-augmented natural processes are relied upon under this alternative.

Implementation of this alternative includes the installation of additional monitoring wells, periodic sample collection and analysis, data evaluation, and contaminant trend analysis. Under this alternative, a network of approximately 33 groundwater monitoring wells (21 existing and 12 to be installed) would be monitored for MNA parameters, which would include groundwater quality. The conceptual sampling schedule used for this alternative assumes 24 groundwater monitoring wells sampled quarterly for the first two years, semi-annually for the next three years, and annually thereafter.

An estimated remediation time frame of 30 years is used for estimating costs associated with operation and maintenance (O&M) activities. The time frame to meet groundwater RAOs in OU1 is difficult to predict since EPA's Supplemental FS Memorandum did not include modeling to estimate remediation time frames. However, under this alternative, it is anticipated that RAOs would not be achieved in a reasonable time frame based on Site-specific conditions.

This alternative includes long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until performance standards are achieved. As additional groundwater data become available, EPA would continue to investigate the soil vapor intrusion pathway for OU1 under Alternative 2. Additionally, in accordance with CERCLA, a review of conditions at the Site will be conducted no less often than once every five years until performance standards are achieved.

Alternative 3: In-Well Vapor Stripping; In-situ Chemical Treatment

Capital Cost:	$ 11,728,000
Annual O&M Costs:	$ 652,000
Present-Worth Cost:	$ 24,000,000
Duration Time:	1 to 2 years

This remedial alternative includes the installation of in-well vapor stripping systems in groundwater at various depths to provide contaminant mass removal and containment at OU1.

In-well vapor stripping is a technology that uses the principles of phase separation to transfer VOCs from the liquid to gas phase by aerating the contaminated water in the wellhead. Aeration can be accomplished by either injecting air into the water table or by using an air stripper mounted at the well head. Typically, extracted vapors are treated (if necessary) above grade and discharged to the atmosphere. Vapor treatment, if required, generally consists of vapor-phase granular activated carbon (GAC).

The in-well vapor stripping well is a closed system where the contaminated groundwater is never exposed at the ground surface or the atmosphere. Typically impacted groundwater is pumped to the well head where it is treated and discharged or directly discharged back into the well. Once treated, the groundwater flows back into the aquifer through screens in the well that are typically located at the water table (unsaturated zone) but can also be located beneath the water table (saturated zone). In some in-well vapor stripping well configurations, the extraction and re-injection of groundwater from the aquifer induces a hydraulic circulation pattern that allows continuous cycling of groundwater through the treatment well. As groundwater circulates through the treatment system in-situ and vapor is extracted the contaminant concentrations in the groundwater are reduced.

In-well vapor stripping can be implemented in different system configurations. For the purposes of developing a conceptual design and cost estimate for comparison with other technologies in the OU1 Supplemental FS Memorandum, wells were configured centrally along the OU1 eastern, central and western plume areas to provide mass removal. Wells were additionally placed perpendicular to groundwater flow along the OU1 plume 100 μg/L total VOC contour to provide containment, treatment, or both of the plume areas. This conceptual design would necessitate installation of 13 permanent in-well vapor stripping wells in the OU1 eastern plume area, eight in the OU1 central plume area, and 51 in the OU1 western plume area. The conceptual layout of these 72 wells targets the shallow (< 175 feet bgs), intermediate (175 -250 feet bgs) and deep (>250 feet bgs) depths. A centralized treatment building was assumed in the conceptual design for vapor treatment.

In-well vapor stripping would target treatment of groundwater contaminated with levels of total VOCs greater than 100 μg/L, but less than 10,000 μg/L. The remedial design would evaluate the use of in-situ chemical treatments such as ISCO to target areas containing high concentrations (greater than 10,000 μg/L) of VOCs.

An estimated remediation time frame of 30 years is used for developing costs associated with O&M activities. The time frame to meet groundwater RAOs in OU1 is difficult if not impossible to predict because it is uncertain how quickly groundwater concentrations will decrease as a result of remedial technologies. Active remediation would be employed in the targeted treatment areas until the MCL for each of the COPCs is attained within the targeted treatment area.

The conceptual design would require further evaluation during the remedial design phase if this alternative is selected. This alternative includes long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until performance standards are achieved. Additional wells would also have to be installed to monitor the progress of the remediation. As additional groundwater data become available, EPA would continue to investigate the soil vapor intrusion pathway for OU1 under Alternative 3. Additionally, in accordance with CERCLA, a review of conditions at the Site will be conducted no less often than once every five years until performance standards are achieved.

Alternative 4: Groundwater Extraction and Treatment; In-situ Chemical Treatment

Capital Cost:	$ 8,862,000
Annual O&M Costs:	$ 834,000
Present-Worth Cost:	$ 24,200,000
Duration Time:	1 to 2 years

This remedial alternative consists of the extraction of groundwater via pumping wells and treatment prior to discharge. Groundwater is pumped and treated to remove contaminant mass from areas of the aquifer with elevated concentrations of VOCs and to provide containment within OU1.

For this conceptual design, it is estimated that 11 extraction wells would be installed in the shallow (< 175 feet bgs), intermediate (175 -250 feet bgs) and deep (>250 feet bgs) intervals of the contaminated portions of the aquifer. The conceptual design estimates three extraction wells in the OU1 eastern plume area, three in the OU1 central plume area and five in the OU1 western plume area.

Extraction wells would target treatment of groundwater contaminated with levels of total VOCs in excess of 100 µg/L. The remedial design would evaluate the use of in-situ chemical treatments such as ISCO to target areas containing high concentrations (greater than 10,000 µg/L) of VOCs.

Extracted groundwater with VOC contamination is typically treated with either liquid phase GAC or air stripping, or both. Air stripper effluent air stream may be treated with vapor phase GAC, if necessary. Extracted groundwater would be pumped from the network of extraction wells to one centralized treatment system facility with a treatment capacity of approximately 700 gallons per minute (gpm), where groundwater would be treated using both an air stripper and liquid phase GAC. Treated groundwater would then be re-injected back into the UGA using an estimated 20 infiltration wells which would be installed in the vicinity of the Nassau County Recharge Basin #51 parcel. However during the remedial design phase, an evaluation and determination would be made whether to re-inject the treated water or to discharge it to a publicly owned treatment works (POTW). This conceptual design including the number and placement of the extraction wells would require further evaluation during the remedial design if this alternative is selected.

An estimated remediation time frame of 30 years is used for developing costs associated with O&M activities. The time frame to meet groundwater RAOs in OU1 is difficult if not impossible to predict because it is uncertain how quickly groundwater concentrations will decrease as a result of remedial technologies. Active remediation would be employed in the targeted treatment areas until the MCL for each of the COPCs is attained within the targeted treatment area.

The conceptual design would require further evaluation during the remedial design phase if this alternative is selected. This alternative includes long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until performance standards are achieved. Additional wells would also have to be installed to monitor the progress of the remediation. As additional groundwater data become available, EPA would continue to investigate the soil vapor intrusion pathway for OU1 under Alternative 4. Additionally, in accordance with CERCLA, a review of conditions at the Site will be conducted no less often than once every five years until performance standards are achieved.

Alternative 5: Hybrid Alternative – In-well Vapor Stripping / Groundwater Extraction and Treatment; In-situ Chemical Treatment

Capital Cost:	$ 10,044,000
Annual O&M Costs:	$ 680,000
Present-Worth Cost:	$ 22,900,000
Duration Time:	1 to 2 years

This remedial alternative consists of a hybrid, or combination, of Alternative 3 (in-well vapor stripping) and Alternative 4 (groundwater extraction and treatment). This hybrid alternative would provide contaminant mass removal and containment through the implementation of both in-well vapor stripping and groundwater extraction and treatment remedial technologies to address groundwater contamination in OU1.

Under the conceptual design, in-well vapor stripping would target treatment of groundwater in areas where concentrations of total VOCs are greater than 100 µg/L but less than 1,000 µg/L. Groundwater extraction and treatment would target groundwater in areas with concentrations of total VOCs greater than 1,000 µg/L but less than 10,000 µg/L. In plume areas where concentrations of total VOCs are greater than 10,000 µg/L, use of in-situ chemical treatment such as ISCO would be evaluated for implementation.

For this conceptual design, it is estimated that three extraction wells would be installed in the OU1 eastern plume area as total VOC concentrations generally exceed 1,000 µg/L. In the OU1 central plume area where total VOC concentrations are generally less than 1,000 µg/L, eight in-well vapor stripping wells would be installed. In the OU1 western plume area, a combination of 12 in-well vapor stripping wells and three extraction wells would be used as the plume area covers a wider area and concentrations are generally less than 1,000 µg/L.

Under this alternative, a centralized treatment plant would be constructed in the vicinity of Nassau County Recharge Basin #51 to treat extracted groundwater and vapors. Extracted groundwater would be pumped to a centralized treatment plant where groundwater would then be treated using both an air stripper and liquid phase GAC. Treated groundwater, after meeting groundwater standards, would then be re-injected back into the UGA using an estimated seven dry wells.

The centralized treatment plant would have the capacity to treat up to 350 gpm. However, during the remedial design, an evaluation and determination would be made whether to re-inject the treated groundwater or discharge it to a POTW. For the in-well vapor stripping wells, extracted vapors are typically treated (if necessary) above grade and discharged to the atmosphere. Vapor treatment, if required, generally consists of vapor-phase GAC, which would be addressed at the centralized treatment plant.

An estimated remediation time frame of 30 years is used for developing costs associated with O&M activities. The time frame to meet groundwater RAOs in OU1 is difficult if not impossible to predict because it is uncertain how quickly groundwater concentrations will decrease as a result of remedial technologies. Active remediation would be employed in the targeted treatment areas until the MCL for each of the COPCs is attained within the targeted treatment area.

The conceptual design would require further evaluation during the remedial design phase if this alternative is selected. This alternative includes long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until performance standards are achieved. Additional wells would also have to be installed to monitor the progress of the remediation. As additional groundwater data become available, EPA would continue to investigate the soil vapor intrusion pathway for OU1 under Alternative 5. Additionally, in accordance with CERCLA, a review of conditions at the Site will be conducted no less often than once every five years until performance standards are achieved.

EVALUATION OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely, overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, and state and community acceptance.

Refer to the text box on the next page for a description of the evaluation criteria.

This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how each compares to the other options under consideration. A detailed analysis of alternatives can be found in EPA's OU1 Supplemental FS Memorandum, dated July 2013.

Overall Protection of Human Health and the Environment

All of the active alternatives provide protection for human health. Alternatives 3, 4, and 5 are the active remedies that address groundwater contamination and would restore groundwater quality over the long-term. Alternatives 3, 4, and 5 would also rely on certain natural processes to achieve the cleanup levels for areas not targeted for active remediation.

Alternative 2 relies entirely on natural attenuation processes to achieve cleanup levels. Protectiveness under Alternative 2 is achieved through reducing contaminant concentrations via naturally occurring processes. However, Alternative 2 does not prevent the migration of contaminants, and based on the natural attenuation evaluation conducted at the Site, there is uncertainty that biodegradation would progress at a rate such that cleanup levels would be achieved in a reasonable time.

The remaining alternatives presented would each address groundwater contamination through active remedial activities. Protectiveness under Alternatives 3, 4, and 5 requires a combination of actively reducing contaminant concentrations in groundwater and limiting exposure to residual contaminants through maintenance of existing institutional controls for groundwater use restrictions.

Institutional controls are anticipated to include existing governmental controls, such as well permit requirements regarding groundwater use in the impacted area. A plan would be developed which would specify institutional

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

Overall Protectiveness of Human Health and the Environment evaluates whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

controls to ensure that remedy is protective.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

EPA and NYSDOH have promulgated health-based protective MCLs (40 CFR Part 141, 10 NYCRR § 5-1.51 Chapter 1), which are enforceable standards for various drinking water contaminants (and are chemical-specific ARARs). If more than one such requirement applies to a contaminant, compliance with the more stringent ARAR is required.

The aquifer at the Site is classified as Class GA (6NYCRR 701.18), meaning that it is designated as a potable drinking water supply. As groundwater within OU1 is a source of drinking water, achieving MCLs in the groundwater is an ARAR.

Alterative 1 would not comply with ARARs. Under Alternative 2, it is not anticipated that ARARs would be achieved in a reasonable time frame as data collected to date has not indicated that complete biodegradation of PCE/TCE is progressing at a significant rate. Thus, degradation of the contaminants throughout the plume to levels which achieve ARARs is likely to exceed a reasonable time. While no single definition of a reasonable timeframe exists, EPA, pursuant to CERCLA and the NCP, considers various factors when evaluating time frame for achieving groundwater restoration cleanup levels. For example, when the contaminated groundwater is not currently used, treated for contamination, or an alternate water source is readily available, it would likely be appropriate to consider a longer time-frame for achieving restoration cleanup levels.

An estimated remediation time frame of 30 years was used for developing costs associated with O&M activities for Alternatives 3, 4 and 5. The time frame to meet groundwater RAOs in OU1 is however, difficult, if not impossible, to predict because it is uncertain how quickly groundwater concentrations will decrease as a result of remedial technologies. Given the successful application of the remedial technologies at other sites, and the response times seen at other Long Island Superfund sites within the same sandy aquifer, it is likely that the RAOs would be achieved sooner than a 30 year time frame. Active remediation under Alternatives 3, 4 and 5 would be employed in the targeted treatment areas until the MCL for each of the COPCs is attained within the targeted treatment area. Alternatives 3, 4, and 5 would comply with location-and action-specific ARARs. Chemical-specific ARARs would also be attained for each of these alternatives through treatment.

Long-Term Effectiveness and Permanence

Alternatives 1 and 2 do not provide long-term effectiveness or permanence as no active remedial measures are proposed. In-well vapor stripping under Alternative 3, extraction and treatment under Alternative 4, and a combination of those technologies under Alternative 5 are considered effective technologies for treatment and/or containment of contaminated groundwater, if designed and constructed properly.

Alternatives 3, 4, and 5 rely on a combination of treatment and institutional controls. Institutional controls are anticipated to include existing governmental controls, such as well permit requirements regarding groundwater use in the impacted area.

Alternative 3, in-well vapor stripping, is expected to be effective and reliable in significantly removing VOC contamination in groundwater. However, the effectiveness of applying this technology to areas with high concentrations of VOC concentrations and at significant depth has been limited. The effectiveness of this alternative is limited by the radius of influence (ROI) or "reach" into the aquifer. The ROI will depend on pumping capacity of each stripping well and hydrogeologic characteristics of the groundwater in OU1 area. The ability to secure access to residential properties may impact the placement of the in-well vapor stripping wells. Effectiveness could also be limited due to the potential that creation of a circulation cell may not be possible and that treatment required in one pass or additional measures will be needed to provide multiple passes through the treatment system. These additions may require not only vertical but horizontal space that may or may not be available due to the presence of existing subsurface utilities. A pilot study would be necessary to determine pre-design parameters, such as the actual ROI, optimal well spacing, depth to the treatment zone, flow rates, and pumping capacity prior to full-scale implementation. The effectiveness of Alternative 3 would necessitate additional measurements of the aquifer's anisotropy.

Alternative 4 would be more reliable than Alternative 3 as there is uncertainty whether in-well vapor stripping could effectively remove contamination in areas with high total VOC concentrations or in areas where the contamination is at significant depths. Alternative 4 is an effective technology that has been utilized at other Superfund sites within Nassau County, New York.

Alternative 5 allows for a combination of both in-well vapor stripping and extraction/treatment technologies to treat for the OU1 plume areas. In the OU1 central plume area, where the contaminant plume is generally less extensive laterally and vertically with lower concentrations of total VOCs, in-well vapor stripping is expected to be effective. In the OU1 eastern and portion of the western plume, use of extraction and treatment is a proven technology which is effective at reducing contaminant mass. Alternative 5 provides the ability to effectively target use of either technology to treat and contain contamination throughout different horizontal and vertical hydraulic and contaminant gradients.

Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment

Alternative 1, No Action, does not address contamination and does not include the long-term monitoring of groundwater conditions.

Alternative 2 relies on natural processes to degrade contaminants and as such the reduction in toxicity, mobility and volume (TMV) will vary with location. Under Alternative 2, the MNA biodegradation processes can transform PCE, TCE, and cis-1,2-DCE into the more toxic vinyl chloride under anaerobic conditions before transformation to the less toxic ethane. This transformation would need to be monitored and managed to prevent potential exposure to contaminated drinking water. Physical processes such as dispersion are working to reduce the toxicity by decreasing contaminant concentrations. The presence of cis-1,2 DCE, trans-1,2-DCE and vinyl chloride, which are ethene breakdown products of PCE and TCE, is evident. However, the limited MNA data set has revealed this breakdown is not occurring throughout the entire OU1 area. Groundwater concentrations greater than 1,000 µg/L coupled with the absence of a significant rate of complete biodegradation indicate that Alternative 2 would not reduce the TMV of contaminants significantly.

Alternatives 3, 4, and 5 would reduce the toxicity and volume of contaminants through treatment of contaminated groundwater. Alternative 3 uses a system to remove the contaminants from groundwater in-situ, and provides chemical treatment for the collected vapor-phase contamination on-Site. Alternative 4 removes contaminated groundwater via extraction and treats the contamination via a carbon treatment process on-Site. Alternative 5 utilizes both those technologies and treats vapor phase-contamination and extracted groundwater on-Site at a central treatment plant.

Under Alternative 3, 4, and 5, in-situ chemical treatment such as ISCO would be applied to areas where total VOC concentrations exceed 10,000 µg/L to reduce TMV. After treatment, Alternatives 3, 4, and 5 would generate residuals in a form of used GAC that would require regeneration, destruction or disposal.

Alternative 5 would be the most effective at reducing TMV as each of the technologies would be applied to those areas best suited for its application, based on depth and concentrations of contaminants. For example, in-well vapor stripping would be utilized in more shallow areas and where concentrations of VOCs are comparatively low to moderate (e.g., less than 1,000 µg/L). Extraction and treatment would be utilized where VOC concentrations are comparatively higher (e.g., greater than 1,000 µg/L) and at intermediate and deeper depths where in-well vapor stripping may not be as effective. If pilot testing indicates that in-well vapor stripping would not be the most efficient technology at reducing TMV for certain areas of contamination, then extraction and treatment could be implemented in those areas under Alternative 5.

Short-Term Effectiveness

Alternative 1 would be the most effective in the short term as there would be no risks posed during the implementation of this alternative. Thereafter, Alternative 2 would be the second most effective in the short term as there would be minimal risks posed during the implementation of the alternative.

Alternatives 3, 4, and 5 may have short-term impacts to remediation workers, the public, and the environment during implementation. Remedy-related construction (e.g., trench excavation) under Alternatives 3, 4, and 5 would require disruptions in traffic and street closure permits. In addition, Alternatives 3, 4, and 5 have above-ground treatment components and infrastructure that may create a minor noise nuisance and inconvenience for local residents during construction.

Exposure of workers, the surrounding community, and the local environment to contaminants during the implementation of Alternatives 3, 4, and 5 is minimal. Drilling activities, including the installation of monitoring, in-well vapor stripping, and extraction wells for Alternatives 3, 4, and 5 could produce contaminated liquids that present some risk to remediation workers at the Site. The potential for remediation workers to have direct contact with contaminants in groundwater could also occur when groundwater remediation systems are operating under Alternatives 4 and 5. Alternatives 4 and 5 could increase the risks to exposure, ingestion, and inhalation of contaminants by workers because contaminated groundwater would be extracted to the surface for treatment. However, measures would be implemented to mitigate exposure risks.

Alternatives 3, 4, and 5 include monitoring that would provide the data needed for proper management of the remedial processes and a mechanism to address any potential impacts to the community, remediation workers, and the environment. Risk from exposure to groundwater during any excavation work would require management via occupational health and safety controls, such as dust control measures.

Groundwater monitoring and discharge of treated groundwater will have minimal impact on workers responsible for periodic sampling. The time required for implementation of Alternative 3, 4, and 5 is estimated to take one to two years.

Implementability

Alternative 1 is no action, and therefore is the easiest of all the alternatives implement. Alternative 2, MNA, is a well-established remedial approach that is also easily implementable as no active remediation would be performed. However, evaluations conducted to date suggest that the conditions in the aquifer are not conducive to the degradation of the COPCs through destructive mechanisms.

In-well vapor stripping and groundwater extraction and treatment are well-established technologies that have commercially available equipment and are implementable. However, obtaining the necessary access to implement Alternatives 3, 4, and 5 may pose access challenges because of multiple wells, below ground piping, and treatment buildings needing to be installed on multiple owners' properties.

Of the three active remediation alternatives, Alternative 4 would be the easiest alternative to construct and would require the least amount of street closure permits and would require less land area and disruption in residential areas. Alternative 3 would be the most difficult to implement as construction activities would result in a significant disruption in residential areas since this alternative would require installation of a large number of wells and associated infrastructures. The ability to reconfigure in-well vapor stripping well locations because of access constraints may be possible, however doing so could potentially impact the effectiveness and schedule of Alternatives 3 and 5. Additionally, there is an increase in the design challenges with Alternatives 3 and 5 as the vapors captured from the in-well vapor stripping wells would need to be transported via transmission lines and blowers to a centralized treatment plant.

Under Alternative 3, the depth of the deepest contamination (estimated between approximately 285 to 502 feet bgs) increases the design challenges of the in-well vapor system. There are practical limitations on the depth that the compressed air can be injected into the aquifer which could result in vapor stripping being conducted effectively over only a portion of the treatment well. Additionally, anisotropic aquifer conditions potentially present in portions of the aquifer could reduce the potential for success of an in-well vapor stripping well to establish a groundwater circulation cell across the treatment zone of the aquifer.

Use of in-situ chemical treatment such as ISCO, under Alternatives 3, 4, and 5, is a well-established treatment that is commercially available. A treatability study would be performed during the remedial design to evaluate the use in-situ chemical treatments, such as ISCO as an element of the selected alternative in a manner that complements and improves the effectiveness of the remedy. In-situ chemical treatment would only be utilized if a determination is made during the remedial design that the application would not adversely affect the public supply wells.

Alternatives 2, 3, 4, and 5 would require routine groundwater quality, performance and administrative monitoring including five-year CERCLA reviews. Alternative 3, 4, and 5 would require periodic operation and maintenance (e.g., substrate inspection, GAC replacement) for the life of the treatment. Reinjection of all or part of treated water under Alternatives 4 and 5 could present implementability challenges if a suitable location is not agreed upon between the EPA and local and county officials. A final determination would be made on discharge location or method once additional design information has been generated.

Cost

The estimated capital costs, O&M, and present worth cost are discussed in detail in EPA's July 2013 OU1 Supplemental FS Memorandum. For estimating costs and for planning purposes, a 30 year time frame was used for O&M under Alternatives 2, 3, 4, and 5. The costs estimates are based on the best available information. The highest present worth cost is Alternative 4 at $24.2 million. Of the three alternatives with active remedial components, Alternative 5 is slightly less expensive than the Alternative 3 and 4.

Alternative	Capital Cost	Annual O&M Cost	Present Worth
1	$0	$0	$0
2	$ 614,000	$115,000	$3,300,000
3	$11,727,000	$652,000	$24,000,000
4	$ 8,862,000	$834,000	$24,200,000
5	$10,044,000	$680,000	$22,900,000

State/Support Agency Acceptance

NYSDEC concurs with the preferred remedial alternative.

Community Acceptance

Community acceptance of the preferred remedial alternative will be evaluated after the public comment period ends and will be described in the ROD for OU1 of the Site. The ROD is the document that formalizes the selection of the remedy for a site.

PREFERRED REMEDY

Based upon an evaluation of the remedial alternatives, EPA, and with the concurrence of NYSDEC, proposes Alternative 5, Hybrid Alternative – In-well Vapor Stripping / Groundwater Extraction and Treatment; In-situ Chemical Treatment as the Preferred Remedial Alternative. Alternative 5 has the following key components: in-situ treatment of groundwater via in-well vapor stripping and treatment of vapor-phase contamination at an on-Site central treatment plant; extraction of groundwater via pumping and ex-situ treatment of extracted groundwater prior to discharge to a POTW or reinjection to groundwater; use of in-situ chemical treatment such as ISCO to target high concentration contaminant areas, as appropriate; and long-term monitoring in conjunction with implementation of institutional controls.

Active remediation elements would be designed to establish containment and effectuate removal of contaminant mass where concentrations of total VOCs are greater than 100 µg/L. Under this flexible approach, Site-specific conditions would be taken into consideration in the design and development of the in-well vapor stripping and groundwater extraction well network. Figure 3 provides the conceptual locations of both the in-well vapor stripping and extraction wells. The exact numbers of in-well vapor stripping and extraction wells and their placement would be determined in the remedial design. An aquifer pump test would be conducted as part of the pre-remedial design to collect aquifer data that would be necessary to complete the design of the extraction and treatment component of the remedy.

The use of in-situ chemical treatment, such as ISCO to target areas containing high concentrations of total VOCs would be utilized, as appropriate, in combination with the other components of this remedy in an effort to reduce the remediation time-frames and the cost of this proposed alternative. The implementation of in-situ chemical treatment such as ISCO would be designed to enhance the remediation of the contaminated groundwater in conjunction with the in-well vapor stripping and extraction/treatment systems. During the remedial design it would be determined if and if so, how best to execute in-situ chemical treatment with the other remedial technology components of this preferred remedial alternative. In-situ chemical treatment would only be utilized if a determination is made during the remedial design that the application would not adversely affect the public supply wells.

A centralized treatment plant with the capacity to achieve contaminant mass removal and containment objectives of the remedy would be constructed. EPA estimates that a capacity of 350 gpm would be required. The extracted groundwater would be treated for total VOC removal with either liquid phase GAC, air stripping, or both. Treated groundwater effluent would be discharged to a POTW or reinjected to groundwater. The method of discharge and discharge location would be determined once additional design information has been generated in the remedial design phase. The design of the treatment plant would take discharge requirements into account. Once additional design information has been generated, the location of the treatment plant and reinjection points would be further discussed with local and county officials.

Both the extraction and treatment system and the in-well vapor stripping system will operate until performance standards are attained at OU1, which EPA's July 2013 OU1 Supplemental FS Memorandum estimated to take 30 years. A more detailed process design to determine the actual number of extraction and in-well vapor stripping wells required to reach RAOs would be determined during the pre-remedial design phase.

The environmental benefits of the preferred remedial alternative may be enhanced by giving consideration, during the design to technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Energy Policy[7]. This would include consideration of green remediation technologies and practices, including GAC regeneration.

A long-term groundwater monitoring program would be implemented to track and monitor changes in the groundwater contamination in OU1 to ensure the RAOs are attained. The results from the long-term monitoring program would be used to evaluate the migration and changes in VOC contaminants over time. The long-term monitoring program would include sampling from two existing, early warning monitoring well clusters and an evaluation of potential impacts to the Bowling Green supply wells. The long-term monitoring program may be optimized accordingly. As additional groundwater data become available, EPA would continue to consider the soil vapor intrusion pathway for OU1. Vapor mitigation systems would be installed, if warranted.

Institutional controls to restrict groundwater extraction and/or consumption are incorporated into this remedy for protection of human health and the environment over the long term. A plan would be developed which would specify institutional controls to ensure that the remedy is protective. Existing local requirements that prevent installation of drinking water wells and informational devices to limit exposure to contaminated groundwater would be implemented

Individual facilities within the NCIA are considered to be among the sources of groundwater contamination for OU1 and continue to be addressed under NYSDEC State Superfund program. Response actions at NCIA facilities are not the focus of this OU1 remedy, although successful completion (*i.e.*, source control or remediation) of the source area(s) at the individual NCIA facilities, under NYSDEC oversight, are essential to the full realization of the objectives of the preferred remedial alternative in this Proposed Plan. In the event that source control is not successfully implemented, EPA may elect to evaluate additional options at individual NCIA facilities pursuant to CERCLA to ensure the effectiveness of the preferred alternative.

While this alternative would ultimately result in reduction of contaminant levels in groundwater such that levels would allow for unlimited use and unrestricted exposure, it is anticipated that it would take longer than five years to achieve these levels. As a result, in accordance with CERCLA, the Site is to be reviewed at least once every five years until performance standards are achieved and unrestricted use is permissible.

Basis for the Remedy Preference

While Alternative 3, in-well vapor stripping and Alternative 4, extraction and treatment, are both proven technologies to actively remediate VOC-contaminated groundwater, there are difficulties at this Site associated with each of these remedial technologies in addressing the groundwater contamination.

Relying exclusively on in-well vapor stripping as envisioned under Alternative 3 would be difficult in a densely populated and developed residential setting. Alternative 3 would require the installation of large numbers of wells and associated infrastructure which would result in a significant disruption in the largely residential area. In addition, the depth of the deepest contamination (estimated between approximately 285 to 502 feet bgs) increases the design challenges of the in-well vapor stripping system. Limits on the hydraulic depth to which the compressed air can be injected into the aquifer could result in air stripping being conducted over only a portion of the treatment well. Anisotropic aquifer conditions potentially present in portions of the aquifer could reduce the potential for an in-well stripping well to establish a groundwater circulation cell across the

[7] See http://epa.gov/region2/superfund/green_remediation.

treatment zone of the aquifer.

Utilizing extraction and treatment as the primary remedial technology in Alternative 4 increases the volume of extracted groundwater that would require ex-situ treatment and handling, thereby increasing both the capital costs and annual operations and maintenance costs without providing a significant reduction of TMV of contaminants relative to Alternative 5.

EPA is proposing Alternative 5, a hybrid of in-well vapor stripping and extraction and treatment as the preferred remedial alternative because a combination of these two active remedial technologies could be designed to utilize the different technologies effectively across a large area of groundwater contamination, based upon location-specific conditions (*i.e.*, depth to treatment, concentration levels). Utilizing both in-well vapor stripping and extraction and treatment would additionally provide cost saving measures by reducing capital costs associated with installing independent remedial systems. Each of the treatment components would be optimized during the remedial design to improve treatment effectiveness or decrease the remedial time frame.

This approach in Alternative 5 is expected to be particularly effective as the total VOC contaminant plumes in the OU1 eastern plume and portions of the western plume are more extensive laterally and/or vertically (greater than 250 feet bgs). For the OU1 eastern and portions of the western plume, use of extraction and treatment is a proven technology which is effective at reducing contaminant mass and providing containment of the contaminant plume under these conditions. In the OU1 central plume, where the contaminant plume is generally less extensive laterally and vertically and generally has lower concentrations of total VOCs, and in portions of the western plume, in-well vapor stripping is expected to be more effective. If during the remedial design investigation activities it is determined that in-well vapor stripping would not be an effective technology at addressing contamination at the OU1 central and portions of the western plume, then the existing extraction and treatment system under Alternative 5 would provide the opportunity to utilize that active remedial technology in those areas as well.
Access to install the in-well vapor stripping wells and the extraction wells under the preferred remedy, Alternative 5, though still complicated, is more manageable. Construction of the treatment plant would be sited in an area that is not zoned residential.

Under the proposed alternative, in-situ chemical treatment, such as ISCO, would be used to target areas containing high concentrations of total VOCs (greater than 10,000 µg/L). It would, as appropriate, be utilized in combination with groundwater extraction or in-well vapor stripping in an effort to reduce the remediation time frames by more effectively reducing the contaminant mass of total VOCs and, therefore, the costs of this alternative.

EPA, with the concurrence of NYSDEC, has concluded that Alternative 5, Hybrid Alternative – In-well Vapor Stripping / Groundwater Extraction and on-Site Treatment, and in-situ chemical treatment such as ISCO provides adequate protection of human health until a final remedy is selected by effectively reducing the toxicity, mobility and volume of contaminated groundwater in OU1 while providing the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. The Preferred Alternative for OU1 does not constitute the final remedy for the Site. Additional data concerning Site-related contamination, to be generated during the far-field RI, may become available prior to the implementation of the Preferred Alternative. This data may be considered during the design of the Preferred Alternative.

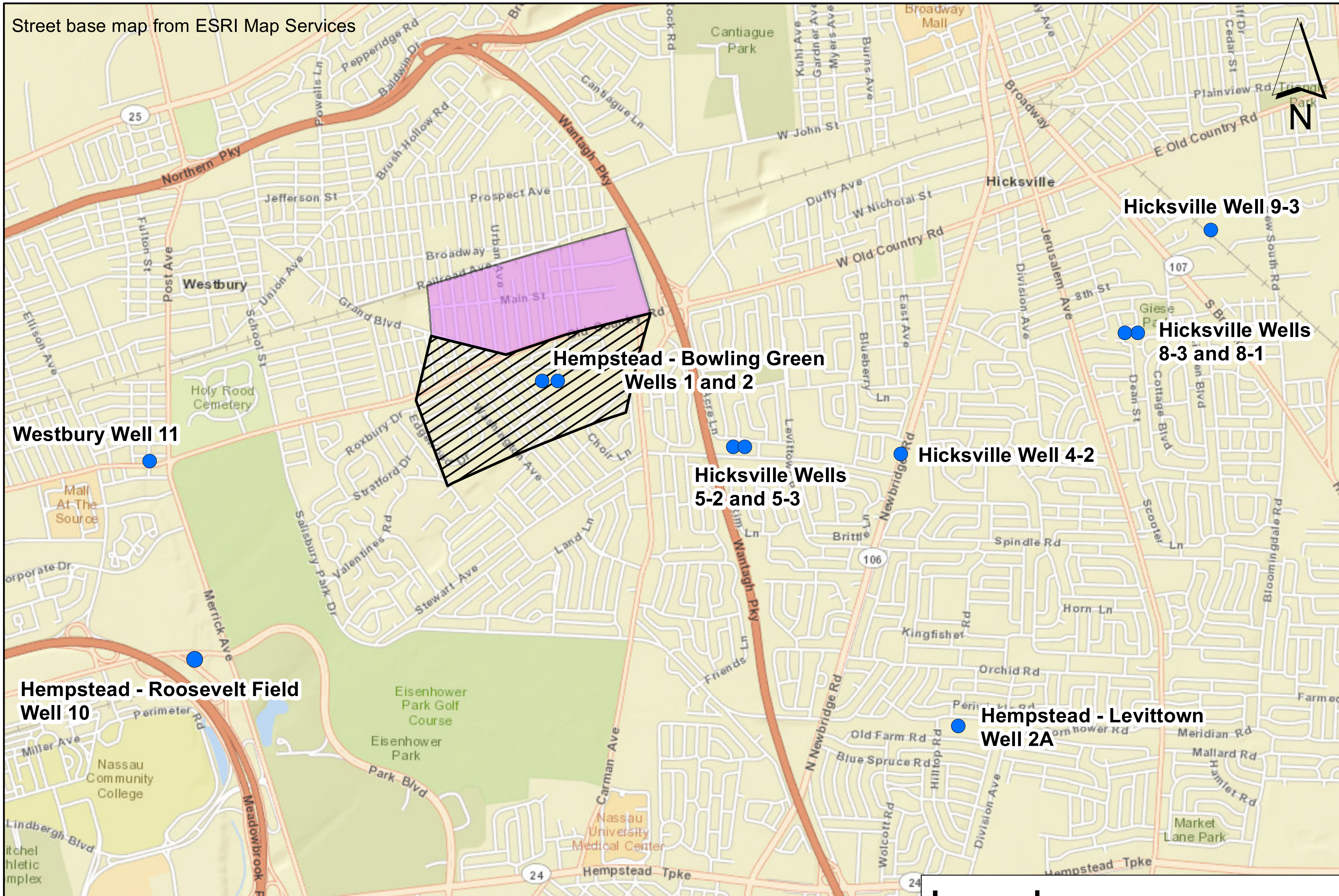
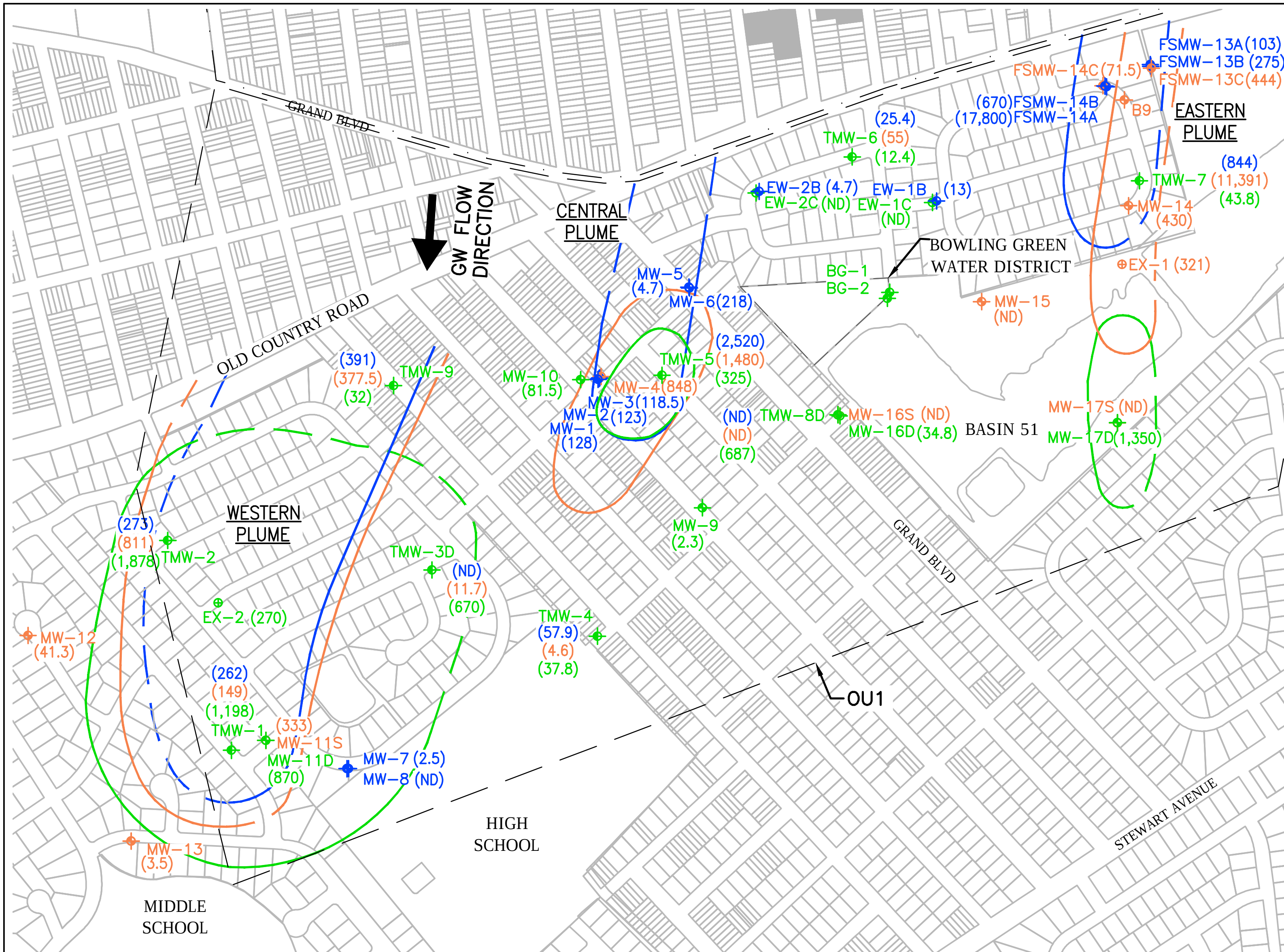


Figure 1 - Site Location
New Cassel/Hicksville Ground Water Contamination Site



LEGEND:

- TMW–7 TEMPORARY MONITORING WELL LOCATION
- MW–5 MONITORING WELL LOCATION
- LIMIT OF OPERABLE UNIT 1 (OU1)
- LIMIT OF NEW CASSEL INDUSTRIAL AREA
- SOURCE AREA PROPERTIES
- BGS BELOW GROUND SURFACE
- PPB PART PER BILLION
- ug/l MICROGRAMS PER LITER
- < 175 FEET BGS
- 175 – 250 FEET BGS
- > 250 FEET BGS
- CVOCs CHLORINATED VOLATILE ORGANIC COMPOUNDS
- (800) CVOCs CONCENTRATION AT 150 FEET BGS
- (11,000) CVOCs CONCENTRATION AT 200 FEET BGS
- (9.2) CVOCs CONCENTRATION AT 285 FEET BGS
- 100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 150 FEET BGS (DASHED WHERE INFERRED)
- 100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 200 FEET BGS (DASHED WHERE INFERRED)
- 100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 285 FEET BGS (DASHED WHERE INFERRED)

NOTES:

1. CONCENTRATIONS OF CVOCs SHOWN ARE THE SUM OF PCE, TCE, AND 1,1,1–TCA. THE SUM OF CVOC CONCENTRATIONS WERE DERIVED FROM THE MOST RECENT SAMPLE EVENT AT THE TMW OR MW LOCATION. SAMPLE DATES RANGE FROM 2008 TO 2011, EXCEPT FOR B9, WHICH WAS A BORING WHERE GROUNDWATER SAMPLES WERE COLLECTED IN 2004. FURTHER INFORMATION CAN BE FOUND IN EPA'S SUPPLEMENTAL FS MEMO DATED JULY 2013.

HDR

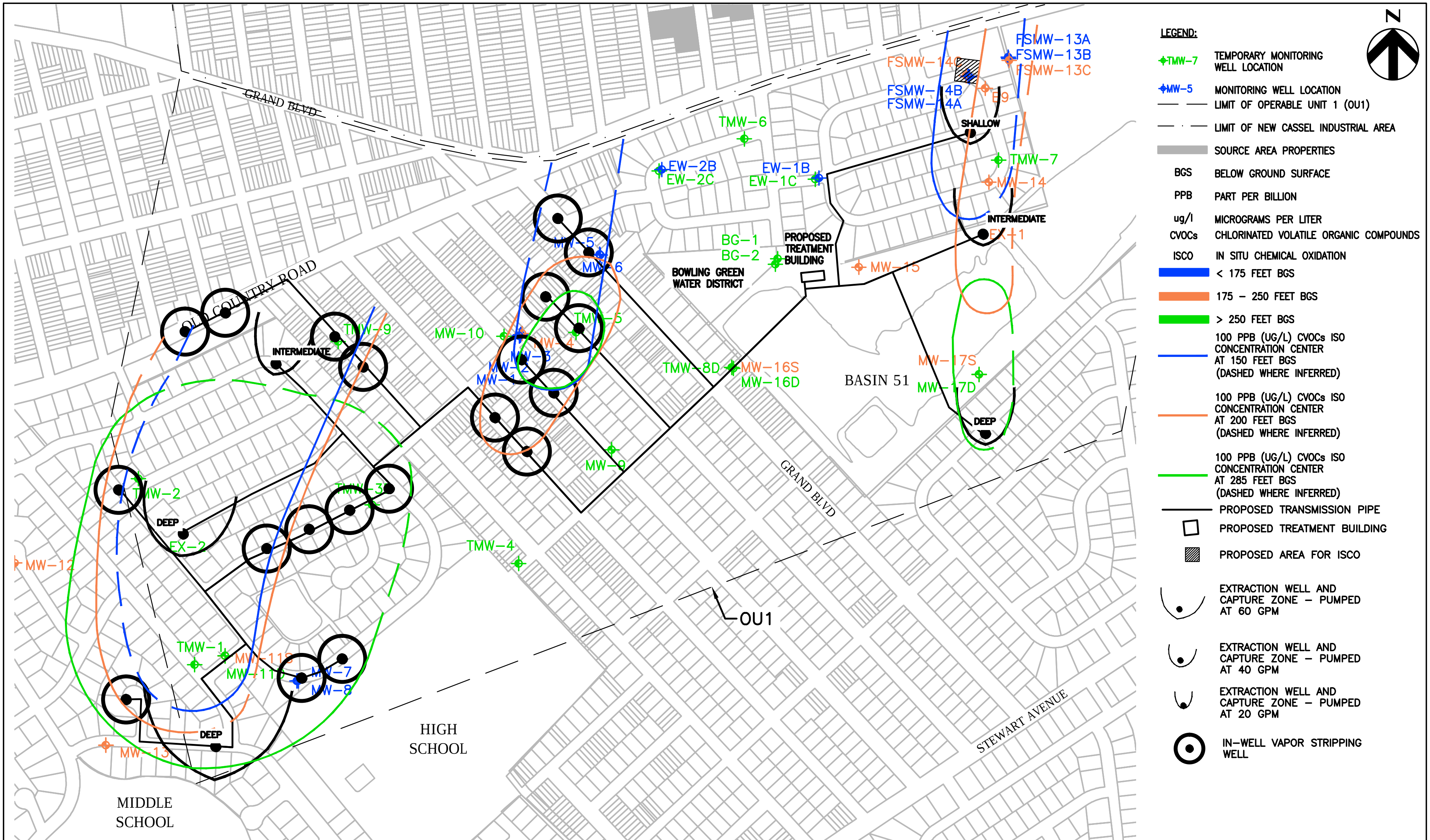
CVOCs ISO-CONCENTRATION MAP

NEW CASSEL/HICKSVILLE GROUND WATER CONTAMINATION SITE OU1

TOWNSHIP OF NORTH HEMPSTEAD AND HEMPSTEAD, NASSAU COUNTY, NY

DATE JULY 2013

FIGURE 2



1 inch = 600 ft.

HDR

ALTERNATIVE 5
COMBINED IN SITU AND EX SITU GROUNDWATER TREATMENT

NEW CASSEL/HICKSVILLE GROUND WATER CONTAMINATION SITE OU1
TOWNSHIP OF NORTH HEMPSTEAD AND HEMPSTEAD, NASSAU COUNTY, NY

DATE	FIGURE
JULY 2013	3