RECORD OF DECISION

Operable Unit One

Peninsula Boulevard Groundwater Contamination Superfund Site

Village of Hewlett, Town of Hempstead, Nassau County, New York

United States Environmental Protection Agency
Region II
New York, New York

September 2011

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Peninsula Boulevard Groundwater Contamination Superfund Site
Village of Hewlett, Town of Hempstead, Nassau County, New York

Superfund Site Identification Number: NYD000204407
Operable Unit: 01

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Environmental Protection Agency's selection of a groundwater remedy for the Peninsula Boulevard Groundwater Contamination Site, chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. Section 9601, *et seq*., and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300. This decision document explains the factual and legal basis for selecting a remedy to address the contaminated groundwater at the Site. The attached index (see Appendix III) identifies the items that comprise the Administrative Record, upon which the selected remedy is based.

The New York State Department of Environmental Conservation (NYSDEC) was consulted on the planned remedy in accordance with CERCLA Section 121(f), 42 U.S.C. Section 9621(f), and NYSDEC concurs with the selected remedy (see Appendix IV for the NYSDEC concurrence letter).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The response action described in this Record of Decision represents the first planned remedial phase or operable unit at the Site. It addresses groundwater contamination. The source of the groundwater contamination will be the addressed as the second remedial phase or operable unit and will be the subject of a subsequent decision document.

The major components of the selected remedy for groundwater include the following:

- Extraction of the groundwater via pumping and ex-situ treatment of the extracted groundwater prior to discharge to a publicly owned treatment works (POTW) or surface water, or reinjection to the aquifer (to be determined during design);

- In-situ chemical treatment of targeted high concentration contaminant areas, as appropriate;

- Monitored natural attenuation for those areas where active remediation is not performed;

- Institutional controls; and,

- Long-term monitoring to ensure the effectiveness of the remedy.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy meets the requirements for remedial actions set forth in CERCLA Section 121, 42 U.S.C. Section 9621, because it meets the following requirements: 1) it is protective of human health and the environment; 2) it meets a level or standard of control of the hazardous substances, pollutants, and contaminants which at least attains the legally applicable or relevant and appropriate requirements under Federal and State laws; 3) it is cost-effective; and 4) it utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. In keeping with the statutory preference for treatment that reduces toxicity, mobility, or volume of contaminated media as a principal element of the remedy, the contaminated groundwater will be treated by implementing the selected remedy.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a policy review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The ROD contains the remedy selection information noted below. More details may be found in the Administrative Record file for this Site.

- Contaminants of concern and their respective concentrations (see ROD, page 9 and Appendix II, Tables 11);

- Baseline risk represented by the contaminants of concern (see ROD, pages 15−18);

- Cleanup levels established for contaminants of concern and the basis for these levels (see ROD, Appendix II, Table 11);

- Manner of addressing source materials constituting principal threats (see ROD, page 34);

- Current and reasonably-anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (see ROD, page 14);

- Potential land and groundwater use that will be available at the Site as a result of the selected remedy (see ROD, page 38);

- Estimated capital, annual operation and maintenance, and present-worth costs; discount rate; and the number of years over which the selected remedy cost estimates are projected (see ROD, pages 26 and Appendix II, Table 13); and

- Key factors used in selecting the remedy (*i.e.*, how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (see ROD, pages 34−36).

AUTHORIZING SIGNATURE

Walter E. Mugdan, Director
Emergency and Remedial Response Division
EPA – Region II

Date

DECISION SUMMARY

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SITE NAME, LOCATION, AND DESCRIPTION

The Peninsula Boulevard Groundwater Contamination Superfund Site[1] (Site) consists of the area within and around a groundwater plume located in the Village of Hewlett, Town of Hempstead, Nassau County, New York. John F. Kennedy International Airport is located approximately three miles to the west of the Site. A Site location map is provided as Figure 1.

The area consists of a mix of commercial and residential properties, with the majority of the commercial properties being located along Mill Road, Peninsula Boulevard, Broadway, and West Broadway. Woodmere Middle School is located along the western Site boundary. Portions of Motts Creek, Doxey Brook Drain, and an unnamed tributary leading to Motts Creek are located within the Site area. The unnamed tributary and Doxey Brook Drain are classified by the New York State Department of Environmental Conservation (NYSDEC) as Class C streams. NYSDEC Classification C is for waters which support fisheries and are suitable for non−contact activities. The unnamed tributary and Doxey Brook Drain merge and eventually drain into Motts Creek (also a Class C stream) at the very northern portion of the Site boundary.

Topographically, the Site slopes north and west toward Doxey Brook Drain and Motts Creek with surface elevations decreasing from approximately 20 feet (ft) above mean sea level (msl) near the southern border of the Site to approximately one foot above msl in the vicinity of Doxey Brook Drain and the nearby Long Island American Water Company (LIAWC) property to the north.

LIAWC operates its Plant #5 Well Field on property located within approximately 1,000 ft of the northern boundary of the study area. LIAWC has been monitoring and treating groundwater pumped from this well field since 1991, and continues to maintain monitoring and treatment activities to address both iron fouling, a common and naturally-occurring problem for Long Island water suppliers, and volatile organic compound (VOC) contamination.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

A series of investigations and removal actions performed by NYSDEC from 1991 to 1999 at the former Grove Cleaners site revealed an extensive groundwater contaminant plume extending both to the north and south of Peninsula Boulevard, primarily consisting of the chlorinated volatile organic compound tetrachloroethylene (PCE).

[1] The Site's Superfund Site Identification Number is NYD000204407. The U.S. Environmental Protection Agency is the lead agency; the New York State Department of Environmental Conservation is the support agency.

The results of these investigations determined that operations at the former Grove Cleaners, located at 1274 Peninsula Boulevard, from 1987 to 1992 resulted in the disposal of hazardous wastes, including the VOCs PCE and trichloroethylene (TCE) to the environment. In March 1991, the Nassau County Department of Health (NCDH) cited Grove Cleaners for discharging hazardous waste into on-site dry wells. PCE was detected in soil and sludge samples collected at the Grove Cleaners site, and in other media at and near the property. The results of the investigation suggested the potential for additional source areas other than the former Grove Cleaners site. Following the implementation of interim remedial measures, which consisted of the removal of impacted soils related to solvent discharge to a dry well, a No Further Action remedy was selected by NYSDEC in March 2003 for the former Grove Cleaners site.

On March 7, 2004, the U.S. Environmental Protection Agency (EPA) proposed inclusion of the Peninsula Boulevard Site on the National Priorities List (NPL); on July 22, 2004, EPA placed the Site on the NPL.

EPA conducted a Remedial Investigation (RI) at the Site from 2005 through 2010. Environmental sampling of groundwater, surface water, soil and sediment was performed and a Data Evaluation Report (DER) presenting the results of the environmental sampling was prepared in October 2008. Supplemental RI work was conducted in 2010 to address data gaps, including hydrogeological sampling and analyses, and to develop a baseline human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA). A DER Addendum was issued in December 2010 presenting the results of this sampling. A RI Report was released in June 2011.

The RI identified groundwater contaminated with PCE, PCE breakdown products and low levels of other VOCs. The source of the PCE groundwater contamination has not yet been identified.

To date, no Potentially Responsible Parties (PRPs) have been identified.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The 2011 RI and Feasibility Study (FS) reports and the Proposed Plan for the contaminated groundwater at the Site were released to the public for comment on July 28, 2011. These documents were made available to the public at information repositories maintained at the Hewlett Library in Hewlett, New York and the EPA Region II Office in New York City. The notice of availability for the above-referenced documents was published in the *South Shore Herald* on July 28, 2011. The public comment period ran from July 28, 2011 to August 27, 2011. On August 3, 2011, EPA conducted a public meeting at the Hewlett High School to inform local officials and interested citizens about the Superfund process, to present the Proposed Plan for the Site, including the preferred groundwater remedial alternative, and to respond to questions and comments from the approximately 20 attendees. Responses to the questions and comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary (see Appendix V).

SCOPE AND ROLE OF THE OPERABLE UNIT

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), at 40 CFR Section 300.5, defines an operable unit as a discrete action that comprises an incremental step toward comprehensively addressing site problems. A discrete portion of a remedial response eliminates or mitigates a release, threat of a release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site.

The work at the Site has been divided into two operable units. Operable Unit 1 addresses the cleanup of the contaminated groundwater and is the subject of this ROD. Operable Unit 2 addresses the delineation of the source of the contaminated groundwater.

The primary objectives of this action are to restore groundwater quality at the Site to drinking-water standards and to minimize any potential future health and environmental impacts from the groundwater.

SUMMARY OF SITE CHARACTERISTICS

EPA collected environmental data during the RI and other sampling efforts in order to determine Site characteristics, as well as gain information to perform a Risk Assessment. RI-related sampling of groundwater, surface and subsurface soil, surface water, sediment, and soil vapor on and around the Site was conducted in several phases from 2005 to 2010.

This ROD addresses the contaminated groundwater at the Site, the characteristics of which are summarized in this section and the "Summary of Site Risks" section, below. The results of the vapor-intrusion investigation, conducted simultaneously with the RI, are also detailed below.

Site Geology/Hydrogeology

The Site is situated within the Atlantic Coastal Plain Physiographic Province in the southwestern corner of Long Island, New York. The geologic conditions of the island are primarily the result of cycles of advancement and retreat of continental glaciers approximately 10,000 years ago. Sediments associated with the glacial periods include deposits of till, ice-contact stratified drift, outwash materials, and various other mixtures of sediments.

The stratified drift and till deposits are concentrated from the terminal moraines in the center of the island and are present northward to the north shore of the island. Unconsolidated Pleistocene-age strata consisting mostly of outwash deposits are present between the moraine sand the south shore of the island, where they overlie Cretaceous-age, marine-derived sediments and Pre-Cambrian bedrock Cretaceous-age deposits range from the late Cretaceous Raritan Formation, composed of an upper clay member (Raritan clay) and a lower sand member (Lloyd aquifer); to the Magothy-Matawan group, which overlies the Raritan Formation. The Magothy is composed of deltaic quartzose sand of continental origin with some interbedded clay and silt. This formation represents one of the important water bearing units that comprise Long Island's water supply aquifers.

Overlying the Magothy-Matawan group in portions of Long Island is the Jameco Gravel formation. The Jameco is the earliest of the Pleistocene deposits in the region, and has only been detected in Kings, southern Queens, and southeastern Nassau County. The thickness of this unit is highly variable owing to its origin as a channel fill deposit within a diversion pathway for the Hudson River. At one time, the course of the river was through what is now the southwestern end of Long Island.

Above the Jameco Gravel is a blue-grey clay layer, the Gardiners Clay, which forms a confining layer over the Jameco and Magothy-Matawan group in areas of the island. The Gardiners was deposited in a marine environment during an interglacial period in the Pleistocene. This unit is the deepest encountered during previous phases of the investigation at the Site, with some of the deeper borings completed at the interface between the Gardiners Clay and the overlying unconsolidated Pleistocene deposits. The sediments above the Gardiners Clay are Pleistocene deposits forming the Upper Glacial Aquifer (UGA), the shallowest aquifer on the island.

The UGA consists primarily of meltwater-derived coalescing sheets of sand and gravel forming an outwash plain that extends southward from the terminal moraines to the Atlantic shore. In the vicinity of the Site, the UGA includes a thin layer of marine clay (as indicated by the presence of marine shells and plant remains), locally referred to as the “20-foot clay”, which was deposited during a phase of warmer climate within the Pleistocene glaciation. The “20-foot clay” thickens southward on the Site. Over approximately the southern half of the Site, available data indicated that it forms a clay layer thick enough to interrupt the hydraulic connection between the shallow and deep portions of the UGA, and thereby, it is thought to effectively result in semi-confined conditions for the deeper UGA in this localized area.

The 2008 DER and the 2010 field investigation indicate that the “20-foot clay” is actually a clayey silt and its competency increases southward across the Site. South of Peninsula Boulevard it appears to act as confining unit and is encountered at depths ranging from 20 to 40 ft. The unit thins significantly to about a one-foot thickness in the northern portion of Site, based on analysis of geophysical logging of the re-drilled LIAWC wells at Plant #5, located just north of the Site. This unit may completely pinch out in the vicinity of the Plant # 5 Well Field. This combination of discontinuity and a significant silt fraction, rather than pure clay, indicates that it is not a complete confining layer but is likely a semi-confining unit, with that level of confinement being lost in the vicinity of the LIAWC Well Field.

The surficial and shallow subsurface geology in the Site includes a combination of pavement, gravel subgrade, and reworked native soils covering the ground surface. Where present, fill materials typically extend to a depth of approximately one foot below grade. Below the fill layer there are sporadic layers of peat, organic silts and fine sands, as noted at several subsurface locations near Peninsula Boulevard. Where present, these layers were encountered at a depth of approximately four to eight ft below grade surface (bgs) and exhibited a maximum thickness of approximately four ft. These layers of organic material may correlate with a former creek channel located in the vicinity of the Grove Cleaners site.

The geology and hydrostratigraphic units encountered during the 2010 supplemental RI field activities were very similar to what was reported from previous investigations conducted at the Site. The 2010 investigation focused on the Pleistocene units, with samples collected during intrusive activities to the top surface of the Gardiners Clay (at depth), upward through the lower portion of the UGA, into the 20-foot clay, and continuing upward to the surface through the shallow interval of the UGA.

On a regional basis, the groundwater regime in this area of Long Island is dominated by a groundwater divide located approximately 2000 ft south of Peninsula Boulevard, along a low ridge trending southwest to northeast. Groundwater in the UGA north of the divide exhibits flow with both northerly and westerly components. This depth-dependent variability in flow direction within the UGA is supported by water level data collected from wells completed in the shallow, unconfined and deeper, semi-confined intervals of the UGA. South of the divide, groundwater flow within the UGA appears to trend southward toward Macy Channel.

In this area of Long Island, the Jameco gravel, despite its limited extent, is a water-bearing zone of primary importance, due to hydraulic conductivity values on the order of 200 feet per day (fpd). The LIAWC Plant #5 Well Field adjacent to the Site utilizes the Jameco as its source aquifer. North of the Site, the UGA directly overlies the Jameco. Given the similar hydraulic properties of the UGA and Jameco, there is the potential for significant hydraulic connection between the two units, with data from a broader area of Long Island indicating that to be the case. However, as noted above, new data obtained as a result of supplemental RI activities indicate that the Gardiners Clay acts as a confining unit in the localized area of the Site and the LIAWC Well Field.

At the Site, previously conducted drilling, sampling, and aquifer tests have focused on the unconfined and semi-confined portions of the UGA. In-situ hydraulic testing and aquifer pump tests indicate horizontal hydraulic conductivity values for the on-site UGA material in the unconfined portion of the aquifer on the order of 5 fpd, with individual test results yielding values as high as 155 fpd. In the deeper portion of the UGA, horizontal hydraulic conductivity values of approximately 40 to 50 fpd were calculated, with individual tests results up to 200 fpd. The interbedded nature of sediments in the UGA suggests significant vertical and horizontal variability in hydraulic conductivity values would be anticipated. Based on previous measurements conducted during drilling and testing at the Site, the depth to groundwater within the unconfined portion of the UGA ranges from approximately three to 15 ft bgs, while ranging from six to 17 ft bgs in the semi-confined portion of aquifer. Saturated thickness of the unconfined UGA above the “20-foot clay” layer ranges from 10 to 30 ft. Saturated thickness of the deeper portion of the UGA below the 20-foot clay, including the pressure head component imparted by the semi-confined conditions, is approximately 55 to 65 ft.

Groundwater elevation data collected from monitoring well clusters installed during the RI suggest that a significant downward vertical gradient exists between the unconfined and semi-confined portions of the UGA, especially toward the southern end of the Site along Broadway and West Broadway, where vertical gradients on the order of -0.1 ft/ft were calculated. Previous monitoring of water levels from on-site wells does not indicate that tidal fluctuation of the water table occurs at the Site. No significant change was noted from manually collected water levels over a period encompassing at least one tidal cycle. Pressure transducer readings collected from other wells on-site likewise exhibited no tidal signature over the period of record.

The groundwater hydraulics at the Site primarily focus on the characteristics of the UGA. In general, groundwater hydraulics are a function of the potentiometric (i.e., hydraulic head) gradient and physical parameters or hydraulic conductivity of the aquifer. At the Site, the UGA is divided into two similar, yet distinctly different regimes. These upper and lower sub-units are divided by the discontinuous "20-foot clay". For wells completed in the upper portion of the UGA, groundwater elevations are indicative of a typical unconfined, water table aquifer. In the deeper portions of the UGA, below the "20-foot clay", groundwater-elevation measurements are similar to or lower than shallower wells at the same location, suggesting that, due to areal discontinuity, the "20-foot clay" does not constitute a fully confining unit between the sub-units of the UGA.

Groundwater Sampling

The RI groundwater sampling and chemical analyses were performed using two different methods, temporary well points and groundwater monitoring wells. The RI also included membrane interface probe (MIP) assessments and the hydraulic (slug) testing of wells. Exhibits summarizing the groundwater analytical data for the RI are presented as Tables 1A-1D**.**

A direct-push MIP investigation was conducted in 2006 and 2007 in the vicinity of the known extent of the groundwater plume (i.e., the plume was noted to be located approximately along Hewlett Parkway, running in a north-south direction across Peninsula Boulevard) , to evaluate subsurface conditions and target sampling intervals for discrete groundwater (Hydropunch®) sampling. The direct push investigation was conducted using MIP in conjunction with an electrical conductivity (EC) probe. The EC probe provided real-time stratigraphic data to supplement the data obtained from the MIP. The MIP system provided real-time, in-situ, qualitative borehole logging data utilizing an electronic capture detector (ECD), a flame ionization detector (FID), and photoionization detector (PID) to evaluate the presence of various VOCs in the subsurface.

MIP technology was used at 65 locations to provide real-time field data. The MIP screening was conducted along transect lines, with each transect starting at the center of the plume and proceeding outward at 150-foot intervals until the suspected boundary of the plume was encountered. Obtaining the data in this manner allowed for a better understanding of the nature and extent of the contaminant plume, provided screening level results to enhance the selection of the groundwater monitoring points and sampling intervals, and provided the project team with current information to support critical on-site decisions on the field sampling.

The MIP/EC probe was advanced through unconsolidated material to an approximate depth of 75 ft bgs using a direct-push drill rig. The resulting data was used to evaluate the appropriate intervals for subsequent Hydropunch® groundwater sampling. Specifically, the MIP data was used to target groundwater sampling intervals in such a way as to "bracket" the plume both horizontally and vertically. At a minimum, the MIP data was used to target groundwater sampling intervals to quantify concentrations at the top of the plume, the mid-depth of the plume, and the bottom of the plume, if evidence of the plume being present (i.e., elevated VOC-related readings) was encountered. Hydropunch® groundwater samples were collected at the plume boundaries to confirm the horizontal extent of the plume. A minimum of three groundwater samples were collected from each sampling location where MIP results indicated the presence of contamination. If no evidence of a VOC contaminant plume was encountered, a groundwater sample was collected from a depth corresponding to the highest measurable VOC response detected in the nearest MIP boring. The locations of the Hydropunch® samples are shown on Figure 2.

The Hydropunch® groundwater samples were analyzed for VOCs on-site by a field gas chromatography (GC). Fifteen groundwater samples were sent off-site to be analyzed in an USEPA Contract Laboratory Program (CLP) Routine Analytical Service (RAS) laboratory. In addition, to evaluate the precision of the field GC methodology, 25%, or 44, of these samples were split and sent to an EPA-approved laboratory for analysis for quality assurance purposes.

Twenty monitoring wells and ten piezometers were installed at the Site in 2007 to evaluate groundwater quality, to determine groundwater and surface water interaction, and provide hydrogeologic flow data.

Twelve of these twenty monitoring wells were installed as six monitoring well couplets consisting of a shallow (well screen located approximately 30 ft below grade or above) and deep (well screen located approximately 60-80 ft below grade or deeper) wells. The well couplets were placed at locations MW-10, MW-13, MW-15, MW-18, MW-21, and MW-22. The couplets were spaced approximately 500 ft apart along a transect running the long north-south axis ("spine") of the PCE plume, parallel to groundwater flow.

Seven of the remaining eight monitoring wells were screened from 15 to 25 ft bgs (MW-14, MW-16, MW-17, MW-19, MW-11, MW-12, MW-20). Monitoring well MW-23 was screened at 35 ft bgs. The final locations of non-couplet wells were determined in the field, dependent on the findings of the MIP screening and the Hydropunch® groundwater sampling. These wells were generally located along the plume boundaries to help define and monitor the horizontal and vertical extent of the plume.

The horizontal placement of the piezometers was based on data from previous studies, data obtained during the MIP/EC screening phase, and data obtained during the Hydropunch® sampling. Piezometers were placed to assist in the collection of groundwater level measurements. The depth of the piezometers ranged from 15 to 20 ft bgs. Some piezometers were located outside the plume boundaries to provide a detailed assessment of groundwater flow direction. The locations of the wells and piezometers are shown on Figure 3.

Twenty-six monitoring wells were installed at the Site and several rounds of sampling were conducted in 2007, 2008, 2010, and 2011. Analytical results for these samples were compared to the EPA and New York State Department of Health (NYSDOH) promulgated health-based protective Maximum Contaminant Levels (MCLs), which are enforceable standards for various drinking water contaminants.

Groundwater contamination exceeding applicable drinking water standards has been shown to exist within the Site plume area, at highly elevated concentrations in some areas. Seven VOCs were detected at concentrations exceeding applicable criteria. Chlorinated VOCs (CVOCs), PCE in particular, were identified as the plume-related contaminants of concern for the shallow and deep portions of the UGA at the Site. Specifically, PCE was detected at levels up to 30,000 micrograms per liter (µg/l) and TCE at concentrations up to 10,000 µg/l. Table 1 presents the maximum concentration detected for all analytes sampled in the groundwater.

The results of the RI indicate that the shallow and deep portions of the UGA have been impacted by CVOC contamination. The shallow UGA groundwater (0 to 30 ft bgs) PCE plume is approximately 3,500 ft long, oriented in a north-south direction. South of Peninsula Boulevard (upgradient), the plume is approximately 1,000 ft wide and north of Peninsula Boulevard (downgradient) the plume is approximately 400 ft wide. The deep UGA (40 to 75 ft bgs) groundwater plume is approximately 1,110 feet long and 400 ft wide, oriented in a northeast-southwest direction (see Figures 4 and 5).

In October 2010, EPA collected a total of five groundwater samples from new production wells (re-drills) in the LIAWC Plant #5 Well Field. The following VOCs were detected in the analysis of these samples: chloromethane, chloroform, MTBE, PCE, and toluene. None of the concentrations detected exceeded groundwater criteria or drinking water standards.

Information obtained from LIAWC and the results of EPA's sampling at the new production wells located on the LIAWC Plant #5 property in October 2010 indicate that the Plant #5 Well Field has contamination similar to that found in the Site plume and, therefore, may have been impacted by the contamination from the Site.

Since 1991, LIAWC has been treating groundwater pumped from this well field with an air stripper prior to distribution. The treated groundwater is tested and monitored by LIAWC in accordance with New York State and Nassau County rules and regulations. No MCL exceedances of CVOCs in water distributed to the general public have been identified.

The results of the RI indicate that the potential for natural attenuation of chlorinated compounds varies across the Site. PCE daughter products were not consistently detected in the same groundwater wells as PCE. Given site-specific conditions, natural attenuation of CVOCs does not appear to be a dominant process in the subsurface.

Surface Water Sampling Results

Five surface water samples were collected within the Site plume boundary. The sixth sample was collected at an off-site location. The six surface water samples were analyzed for VOCs, SVOCs, and metals. The laboratory analytical results were compared to the Chapter X, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Part 703.5, Table 1, Class C.

PCE and TCE were detected in all six of the surface water samples. PCE was detected at concentrations between 3.3 - 49 ug/l; and TCE between 0.32 - 4.3 ug/l. The highest concentrations of PCE and TCE were found at the unnamed tributary to Mott's Creek. The sample with the lowest concentration of both PCE and TCE was located off-site.

VOCs, SVOCs and metals were not detected in concentrations above the Surface Water Quality Standard in any of the six samples analyzed.

Sediment Sampling Results

Five sediment samples were collected within the plume boundary and a sixth sample was collected off-site. The six sediment samples were analyzed for VOCs, SVOCs, pesticides and metals. The VOC, SVOC and pesticide results were compared to the NYSDEC Technical Guidance for Screening Contaminated Sediments, Table 1, Human Health Bioaccumulation, Sediment Criteria. Human health-based sediment criteria for the plume-related compounds (and other VOCs detected) were not available. The metals results were compared to the NYSDEC Technical Guidance for Screening Contaminated Sediments, Table 2, Lowest Effect Level and Severe Effect Level. No Site related contaminants were detected above the criteria

Six SVOCs were detected in one or more samples above the criteria. Dichlorodiphenyldichloroethane (DDD) was detected above the criteria in four of the samples; dichlorodiphenyldichloroethylene (DDE) in two samples and dichlorodiphenyltrichloroethane (DDT) in one sample.

Metals detected above their constituent criteria include cadmium, copper, lead, mercury and zinc. Cadmium concentrations ranged from 0.46 - 0.89 parts per million (ppm); copper, 5.5- 37 ppm; lead, 15-140 ppm; mercury, 0.034-0.49 ppm; and zinc from 18-180 ppm.

Samples collected from the unnamed tributary to Mott's Creek and the Doxey Brook Drain exhibited the highest number of metal exceedances. The off-site sediment sample generally had similar or lower concentrations of analytes detected.

Interstitial Water Sampling Results

Five interstitial water samples were collected within the Site plume boundary and a sixth sample was collected off-site. The six interstitial water samples were analyzed for VOCs. The laboratory analytical results were not compared to any criteria, as none are directly applicable.

VOCs were detected in all of the interstitial water samples, except the sample located in Motts Creek. Plume-related VOCs, PCE and TCE, were detected. PCE and TCE were detected in 3 samples PB-DBW01-01, PB-DBW02-01, PB-DBW03-01; PCE was also detected in an additional sample. PCE was detected at concentrations between 0.13 - 15 µg/l; TCE between 0.2 – 1.6 µg/l.

Vapor Intrusion

EPA is investigating the soil vapor intrusion pathway at the Site. VOC vapors released from contaminated groundwater and/or soil have the potential to move through the soil and seep through cracks in basements, foundations, sewer lines and other openings.

EPA conducted vapor intrusion sampling at fifteen residences at the Site. EPA drilled through the slabs in the basements and installed ports in order to sample the soil vapor under these residences. Samples of this air from beneath the slab, and referred to as "sub-slab samples" were collected at a slow flow rate over a twenty-four hour period. Samples were also collected outside several residences to determine if there were any outdoor sources that may impact indoor air. These samples were then sent to a laboratory for analyses. The results of the analyses indicated that one residence had concentrations of VOCs at or above EPA Region 2 screening levels in sub-slab.

In July 2008, sub-slab, indoor air and ambient air samples were collected from two residential locations not previously sampled, in addition to one of the initial nine residential properties sampled in March 2008. This sampling indicated that the same residence had concentrations of PCE and TCE in the sub-slab and indoor air at or above EPA Region 2 screening levels.

EPA performed additional vapor intrusion sampling in February 2009, collecting sub-slab, indoor air and ambient air samples from four residences, including the residence

with elevated levels of VOCs. VOCs were found at concentrations at or above EPA Region 2 screening levels in sub-slab and indoor air at the residence of concern. EPA installed a sub-slab depressurization system at this residence on July 28, 2009 to mitigate the impacts of soil vapor intrusion by reducing or eliminating vapor entry into the building. EPA sampled indoor air in this residence in February 2010 and PCE was not detected.

EPA sampled sub-slab, indoor air and ambient air at four residences in March 2011, including the one residence which has an operational a sub-slab depressurization system. The results of these analyses indicate that two residences have concentrations of PCE in the sub-slab (including the residence with the sub-slab depressurization system) at or above EPA Region 2 screening levels. Future monitoring will be conducted.

In addition to sampling residences for soil vapor intrusion, EPA sampled the North Woodmere Middle School in 2004 using a mobile laboratory to analyze the results. PCE was not detected in the basement, the area through which vapors would enter the building if there were vapor intrusion impact from the groundwater plume (there is no slab in the basement, but a dirt floor). No PCE was detected in the classrooms or the auditorium. Trace levels of PCE were detected in the art room and in the drains in a bathroom (possibly from art supplies and personal hygiene products such as hair gel). The trace levels detected (0.15 - 0.35 parts per billion or ppb) do not pose any health concern.
To date, sub-slab soil gas and/or indoor air samples have been collected and analyzed from fifteen residential locations. EPA will continue to investigate the soil vapor intrusion pathway at the Site.

Contamination Fate and Transport

The migration of plume-related VOCs has most probably occurred from unknown disposal activities at formerly and currently operating dry cleaners in the area of the Site. The discharge of commercially-used products, i.e., PCE used by dry cleaning operations through uncontrolled disposal methods such as Class 5 Underground Injection Control (UIC) dry wells is a primary mechanism of release. The behavior of chlorinated solvents (e.g., PCE and TCE) dissolved in ground water is governed by their physical and chemical properties and the nature of the subsurface through which the groundwater flows.

Contaminants may migrate through the environment via percolation of rainfall through soil to groundwater. Once mobile chemicals are discharged to the environment and are contained in soils, natural processes act to move those chemicals through the subsurface soil and groundwater. This mechanism can be enhanced through discharge of contaminants through a “delivery system” to deeper levels of soil and groundwater, such as a dry well. The pumping of wells in the area of groundwater contamination can also enhance the flow rate or modify the direction of flow in an aquifer.

The plume-related VOC contamination, including elevated levels of PCE, and to a lesser extent, TCE and cis-1,2-dichloroethene (cis-1,2-DCE), are known to have adversely impacted the UGA aquifer and have potentially impacted the public water supply wells tapping the deeper Jameco aquifer within and in the vicinity of the Site area.

The potential for Dense Non-Aqueous Phase Liquid (DNAPL) exists at the Site, based on the elevated concentrations of PCE detected at several sampling locations during the RI. PCE has a solubility of 200,000 ug/l, and may be present in the subsurface as a DNAPL at locations where the concentration of PCE in groundwater is above 1 % of its solubility (i.e., greater than 2,000 ug/l). DNAPLs are chemicals or mixtures of chemicals that have two major characteristics in common: DNAPLs are heavier than water, and they are only slightly soluble in water. These two physical characteristics mean that when released into the environment in sufficient quantity, they can move through soils and groundwater until they encounter a sufficiently resistant layer that will impede further mass vertical movement and allow the liquid to pool. Depending upon the nature of the release, the movement through the subsurface soils can be quite complex, as the liquid follows the path of least resistance, not necessarily following the groundwater flow. For example, soils considered homogenous often have subtle differences in layering that can cause a DNAPL to run and drop many times, creating a complex of thin horizontal and vertical ganglia, or stringy pools that flow vertically with gravity or horizontally along confining zones in the subsurface.

Both DNAPL soil residuals, which are the most common form of contamination or release encountered, and pools become slowly dissolving sources of groundwater and soil vapor contamination. In addition, low conductivity areas into which the DNAPL mass/or and the dissolved-phase plume have diffused or migrated can in turn become sources of low-level contamination after the DNAPL mass has disappeared.

In theory, DNAPL PCE may have accumulated at the top of the confining unit and gradually diffused through this unit to the deep UGA. The DNAPL may also have traveled northward along the surface of the Gardiners Clay to appear where our limited deep UGA data was collected.

Figure 6 depicts the current conceptual Site model which illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors.

CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

Land Use

The land use pattern at the Site is one of complete development, with large areas of impervious surfaces and little remaining natural area. The area consists of a mix of commercial and residential properties, with the majority of the commercial properties being located along principal thoroughfares of Mill Road, Peninsula Boulevard, Broadway, and West Broadway. Several hundred residences are located throughout the Site. Most residences are single-family homes. There are several small apartment buildings at the Site, as well as commercial buildings containing medical and professional offices. Approximately 24,688 people live within one mile of the center of the Site according to the 2000 Census.

LIAWC operates its Plant #5 Well Field on property located within approximately 1,000 feet of the northern boundary of the Site. All residences and commercial buildings within the Site are connected to the public-water supply.

EPA expects that the land-use pattern at the Site will not change. Figure 7 presents the Town of Hempstead Land Use Map.

Groundwater Use

Groundwater use on Long Island is dependent on the supply provided by the aquifers underlying the island. These aquifers, including the UGA, Jameco, Magothy and Lloyd, comprise a system of sole or principal source aquifers that are defined by EPA as supplying at least 50%, and in actuality providing 100% of drinking water consumed in the area overlying the aquifers. The aquifers underlying Long Island are composed primarily of sand and gravel, mixed with lesser amounts of silt and clay.

In the vicinity of the Site, adjacent to the northern plume boundary, LIAWC maintains a water supply plant (Plant #5) and well field that, along with other area LIAWC plants, provides water to a significant population of southwestern Nassau County. LIAWC utilized wells from the shallowest aquifer, the UGA, through at least the mid-1990s. There is evidence that the confining layer of the “20-foot clay” pinches out in the vicinity of Plant #5 Well Field. Information provided by LIAWC during the RI indicates that, as of September 2010, LIAWC had taken all of its UGA wells out of commission and was pumping exclusively from the Jameco at the Plant #5 Well Field.

Other LIAWC plants in the area (including Plants #9, #10, #15, and #24), located north of Plant #5 Well Field and the Site, utilize the Magothy as their source aquifer. Water supplied to the residences and businesses at the Site is a blend of water provided through a complex, integrated system of well fields and water treatment and storage plants.

SUMMARY OF SITE RISKS

A baseline risk assessment is an analysis of the potential adverse human health effects caused by the release of hazardous substances from a site in the absence of any actions to control or mitigate these under current and anticipated future land uses.

EPA's baseline risk assessment for this Site, which was part of the 2011 RI/FS report, focused on contaminants in the groundwater which were likely to pose significant risks to human health and the environment. The risk assessment for this Site, entitled Baseline *Human Health Risk Assessment for the Peninsula Boulevard Groundwater Plume Site, Village of Hewlett, Town of Hempstead, Nassau County, New York*, prepared by CH2M Hill for HDR Inc., May 17, 2011, is available in the Administrative Record.

Human Health Risk Assessment

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance exposure 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 contaminants of concern at the Site in various media (*i.e.*, soil, groundwater, surface water, sediment, 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 identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of, inhalation of, and dermal contact with contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations to which people may be exposed and the potential frequency and duration of 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 contaminant exposures and the relationship between magnitude of exposure and severity of adverse health effects are determined. Potential health effects are contaminant-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some contaminants are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one-in-ten-thousand excess cancer risk"; or, stated another way, one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime site-related excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure. For non-cancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a "threshold level" (measured as an HI of less than 1) exists below which non-cancer health effects are not expected to occur.

As part of the RI, EPA conducted a baseline risk assessment to estimate the current and future effects of contaminants on human health and the environment. A baseline risk assessment is an analysis of the potential adverse human health and ecological 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, groundwater, surface water and sediment uses. The baseline risk assessment includes a Human-Health Risk Assessment (HHRA) and an ecological risk assessment.

The cancer risk and non-cancer 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 chemicals of potential concern (COPCs), as well as the toxicity of these contaminants. Cancer risks and non-cancer health hazard indexes (HIs) are summarized.

The Site is currently a residential neighborhood, with some nearby properties designated as mixed commercial. Future land use is expected to remain the same. The baseline risk assessment began by selecting COPCs in the various media that would be representative of Site risks. The media evaluated as part of the human health risk assessment included soil (0-10 feet), groundwater, and surface water and sediment from the Doxy Brook Drain, Motts Creek and the unnamed waterway. Groundwater at the Site is designated by NYSDEC as a potable water supply. The chemicals of concern (COCs) for the Site are cis-1,2-DCE), PCE, TCE, and vinyl chloride (VC) for groundwater pathways.

The baseline risk assessment evaluated health effects that could result from exposure to contaminated media though use of groundwater for potable purposes (including inhalation of vapors in the bathroom after showering), direct exposure to groundwater in an excavation trench, wading in Site waterways, direct contact exposure to surface (0-2 ft) and subsurface soil (2-10 ft), and inhalation of vapors from surface soils. Based on the current zoning and anticipated future use, the risk assessment focused on a variety of possible receptors, including current and future recreational users, future residents, future commercial workers and future construction workers. However, consistent with the anticipated future use of the Site, the receptors most likely to be in contact with media impacted by site-related contamination [e.g., groundwater] were primarily considered when weighing possible remedies for the Site.

These include the future residents, future commercial workers and future construction workers. A complete discussion of the exposure pathways and estimates of risk can be found in the *Human Health Risk Assessment* for the Site in the information repository.

EPA's statistical analysis of groundwater-sampling data determined that the average exposure concentration of cis-1,2-DCE, PCE, TCE, and VC in the groundwater were 710 µg/l, 11,000 µg/l, 920 µg/l, and 59 µg/l, respectively. All of these exposure concentrations are in excess of EPA's Safe Drinking Water Act MCLs of 70 µg/l, 5 µg/l, 5µg/l, and 2 µg/l, respectively; these concentrations also exceed the NYSDOH MCLs, which are 5 µg/l for cis-1,2-DCE, PCE, and TCE, and 2 µg/l for VC. These concentrations are associated with an excess lifetime cancer risk 2×10^{-1} for the future adult and child resident and 2×10^{-2} for the future commercial worker. The calculated non-carcinogenic hazard quotients (HQs) are: future adult resident HQ=300, future child resident HQ=600, and future commercial worker HQ=50.

These cancer risks and non-cancer health hazards indicate that there is significant potential risk to potentially exposed populations from direct exposure to groundwater or and groundwater vapors. 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. The chemicals in groundwater that contribute most significantly to the cancer risk and non-cancer hazard are cis-1,2-DCE, PCE, TCE, and VC.

A summary of the contaminants of concern (COCs) and groundwater exposure point concentrations is listed in Appendix II, Table 6. The cancer and non-cancer risk-characterization summary for the groundwater COCs are presented in Appendix II, Tables 7 and 8**.** Cancer and non-cancer toxicity data for the groundwater COCs are presented in Appendix II, Tables 9 and 10.

Ecological Risk Assessment

The SLERA focused on potential exposure to plume-related contaminants (i.e., CVOCs). The CVOCs identified in the surface water, interstitial water and/or sediments include cis-DCE; methylene chloride; PCE; TCE, and VC. While other contaminants were detected in environmental samples, these other compounds and their concentrations may be indicative of the urbanized nature of the area and are not considered site-specific contaminants.

The ecological receptors evaluated in the risk assessment included benthic macroinvertebrates in the aquatic environment and birds and small mammals in the terrestrial environment. Birds that were observed using the Site included mallard duck, American robin, red-winged blackbird, common grackle, double-crested cormorant, blue jay, mourning dove, white-throated sparrow, green-winged teal, black-capped chickadee, tufted titmouse, northern flicker, song sparrow, Canada goose, northern cardinal, house sparrow, house finch, European starling, and killdeer. Mammals that were observed included Norway rat, raccoon and gray squirrel. Potential risks were not quantified for each observed species, however, the risk for each category of species was estimated using a receptor species (e.g., raccoon) or species groups (e.g., benthic macroinvertebrates) as surrogates to represent the various components of the ecological community.

The ecological receptors were assumed to be exposed to CVOCs in surface waters, interstitial waters and sediments. However, it was assumed that the ecological receptors would not be exposed directly to groundwater resources. Additionally, it should be noted that VOCs were not detected in surface soil samples. Therefore, it is assumed that there was no contamination of these soils from the groundwater plume by the contaminants of concern.

The SLERA analyses included the comparison of the maximum concentrations of the contaminants of potential concern with the most appropriate, conservative ecological screening values that were identified for these compounds for each of the media of interest. The comparison of the maximum concentrations of each contaminant detected in the surface water, interstitial water, sediment, and surface soil with the ecological screening value(s) for each media medium did not reveal any contaminants in excess of these screening values. Additionally, none of the contaminants of interest are known to bioconcentrate, biomagnify, or bioaccumulate.

Based on the results of the SLERA, concentrations of contaminants detected in surface water, interstitial water, sediment and surface soil at the Site are unlikely to pose any unacceptable risks to aquatic or terrestrial ecological receptors at the Site.

Uncertainties in the Risk Assessment

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include the following: environmental chemistry sampling and analysis; environmental parameter measurement; fate and transport modeling; exposure parameter estimation; and toxicological data. Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there can be significant uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources, including the errors inherent in the analytical methods and characteristics of the matrix being sampled.
Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and the fate and transport models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the Risk Assessment provides upper-bound estimates of the risks to populations near the Site, and it is highly unlikely to underestimate actual risks related to the Site.An estimate of central tendency risk can be obtained by substituting average or median values for upper bound values. This is most useful for the exposure pathway which results in the highest estimated carcinogenic or non-carcinogenic risk, i.e., groundwater ingestion.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the Risk Assessment Report. Additionally, specific uncertainties associated with the HHRA for the Site are discussed below.

Data Evaluation Uncertainty

The purpose of data evaluation is to determine which constituents, if any, are present at the site at concentrations requiring evaluation in the HHRA. Uncertainty with respect to data evaluation can arise from many sources, such as the quality of data used to characterize a site and the process used to select data and COPCs included in the HHRA.

The screening levels of surrogate chemicals were used for various chemicals missing screening levels in the COPC selection process. These chemicals include polycyclic aromatic hydrocarbons (PAHs) and chlorinated pesticides. Surrogate chemicals were selected based on their similarities in chemical structure and/or expected mode of action and toxicology, and most of the surrogate chemicals selected for pesticide metabolites are their parent compound (for example, endrin selected as a surrogate chemical for endrin aldehyde). Although some uncertainty associated with the use of surrogate chemicals exists, the overall impacts on the results of COPC selection are expected insignificant because many of these chemicals are detected at low concentrations (that is, one to a few orders of magnitude lower than their surrogate screening levels).

Exposure Assessment Uncertainty

The 95 percent upper confidence level (UCL) concentrations were selected as exposure point concentrations (EPCs) for the chemicals for which more than eight samples and four detected concentrations are present within a data group. In general, the smaller the sample size and number of detected concentration of a chemical, the less reliable the calculated 95 percent UCL becomes. Although the potential impacts on the overall HHRA conclusions (such as COCs) are minimal because of the elevated concentrations in groundwater, the 95 percent UCL concentrations based on the small number of detected concentrations observed at the Site may not be reliable.

Using the EPCs based on 95 percent UCLs or maximum detected concentrations likely leads to an overestimation of actual exposure because receptors are assumed to be exposed to the 95 percent UCL or maximum detected concentration for the entire exposure duration. As the data indicate, many COPCs were not detected in all samples. Thus, the assumption that all potential exposures are to the 95 percent UCL or maximum detected concentration likely results in an overestimation of actual exposures and estimates of potential risk.

In accordance with EPA guidance, exposure estimates were calculated for a reasonable maximum exposure (RME) scenario. An RME scenario results in upper-bound exposure estimates and overestimates average site exposures. For example, recreational receptors are assumed to ingest 40 milliliters (that is, approximately 1.5 ounces) of surface water each time they contact surface water. Exposure to surface water is unlikely to occur to such a great extent; therefore, the exposure assumptions used in this HHRA are expected to be conservative. Any reasonably expected risks are likely to be less than the RME estimates presented in this HHRA.

Toxicity Assessment Uncertainty

Non-cancer toxicity values were not available for two COPCs. An RfD was not available for methyl ter-butyl ether for the ingestion exposure route (that is, oral RfD) and for cis-1,2-DCE for the inhalation route (that is, inhalation RfC). This leads to an underestimation of non-cancer hazards, although the extent cannot be determined.

Toxicity values for TCE are not currently available in Tier 1 or Tier 2 sources discussed in Section 4. Therefore, toxicity values obtained from Tier 3 toxicity sources (Cal/EPA, NCEA, and NYSDOH) were used in the HHRA. For assessing non-carcinogenic effects of TCE, USEPA Office of Solid Waste and Emergency Response has identified the following two non-carcinogenic RfC values that can be considered in evaluating systemic toxicity at sites addressed under CERCLA.

- Air criterion developed by NYSDOH (10 micrograms per cubic meter [$\mu g/m^3$])
- Chronic reference exposure level (REL) developed by Cal/EPA (600 $\mu g/m^3$)

The estimated non-cancer HQ/HI (presented in Section 5.4 of the HHRA) is based on the more conservative value (from NYSDOH) of the two Tier 3 RfCs. As discussed in USEPA's Toxicity Hierarchy guidance, draft toxicity assessments generally are not appropriate for use until they have been through peer review, the peer review comments have been addressed in a revised draft, and the revised draft is publicly available. Because of the uncertainty associated with the draft toxicity values, another set of non-cancer estimates were calculated based on the Cal/EPA chronic REL of 600 $\mu g/m^3$.

Summary of Human Health Risks

The results of the human health risk assessment indicate that the contaminated groundwater presents an unacceptable exposure risk. The screening-level ecological risk assessment indicated that the Site does not pose any unacceptable risks to aquatic or terrestrial ecological receptors.

Based upon the results of the RI and the risk assessment, EPA has determined that actual or threatened releases of hazardous substances from the Site, if not addressed by the response action selected in this ROD, may present a current or potential threat to human health and the environment.

Basis for Action

Based upon the quantitative human-health risk assessment and ecological evaluation, EPA has determined that actual or threatened releases of hazardous substances from the Site, if not addressed by the response action selected in this ROD, may present a current or potential threat to human health and the environment.

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 RAOs for contaminated groundwater (OU 1) will address the human health risks and environmental concerns:

- Restore the impacted aquifer to beneficial use as a source of drinking water by reducing contaminant levels to the federal and State MCLs; and,
- Reduce or eliminate the potential for migration of contaminants towards the LIAWC.

The following RAO for soil vapor will address the human health risks and environmental concerns:

- Address existing or potential future exposure through inhalation of vapors migrating from contaminated groundwater into buildings at the Site.

The cleanup levels for the groundwater COCs and their basis are presented in Appendix II, Table 11.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA Section 121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, comply with ARARs, and utilize permanent solutions, 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 permanently and significantly reduce 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 that at least attains federal and state ARARs, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

The FS report presents detailed descriptions of four remedial alternatives for addressing the groundwater contamination. The four alternatives are: 1) No Action, 2) Enhanced Bioremediation, 3) In-Well Air Stripping, and, 4) Groundwater Pump and Treat.

The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate the performance of the remedy with any potentially responsible parties (PRPs), or procure contracts for design and construction.

The remedial alternatives for the Site are:

Alternative 1: No Action

Capital Cost:	$0
Annual Operation/Maintenance (O&M) Cost:	$0
Present-Worth Cost:	$0
Construction Time:	0 months

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. The no further action alternative does not include any physical remedial measures (beyond those remedial and removal actions already completed) that address any site-related media.

Because this alternative would result in contaminants remaining on-site which exceed acceptable health-based levels, CERCLA would require that the Site be reviewed every five years. If justified by the review, additional response actions may be implemented.

Alternative 2: Enhanced Bioremediation

Capital Cost:	$4,344,000
Annual O&M Cost:	$835,000
Present-Worth Cost:	$15,830,000
Construction Time:	9 – 12 months

This remedial alternative consists of implementing enhanced bioremediation in the plume area. Enhanced bioremediation is the process of destruction of contaminants by microorganisms in contaminated soil and water. Microrganisms consume organic substances for nutrients and energy. Enhanced bioremediation involves creating the proper conditions by injecting microorganisms or nutrients to the subsurface to accelerate the biodegradation of the CVOC contamination. The end products include carbon dioxide, water and microbial cell mass. Monitoring of biogeochemical parameters is used to monitor the effectiveness of remediation.

Enhanced bioremediation 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 FS, a transect configuration was evaluated. This conceptual design would require the installation of approximately 146 permanent injection wells to remediate contamination in the shallow UGA plume and 78 permanent injection wells to remediate contamination in the deeper UGA. This conceptual design would require further evaluation during the remedial design if chosen to be implemented. Additional wells would have to be installed to monitor the progress of the remediation. This alternative is expected to remove the contaminant mass within eight to 16 years in the shallow UGA plume remediation area and within 25 to 50 years in the deep UGA plume remediation area.

Figure 8 illustrates the conceptual layout of extraction wells under Alternative 2.

Monitored natural attenuation (MNA)/long-term monitoring would be implemented to address areas of the plumes outside of the active remediation areas. MNA is a variety of in-situ processes which, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. Institutional controls would be established for groundwater use restrictions.

It is estimated that system construction would be completed in one year.

Because this alternative would take longer than five years for contaminants to achieve acceptable health-based levels, CERCLA would require that the Site be reviewed every five years. If justified by the review, additional response actions may be implemented.

Alternative 3: In-Well Air Stripping

Capital Cost:	$7,730,000
Annual O&M Costs:	$730,000
Present-Worth Cost:	$16,710,000
Construction Time:	9 – 12 months

This remedial alternative includes the installation of in-well air stripping systems over the plume area. In-well air stripping is a physical treatment technology whereby air is injected into a vertical well that is installed and screened at two depths in the groundwater. Pressurized air is injected into the well below the water table, aerating the water. The aerated water rises in the well and flows out of the system at the upper screen, inducing localized movement of groundwater into (and up) the well as contaminated groundwater is drawn into the system at the lower screen. VOCs vaporize within the well at the top of the water table, where the air bubbles out of water. The contaminated vapors accumulating in the wells are collected via vapor extraction contained within the well. 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 partially treated groundwater is never brought to the surface; it is forced into the unsaturated zone, and the process is repeated as water follows a hydraulic circulation pattern that allows continuous cycling of groundwater. As groundwater circulates through the treatment system in-situ, and vapor is extracted, contaminant concentrations are reduced.

In-well air 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 FS, a grid configuration was evaluated. This conceptual design would require the installation of approximately 80 permanent air stripping wells to remediate contamination in the shallow UGA plume and 30 permanent air stripping wells to remediate contamination in the deeper UGA. This conceptual design would require further evaluation during the remedial design if chosen to be implemented. Additional wells would have to be installed to monitor the progress of the remediation. This alternative is expected to remove the contaminant mass within five to 10 years in the shallow UGA plume remediation area and within 10 to 20 years in the deep UGA plume remediation area.

Figure 9 illustrates a typical In-Well Air Stripping system.

Monitored natural attenuation (MNA)/long-term monitoring would be implemented to address areas of the plumes outside of the active remediation areas. MNA is a variety of in-situ processes which, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. Institutional controls would be established for groundwater use restrictions.

It is estimated that construction related to this effort would be completed in one year.

The system would operate until one or more performance measures (*e.g.*, diminished contaminant-removal efficiencies, *etc*.) are attained, at which point amendments such as ozone would be injected into the subsurface in order to aggressively destroy some of the remaining source materials. It is estimated that this system would need to be run for approximately seven years.

The effectiveness of this alternative would be determined based upon the attainment of specific performance standards and cleanup goals for each step in the treatment process (*e.g.*, attainment of MNA performance monitoring standards, reduction in mass flux, etc.).

Under this alternative, pilot-scale testing would be used to determine, among other things, the configuration and number of in-well air stripper wells, the characterization of the extracted vapors, the application rates of the various reagents, and any other operation-and-performance parameters. These data would be used in the system-design evaluation. In addition, the extracted vapors might need to be treated before being vented to the atmosphere. Any treatment residuals would have to be appropriately handled (*e.g.*, off-site treatment/disposal).

Same editBecause this alternative would result in contaminants remaining on-site which exceed acceptable health-based levels, CERCLA would require that the Site be reviewed every five years. If justified by the review, additional response actions may be implemented.

Alternative 4: Groundwater Pump and Treat

Capital Cost:	$2,997,000
Annual O&M Costs:	$1,185,000
Present-Worth Cost:	$21,560,000
Construction Time:	6 – 9 months

This remedial alternative consists of the extraction of groundwater via pumping wells and treatment prior to disposal. Groundwater is pumped to remove contaminant mass from areas of the aquifer with elevated PCE concentrations. Pumping from downgradient wells would provide hydraulic control of the contaminated groundwater with lower PCE concentrations. For this conceptual design, it is estimated that nine groundwater extraction wells would be installed in the shallow and deep UGA. A treatment plant with the capacity of approximately 350 (gallons per minute) gpm would be constructed within or nearby the Site to achieve the mass removal and hydraulic control objectives. 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. During the remedial design, a determination will be made whether to discharge treated extracted groundwater to a publically owned treatment works (POTW) or surface water, or reinject it to groundwater.

In-situ chemical treatment would be utilized to enhance the groundwater pump and treat remedy, as appropriate. During the remedial design, a treatability study would be performed to evaluate the use of in-situ chemical treatment, either in-situ chemical oxidation (ISCO) or in-situ chemical reduction (ISCR). The results of the study would be used to design the in-situ chemical treatment component of this alternative in a manner that complements and improves the effectiveness of the groundwater extraction and treatment component.

ISCO is a process that involves the injection of reactive chemical oxidants (such as Peroxide, Fenton's Reagent, Permanganate) into the subsurface for rapid contaminant destruction. Oxidation of organic compounds using ISCO is rapid and exothermic and results in the reduction of contaminants to primarily carbon dioxide and oxygen. ISCR uses chemical reductants such as zero-valent iron (ZVI). The ZVI donates electrons, acting as the reductant in a reaction that removes chlorine atoms from chlorinated hydrocarbon contaminants such as PCE.

In-situ chemical treatments, such as ISCO and ISCR were evaluated in the initial stages of the FS, but were screened out of the final alternatives as stand-alone remedies, because of the difficulty in implementation in a residential neighborhood, specifically obtaining access to residential properties. However, the use of in-situ chemical treatments targeting areas containing high concentrations of PCE that may reside outside the radius of influence of the pump within the inferred plume, as appropriate, in combination with groundwater extraction could potentially reduce the remediation time frames and the costs of this alternative.

Figures 10 and 11 illustrate a pump and treat system in the shallow and deep UGA.

Monitored natural attenuation (MNA)/long-term monitoring would be implemented to address areas of the plumes outside of the active remediation areas. MNA is a variety of in-situ processes which, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. Institutional controls would be established for groundwater use restrictions.

It is estimated that system construction would be completed in nine months.

Same editBecause this alternative would result in contaminants remaining on-site which exceed acceptable health-based levels, CERCLA would require that the Site be reviewed every five years. If justified by the review, additional response actions may be implemented.

COMPARATIVE ANALYSIS 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 ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, and state and community acceptance.

The evaluation criteria are described below.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies, with respect to these parameters, which a remedy may employ.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation, maintenance, and monitoring (OM&M) costs, and net present-worth costs.

- State acceptance indicates if, based on its review of the 2011 FS and Proposed Plan, the state concurs with the preferred remedy at the present time.

- Community acceptance refers to the public's general response to the alternatives described in the 2011 FS report and Proposed Plan.

A comparative analysis of these alternatives based upon the evaluation criteria noted above follows.

Overall Protection of Human Health and the Environment

All of the alternatives except Alternative 1 (No Action) would provide protection of human health and the environment. Alternative 1 is not considered protective of human health and the environment because it does not restore groundwater quality or limit potential exposure to contaminated groundwater.. Alternatives 2, 3, and 4 are active remedies that address groundwater contamination and would restore groundwater quality over the long term. Alternatives 2, 3, and 4 would also rely on certain natural processes to achieve the cleanup levels for areas outside of the treatment zones.

Protectiveness under Alternatives 2 and 3 requires a combination of reducing contaminant concentrations in groundwater and limiting exposure to residual contaminants through maintenance of existing, and implementation of additional institutional controls, as well as MNA.

Protectiveness under Alternative 4 is achieved through reducing contaminant concentrations via extraction and treatment of groundwater. Alternative 4 also protects against the further migration of contaminated groundwater, as the extraction functions as a hydraulic plume containment mechanism.

The long-term monitoring program for groundwater and vapor would monitor the migration and fate of the contaminants and ensure that human health is protected. Combined with MNA, long-term monitoring, and institutional controls, Alternatives 2, 3, and 4 would meet the RAOs. Alternative 1 would not meet the RAOs.

Compliance with ARARs

EPA and NYSDOH have promulgated health-based protective MCLs (40 CFR Part 141, and 10 NYCRR, Chapter 1), which are enforceable standards for various drinking water contaminants (chemical-specific ARARs). The aquifer is classified as Class GA (6 NYCRR 701.18), meaning that it is designated as a potable water supply.
Although the groundwater at the Site is not presently being utilized as a potable water source, achieving MCLs in the groundwater is an applicable or relevant and appropriate standard, because area groundwater is a source of drinking water. Alternative 1 (No Action) would not involve any action to remediate contaminated groundwater, and would not comply with chemical specific ARARs for groundwater. Alternatives 2 and 3 may potentially reach ARARs in the active remediation area of the plume sooner than Alternative 4. However, chemical-specific ARARs will be attained through treatment and certain natural processes (dilution and dispersion) for groundwater in all three of these alternatives.

Alternatives 2, 3, and 4 would comply with location- and action- specific ARARs

Long-Term Effectiveness and Permanence

Alternative 1 (No Action) would not reduce risk in the long-term, since the contaminants would not be controlled, treated or removed. Enhanced bioremediation under Alternative 2 is considered a reliable method for reducing contaminant concentrations in groundwater. In-well stripping under Alternative 3 and pump and treat under Alternative 4 are also considered effective technologies for treatment and/or containment of contaminated groundwater, if designed and constructed properly.

All three alternatives rely on a combination of treatment in the active remediation area, natural processes, including dilution and dispersion for areas where active remediation is not implemented, and institutional controls.

Enhanced bioremediation under Alternative 2 has been demonstrated to be effective and reliable at numerous sites for groundwater treatment for CVOCs in contaminated areas. However, groundwater concentrations may rebound if there is continued migration of CVOCs from unknown source areas. If this were to occur, the time frame to achieve cleanup levels may be longer than estimated..

In-well air stripping under Alternative 3 is expected to be effective and reliable to significantly remove CVOCs. However, the effectiveness of this alternative is limited by radius of influence (ROI) or "reach" into the aquifer. The ROI would depend on pumping capacity of each well and the hydrogeologic characteristics of the Site. In addition, the effectiveness of in-well air stripping may be limited in shallow aquifers, due to the lack of vertical space in the well for "stripping." A field pilot study would be necessary to determine pre-design parameters such as actual ROI, optimal well spacing, flow rates, and pumping capacity prior to full-scale implementation.

All three active alternatives rely upon institutional controls and MNA to ensure protection over the long term.

Reduction of Toxicity, Mobility, or Volume through Treatment

Under Alternative 1 (No Action), there would be no reduction in toxicity, mobility or volume as there would not be any active treatment of contaminants in groundwater. Alternatives 2, 3 and 4 reduce the toxicity and volume of contaminants at the Site through treatment of contaminated groundwater. Alternative 2 uses biological processes to degrade contaminants in groundwater to less harmful compounds. Alternative 3 uses physical processes to remove the contaminants from the aquifer, and provides chemical treatment for the collected vapor-phase contamination. Alternative 4 removes contaminated groundwater and treats it via a carbon treatment process.

Alternative 2 does not reduce the mobility of the contaminants in groundwater and Alternative 3 may change the movement of contaminants in groundwater because the in-well air stripping treatment is expected to create groundwater mounding. Alternative 4 would be the most effective at reducing the mobility of the groundwater contamination by providing hydraulic control of the plume.

Each of the three active alternatives includes an MNA component for the lesser contaminated portion of the plume outside the active remediation area. MNA would provide limited further reduction in the toxicity and volume of contaminants in groundwater by transforming them into less harmful substances through natural biological, chemical and other processes.

During the enhanced bioremediation and MNA biological degradation processes, PCE, TCE and cis-1,2-DCE could be transformed into the more toxic vinyl chloride under anaerobic conditions in the subsurface, prior to aerobic degradation to the less toxic ethane. This transformation would need to be monitored and managed to prevent exposure via drinking contaminated water or inhalation through the vapor intrusion pathway.

After treatment, Alternatives 3 and 4 would generate residuals in a form of used GAC that would require regeneration, destruction or disposal.

Short-Term Effectiveness

Alternative 1(No Action) includes no construction or monitoring and would have no short-term impacts at the Site. Alternatives 2, 3 and 4 may have short-term impacts to remediation workers, the public, and the environment during implementation. Each of these three alternatives has short-term impacts because it would be necessary to construct parts of the remedy on the property of land owners, and over roadways and right-of-ways. Remedy-related construction (e.g., trench excavation) under Alternatives 3 and 4 would require disruptions in traffic and street closure permits. In addition, Alternatives 3 and 4 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 implementation of the three alternatives would be minimal. No difficulties are foreseen with managing the required quantity of the bioremediation injection material needed in Alternative 2, as it is non-hazardous. Excavation activities in Alternatives 3 and 4 could produce contaminated vapors that present some risk to remediation workers at the Site. Drilling activities, including the installation of monitoring, in-well air stripping, injection, and extraction wells for Alternatives 2, 3, and 4 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 Alternative 4. Alternative 4 could increase the risks of exposure, ingestion and inhalation of contaminants by workers and the community because contaminated groundwater would be extracted to the surface for treatment
However, all three alternatives 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 excavation would also require management via occupational health and safety controls.

Groundwater monitoring and discharge of treated groundwater will have minimal impact on workers responsible for periodic sampling. The time required for implementation of Alternative 4 is estimated at 6 – 9 months. Alternatives 2 and 3 are estimated to take about 9 – 12 months to implement.

RAOs would be achieved in Alternatives 3, 2, and 4 within short, medium and longer time frames, respectively. In-well air stripping is expected to achieve groundwater RAOs within five to 20 years under Alternative 3. Enhanced bioremediation is expected is expected to achieve RAOs within eight to 50 years under Alternative 2, and groundwater pump and treat technology is expected to achieve groundwater RAOs in 30 or more years under Alternative 4. The time frame to meet groundwater RAOs in the non-active remediation area where MNA/LTM would be implemented is difficult to predict, but is expected to exceed 30 years.

Implementability

Alternative 1 (No Action) would be the easiest both technically and administratively to implement, as no work would be performed at the Site to address groundwater contamination. Alternatives 2, 3, and 4rely on well-established technologies that have commercially available equipment and are implementable. All three of these alternatives have access challenges that would have to be addressed with property owners. Of the three alternatives, Alternative 4, Groundwater Pump and Treat is probably the easiest to construct at the Site and would require the least amount of street closure permits and would require less land and disruption in residential areas. Alternatives 2 and 3 would be moderately difficult to construct in the residential areas, requiring securing access to homes and obtaining street closure permits. The need to reconfigure the treatment injection and in-well air stripping well locations in Alternatives 2 and 3 due to access constraints map be possible; however, doing so potentially impacts the effectiveness and schedule of these remedial alternatives.

Alternatives 2, 3, and 4 would require routine groundwater quality, performance and administrative monitoring. Alternatives 3 and 4 require periodic operations and maintenance (e.g., substrate injection, GAC replacement) for the life of the treatment.

Cost

The present-worth costs for Alternatives 1 through 4 are calculated using a discount rate of 7 percent and a 30-year time interval.

The estimated capital, annual O&M, and present-worth costs for each of the alternatives are presented in the table below.

Alternative	Capital Cost	Annual O&M Cost	Present Worth Cost
1	$0	$0	$0
2	$4,344,000	$835,000	$15,830,000
3	$7,730,000	$730,000	$16,710,000
4	$2,997,000	$1,185,000	$21,560,000

Alternative 1 (No Action) would have no costs associated with it because no activities would be implemented. Alternative 4 is the most costly remedy with a present-worth cost of $21.6 million. The present-worth cost for Alternative 2 is $15.8 million and the present-worth cost for Alternative 3 is $16.7 million.

State Acceptance

NYSDEC concurs with the selected remedy; a letter of concurrence is attached (see Appendix IV).

Community Acceptance

Comments received during the public comment period indicate that the public generally supports the selected remedy. These comments are summarized and addressed in the Responsiveness Summary, which is attached as Appendix V to this document.

PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430 (a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for the migration of contamination to groundwater, surface water, or air, or act as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of alternatives, using the remedy selection criteria which are described above. The manner in which principal threats are addressed provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

The contamination being addressed in this operable unit is in the groundwater and while there is no definitive evidence was found during the remedial investigation that nonaqueous phase liquids are present within the aquifers, based on the elevated concentrations of PCE detected at several sampling locations during the RI, the potential does exist that principal threat wastes could exist at the Site. The locations of high concentration will be addressed through the groundwater extraction and treatment and/or targeted in-situ chemical treatment.

SELECTED REMEDY

Summary of the Rationale for the Selected Remedy

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative 4, Groundwater Pump and Treat, best satisfies the requirements of CERCLA Section 121, 42 U.S.C. §9621, and provides the best balance of tradeoffs among the remedial alternatives with respect to the NCP's nine evaluation criteria, 40 CFR § 300.430(e)(9).

EPA is proposing Alternative 4 due to the difficulty in implementing Alternatives 2 and 3 in the densely-populated and fully-developed residential and commercial setting of the Site. Alternative 2, and Alternative 3 to a somewhat lesser degree, would require securing access to a significant number of residential properties to perform construction activities. Under Alternatives 2 and 3, access would be necessary to the residential properties for an extended period of time to perform the initial construction activities and to subsequently conduct monitoring. Under Alternative 2, multiple injections are likely to be necessary over time. These activities would cause a significant disturbance to the residential neighborhood. Reconfiguration of the injection or in-well stripping wells due to access constraints could potentially impact significantly the effectiveness of the technology. Access to install extraction wells under the preferred remedy, Alternative 4, Groundwater Pump and Treat, though still complicated, is more manageable. Access to property and construction of the treatment plant is expected to be performed in an area zoned for commercial activity. Furthermore, the uncertainty of an unknown source investigation that could result in a continued migration of contamination from source areas adds to the uncertainty that the remedial action objectives would be achieved with Alternative 2.

Alternative 4, Groundwater Pump and Treat, uses proven technologies that can be more readily implemented than the other alternatives. The treatment components can be expanded to improve treatment effectiveness or decrease the remedial time frame, if required. Groundwater Pump and Treat has been demonstrated as an effective remedial approach for contaminant mass removal over the long term. This approach would be particularly effective as the contaminant plumes are relatively accessible and have a specific configuration. The shallow UGA groundwater (0 to 20 feet bgs) PCE plume is approximately 3,500 feet long and between 400 and 100 feet wide. The deep groundwater plume is approximately 1,110 feet long. Groundwater Pump and Treat would also be the most effective of the alternatives in establishing hydrodynamic control of the aquifer to minimize off-site migration of contaminants and isolate the contaminated groundwater area. The prevention of off-site migration would prevent CVOC contamination from flowing toward the LIAWC well field. Long-term groundwater monitoring would ensure that remedial action objectives are achieved at the Site.

Although the preferred remedy is more expensive than either Alternatives 2 or 3, there is a greater degree of uncertainty that the remedial action objectives would be achieved by both Alternatives 2 and 3. Based on the Site conditions, Alternative 4, Groundwater Pump and Treat, is the most effective of the alternatives.

The addition of in-situ chemical treatments targeting areas containing high concentrations of PCE that may reside outside the radius of influence of the pump within the inferred plume, as appropriate, in combination with groundwater extraction could potentially reduce the remediation time frames by reducing the contaminant mass of PCE, and, therefore, the costs of this alternative.

EPA, in conjunction with NYSDEC, believes that the selected remedy would be protective of human health and the environment, provide the greatest long-term effectiveness, comply with ARARs, and be cost-effective among alternatives with respect to the evaluation criteria. The selected remedy best satisfies the requirements of CERCLA Section 121, 42 U.S.C. §9621, and provides the best balance of tradeoffs among the remedial alternatives with respect to the NCP's nine evaluation criteria, 40 CFR § 300.430(e)(9). The selected remedy also will meet the statutory preference for the use of treatment as a principal element.

Description of the Selected Remedy

The selected remedy to address the contaminated groundwater includes the following components:

- Extraction of the groundwater via pumping and ex-situ treatment of the extracted groundwater prior to discharge to a POTW or surface water, or reinjection to the aquifer (to be determined during design); in-situ chemical treatment of targeted high concentration contaminant areas, as appropriate; monitored natural attenuation for the areas where active remediation is not performed; and long-term monitoring in conjunction with implementation of institutional controls. In addition, EPA will continue to evaluate the potential for vapor intrusion at the Site, and will install vapor mitigation systems, where necessary.

- The groundwater extraction well network will be designed to effectuate removal of the contaminant mass from the groundwater plume and establish hydrodynamic control of the plume. Figures 10 and 11 provide the conceptual pump and treat well locations within the shallow and deep UGA plume areas. The exact number of extraction wells and their placement will be determined in the remedial design. An aquifer pump test would be conducted as part of the pre-remedial design to collect necessary aquifer data necessary to complete the design of the groundwater pump and treat system.

- The use of in-situ chemical treatments, targeting areas containing high concentrations of PCE that may reside outside the radius of influence of the pumping wellswithin the inferred plume, as appropriate, in combination with groundwater extraction could potentially reduce the remediation time frames and the cost of this alternative. The implementation of in-situ chemical treatment (e.g. ISCO, ISCR) will be designed to enhance the remediation of the contaminated groundwater in conjunction with the pump and treat system. The remedial design will determine how best to execute the ISCR or ISCO with the pump and treat system.

- A treatment plant with the capacity to achieve the mass removal and hydraulic control objectives of the remedy will be constructed within or nearby the area of the plume. EPA estimates that a capacity of 350 gallons per minute may be required. The extracted groundwater would be treated for CVOC removal with either liquid phase GAC or air stripping, or both. Treated groundwater effluent will be discharged to a POTW or surface water, or reinjected to groundwater. The method of discharge will be determined in the remedial design. The design of the treatment facility will take discharge requirements into account.

- The pump and treat system would operate until MCLs are attained in the shallow and deep UGA where active remediation is employed. The FS presents calculations determining the duration of the operation of the extraction system. These calculations to determine the remedial time frame require additional data regarding contaminant mass flux, as well as more detailed process design to determine the actual number of recovery/injection wells and pore volumes of clean water required to reach RAOs. This data will be collected during the pre-remedial design phase. EPA assumes the duration of this alternative is 30 years or more.

- The environmental benefits of the preferred remedy may be enhanced by consideration, during the design, of technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Policy. This will include consideration of green remediation technologies and practices, including GAC regeneration.

- Monitored natural attenuation is a necessary component in those areas where active remediation is not anticipated, such as the areas of lower contaminant concentrations at edges of the contaminant plume.

A Site Management Plan would also be developed and would provide for the proper management of the Site remedy post-construction, such as institutional controls, and will also include:

- Monitoring of Site groundwater to ensure that, following remedy implementation, the groundwater quality improves. A long-term groundwater monitoring program would be implemented to track and monitor changes in the groundwater contamination and ensure the remedial action objectives are attained. The results from the long-term monitoring program will be used to evaluate the migration and changes in the contaminant plume over time. The long-term monitoring program will be modified accordingly. The SMP will also include provisions for any operation and maintenance required for the remedy; and

- Periodic certifications by the owner/operator or other person implementing the remedy that any institutional and engineering controls are in place.

The groundwater monitoring well sample results will also be used to track changes in the contaminant plume in order to determine homes considered "at risk" for vapor intrusion. Selected structures/homes determined to be "at risk" would be sampled periodically for vapor intrusion during the winter heating season.
Vapor intrusion caused by volatilization from the groundwater contaminant plume has been monitored at 15 homes; one of these homes has been outfitted with a vapor mitigation system. Vapor extraction systems would be installed at additional homes, if future sampling results indicate such systems are warranted. Institutional controls are incorporated into this remedy for protection of human health and the environment over the long term. EPA anticipates using existing governmental controls to prevent use of groundwater and informational and or governmental controls to ensure that vapor intrusion issues are identified.

While this alternative will ultimately result in reduction of contaminant levels in groundwater to levels that would allow for unlimited use and unrestricted exposure, it will take longer than five years to achieve these levels. As a result, in accordance with EPA policy, the Site is to be reviewed at least once every five years.

Summary of the Estimated Selected Remedy Costs

The estimated capital, annual O&M, and total present-worth costs (using the federal standard 7% discount rate) for the selected remedy are $2,997,000, $1,185,000, and $21,560,000, respectively. Appendix II, Table 13 provides the basis for the cost estimates for Alternative 4.

It should be noted that these cost estimates are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost. These cost estimates are based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedy.

Expected Outcomes of the Selected Remedy

The selected remedy addresses the contamination in the groundwater. The results of the risk assessment indicate that the hypothetical future use of the groundwater at the Site will pose an unacceptable increased future cancer risk and an unacceptable non-cancer hazard risk to human health. Under the selected alternative, a groundwater pump and treatment technology will be used to remediate contaminated groundwater and will restore the aquifer at the Site as a potential source of drinking water in a reasonable period of time by reducing contaminant levels to the federal and state MCLs.

Federal and state MCLs for the Contaminants of Concern are presented in Appendix II, Table 11. Achieving the cleanup levels will restore the aquifer to its beneficial use.

It is estimated that it will take 30 years to achieve the groundwater cleanup objectives under the selected remedy. If potential source areas are identified and addressed under OU2, the time it takes to achieve the MCLs within the aquifer at the Site may be reduced.

STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, or contaminants at a Site.

For the reasons discussed below, EPA has determined that the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The results of the risk assessment indicate that, if no action is taken, the hypothetical future use of the groundwater at the Site will pose an unacceptable increased future cancer risk and an unacceptable non-cancer hazard risk to human health. The selected remedy will be protective of human health and the environment and it will restore groundwater quality at the Site to drinking-water standards over the long term. Combined with institutional controls, the selected remedy will provide protectiveness of human health and the environment over both the short and long term.

Compliance with ARARs and Other Environmental Criteria

A summary of the ARARs and "Other Criteria, Advisories, or Guidance TBCs" which will be complied with during implementation of the selected remedy is presented below.

- Clean Air Act, National Ambient Air Quality Standards (40 CFR 50)
- Groundwater Quality Regulations (6 NYCRR Parts 700-705)
- National Primary Drinking Water Standards (MCLs and non-zero maximum contaminant level goals) (40 CFR 141)
- National Environmental Policy Act (40 CFR 1500 to 1508)
- National Emissions Standards for Hazardous Air Pollutants (40 CFR Parts 51, 52, 60, and 61)
- New York State Department of Health Drinking Water Standards (10 NYCRR Part 5)
- New York State Regulations for Prevention and Control of Air Contamination and Air Pollution (6 NYCRR Part 200)

- New York State Drinking Water Standards (NYCRR Part 5)
- New York State Air Cleanup Criteria, January 1990
- New York State Department of Environmental Conservation Guidelines for the Control of Toxic Ambient Air Contaminants, DAR-1, November 12, 1997
- New York Air Quality Standards (6 NYCRR Part 257)
- New York State Department of Environmental Conservation, Technical and Operational Guidance Series 1.1.1, November 1991
- Safe Drinking Water Act Proposed MCLs and nonzero MCL Goals

Cost-Effectiveness

A cost-effective remedy is one whose costs are proportional to its overall effectiveness (NCP Section 300.430(f)(1)(ii)(D)). Overall effectiveness is based on the evaluations of: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Based on the comparison of overall effectiveness (discussed above) to cost, the selected remedy meets the statutory requirement that Superfund remedies be cost-effective in that, even though it is the most costly of the alternatives considered it is expected to be much more readily implementable than the other alternatives and will achieve the remediation goals in a reasonable time frame.

Each of the alternatives underwent a detailed cost analysis. In that analysis, capital and annual O&M costs were estimated and used to develop present-worth costs. In the present-worth cost analysis, annual O&M costs were calculated for the estimated life of each alternative using a 7% discount rate. The estimated present-worth cost of the selected remedy, using a 30-year time interval, is $21,560,000.

While Alternatives 2 and 3 will achieve the groundwater cleanup objectives and provide the same degree of protection of human receptors, the selected alternative is the most implementable of the alternatives and will result in the restoration of water quality in the aquifer much more effectively than the other alternatives.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria set forth in NCP Section 300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site. The selected remedy satisfies the criteria for long-term effectiveness and permanence by removing contaminant mass from areas of the aquifer with elevated PCE concentrations. In addition to being the most effective in reducing the mobility of groundwater contamination by providing hydraulic control of the plume, the combination of groundwater extraction and treatment and in-situ treatment will permanently reduce the

mass of contaminants in the groundwater, thereby reducing the toxicity, mobility, and volume of contamination.

The selected remedy presents a higher short-term risk different than Alternative 2 because of the above-ground treatment components and infrastructure that may create a noise nuisance and inconvenience for local residents during construction. In addition, the selected remedy could increase the risks of exposure, ingestion and inhalation of contaminants by workers and the community because contaminated groundwater would be extracted to the surface for treatment. However, measures would be implemented, through the development of a health and safety plan and a quality of life plan, to mitigate these short-term risks.

The selected remedy is implementable since it employs standard technologies that are readily available and allows flexibility to use in-situ chemical treatments to enhance the remediation of the contaminated groundwater in conjunction with the pump and treat system.

Preference for Treatment as a Principal Element

By using a combination of groundwater extraction and treatment, which is an ex-situ treatment process, as well as the use of in-situ chemical treatments, targeting areas containing high concentrations of PCE that may reside outside the radius of influence of the pumping wells within the inferred plume, as appropriate, the selected remedy satisfies the statutory preference for remedies that employ treatment as a principal element.

Five-Year Review Requirements

The selected remedy will not result in contaminated groundwater remaining on-site above levels that allow for site unlimited use and unrestricted exposure, though it is likely that the selected remedy may take more than five years to attain the cleanup levels. Therefore, a policy review may be conducted within five years of construction completion for the Site to ensure that the remedy is, or will be, protective of human health and the environment.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan, released for public comment on July 28, 2011, identified Alternative 4, Groundwater Pump and Treat, as the preferred groundwater remedy. Based upon its review of the written and oral comments submitted during the public comment period, EPA has determined that no significant changes to the remedy, as originally identified in the Proposed Plan, are necessary or appropriate.

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX I

FIGURES

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX II

TABLES

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX III

ADMINISTRATIVE RECORD INDEX

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX IV

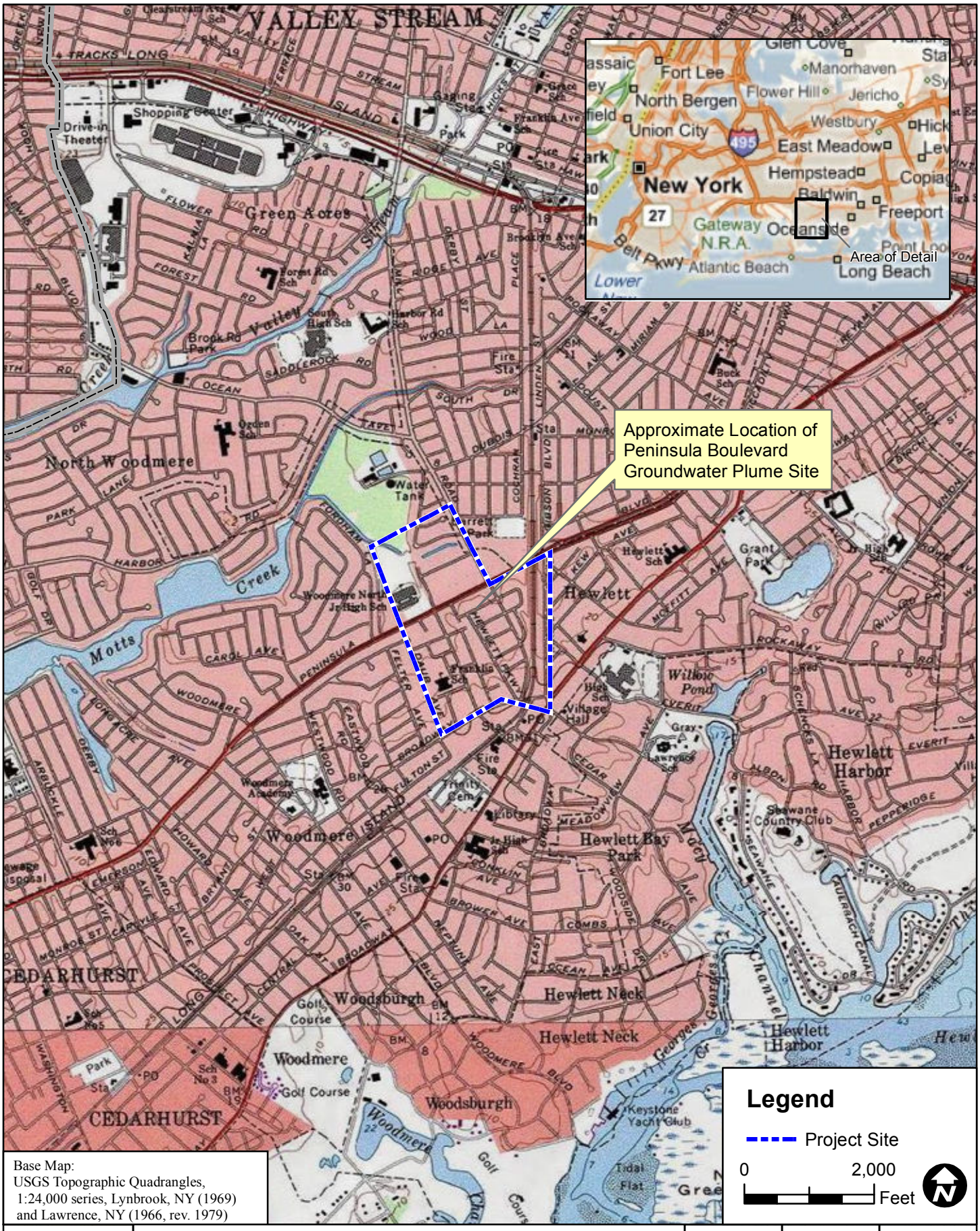
STATE LETTER OF CONCURRENCE

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX V

RESPONSIVENESS SUMMARY



\\prl-srv3\gis_projects\443005_USEPA REGION 2\0112840_EPAR2-002RIC002TV- PENINSULA\GIS\map_docs\mxd\Draft RI Rpt\Figure 1-1 Site Location.mxd

HDR	Site Location - Peninsula Boulevard Groundwater Plume RI Town of Hempstead, Village of Hewlett Nassau County, New York	Job No.	Date	Figure No.
		112840	01/25/11	1

LEGEND:

- SITE BOUNDARY
- MIP-006 — MEMBRANE INTERFACE PROBE (MIP) SAMPLE LOCATION
- HW-006 — HYDROPUNCH GROUNDWATER SAMPLE LOCATION
- ACTIVE OR FORMER DRY CLEANER LOCATION (APPROXIMATE)

NOTES:

1. SURVEY SOURCES:
   –TETRATECH E.C., INC., DATA EVALUATION REPORT, OCTOBER 2008.
2. FILE FORMAT: AUTOCAD (.DWG FORMAT)
3. ONLY MONITORING WELL LOCATIONS WERE SURVEYED. ALL OTHER SAMPLE LOCATIONS AND SITE BOUNDARY ARE APPROXIMATE.

DRAFT

Henningson, Durham & Richardson, Architecture and Engineering, P.C. In Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
1	02–01–11	DRAFT ISSUE

PROJECT MANAGER	MM
LEAD DESIGN PROF	MM
DESIGN ENGINEER	JJ
DRAWN BY	JW, SS
PROGRAM MANAGER	BW
QUALITY ASSURANCE MGR	CZ
PROJECT NUMBER	147–112840

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 002-RICO-02TV

PENINSULA BOULEVARD GROUNDWATER PLUME RI

TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

MEMBRANE INTERFACE PROBE AND HYDROPUNCH SAMPLE LOCATIONS (2006, 2007)

0 200 400
0 1" 2"

FILENAME	00C–02–07
SCALE	–

SHEET **2-2**

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C:\pwworking\pitt\d0370413\00C-42.dwg, 2-3 MONITORING WELL - TtECH, 2/1/2011 12:56:19 PM, ssweeton

LEGEND:

- SITE BOUNDARY
- MW-27 MONITORING WELL LOCATION
- PZ-1 PIEZOMETER LOCATION
- GP-06 GEOPROBE BORING/PIEZOMETER LOCATION
- ACTIVE OR FORMER DRY CLEANER LOCATION (APPROXIMATE)

NOTES:

1. SAMPLE LOCATION SOURCES:
   - TETRATECH E.C., INC., DATA EVALUATION REPORT, OCTOBER 2008.
   - RETTEW, JANUARY 19, 2007 AND MAY 19, 2010.
2. DATUM: NEW YORK STATE PLANE (L.I.)–NORTH AMERICAN DATUM (NAD83:FEET)
3. FILE FORMAT: AUTOCAD (.DWG FORMAT)
4. ONLY MONITORING WELL LOCATIONS WERE SURVEYED. ALL OTHER SAMPLE LOCATIONS AND SITE BOUNDARY ARE APPROXIMATE.
5. MONITORING WELLS INSTALLED IN 2007. WELL N114 IS A NASSAU COUNTY WELL. PZ WELLS INSTALLED AND ACCESSED BY TETRATECH IN 2007 FOR GROUNDWATER ELEVATION MEASUREMENTS; GROUNDWATER SAMPLES WERE NOT COLLECTED FROM PZ WELLS.
6. GEOPROBE BORING/PIEZOMETER LOCATIONS ARE BASED ON INFORMATION FROM: FINAL REMEDIAL INVESTIGATION, GROVE CLEANERS, SITE NO.1-30-059, PREPARED FOR THE NYSDEC BY TAMS CONSULTANTS, INC. AND GZA GEOENVIRONMENTAL OF NEW YORK, DATED FEBRUARY 2002.

DRAFT

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ISSUE	DATE	DESCRIPTION
1	02-01-11	DRAFT ISSUE

PROJECT MANAGER	MM
LEAD DESIGN PROF	MM
DESIGN ENGINEER	JJ
DRAWN BY	JW, SS
PROGRAM MANAGER	BW
QUALITY ASSURANCE MGR	CZ
PROJECT NUMBER	147-112840

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 002-RICO-02TV

PENINSULA BOULEVARD GROUNDWATER PLUME RI

TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

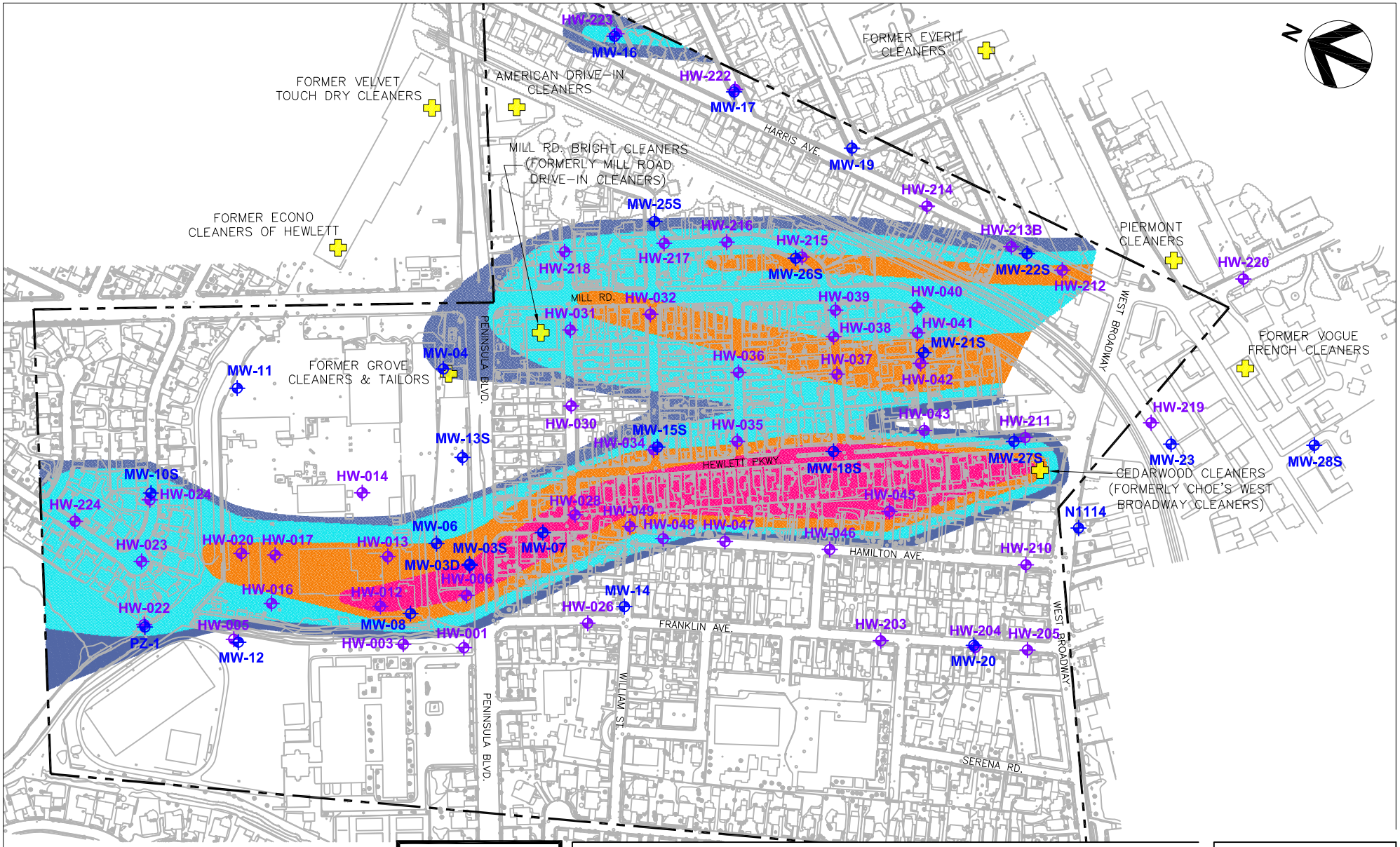
GROUNDWATER MONITORING WELL AND PIEZOMETER SAMPLE LOCATIONS (2007)

Scale: 0 — 200 — 400; 0 — 1" — 2"

FILENAME: 00C-42

SCALE: –

SHEET: 2-3



SCALE: 1"=400'

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SHALLOW UGA PLUME MAP

FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT,
NASSAU COUNTY, NEW YORK

DATE
06-23-2011

FIGURE
2

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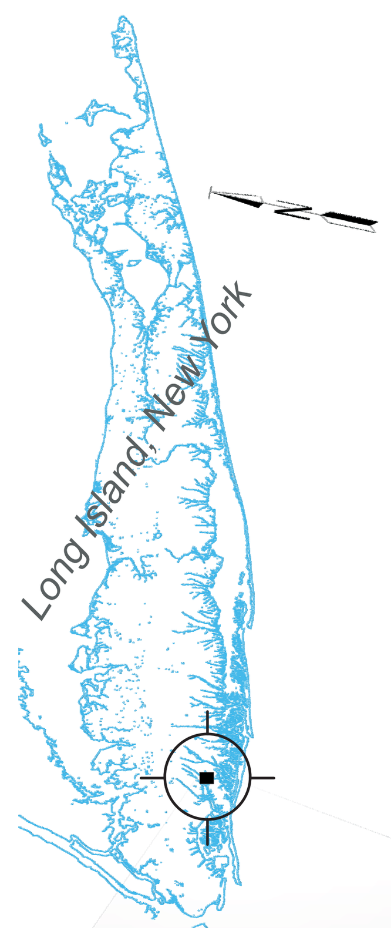
DEEP UGA PLUME MAP

FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT,
NASSAU COUNTY, NEW YORK

DATE
06-23-2011

FIGURE
3

1	2	3	4	5	6	7	8




Former Grove Cleaners (looking North from across Peninsula Blvd.)


Former Velvet Touch Cleaners store front 1338 Peninsula Blvd (currently vacant).


American Drive-In Cleaners - 1345 Peninsula Blvd.


Mill Road Brite Cleaners - 401 Mill Rd.


Strip mall housing former Everit Cleaners - 1344 Broadway.


Piermont Cleaners front view - 1309 Broadway.

Former Vogue French Cleaners - 1245 Broadway (looking SSE across Broadway).


Cedarwood (formerly Choe's) Cleaners - front 1244 West Broadway.


Rear view of former Grove Cleaners.


Rear of strip mall housing former Velvet Touch Cleaners.


American Drive-In - back end of property.

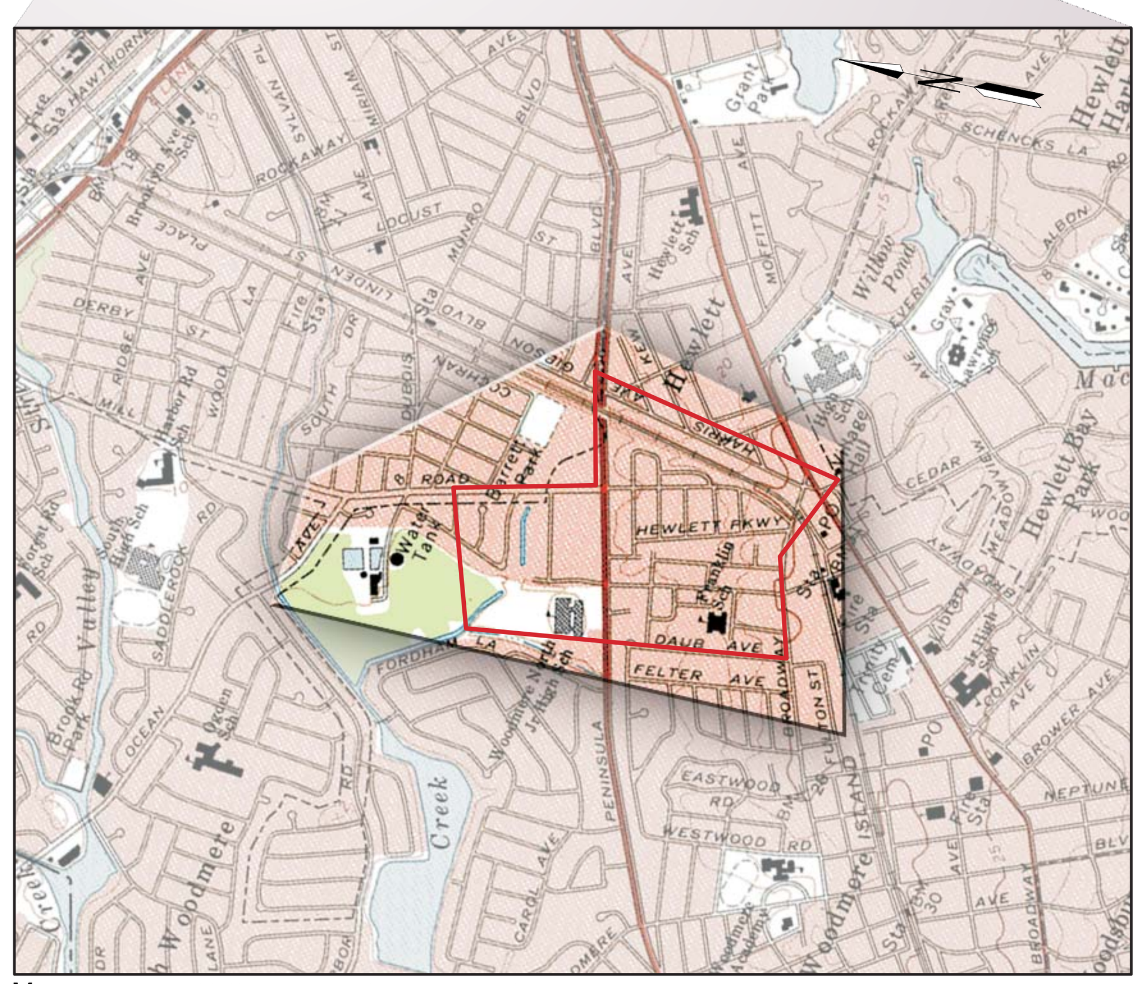

Mill Road view of back of Mill Rd Brite Cleaners.


Rear of former Everit Cleaners - and neighboring house.

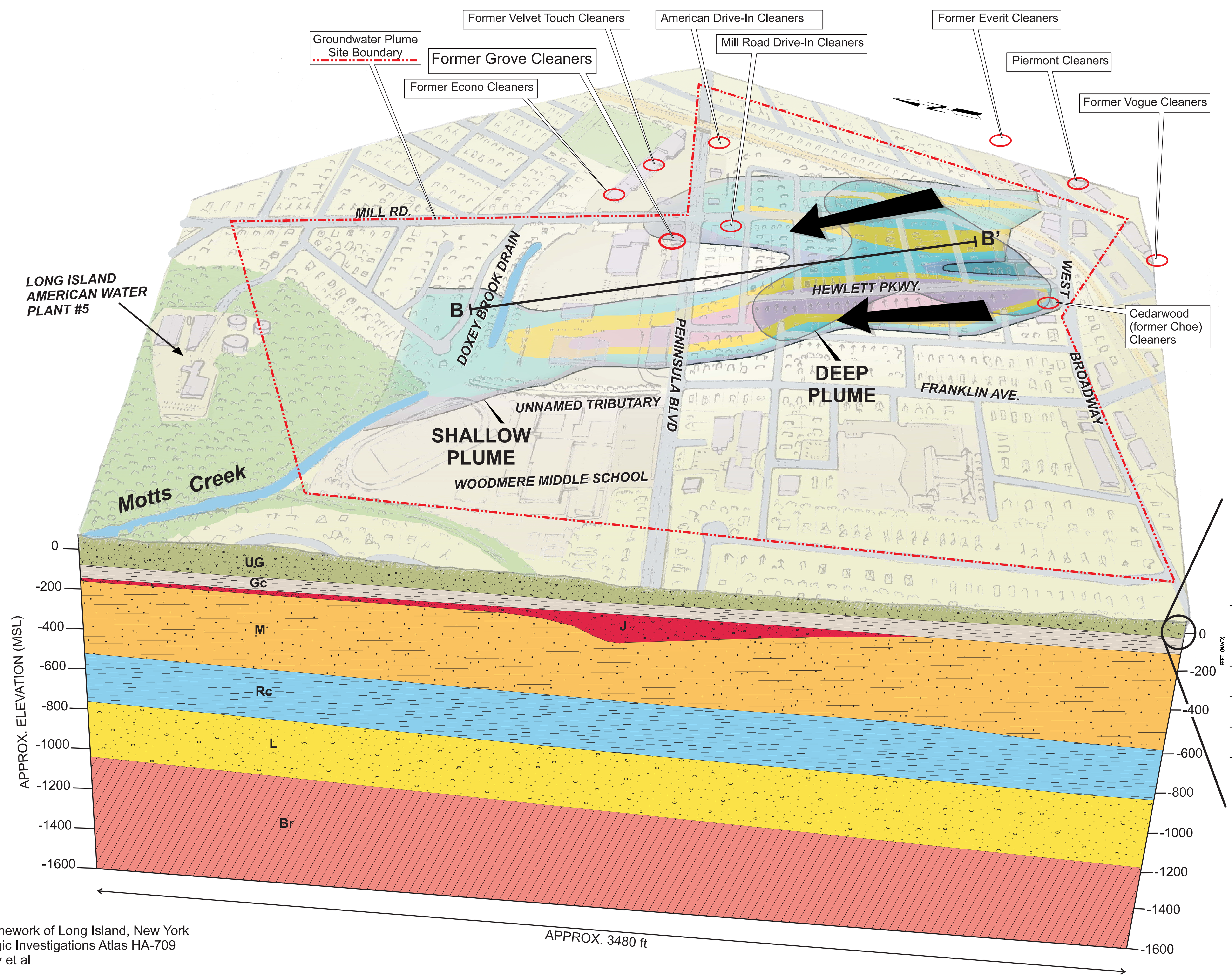

Back door of Piermont Cleaners.


Rear of former Vogue French Cleaners.


Rear of Cedarwood Cleaners.


Map source: USGS 7.5-min. Quadrangle Series Lynbrook, NY, 1969.

0 2000 ft SCALE



LAND USE KEY (General)

- Residential or unspecified
- Education
- Wooded
- Paved road
- Paved parking
- Commercial
- Water
- Park
- LIRR

GEOLOGICAL FORMATION KEY

- UG Upper glacial aquifer
- Gc Gardiners clay
- J Jameco aquifer
- M Magothy aquifer
- Rc Raritan clay
- L Lloyd aquifer
- Bedrock

General groundwater flow (Shallow Upper Glacial Aquifer)

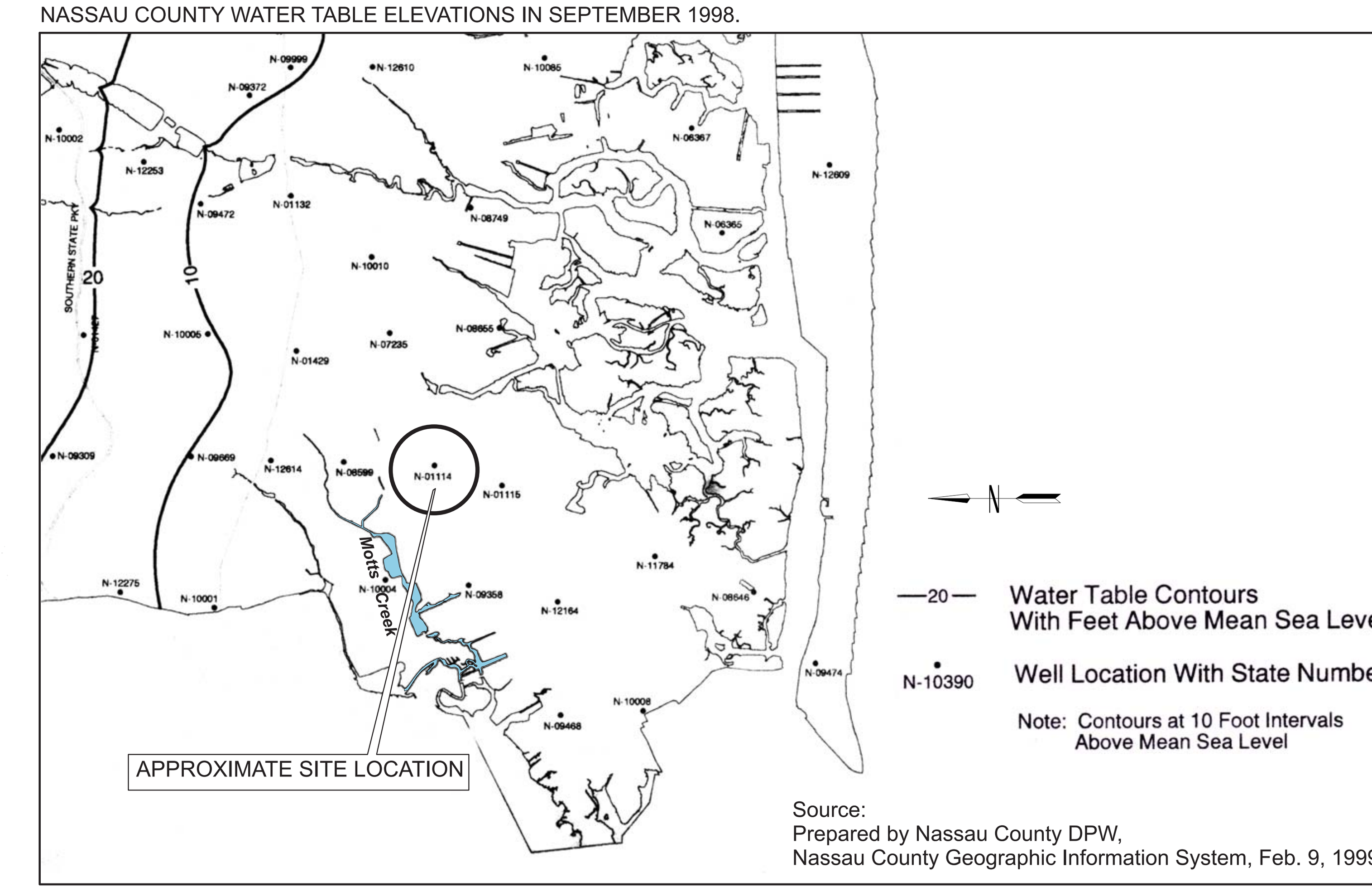
Shallow Groundwater Plume

(Blue)	< 5 µg/L
(Turquoise)	5-100 µg/L
(Yellow)	100-1,000 µg/L
(Red/Pink)	>1,000 µg/L

NOTE: Plume edges are approximate

Source:
Hydrologic Framework of Long Island, New York
USGS Hydrologic Investigations Atlas HA-709
D.A. Smolensky et al
1989

NASSAU COUNTY WATER TABLE ELEVATIONS IN SEPTEMBER 1998.

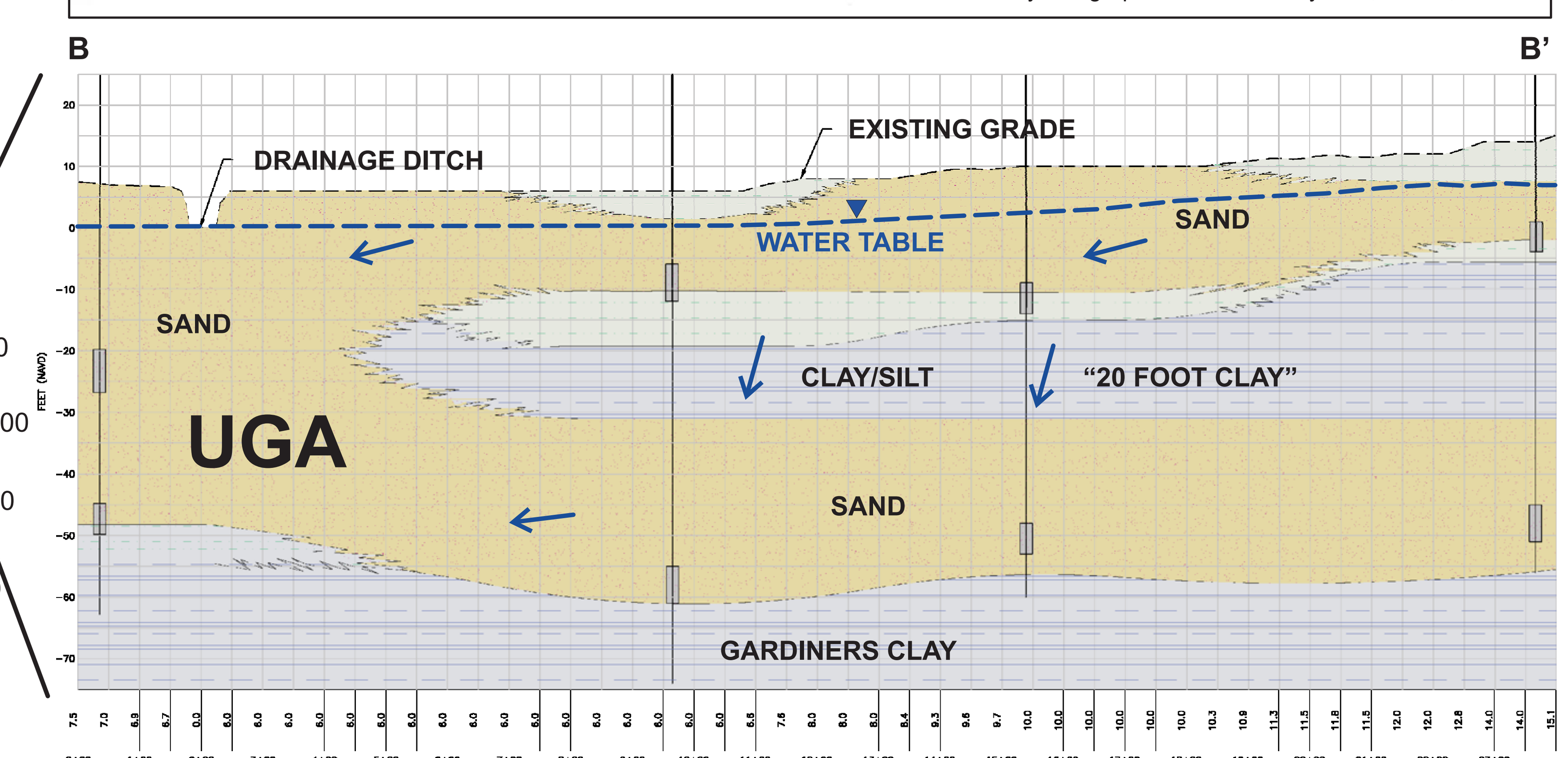


—20— Water Table Contours With Feet Above Mean Sea Level

N-10390 Well Location With State Number

Note: Contours at 10 Foot Intervals Above Mean Sea Level

Source:
Prepared by Nassau County DPW,
Nassau County Geographic Information System, Feb. 9, 1999.



LEGEND

Monitoring Well Screen Interval

Inferred Groundwater Flow Direction

CROSS SECTION B-B'

NOTE:
Dashed lines represent inferred contacts between stratigraphic units.

PROJECT MANAGER	M. MUSSO
LEAD DESIGN PROF	T. FOWLER
DESIGN ENGINEER	Z. ZURLO, T. FOWLER
DRAWN BY	J. GUDERIAN
PROGRAM MANAGER	B. WILLIAMS
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PROJECT NUMBER	147-112840

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ISSUE	DATE	DESCRIPTION
		DRAFT JANUARY 2011

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

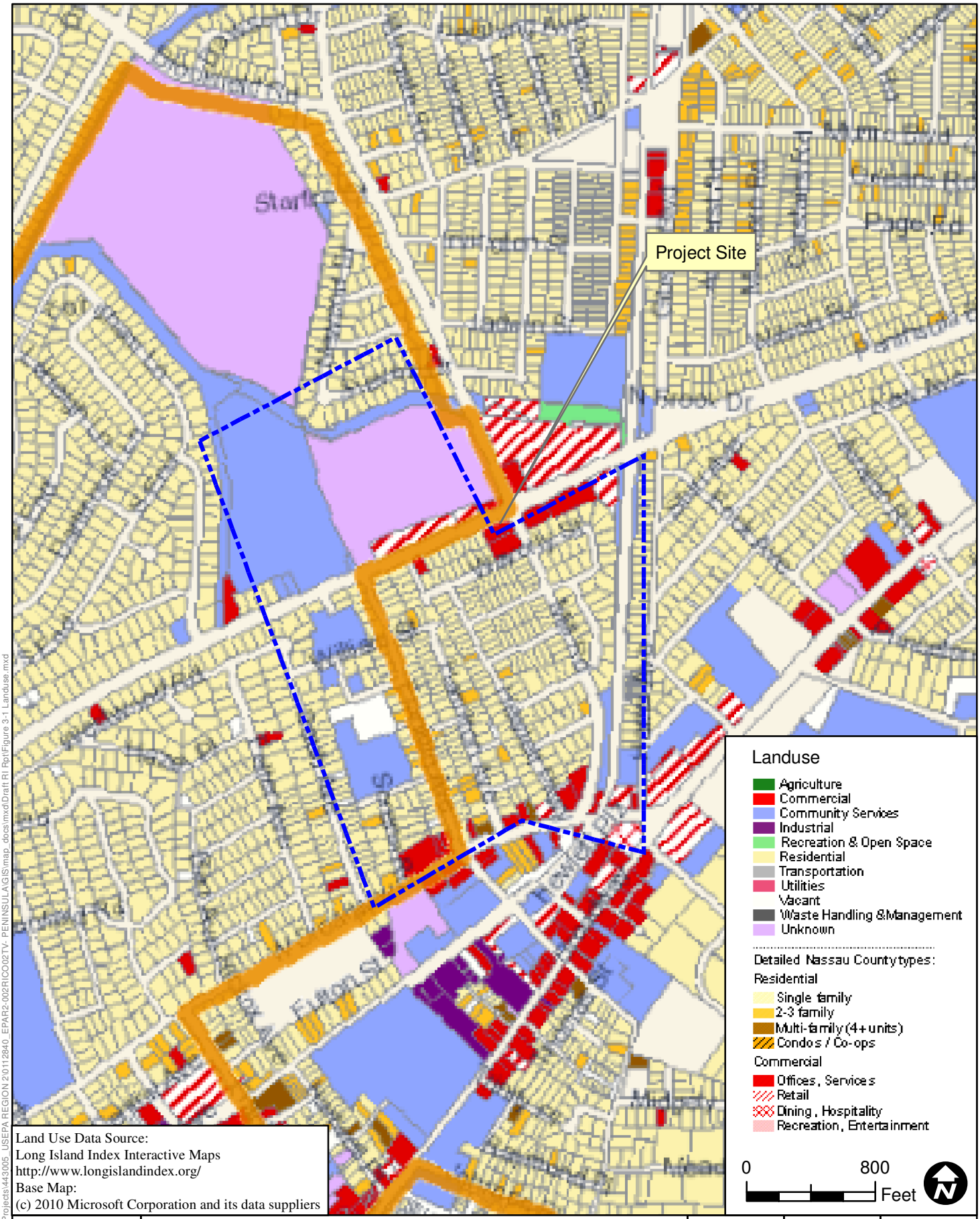
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 002-RICO-02TV

PENINSULA BOULEVARD GROUNDWATER PLUME FS

TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

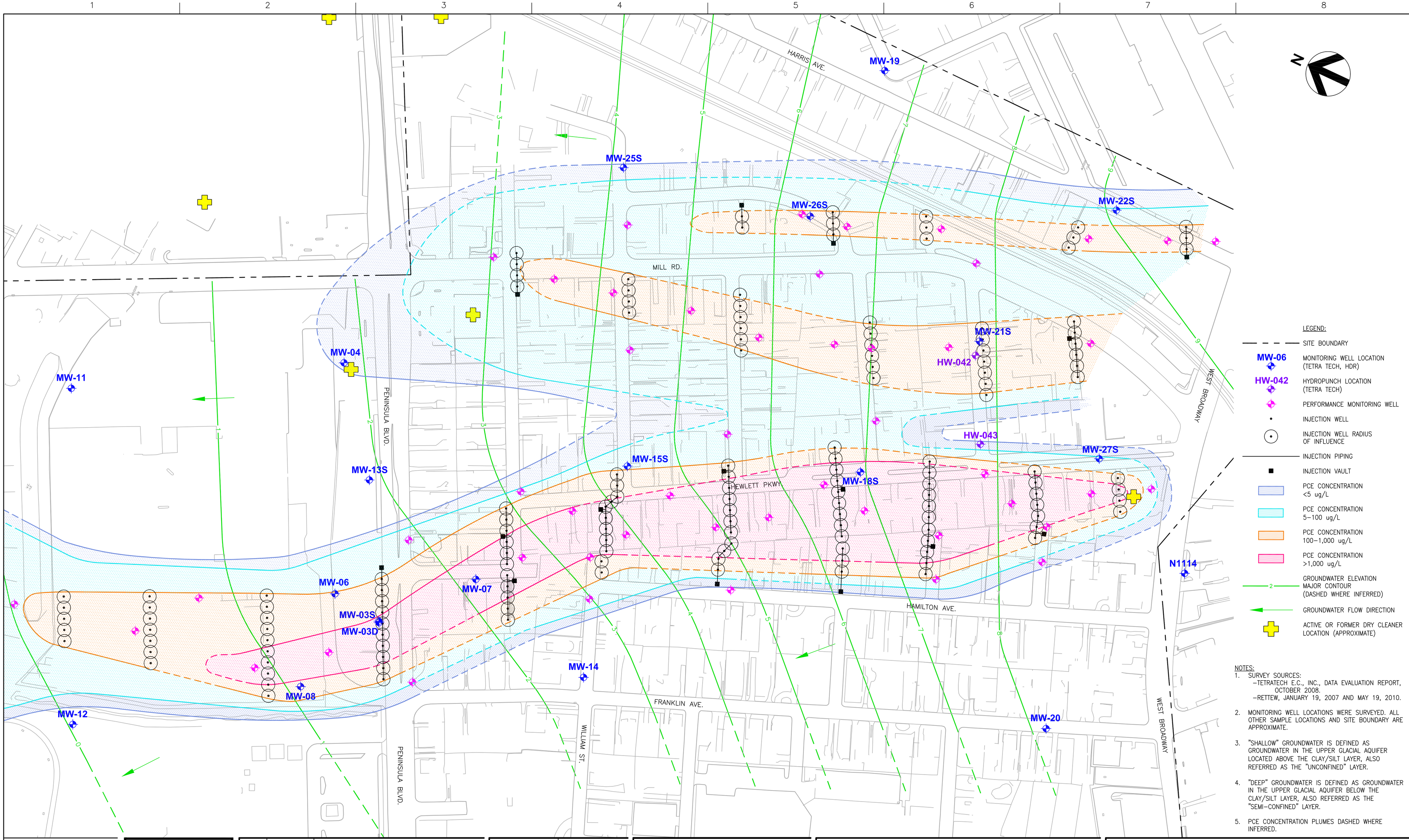
CONCEPTUAL SITE MODEL WITH PHOTOS

FILENAME	
SCALE	N.T.S.
SHEET	2-3



HDR	Land Use at Site and Vicinity - Peninsula Boulevard Groundwater Plume RI Town of Hempstead, Village of Hewlett Nassau County, New York	Job No.	Date	Figure No.
		112840	01/25/11	3-21

\\Phl-srv3\GIS_Projects\443005_USEPA REGION 2\0112840_EPAR2-002RICO02TV- PENINSULA\GIS\map_docs\mxd\Draft RI Rpt\Figure 3-1 Landuse.mxd



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1	04/26/11	DRAFT ISSUE

PROJECT MANAGER	MM
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DESIGN ENGINEER	AP
DRAWN BY	JW
PROGRAM MANAGER	BW
QUALITY ASSURANCE MGR	CZ
PROJECT NUMBER	147–112840

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME

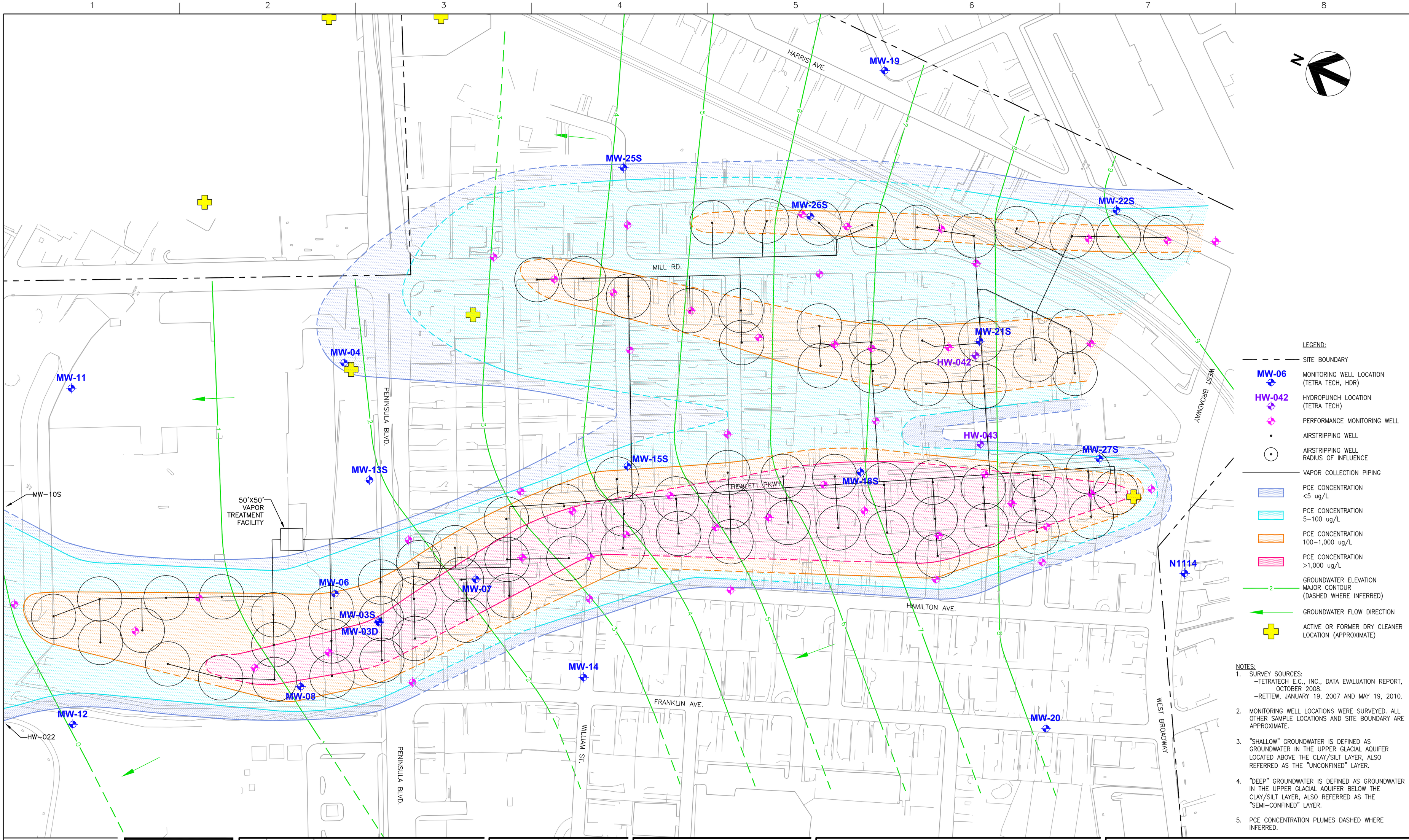
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

ALTERNATIVE G2 - ENHANCED BIO-REMEDIATION SHALLOW GROUNDWATER PLUME CONCEPTUAL INJECTION LOCATIONS

0 100 200
0 1" 2"

FILENAME –
SCALE 1" = 100'

SHEET 11-1



NOTES:
1. SURVEY SOURCES:
   –TETRATECH E.C., INC., DATA EVALUATION REPORT, OCTOBER 2008.
   –RETTEW, JANUARY 19, 2007 AND MAY 19, 2010.
2. MONITORING WELL LOCATIONS WERE SURVEYED. ALL OTHER SAMPLE LOCATIONS AND SITE BOUNDARY ARE APPROXIMATE.
3. "SHALLOW" GROUNDWATER IS DEFINED AS GROUNDWATER IN THE UPPER GLACIAL AQUIFER LOCATED ABOVE THE CLAY/SILT LAYER, ALSO REFERRED AS THE "UNCONFINED" LAYER.
4. "DEEP" GROUNDWATER IS DEFINED AS GROUNDWATER IN THE UPPER GLACIAL AQUIFER BELOW THE CLAY/SILT LAYER, ALSO REFERRED AS THE "SEMI–CONFINED" LAYER.
5. PCE CONCENTRATION PLUMES DASHED WHERE INFERRED.

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1	04/26/11	DRAFT ISSUE

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PROGRAM MANAGER	BW
QUALITY ASSURANCE MGR	CZ
PROJECT NUMBER	147–112840

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME

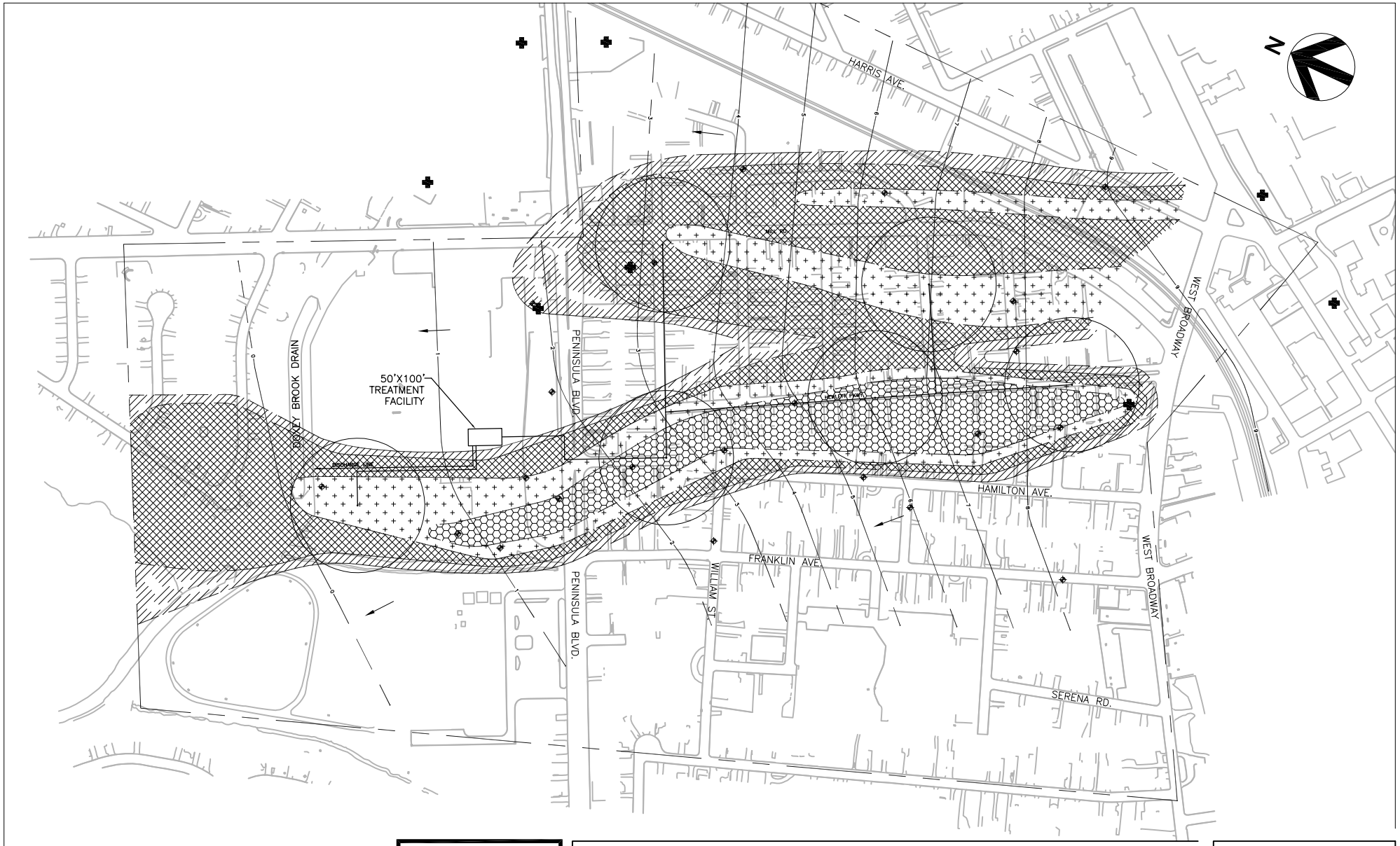
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

ALTERNATIVE G4 - IN-WELL AIR STRIPPING SHALLOW GROUNDWATER PLUME CONCEPTUAL WELL LOCATIONS

0 100 200
0 1" 2"

FILENAME –
SCALE 1" = 100'

SHEET 11-3



SCALE: 1"=400'

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SHALLOW UGA PUMP & TREAT LOCATIONS

FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT,
NASSAU COUNTY, NEW YORK

DATE
06-23-2011

FIGURE
4

SCALE: 1"=400'

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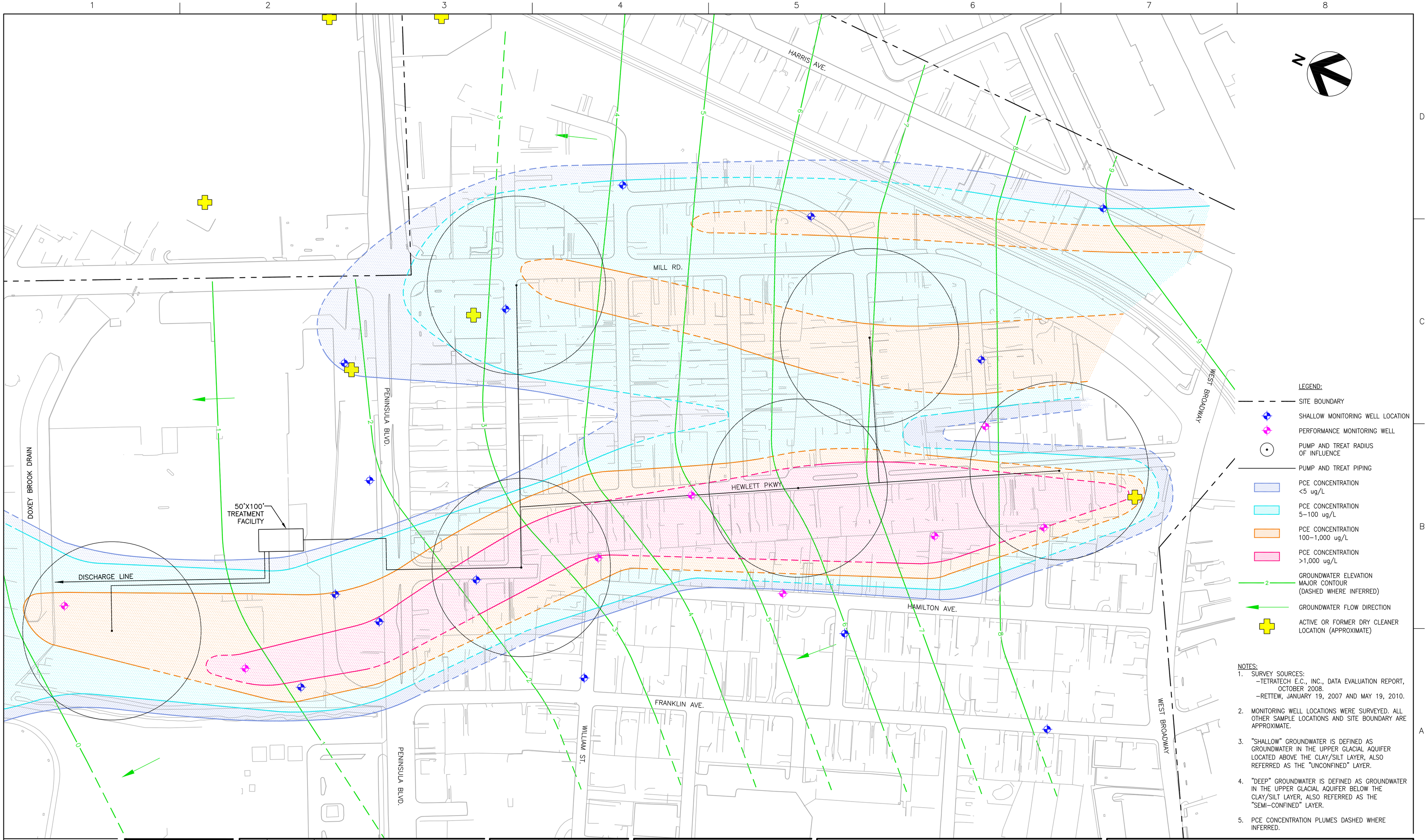
DEEP UGA PUMP & TREAT LOCATIONS

FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT,
NASSAU COUNTY, NEW YORK

DATE
06-23-2011

FIGURE
5



NOTES:
1. SURVEY SOURCES:
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   –RETTEW, JANUARY 19, 2007 AND MAY 19, 2010.
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5. PCE CONCENTRATION PLUMES DASHED WHERE INFERRED.

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1	04/26/11	DRAFT ISSUE

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LEAD DESIGN PROF	TC
DESIGN ENGINEER	AP
DRAWN BY	JW
PROGRAM MANAGER	BW
QUALITY ASSURANCE MGR	CZ
PROJECT NUMBER	147–112840

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 002-RICO-02TV

FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME

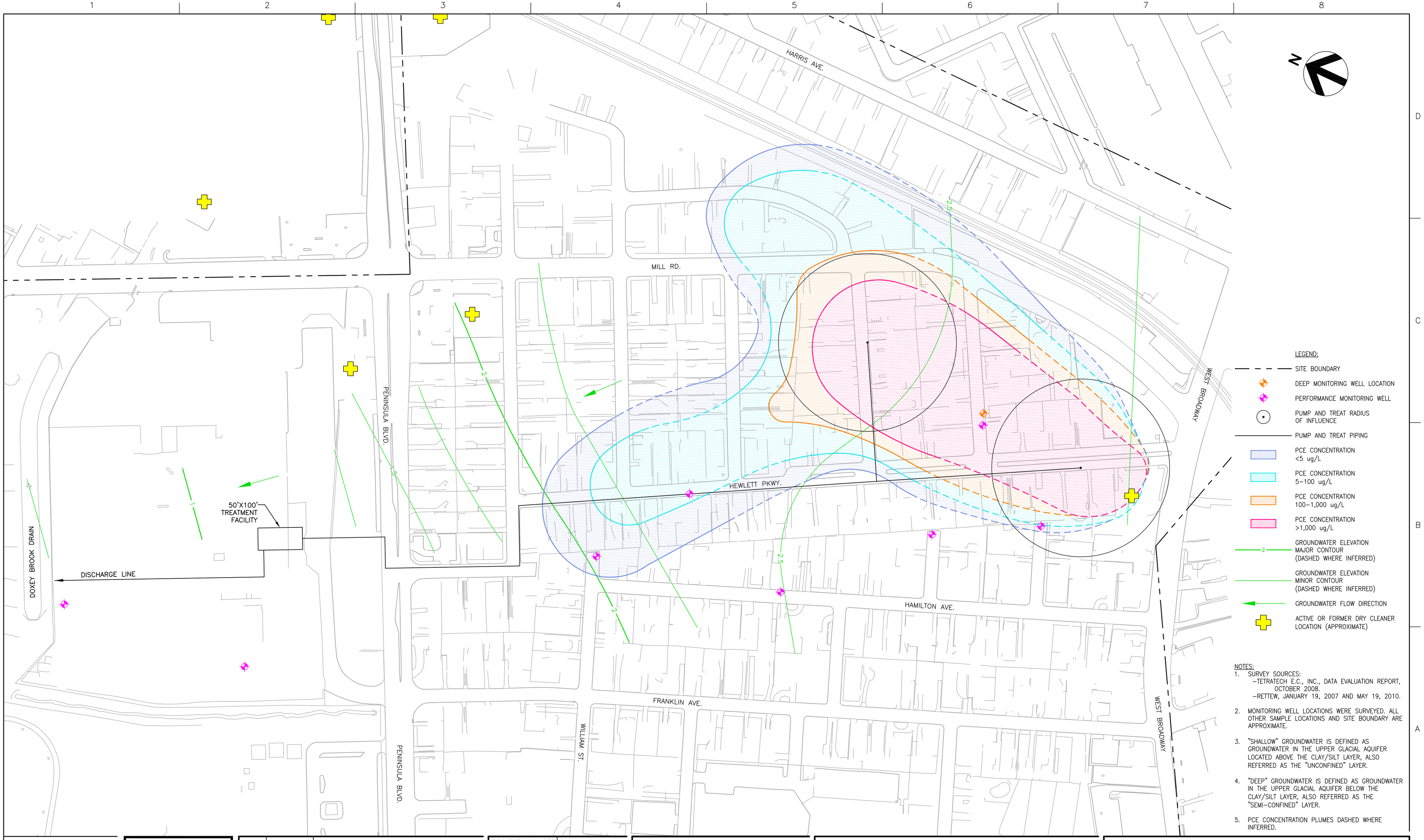
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

ALTERNATIVE G6 - GROUNDWATER PUMP AND TREAT SHALLOW GROUNDWATER PLUME CONCEPTUAL WELL LOCATIONS

0 100 200
0 1" 2"

FILENAME –
SCALE 1" = 100'

SHEET 11-5



NOTES:
1. SURVEY SOURCES:
   –TETRATECH E.C., INC., DATA EVALUATION REPORT, OCTOBER 2008.
   –RETTEW, JANUARY 19, 2007 AND MAY 19, 2010.
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1	04/26/11	DRAFT ISSUE

PROJECT MANAGER	MM
LEAD DESIGN PROF	TC
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QUALITY ASSURANCE MGR	CZ
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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FEASIBILITY STUDY
PENINSULA BOULEVARD GROUNDWATER PLUME

TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK

ALTERNATIVE G6 - GROUNDWATER PUMP AND TREAT DEEP GROUNDWATER PLUME CONCEPTUAL WELL LOCATIONS

0 100 200
0 1" 2"

FILENAME	–
SCALE	1" = 100'

SHEET **11-6**

Table 1

Summary Of Maximum Concentrations in Groundwater above Groundwater Quality Standards

Chemical	***Concentration***
Benzene	150 µg/l
Cis-1,2-DCE	9,400 µg/l
Ethylbenzene	17 µg/l
Isopropylbenzene	7.2 µg/l
PCE	30,000 µg/l
TCE	10,000 µg/l
Vinyl chloride	59 µg/l
Acenaphthene	22 µg/l
bis(2-ethylhexyl)phthalate	5.1 µg/l
Fluoranthene	1.3 µg/l
Fluorene	13 µg/l
Naphthalene	4.3 µg/l
Phenanthrene	1.4 µg/l
Dieldrin -	0.039 µg/l
Chromium	170 mg/l
Iron	42,000 mg/l
Manganese	1,100 mg/l
Nickel	110 mg/l
Sodium	340,000 mg/l
Zinc	940 mg/l

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-03D	MW-03S	MW-04	MW-06
Sample ID	PB-GWMW3D-01	PB-GWMW3S-01	PB-GWMW4-01	PB-GWMW6-01
Sample Date	8/30/2007	8/30/2007	8/30/2007	8/29/2007
Chemical - ug/L				
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U
Benzene	0.24 J	0.13 J	150	0.5 U
Carbon Disulfide	0.5 U	0.5 U	0.18 J	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.36 J	0.5 U
Chloroform	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.22 J	0.5 U	0.14 J	0.5 U
Cis-1,2-Dichloroethylene	27 J	7.7	2.3	0.85
Cyclohexane	0.5 U	0.5 U	25	0.5 U
Dimethyl Benzene	0.5 U	0.5 U	4.8	0.5 U
Ethylbenzene	0.5 U	0.5 U	17	0.5 U
Isopropylbenzene	0.5 U	0.5 U	7.2	0.5 U
Methylcyclohexane	0.5 U	0.5 U	17 J	0.5 U
Methylene Chloride	0.5 U	0.93	0.5 U	1.6
o-Xylene	0.5 U	0.5 U	1.2	0.5 U
Methyl tert-butyl ether (MTBE)	0.6	0.5 U	0.5 U	0.5 U
Tetrachloroethylene (PCE)	1,000	1,000	1.2	1.2
Toluene	0.5 U	0.5 U	3.3	0.5 U
Trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene (TCE)	38 J	10	0.75	0.25 J
Vinyl Chloride	0.5 U	0.5 U	1.8	0.5 U
2-Methylnaphthalene	5 U	5 U	1.1 J	5 U
Acenaphthene	5 U	5 U	22	5 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	2 J	1.9 J
Carbazole	5 U	5 U	3.6 J	5 U
Dibenzofuran	5 U	5 U	11	5 U
Diethyl Phthalate	5 U	5 U	5 U	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-03D	MW-03S	MW-04	MW-06
Sample ID	PB-GWMW3D-01	PB-GWMW3S-01	PB-GWMW4-01	PB-GWMW6-01
Sample Date	8/30/2007	8/30/2007	8/30/2007	8/29/2007
Chemical - ug/L				
Fluoranthene	5 U	5 U	1.3 J	5 U
Fluorene	5 U	5 U	13	5 U
Naphthalene	5 U	5 U	4.3 J	5 U
Phenanthrene	5 U	5 U	1.4 J	5 U
Dieldrin	0.039 J	0.1 U	0.1 U	0.1 U
Aluminum	200 U	200 U	200 U	200 U
Arsenic	8 U	8 U	8 U	8 U
Calcium	47,000	45,000	71,000	40,000
Chromium	8.1	5 U	5 U	5 U
Copper	10 U	10 U	10 U	10 U
Iron	86	180	620	66
Magnesium	7,400	12,000	16,000	10,000
Manganese	750	560	90	20
Nickel	20 U	20 U	20 U	20 U
Potassium	5,100	5,100	4,400	3,100
Sodium	95,000	91,000	57,000	49,000
Vanadium	20 U	20 U	20 U	20 U
Zinc	20 U	20 U	20 U	20 U
MNA/WQ - mg/L				
Alkalinity, Total (AS CACO3)	93	140	210	110
Biochemical Oxygen Demand (BOD)	2 U	2 U	2 U	2 U
Chloride (as CL)	180	140	94	66
Chemical Oxygen Demand (COD)	20 U	20 U	20 U	20 U
Nitrogen, Ammonia (as N)	0.26	0.05 U	2.1	0.18
Nitrogen, Nitrate (AS N)	2.1	3.2	2.44	2.26
Nitrogen, Nitrite	0.2 U	0.28	0.2 U	0.2
Phosphorus, Total (as P)	0.05 U	0.05 U	0.05	0.05 U
Sulfate (as SO4)	40	32	21	23
Sulfide	0.01 U	0.01 U	0.12	0.01 U
Total Organic Carbon	1 U	1 U	1 U	1 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-03D	MW-03S	MW-04	MW-06
Sample ID	PB-GWMW3D-01	PB-GWMW3S-01	PB-GWMW4-01	PB-GWMW6-01
Sample Date	8/30/2007	8/30/2007	8/30/2007	8/29/2007
Chemical - ug/L				
Total Dissolved Solids	450	450	440	310

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-07	MW-08	MW-10D	MW-10S	MW-11
Sample ID	PB-GWMW7-01	PB-GWMW08-01	PB-GWMW10D-01	PB-GWMW10S-01	PB-GWMW11-01
Sample Date	9/6/2007	8/28/2007	8/28/2007	8/28/2007	8/29/2007
Chemical - ug/L					
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzene	0.22 J	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.13 J	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cis-1,2-Dichloroethylene	12	18	0.5 U	1.8	5.5
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dimethyl Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene Chloride	1.2	0.5 U	0.5 U	0.5 U	1.7
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U	14	0.5 U	10	1.6
Tetrachloroethylene (PCE)	1,300	430	0.5 U	27	0.5 U
Toluene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene (TCE)	31 J	61	0.5 U	4.2	0.5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.99
2-Methylnaphthalene	5 U	5 U	1 J	5 U	5 U
Acenaphthene	5 U	5 U	5 U	5 U	1.3 J
Bis(2-ethylhexyl)phthalate	5 U	5 U	5 U	5 U	1.2 J
Carbazole	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 U	5 U	5 U	5 U	5 U
Diethyl Phthalate	5 U	5 U	5 U	5 U	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-07	MW-08	MW-10D	MW-10S	MW-11
Sample ID	PB-GWMW7-01	PB-GWMW08-01	PB-GWMW10D-01	PB-GWMW10S-01	PB-GWMW11-01
Sample Date	9/6/2007	8/28/2007	8/28/2007	8/28/2007	8/29/2007
Chemical - ug/L					
Fluoranthene	5 U	5 U	5 U	5 U	5 U
Fluorene	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U
Phenanthrene	5 U	5 U	5 U	5 U	5 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Aluminum	200 U	200 U	200 U	200 U	5,600
Arsenic	8 U	8 U	8 U	8 U	8 U
Calcium	44,000	52,000	22,000	27,000	42,000
Chromium	5 U	5 U	5 U	5 U	28
Copper	10 U	10 U	10 U	10 U	13
Iron	1,200	810	36,000	800	18,000
Magnesium	9,600	11,000	6,300	4,700	8,900
Manganese	130	350	760	1,100	230
Nickel	20 U	20 U	20 U	20 U	20
Potassium	5,400	9,700	2,100	5,200	5,500
Sodium	190,000	140,000	13,000	81,000	56,000
Vanadium	20 U	20 U	20 U	20 U	23
Zinc	20 U	20 U	20 U	27	56
MNA/WQ - mg/L					
Alkalinity, Total (AS CACO3)	100	100	64	68	96
Biochemical Oxygen Demand (BOD)	2 U	2 U	2.6 J	2 U	2 U
Chloride (as CL)	340	280	41	140	110
Chemical Oxygen Demand (COD)	20 U	20 U	20 U	20 U	20 U
Nitrogen, Ammonia (as N)	0.05 U	0.05 U	0.16	2.8	0.21
Nitrogen, Nitrate (AS N)	1.56	0.66	0.2 U	0.26	0.2 U
Nitrogen, Nitrite	0.5 R	0.2 U	0.2 U	0.2 U	0.2 U
Phosphorus, Total (as P)	0.05 U	0.05 U	0.079	0.05 U	0.17
Sulfate (as SO4)	44	37	35	39	18
Sulfide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Total Organic Carbon	27 J	1 U	1 U	1 U	1 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-07	MW-08	MW-10D	MW-10S	MW-11
Sample ID	PB-GWMW7-01	PB-GWMW08-01	PB-GWMW10D-01	PB-GWMW10S-01	PB-GWMW11-01
Sample Date	9/6/2007	8/28/2007	8/28/2007	8/28/2007	8/29/2007
Chemical - ug/L					
Total Dissolved Solids	630	620 J	250 J	400 J	350

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-12
Sample ID	PB-GWMW12-01
Sample Date	8/29/2007
Chemical - ug/L	
1,1,1-Trichloroethane	0.5 U
1,1-Dichloroethane	0.5 U
1,1-Dichloroethene	0.5 U
1,2-Dichlorobenzene	0.5 U
1,4-Dichlorobenzene	0.5 U
Benzene	0.5 U
Carbon Disulfide	0.5 U
Chlorobenzene	0.5 U
Chloroform	0.5 U
Chloromethane	0.5 U
Cis-1,2-Dichloroethylene	0.5 U
Cyclohexane	0.5 U
Dimethyl Benzene	0.5 U
Ethylbenzene	0.5 U
Isopropylbenzene	0.5 U
Methylcyclohexane	0.5 U
Methylene Chloride	1.5
o-Xylene	0.5 U
Methyl tert-butyl ether (MTBE)	1.7
Tetrachloroethylene (PCE)	0.5 U
Toluene	0.5 U
Trans-1,2-Dichloroethene	0.5 U
Trichloroethylene (TCE)	0.5 U
Vinyl Chloride	0.5 U
2-Methylnaphthalene	5 U
Acenaphthene	5.3
Bis(2-ethylhexyl)phthalate	5 U
Carbazole	5 U
Dibenzofuran	5 U
Diethyl Phthalate	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-12
Sample ID	PB-GWMW12-01
Sample Date	8/29/2007
Chemical - ug/L	
Fluoranthene	5 U
Fluorene	5 U
Naphthalene	5 U
Phenanthrene	5 U
Dieldrin	0.1 U
Aluminum	520
Arsenic	8 U
Calcium	67,000
Chromium	5 U
Copper	10 U
Iron	9,000
Magnesium	10,000
Manganese	800
Nickel	20 U
Potassium	6,700
Sodium	75,000
Vanadium	20 U
Zinc	20 U
MNA/WQ - mg/L	
Alkalinity, Total (AS CACO3)	150 L
Biochemical Oxygen Demand (BOD)	2 U
Chloride (as CL)	170
Chemical Oxygen Demand (COD)	20 U
Nitrogen, Ammonia (as N)	0.37
Nitrogen, Nitrate (AS N)	0.2 U
Nitrogen, Nitrite	0.2 U
Phosphorus, Total (as P)	0.12
Sulfate (as SO4)	9.5
Sulfide	0.01 U
Total Organic Carbon	1 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-12
Sample ID	PB-GWMW12-01
Sample Date	8/29/2007
Chemical - ug/L	
Total Dissolved Solids	540

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-13D	MW-13S	MW-14	MW-15D	MW-15S
Sample ID	PB-GWMW13D-01	PB-GWMW13S-01	PB-GWMW14-01	PB-GWMW15D-01	PB-GWMW15S-01
Sample Date	8/30/2007	8/30/2007	9/5/2007	9/4/2007	9/4/2007
Chemical - ug/L					
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.54	0.17 J	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzene	1.8	0.5 U	0.5 U	10	0.5 U
Carbon Disulfide	0.5 U	0.19 J	0.5 U	0.5 U	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.17 J	0.5 U	0.5 U	0.5 U
Cis-1,2-Dichloroethylene	0.5 U	0.5 U	0.5 U	0.88	0.5 U
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dimethyl Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene Chloride	0.57	0.5 U	0.78	1.7	1.3
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U	0.56	180	0.4 J	0.5 U
Tetrachloroethylene (PCE)	0.5 U	2.5	0.5 U	20	5.4
Toluene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene (TCE)	0.5 U	1	0.5 U	16	0.75
Vinyl Chloride	1.3	0.5 U	0.5 U	3.3	0.5 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U
Acenaphthene	5 U	5 U	5 U	5 U	5 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	5 U	5.1	5 U
Carbazole	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 U	5 U	5 U	5 U	5 U
Diethyl Phthalate	5 U	5 U	5 U	5 U	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-13D	MW-13S	MW-14	MW-15D	MW-15S
Sample ID	PB-GWMW13D-01	PB-GWMW13S-01	PB-GWMW14-01	PB-GWMW15D-01	PB-GWMW15S-01
Sample Date	8/30/2007	8/30/2007	9/5/2007	9/4/2007	9/4/2007
Chemical - ug/L					
Fluoranthene	5 U	5 U	5 U	5 U	5 U
Fluorene	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U
Phenanthrene	5 U	5 U	5 U	5 U	5 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.032 J
Aluminum	200 U	240 J	6,700	1,500	760
Arsenic	8 U	8 U	12	8 U	8 U
Calcium	30,000	41,000	13,000	49,000	31,000
Chromium	5 U	25	51	5 U	5 U
Copper	10 U	10 U	10 U	10 U	10 U
Iron	42,000	2,200	18,000	16,000	2,600
Magnesium	8,800	5,600	11,000	10,000	6,500
Manganese	1,000	530	280	900	90
Nickel	20 U	20 U	42	20 U	20 U
Potassium	2,600	4,300	5,600	20,000	4,300
Sodium	24,000	64,000	33,000	29,000	95,000
Vanadium	20 U	20 U	20 U	20 U	20 U
Zinc	20 U	20 U	32	20 U	20 U
MNA/WQ - mg/L					
Alkalinity, Total (AS CACO3)	73	91	17	120	61
Biochemical Oxygen Demand (BOD)	2.8 J	2 U	2 U	2 U	2 U
Chloride (as CL)	52	110	73	53	170
Chemical Oxygen Demand (COD)	20 U	20 U	20 U	20 U	20 U
Nitrogen, Ammonia (as N)	0.65	1.5	1.9	0.8	0.05 U
Nitrogen, Nitrate (AS N)	0.04 J	0.7	0.04 J	0.2 U	3.72
Nitrogen, Nitrite	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Phosphorus, Total (as P)	0.08	0.05 U	0.11	0.091	0.05 U
Sulfate (as SO4)	42	33	54	35	32
Sulfide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Total Organic Carbon	1 U	1 U	4.2 J	1 U	1 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-13D	MW-13S	MW-14	MW-15D	MW-15S
Sample ID	PB-GWMW13D-01	PB-GWMW13S-01	PB-GWMW14-01	PB-GWMW15D-01	PB-GWMW15S-01
Sample Date	8/30/2007	8/30/2007	9/5/2007	9/4/2007	9/4/2007
Chemical - ug/L					
Total Dissolved Solids	260	340	160	240	340

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-16
Sample ID	PB-GWMW16-01
Sample Date	9/5/2007
Chemical - ug/L	
1,1,1-Trichloroethane	0.5 U
1,1-Dichloroethane	0.5 U
1,1-Dichloroethene	0.5 U
1,2-Dichlorobenzene	0.5 U
1,4-Dichlorobenzene	0.5 U
Benzene	0.5 U
Carbon Disulfide	0.5 U
Chlorobenzene	0.5 U
Chloroform	0.5 U
Chloromethane	0.5 U
Cis-1,2-Dichloroethylene	0.5 U
Cyclohexane	0.5 U
Dimethyl Benzene	0.5 U
Ethylbenzene	0.5 U
Isopropylbenzene	0.5 U
Methylcyclohexane	0.5 U
Methylene Chloride	1.1
o-Xylene	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U
Tetrachloroethylene (PCE)	0.68
Toluene	0.5 U
Trans-1,2-Dichloroethene	0.5 U
Trichloroethylene (TCE)	0.5 U
Vinyl Chloride	0.5 U
2-Methylnaphthalene	5 U
Acenaphthene	5 U
Bis(2-ethylhexyl)phthalate	5 U
Carbazole	5 U
Dibenzofuran	5 U
Diethyl Phthalate	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-16
Sample ID	PB-GWMW16-01
Sample Date	9/5/2007
Chemical - ug/L	
Fluoranthene	5 U
Fluorene	5 U
Naphthalene	5 U
Phenanthrene	5 U
Dieldrin	0.1 U
Aluminum	250 J
Arsenic	8 U
Calcium	30,000
Chromium	5 U
Copper	10 U
Iron	250
Magnesium	6,700
Manganese	37
Nickel	20 U
Potassium	3,000
Sodium	74,000
Vanadium	20 U
Zinc	20 U
MNA/WQ - mg/L	
Alkalinity, Total (AS CACO3)	53
Biochemical Oxygen Demand (BOD)	2 U
Chloride (as CL)	140
Chemical Oxygen Demand (COD)	20 U
Nitrogen, Ammonia (as N)	0.29
Nitrogen, Nitrate (AS N)	0.88
Nitrogen, Nitrite	0.2 U
Phosphorus, Total (as P)	0.05 U
Sulfate (as SO4)	36
Sulfide	0.01 U
Total Organic Carbon	13 J

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-16
Sample ID	PB-GWMW16-01
Sample Date	9/5/2007
Chemical - ug/L	
Total Dissolved Solids	280

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-17	MW-18D	MW-18S	MW-19	MW-20
Sample ID	PB-GWMW17-01	PB-GWMW18D-01	PB-GWMW18S-01	PB-GWMW19-01	PB-GWMW20-01
Sample Date	9/10/2007	9/7/2007	9/7/2007	9/6/2007	9/4/2007
Chemical - ug/L					
1,1,1-Trichloroethane	0.22 J	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J
Carbon Disulfide	1.5	3.9 J	0.5 U	1.5	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	1.9	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.31 J	0.33 J	0.5 U	0.5 U
Cis-1,2-Dichloroethylene	0.14 J	0.5 U	0.36 J	0.88	0.5 U
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dimethyl Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	1.4	2.1
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U	8.2	0.5 U	0.5 U	0.5 U
Tetrachloroethylene (PCE)	0.41 J	2.3	5.9	0.5 U	0.5 U
Toluene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene (TCE)	0.23 J	0.5 U	0.56	0.5 U	0.5 U
Vinyl Chloride	0.5 U	0.37 J	0.5 U	0.5 U	0.5 U
2-Methylnaphthalene	5 U	7.7	5 U	5 U	5 U
Acenaphthene	5 U	5 U	5 U	5 U	5 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	5 U	5 U	5 U
Carbazole	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 U	5 U	5 U	5 U	5 U
Diethyl Phthalate	5 U	5 U	1 J	5 U	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-17	MW-18D	MW-18S	MW-19	MW-20
Sample ID	PB-GWMW17-01	PB-GWMW18D-01	PB-GWMW18S-01	PB-GWMW19-01	PB-GWMW20-01
Sample Date	9/10/2007	9/7/2007	9/7/2007	9/6/2007	9/4/2007
Chemical - ug/L					
Fluoranthene	5 U	5 U	5 U	5 U	5 U
Fluorene	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	1.3 J	5 U	5 U	5 U
Phenanthrene	5 U	5 U	5 U	5 U	5 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Aluminum	4,200	5,100	360 J	1,200	200 U
Arsenic	8 U	8 U	8 U	8 U	8 U
Calcium	60,000	27,000	39,000	81,000	42,000
Chromium	77	12	5 U	6	27
Copper	10 U	10 U	10 U	10 U	10 U
Iron	9,700	17,000	740	4,500	460
Magnesium	12,000	5,100	8,000	20,000	6,900
Manganese	510	450	5 U	220	280
Nickel	49	20 U	20 U	20 U	21
Potassium	4,500	3,300	4,600	6,200	15,000
Sodium	110,000	200,000	110,000	340,000	160,000
Vanadium	20 U	20 U	20 U	20 U	20 U
Zinc	45	20 U	20 U	20 U	20 U
MNA/WQ - mg/L					
Alkalinity, Total (AS CACO3)	90	230	74	220	89
Biochemical Oxygen Demand (BOD)	2 J	2 U	2 R	2 U	2 U
Chloride (as CL)	230	93	190	640	310
Chemical Oxygen Demand (COD)	20 U	110	20 U	20 U	20 U
Nitrogen, Ammonia (as N)	0.05 U	0.16	0.13	0.5	0.12
Nitrogen, Nitrate (AS N)	0.18 J	4.06	0.04 J	0.2 U	0.68
Nitrogen, Nitrite	0.2 U	0.2 U	0.2 U	1 R	0.5 R
Phosphorus, Total (as P)	0.17	0.19	0.05 U	0.065	0.05 U
Sulfate (as SO4)	37	200	32	9.8	17
Sulfide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Total Organic Carbon	21 J	73 J	19 J	50 J	1 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-17	MW-18D	MW-18S	MW-19	MW-20
Sample ID	PB-GWMW17-01	PB-GWMW18D-01	PB-GWMW18S-01	PB-GWMW19-01	PB-GWMW20-01
Sample Date	9/10/2007	9/7/2007	9/7/2007	9/6/2007	9/4/2007
Chemical - ug/L					
Total Dissolved Solids	NA	680	390	1100	540

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21D
Sample ID	PB-GWMW21D-01
Sample Date	9/5/2007
Chemical - ug/L	
1,1,1-Trichloroethane	0.5 U
1,1-Dichloroethane	0.5 U
1,1-Dichloroethene	3.3
1,2-Dichlorobenzene	0.5 U
1,4-Dichlorobenzene	0.5 U
Benzene	6.1
Carbon Disulfide	0.5 U
Chlorobenzene	0.5 U
Chloroform	0.5 U
Chloromethane	1.2
Cis-1,2-Dichloroethylene	1.6
Cyclohexane	0.5 U
Dimethyl Benzene	0.5 U
Ethylbenzene	0.5 U
Isopropylbenzene	0.5 U
Methylcyclohexane	0.5 U
Methylene Chloride	1.7
o-Xylene	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U
Tetrachloroethylene (PCE)	2,600
Toluene	0.5 U
Trans-1,2-Dichloroethene	0.56
Trichloroethylene (TCE)	240
Vinyl Chloride	1.6
2-Methylnaphthalene	5 U
Acenaphthene	5 U
Bis(2-ethylhexyl)phthalate	5 U
Carbazole	5 U
Dibenzofuran	5 U
Diethyl Phthalate	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21D
Sample ID	PB-GWMW21D-01
Sample Date	9/5/2007
Chemical - ug/L	
Fluoranthene	5 U
Fluorene	5 U
Naphthalene	5 U
Phenanthrene	5 U
Dieldrin	0.1 U
Aluminum	1,800
Arsenic	8 U
Calcium	34,000
Chromium	7.8
Copper	10 U
Iron	38,000
Magnesium	9,800
Manganese	1,100
Nickel	20 U
Potassium	3,400
Sodium	13,000
Vanadium	20 U
Zinc	20 U
MNA/WQ - mg/L	
Alkalinity, Total (AS CACO3)	76
Biochemical Oxygen Demand (BOD)	2.5
Chloride (as CL)	59
Chemical Oxygen Demand (COD)	20 U
Nitrogen, Ammonia (as N)	0.33
Nitrogen, Nitrate (AS N)	
Nitrogen, Nitrite	0.2 U
Phosphorus, Total (as P)	0.05 U
Sulfate (as SO4)	27
Sulfide	0.01 U
Total Organic Carbon	13 J

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21D
Sample ID	PB-GWMW21D-01
Sample Date	9/5/2007
Chemical - ug/L	
Total Dissolved Solids	210

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21S	MW-22D	MW-22S	MW-23	N1114
Sample ID	PB-GWMW21S-01	PB-GWMW22D-01	PB-GWMW22S-01	PB-GWMW23-01	PB-GWN1114-01
Sample Date	9/5/2007	8/31/2007	8/31/2007	9/6/2007	9/10/2007
Chemical - ug/L					
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.32 J	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U
Benzene	0.5 U	9.6	0.5 U	0.5 U	0.5 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.18 J
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.71	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U
Cis-1,2-Dichloroethylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.7
Dimethyl Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	1.4
Isopropylbenzene	0.5 U	0.5 U	0.5 U	2	0.65
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	1.4	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether (MTBE)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethylene (PCE)	140	0.5 U	0.5 U	0.5 U	0.14 J
Toluene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene (TCE)	0.28 J	0.5 U	0.5 U	0.5 U	0.1 J
Vinyl Chloride	0.5 U	2.1	0.5 U	0.5 U	0.5 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U
Acenaphthene	5 U	5 U	5 U	5 U	5 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	5 U	5.1	1.6 J
Carbazole	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 U	5 U	5 U	5 U	5 U
Diethyl Phthalate	5 U	5 U	5 U	5 U	5 U

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21S	MW-22D	MW-22S	MW-23	N1114
Sample ID	PB-GWMW21S-01	PB-GWMW22D-01	PB-GWMW22S-01	PB-GWMW23-01	PB-GWN1114-01
Sample Date	9/5/2007	8/31/2007	8/31/2007	9/6/2007	9/10/2007
Chemical - ug/L					
Fluoranthene	5 U	5 U	5 U	5 U	5 U
Fluorene	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U
Phenanthrene	5 U	5 U	5 U	5 U	5 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Aluminum	3,000	1,400	870	200 U	100 U
Arsenic	8 U	8 U	8 U	8 U	8 U
Calcium	30,000	41,000	46,000	32,000	44,000
Chromium	170	5 U	11	10	5 U
Copper	10 U	64	10 U	10 U	10 U
Iron	7,200	34,000	1,700	1,000	21,000
Magnesium	6,700	11,000	5,300	5,500	4,900
Manganese	88	810	48	80	140
Nickel	110	20 U	20 U	20 U	20 U
Potassium	4,000	3,300	2,800	2,800	6,200
Sodium	110,000	18,000	170,000	67,000	93,000
Vanadium	20 U	20 U	20 U	20 U	20 U
Zinc	47	42	20 U	20 U	940
MNA/WQ - mg/L					
Alkalinity, Total (AS CACO3)	40	48 J	83 J	51	70
Biochemical Oxygen Demand (BOD)	2 U			2 U	2 U
Chloride (as CL)	230	98 J	320 J	140	190
Chemical Oxygen Demand (COD)	20 U	20 U	20 U	20 U	20 U
Nitrogen, Ammonia (as N)	0.05 U	1.3 J	0.27 J	0.05 U	1.7
Nitrogen, Nitrate (AS N)	3.08			1.82	
Nitrogen, Nitrite	0.2 U			0.2 U	0.2 U
Phosphorus, Total (as P)	0.05 U	0.05 U	0.062 J	0.05 U	0.05 U
Sulfate (as SO4)	26	24 J	29 J	21	21
Sulfide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Total Organic Carbon	9.8 J	11	20	13 J	20 J

Table 2
Analytical Results for Groundwater - 2007

Location ID	MW-21S	MW-22D	MW-22S	MW-23	N1114
Sample ID	PB-GWMW21S-01	PB-GWMW22D-01	PB-GWMW22S-01	PB-GWMW23-01	PB-GWN1114-01
Sample Date	9/5/2007	8/31/2007	8/31/2007	9/6/2007	9/10/2007
Chemical - ug/L					
Total Dissolved Solids	200	360	640	270	

Notes:
J - estimated
mg/L - milligrams per liter
R - Rejected
U - not detected
ug/L - micrograms per liter

Table 3
Analytical Results for Groundwater - May 2010

Location ID	MW-10D	MW-10S	MW-11	MW-12	MW-13D	MW-13S
Sample ID	PEN-GW10D-01	PEN-GW10S-01	PEN-GW11-01	PEN-GW12-01	PEN-GW13D-01	PEN-GW13S-01
Sample Date	5/11/2010	5/11/2010	5/17/2010	5/19/2010	5/12/2010	5/12/2010
Chemical - ug/L						
Benzene	5 U	5 U	5 U	5 U	7	5 U
Cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)	5 U	11	5 U	5 U	5 U	5 U
Tetrachloroethylene (PCE)	5 U	7.8	5 U	5 U	5 U	5 U
Trichloroethylene (TCE)	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	59	5 U	5 U	5 U

Notes:
U - not detected
ug/L - micrograms per liter

Table 3
Analytical Results for Groundwater - May 2010

Location ID	MW-14	MW-15D	MW-15S	MW-16	MW-17	MW-18D
Sample ID	PEN-GW14-01	PEN-GW15D-01	PEN-GW15S-01	PEN-GW16-01	PEN-GW17-01	PEN-GW18D-01
Sample Date	5/17/2010	5/13/2010	5/13/2010	5/17/2010	5/14/2010	5/13/2010
Chemical - ug/L						
Benzene	5 U	18	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethylene	5 U	7.3	5 U	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)	26	5 U	5 U	5 U	5 U	8.8
Tetrachloroethylene (PCE)	5 U	53	8.7	18	5 U	5 U
Trichloroethylene (TCE)	5 U	70	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
U - not detected
ug/L - micrograms per liter

Table 3
Analytical Results for Groundwater - May 2010

Location ID	MW-18S	MW-19	MW-20	MW-21D	MW-21S	MW-22D
Sample ID	PEN-GW18S-01	PEN-GW19-01	PEN-GW20-01	PEN-GW21D-01	PEN-GW21S-01	PEN-GW22D-01
Sample Date	5/13/2010	5/14/2010	5/19/2010	5/17/2010	5/17/2010	5/18/2010
Chemical - ug/L						
Benzene	5 U	5 U	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethylene	12	5 U	5 U	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene (PCE)	2,300	5 U	5 U	4,000	5 U	5 U
Trichloroethylene (TCE)	16	5 U	5 U	270	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
U - not detected
ug/L - micrograms per liter

Table 3
Analytical Results for Groundwater - May 2010

Location ID	MW-22S	MW-24	MW-25D	MW-25S	MW-26D	MW-26S
Sample ID	PEN-GW22S-01	PEN-GW24-01	PEN-GW25D-01	PEN-GW25S-01	PEN-GW26D-01	PEN-GW26S-01
Sample Date	5/18/2010	5/18/2010	5/13/2010	5/13/2010	5/14/2010	5/14/2010
Chemical - ug/L						
Benzene	5 U	5 U	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene (PCE)	5 U	5 U	5 U	5 U	5 U	20
Trichloroethylene (TCE)	5 U	5 U	5 U	5 U	5 U	5.3
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
U - not detected
ug/L - micrograms per liter

Table 3
Analytical Results for Groundwater - May 2010

Location ID	MW-27D	MW-27S	MW-28D	MW-28S	MW-29	PZ-1
Sample ID	PEN-GW27D-01	PEN-GW27S-01	PEN-GW28D-01	PEN-GW28S-01	PEN-GW29-01	PEN-GWPZ01-01
Sample Date	5/12/2010	5/12/2010	5/11/2010	5/11/2010	5/19/2010	5/17/2010
Chemical - ug/L						
Benzene	500 U	5.3	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethylene	520	5 U	5 U	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)	500 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene (PCE)	30,000	5 U	5 U	5 U	5 U	5 U
Trichloroethylene (TCE)	10,000	11	5 U	5 U	5 U	5 U
Vinyl Chloride	500 U	5 U	5 U	5 U	5 U	5 U

Notes:
U - not detected
ug/L - micrograms per liter

Table 4
Analytical Reults for Groundwater - August 2010

Location ID	MW-24	MW-25D	MW-25S	MW-26D	MW-26S	MW-27D
Sample ID	PEN-GW24-02	PEN-GW25D-02	PEN-GW25S-02	PEN-GW26D-02	PEN-GW26S-02	PEN-GW27D-02
Sample Date	8/16/2010	8/17/2010	8/17/2010	8/18/2010	8/18/2010	8/18/2010
Chemical - ug/L						
Benzene	5 U	5 U	5 U	5 UJ	5 UJ	500 UJ
Cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 UJ	5 UJ	9,400 J
Tetrachloroethylene (PCE)	5 U	5 U	5 U	5 UJ	26 J	23,000 J
Trichloroethylene (TCE)	5 U	5 U	5 U	5 UJ	5 UJ	5,800 J

Notes:
J - estimated value
U - not detected
ug/L - micrograms per liter

Table 4
Analytical Reults for Groundwater - August 2010

Location ID	MW-27S	MW-28D	MW-28S	MW-29
Sample ID	PEN-GW27S-02	PEN-GW28D-02	PEN-GW28S-02	PEN-GW29-02
Sample Date	8/18/2010	8/17/2010	8/17/2010	8/16/2010
Chemical - ug/L				
Benzene	6.8 J	5 U	5 U	5 U
Cis-1,2-Dichloroethylene	5 UJ	5 U	5 U	5 U
Tetrachloroethylene (PCE)	5 UJ	5 U	5 U	5 U
Trichloroethylene (TCE)	5 UJ	5 U	5 U	5 U

Notes:
J - estimated value
U - not detected
ug/L - micrograms per liter

Table 5

Analytical Results of EPA Sampling of Groundwater at LIAWC Well Field #5, October 2010

	Location ID	WF5-5R	WF5-7R	WF5-21R	WF5-52R	WF5-55R
	Sample ID	AM04366	AM04368	AM04363	AM04364	AM04365
	Sample Date	10/5/2010	10/4/2010	10/4/2010	10/5/2010	10/5/2010
	Result Units	ug/l	ug/l	ug/l	ug/l	ug/l
CHEMICAL NAME	**CAS**					
CHLOROMETHANE	74-87-3	ND	1	0.85	0.9	0.94
CHLOROFORM	67-66-3	ND	ND	ND	ND	0.57
TETRACHLOROETHENE (PCE)	127-18-4	ND	ND	ND	ND	4.1
METHYL TERT-BUTYL ETHER	1634-04-4	1.6	ND	ND	ND	ND
TOLUENE	108-88-3	ND	0.89	ND	ND	ND

All samples were collected by EPA and analyzed for TCL VOCs.
ND - Not detected
ug/l - micrograms per liter

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-03D AN01823 4/26/2011	MW-03S AN01824 4/26/2011	MW-04 AN01825 4/27/2011	MW-06 AN01826 4/26/2011	MW-07 AN01827 4/26/2011	MW-10D AN01828 4/27/2011
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	2 U	2 U	0.5 U	2 U	2 U	0.5 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	5 U	5 U	5 U	5 U	5 U	5 U
ACETONE	190	5 U	24	15	13	5 U
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOCHLOROMETHANE	1 U	1 U	0.5 U	1 U	1 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHYLENE	12	6.7	0.96	0.5 U	5.7	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ISOBUTYLENE						

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-03D AN01823 4/26/2011	MW-03S AN01824 4/26/2011	MW-04 AN01825 4/27/2011	MW-06 AN01826 4/26/2011	MW-07 AN01827 4/26/2011	MW-10D AN01828 4/27/2011
ISOPROPYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
M, P XYLENES	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYL ACETATE	2 U	2 U	0.5 U	2 U	2 U	0.5 U
METHYL ETHYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYL ISOBUTYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYLCYCLOHEXANE	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
O-XYLENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-BUTYL METHYL ETHER	2 UJ	2 UJ	0.5 U	2 UJ	2 UJ	0.5 U
TETRACHLOROETHYLENE (PCE)	240	290	0.5 U	3.6	430	0.5 U
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.86	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROETHYLENE (TCE)	20	10	0.5 U	0.5 U	31	0.5 U
TRICHLOROFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	21	0.5 U	0.5 U	0.5 U

Notes:
J - estimated value
U - non-detect
ug/L - micrograms per Liter

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-10S AN01829 4/27/2011	MW-11 AN01830 4/27/2011	MW-13D AN01831 4/26/2011	MW-13S AN01832 4/26/2011	MW-14 AN01853 5/2/2011	MW-15D AN01834 4/25/2011
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.56	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	0.5 U	0.5 U	2 U	2 U	2 U	2 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	5 U	5 U	5 U	5 U	5 U	10 U
ACETONE	120	5 U	5 U	5 U	5 U	530
BENZENE	0.5 U	0.5 U	7.8	0.5 U	0.5 U	16
BROMOCHLOROMETHANE	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHYLENE	1.6	1.5	0.5 U	0.5 U	0.5 U	19
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ISOBUTYLENE						

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-10S AN01829 4/27/2011	MW-11 AN01830 4/27/2011	MW-13D AN01831 4/26/2011	MW-13S AN01832 4/26/2011	MW-14 AN01853 5/2/2011	MW-15D AN01834 4/25/2011
ISOPROPYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
M, P XYLENES	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYL ACETATE	0.5 U	0.5 U	2 U	2 U	2 U	1 U
METHYL ETHYL KETONE	5 U	5 U	5 U	5 U	5 U	10 U
METHYL ISOBUTYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYLCYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
O-XYLENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-BUTYL METHYL ETHER	7.3	0.5 U	2 UJ	2 UJ	4.5 J	2 U
TETRACHLOROETHYLENE (PCE)	8.7	0.5 U	0.5 U	11	0.5 U	36
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U
TRICHLOROETHYLENE (TCE)	1.1	0.5 U	0.67	0.67	0.5 U	38
TRICHLOROFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	5.7	1.7	0.5 U	0.5 U	1.5

Notes:
J - estimated value
U - non-detect
ug/L - micrograms per Liter

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-15S AN01835 4/25/2011	MW-16 AN01836 4/28/2011	MW-17 AN01838 4/27/2011	MW-18D AN01839 4/25/2011	MW-18S AN01840 4/25/2011	MW-19 AN01841 4/27/2011
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	2 U	0.5 U	0.5 U	2 U	2 U	0.5 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	10 U	5 U	5 U	10 U	5 U	5 U
ACETONE	9	57	5 U	14	130	5 U
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHYLENE	0.5 U	0.5 U	0.5 U	4.3	0.5 U	0.75
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ISOBUTYLENE				2.5 NJ		

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-15S AN01835 4/25/2011	MW-16 AN01836 4/28/2011	MW-17 AN01838 4/27/2011	MW-18D AN01839 4/25/2011	MW-18S AN01840 4/25/2011	MW-19 AN01841 4/27/2011
ISOPROPYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
M, P XYLENES	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYL ACETATE	1 U	0.5 U	0.5 U	1 U	2 U	0.5 U
METHYL ETHYL KETONE	10 U	5 U	5 U	10 U	5 U	5 U
METHYL ISOBUTYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYLCYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
O-XYLENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-BUTYL METHYL ETHER	2 U	0.5 U	0.5 U	2 U	2 UJ	0.5 U
TETRACHLOROETHYLENE (PCE)	36	0.5 U	0.5 U	0.5 U	8	0.5 U
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	1 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
TRICHLOROETHYLENE (TCE)	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:
J - estimated value
U - non-detect
ug/L - micrograms per Liter

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-20 AN01854 5/2/2011	MW-21D AN01842 4/26/2011	MW-21S AN01843 4/26/2011	MW-22D AN01844 4/27/2011	MW-22S AN01845 4/27/2011	MW-23 AN01846 4/28/2011
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	3.1	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	2 U	2 U	2 U	0.5 U	2 U	2 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	5 U	5 U	5 U	5 U	5 U	5 U
ACETONE	5 U	5 U	5 U	27	5 U	5 U
BENZENE	0.5 U	0.5 U	4.7	2.6	0.5 U	0.5 U
BROMOCHLOROMETHANE	1 U	1 U	1 U	0.5 U	1 U	1 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHYLENE	0.5 U	0.5 U	1.5	0.5 U	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	12
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	46
ISOBUTYLENE						

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-20 AN01854 5/2/2011	MW-21D AN01842 4/26/2011	MW-21S AN01843 4/26/2011	MW-22D AN01844 4/27/2011	MW-22S AN01845 4/27/2011	MW-23 AN01846 4/28/2011
ISOPROPYLBENZENE	0.63	0.5 U	0.5 U	0.5 U	0.5 U	9.5
M, P XYLENES	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	820
METHYL ACETATE	2 U	2 U	2 U	0.5 U	2 U	2 U
METHYL ETHYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYL ISOBUTYL KETONE	5 U	5 U	5 U	5 U	5 U	5 U
METHYLCYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	26
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
O-XYLENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	60
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-BUTYL METHYL ETHER	2 UJ	2 UJ	2 UJ	0.5 U	2 UJ	2 UJ
TETRACHLOROETHYLENE (PCE)	0.5 U	100	4000	0.5 U	0.5 U	0.5 U
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.82	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROETHYLENE (TCE)	0.5 U	0.9	290	0.5 U	0.5 U	0.5 U
TRICHLOROFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	1.5	5	0.5 U	0.5 U

Notes:
J - estimated value
U - non-detect
ug/L - micrograms per Liter

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-24 AN01852 4/28/2011	MW-29 AN01855 5/2/2011	PZ-1 AN01847 4/28/2011
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	2 U	2 U	2 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U
2-HEXANONE	5 U	5 U	5 U
ACETONE	5 U	5 U	83
BENZENE	0.5 U	0.5 U	0.5 U
BROMOCHLOROMETHANE	1 U	1 U	1 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U
CHLOROFORM	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHYLENE	0.5 U	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U
ISOBUTYLENE			

Table 6
Analytical Results for Groundwater - 2011

Location ID Sample ID Sample Date Chemical - ug/L	MW-24 AN01852 4/28/2011	MW-29 AN01855 5/2/2011	PZ-1 AN01847 4/28/2011
ISOPROPYLBENZENE	0.5 U	0.5 U	0.5 U
M, P XYLENES	0.5 U	0.5 U	0.5 U
METHYL ACETATE	2 U	2 U	2 U
METHYL ETHYL KETONE	5 U	5 U	5 U
METHYL ISOBUTYL KETONE	5 U	5 U	5 U
METHYLCYCLOHEXANE	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U
O-XYLENE	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U
TERT-BUTYL METHYL ETHER	2 UJ	2 UJ	2 UJ
TETRACHLOROETHYLENE (PCE)	1	0.5 U	0.5 U
TOLUENE	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U
TRICHLOROETHYLENE (TCE)	0.62	0.5 U	0.5 U
TRICHLOROFLUOROMETHANE	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	0.5 U

Notes:
J - estimated value
U - non-detect
ug/L - micrograms per Liter

Table 7
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Groundwater (Tap Water)	Benzene	ug/L	9.3E+00	6.4E+00	1.8E+01	6.4E+00	ug/L	95% KM (t)	(2)
	cis-1,2-Dichloroethene	ug/L	2.5E+03	7.1E+02	9.4E+03 J	7.1E+02	ug/L	95% KM (t)	(2)
	Methyl tert-butyl ether	ug/L	1.5E+01	--	2.6E+01	2.6E+01	ug/L	Maximum Detected Concentratoin	(1)
	Tetrachloroethene	ug/L	5.9E+03	1.1E+04	3.0E+04	1.1E+04	ug/L	99% KM (Chebyshev)	(2)
	Trichloroethene	ug/L	2.3E+03	9.2E+02	1.0E+04	9.2E+02	ug/L	95% KM (t)	(2)
	Vinyl chloride	ug/L	--	--	5.9E+01	5.9E+01	ug/L	Maximum Detected Concentratoin	(1)

(1) The maximum detected concentration was used as the EPC because there were less than 4 detected results.
(2) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

NA = Not applicable
ug/L = Microgram per liter
J = Analyte was detected, but should be considered an estimated value.

Table 7
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Bathroom Air

Exposure Point	Chemical of Potential Concern	Exposure Point Concentration		
		Value (1)	Value (2)	Units
Water Vapors in Bathroom Air	Benzene	1.9E-01	3.3E-01	mg/m^3
	cis-1,2-Dichloroethene	2.1E+01	3.7E+01	mg/m^3
	Methyl tert-butyl ether	7.6E-01	1.4E+00	mg/m^3
	Tetrachloroethene	3.3E+02	5.8E+02	mg/m^3
	Trichloroethene	2.7E+01	4.8E+01	mg/m^3
	Vinyl chloride	1.7E+00	3.1E+00	mg/m^3

(1) Adult shower air concentration.
(2) Child shower air concentration.

NA = Not applicable
ug/L = Microgram per liter
mg/m^3 = milligram per cubic meter

Table 7
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater (Construction Worker)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Groundwater (Excavation/Trench)	Benzene	ug/L	1.3E+01	--	1.8E+01	1.8E+01	ug/L	Maximum Detected Concentration	(1)
	cis-1,2-Dichloroethene	ug/L	9.7E+00	--	1.2E+01	1.2E+01	ug/L	Maximum Detected Concentration	(1)
	Methyl tert-butyl ether	ug/L	1.5E+01	--	2.6E+01	2.6E+01	ug/L	Maximum Detected Concentration	(1)
	Tetrachloroethene	ug/L	3.5E+02	6.1E+02	2.3E+03	6.1E+02	ug/L	97.5% KM (Chebyshev)	(2)
	Trichloroethene	ug/L	3.0E+01	--	7.0E+01	7.0E+01	ug/L	Maximum Detected Concentration	(1)
	Vinyl chloride	ug/L	5.9E+01	--	5.9E+01	5.9E+01	ug/L	Maximum Detected Concentration	(1)

(1) The maximum detected concentration was used as the EPC because there were less than 4 detected results.
(2) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

NA = Not applicable
ug/L = Microgram per liter

Table 7
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Ambient Air

Exposure Point	Chemical of Potential Concern	Exposure Point Concentration in Ambient Air			
		Value	Units	Statistic	Rationale
Ambient Air (Excavation/Trench)	Benzene	7.7E-04	mg/m^3	Calculated using Two-Film Model	(1)
	cis-1,2-Dichloroethene	5.5E-04	mg/m^3	Calculated using Two-Film Model	(1)
	Methyl tert-butyl ether	9.6E-04	mg/m^3	Calculated using Two-Film Model	(1)
	Tetrachloroethene	2.5E-02	mg/m^3	Calculated using Two-Film Model	(1)
	Trichloroethene	3.0E-03	mg/m^3	Calculated using Two-Film Model	(1)
	Vinyl chloride	2.9E-03	mg/m^3	Calculated using Two-Film Model	(1)

(1) Concentrations in ambient air were calculated using the Two-Film Model (EPA, 1994).

mg/m^3 = milligrams per cubic meter

Sources:
EPA, 1994: *Air Emissions and Models for Waste and Wastewater* . Office of Air Quality Planning and Standards. Research Triangle Park, NC. USEPA, EPA/453/R-94/080A.

Table 8
Risk Characterization Summary: Carcinogens

Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	N/A	N/A	N/A
			Trichloroethene	N/A	N/A	N/A
			Vinyl chloride	N/A	N/A	N/A
Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Child						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	N/A	N/A	N/A
			Trichloroethene	N/A	N/A	N/A
			Vinyl chloride	N/A	N/A	N/A

Table 8
Risk Characterization Summary: Carcinogens

Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Adult/Child Aggregate						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	5.23E-06	7.95E-07	6.02E-06
			cis-1,2-Dichloroethene	N/A	N/A	N/A
			Methyl tert-butyl ether	6.99E-07	1.60E-08	7.15E-07
			Tetrachloroethene	8.61E-02	5.19E-02	1.38E-01
			Trichloroethene	8.12E-05	1.34E-05	9.46E-05
			Vinyl chloride	1.02E-03	4.89E-05	1.07E-03
						Receptor Population Risk = 1.39E-01
Scenario Timeframe: Future						
Receptor Population: Commercial Worker						
Receptor Age: Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	1.22E-06	3.28E-08	1.26E-06
			cis-1,2-Dichloroethene	N/A	N/A	N/A
			Methyl tert-butyl ether	1.64E-07	6.63E-10	1.64E-07
			Tetrachloroethene	2.09E-02	2.24E-03	2.31E-02
			Trichloroethene	1.90E-05	5.63E-07	1.96E-05
			Vinyl chloride	1.48E-04	1.35E-06	1.50E-04
						Receptor Population Risk = 2.33E-02

Table 8
Risk Characterization Summary: Carcinogens

Scenario Timeframe: Future					
Receptor Population: Construction Worker					
Receptor Age: Adult					
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Excavation / Trench)	Benzene	3.60167E-09	3.60E-09
			cis-1,2-Dichloroethene	N/A	N/A
			Methyl tert-butyl ether	2.54388E-11	2.54E-11
			Tetrachloroethene	3.39302E-06	3.39E-06
			Trichloroethene	1.33727E-09	1.34E-09
			Vinyl chloride	5.81605E-08	5.82E-08
					Receptor Population Risk = 3.46E-06
				Total Risk =	**1.62E-01**

Notes:
N/A - not applicable

Table 9
Risk Characterization Summary: Non-Carcinogens

Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Adult						
				Non-Carcinogenic Hazard Quotient		
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	4.36E-02	6.63E-03	5.02E-02
			cis-1,2-Dichloroethene	9.67E+00	8.62E-01	1.05E+01
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	3.06E+01	1.84E+01	4.90E+01
			Trichloroethene	8.42E+01	1.41E+01	9.83E+01
			Vinyl chloride	5.39E-01	2.87E-02	5.67E-01
Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Child						
				Non-Carcinogenic Hazard Quotient		
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	1.02E-01	1.56E-02	1.17E-01
			cis-1,2-Dichloroethene	2.26E+01	2.00E+00	2.46E+01
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	7.14E+01	4.14E+01	1.13E+02
			Trichloroethene	1.96E+02	3.18E+01	2.28E+02
			Vinyl chloride	1.26E+00	6.82E-02	1.33E+00

Table 9
Risk Characterization Summary: Non-Carcinogens

Scenario Timeframe: Future						
Receptor Population: Resident						
Receptor Age: Adult/Child Aggregate						
						Non-Carcinogenic Hazard Quotient
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	N/A	N/A	N/A
			Trichloroethene	N/A	N/A	N/A
			Vinyl chloride	N/A	N/A	N/A
Scenario Timeframe: Future						
Receptor Population: Commercial Worker						
Receptor Age: Adult						
						Non-Carcinogenic Hazard Quotient
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Tap Water)	Benzene	1.6E-02	4.17E-04	1.60E-02
			cis-1,2-Dichloroethene	3.45499	5.43E-02	N/A
			Methyl tert-butyl ether	N/A	N/A	N/A
			Tetrachloroethene	1.1E+01	1.16E+00	1.21E+01
			Trichloroethene	3.0E+01	8.90E-01	3.09E+01
			Vinyl chloride	1.9E-01	1.76E-03	1.94E-01

Table 9
Risk Characterization Summary: Non-Carcinogens

Scenario Timeframe: Future					
Receptor Population: Construction Worker					
Receptor Age: Adult					
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater (Excavation / Trench)	Benzene	1.15E-03	1.15E-03
			cis-1,2-Dichloroethene	8.34E-04	8.34E-04
			Methyl tert-butyl ether	N/A	N/A
			Tetrachloroethene	4.40E-02	4.40E-02
			Trichloroethene	5.29E-02	5.29E-02
			Vinyl chloride	1.88E-03	1.88E-03
				Receptor Hazard Index =	**5.69E+02**

Notes:
N/A - not applicable

Table 10
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal						
Chemical of Concern	**Oral Cancer Slope Factor**	**Dermal Cancer Slope Factor**	**Slope Factor Units**	**Weight of Evidence/Cancer Guideline Description**	**Source**	**Date**
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	5/9/2011
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A
Methyl tert-butyl ether	1.8E-03	1.8E-03	$(mg/kg\text{-}day)^{-1}$	N/A	Cal/EPA	5/9/2011
Tetrachloroethene	5.4E-01	5.4E-01	$(mg/kg\text{-}day)^{-1}$	N/A	Cal/EPA	5/9/2011
Trichloroethene	5.9E-03	5.9E-03	$(mg/kg\text{-}day)^{-1}$	N/A	Cal/EPA	5/9/2011
Vinyl chloride (adulthood)	7.2E-01	7.2E-01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	5/9/2011
Vinyl chloride (from birth)	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	5/9/2011
Pathway: Inhalation						
Chemical of Concern	**Unit Risk**	**Units**	**Weight of Evidence / Cancer Guideline Description**	**Source**	**Date**	
Benzene	7.8E-06	$(ug/m^3)^{-1}$	A	IRIS	5/9/2011	
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	
Methyl tert-butyl ether	2.6E-07	$(ug/m^3)^{-1}$	N/A	Cal/EPA	5/9/2011	
Tetrachloroethene	5.9E-06	$(ug/m^3)^{-1}$	N/A	Cal/EPA	5/9/2011	
Trichloroethene	2.0E-06	$(ug/m^3)^{-1}$	N/A	Cal/EPA	5/9/2011	
Vinyl chloride (adulthood) (1)	4.4E-06	$(ug/m^3)^{-1}$	A	IRIS	5/9/2011	
Vinyl chloride (from birth) (1)	8.8E-06	$(ug/m^3)^{-1}$	A	IRIS	5/9/2011	

Notes:
Cal/EPA - California Environmental Protection Agency
IRIS - Integrated Risk Information System
N/A - not available
Weight of Evidence definition: Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer.

Table 11
Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal									
Chemical of Concern	**Chronic / Subchronic**	**Oral RfD Value**	**Oral RfD Units**	**Dermal RfD**	**Dermal RfD Units**	**Primary Target Organ**	**Combined Uncertainty / Modifying Factors**	**Sources of RfD: Target Organ**	**Dates of RfD: Target Organ**
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Blood	300 / 1	IRIS	5/9/2011
Benzene	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethene	Chronic	2.0E-03	mg/kg-day	2.0E-03	mg/kg-day	Increased relative kidney weight in male rats	3000	IRIS	5/9/2011
cis-1,2-Dichloroethene	Subchronic	1.0E-01	mg/kg-day	1.0E-01	mg/kg-day	Blood	300	HEAST	7/31/1997
Methyl tert-butyl ether	Chronic/Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Liver	1000 / 1	IRIS	5/9/2011
Tetrachloroethene	Subchronic	1.0E-01	mg/kg-day	1.0E-01	mg/kg-day	Liver	100	HEAST	7/31/1997
Trichloroethene	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Liver, Kidney, Fetus	N/A	NCEA	08/2001
Trichloroethene	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	Chronic	3.0E-03	mg/kg-day	3.0E-03	mg/kg-day	Liver	30 / 1	IRIS	5/9/2011
Vinyl chloride	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pathway: Inhalation									
Chemical of Concern	**Chronic / Subchronic**	**Inhalation RfC**	**Units**	**Primary Target Organ**	**Combined Uncertainty / Modifying Factors**	**Sources of RfC: Target Organ**	**Dates of RfC: Target Organ**		
Benzene	Chronic	3.0E-02	mg/m^3	Blood	300 / 1	IRIS	5/9/2011		
Benzene	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		
cis-1,2-Dichloroethene	Chronic/Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		
Methyl tert-butyl ether	Chronic	3.0E+00	mg/m^3	Liver, Kidney	100/1	IRIS	5/9/2011		
Methyl tert-butyl ether	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		
Tetrachloroethene	Chronic	2.7E-01	mg/m^3	Neurological	10 / 1	ATSDR	5/9/2011		
Tetrachloroethene	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		
Trichloroethene	Chronic	6.0E-01	mg/m^3	Nervous System, Eyes	N/A	Cal/EPA	5/9/2011		
Trichloroethene	Chronic	1.0E-02	mg/m^3	CNS, liver, kidney, male reproductive system, and embryo, fetuses, and neonates (development toxicity)	N/A	NY	10/2006		
Trichloroethene	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		
Vinyl chloride	Chronic	1.0E-01	mg/m^3	Liver	30/1	IRIS	5/9/2011		
Vinyl chloride	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A		

Notes:
ATSDR - Agency for Toxic Substances and Disease Registry
Cal/EPA - California Environmental Protection Agency
HEAST - Health Effects Assessment Summary Tables
IRIS - Integrated Risk Information System
mg/kg-day - milligrams per kilogram per day
mg/m^3 - milligrams per cubic meter
N/A - not available
NCEA - National Center for Environmental Assessment
NY - New York State Department of Public Health

Table 12
Cleanup Levels for Chemicals of Concern

Media: Groundwater
Site Area: OU1
Available Use: Environmental Monitoring

Controls to Ensure Restricted Use: Not applicable

Chemical of Concern	Cleanup Level (ppb)	Basis for Cleanup Level
Benzene	1	New York State Water Quality Standards
cis-1,2-dichloroethylene	5	New York State Water Quality Standards
Methyl tert-butyl ether (MTBE)	none	
Tetrachloroethylene (PCE)	5	New York State Water Quality Standards and Federal MCL
Trichloroethylene (TCE)	5	New York State Water Quality Standards and Federal MCL
Vinyl Chloride	2	New York State Water Quality Standards and Federal MCL

Notes:
Federal MCL is derived from CFR Title 40, Chapter 1, Part 141 National Primary Drinking Water Regulations, 141.61 Maximum Contaminant Levels for Organic Contaminants
New York State Water Quality Standards derived from NYCRR, Title 6, Chapter X - Division of Water, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Table 1
ppb - parts per billion

Table 13
Chemical-Specific Groundwater ARARs and TBCs

Constituent Information		Federal Safe Drinking Water Act (1)		New York State Water Quality Standards for Class GA (Groundwater) (2)	Preliminary Remediation Goal (3)	Maximum Concentration Greater than Remediation Goal
Parameter	**Range of Detections in Groundwater (ug/L)**	**MCL (ug/L)**	**MCLG (ug/L)**	**NYCRR, Title 6, Part 703, Table 1 (ug/L)**	**(ug/L)**	
1,1,1-Trichloroethane	ND	200	200	5	5	No
1,1,2,2-Tetrachloroethane	ND	NS	NS	5	5	No
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	NS	NS	NS	N/A	No
1,1,2-Trichloroethane	ND	5	3	1	1	No
1,1-Dichloroethane	ND - 0.54	NS	NS	5	5	No
1,1-Dichloroethene	ND - 3.3	7	7	5	5	No
1,2,3-Trichlorobenzene	ND	NS	NS	NS	N/A	No
1,2,4-Trichlorobenzene	ND	70	70	NS	70	No
1,2-Dibromo-3-Chloropropane	ND	0.2	NS	0.04	0.04	No
1,2-Dibromoethane	ND	NS	NS	0.0006	0.0006	No
1,2-Dichlorobenzene	ND	NS	NS	3	3	No
1,2-Dichloroethane	ND	5	NS	0.6	0.6	No
1,2-Dichloropropane	ND	5	NS	1	1	No
1,3-Dichlorobenzene	ND	NS	NS	3	3	No
1,4-Dichlorobenzene	ND	NS	NS	3	3	No
2-Hexanone	ND	NS	NS	NS	N/A	No
Acetone	ND	NS	NS	NS	N/A	No
Benzene	ND - 7	5	NS	1	1	Yes
Bromochloromethane	ND	NS	NS	5	5	No
Bromodichloromethane	ND	NS	NS	NS	N/A	No
Bromoform	ND	NS	NS	NS	N/A	No
Bromomethane	ND	NS	NS	5	5	No
Carbon Disulfide	ND - 3.9	NS	NS	60	60	No
Carbon Tetrachloride	ND	5	NS	5	5	No
Chlorobenzene	ND	100	100	5	5	No

Table 13
Chemical-Specific Groundwater ARARs and TBCs

Constituent Information		Federal Safe Drinking Water Act (1)		New York State Water Quality Standards for Class GA (Groundwater) (2)	Preliminary Remediation Goal (3)	Maximum Concentration Greater than Remediation Goal
Parameter	**Range of Detections in Groundwater (ug/L)**	**MCL (ug/L)**	**MCLG (ug/L)**	**NYCRR, Title 6, Part 703, Table 1 (ug/L)**	**(ug/L)**	
Chloroethane	ND	NS	NS	5	5	No
Chloroform	ND - 1.9	NS	NS	7	7	No
Chloromethane	ND - 1.2	NS	NS	5	5	No
Cis-1,2-Dichloroethylene	ND - 9400	70	70	5	5	Yes
Cis-1,3-Dichloropropene	ND	NS	NS	NS	N/A	No
Cyclohexane	ND - 25	NS	NS	NS	N/A	No
Dibromochloromethane	ND	NS	NS	NS	N/A	No
Dichlorodifuloromethane	ND	NS	NS	5	5	No
Ethylbenzene	ND - 17	700	700	5	5	Yes
Isopropylbenzene	ND - 7.2	NS	NS	5	5	Yes
M, P Xylenes	ND	10,000 (total)	10,000 (total)	NS	10,000 (total)	No
Methyl Acetate	ND	NS	NS	NS	N/A	No
Methyl Ethyl Ketone	ND	NS	NS	NS	N/A	No
Methyl Isobutyle Ketone	ND	NS	NS	NS	N/A	No
Methylcyclohexane	ND - 17	NS	NS	NS	N/A	No
Methylene Chloride	ND - 2.1	NS	NS	5	5	No
O-Xylene	ND	10,000 (total)	10,000 (total)	5	5	No
Styrene	ND - 1.2	100	100	5	5	No
Methyl Tert-Butyl Ether (MTBE)	ND - 180	NS	NS	NS	N/A	No
Tetrachloroethylene (PCE)	ND - 30,000	5	NS	5	5	Yes
Toluene	ND - 3.3	1000	1000	5	5	No
Trans-1,2-Dichloroethene	ND - 0.56	NS	NS	5	5	No
Trans-1,3-Dichloropropene	ND	NS	NS	NS	N/A	No
Trichloroethylene (TCE)	ND - 10,000	5	NS	5	5	Yes
Trichlorofluoromethane	ND	NS	NS	5	5	No

Table 13
Chemical-Specific Groundwater ARARs and TBCs

Constituent Information		Federal Safe Drinking Water Act (1)		New York State Water Quality Standards for Class GA (Groundwater) (2)	Preliminary Remediation Goal (3)	Maximum Concentration Greater than Remediation Goal
Parameter	**Range of Detections in Groundwater (ug/L)**	**MCL (ug/L)**	**MCLG (ug/L)**	**NYCRR, Title 6, Part 703, Table 1 (ug/L)**	**(ug/L)**	
Vinyl Chloride	ND - 59	2	NS	2	2	Yes

Notes:
1. CFR Title 40, Chapter 1, Part 141 National Primary Drinking Water Regulations, 141.61 Maximum Contaminant Levels for Organic Contaminants
2. NYCRR, Title 6, Chapter X - Division of Water, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Table 1
3. Preliminary Remediation Goal is the most stringent of the ARARs listed.
MCL - maximum contaminant level
MCLG - maximum contaminant level goal
N/A - not applicable
ND - not detected
NS - no standard
ug/L - micrograms per liter

Table 14
Cost Estimate for Alternative 4 - Groundwater Pump and Treat

Site: Peninsula Boulevard Groundwater Plume
Location: Town of Hempstead, Village of Hewlett
Phase: Feasibility Study (-30% - +50%)
Base Year: 2011
Date: April 26, 2011

Description: Alternative G6 consists of pumping groundwater to remove mass from high concentration areas of the aquifer and to establish hydraulic control of the aquifer to minimize off-Site migration of the groundwater plume. Extracted groundwater will be treated via an air stripper prior to discharge to adjacent surface water. The air stream will be treated using vapor phase GAC.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Pre-Design Investigation**					
1.1	Well Driller Mob/Demob	1	LS	$ 7,000.00	$ 7,000	
1.2	Monitoring Well Installation- Shallow	5	EA	$ 2,000.00	$ 10,000	2-inch diameter; 25 ft deep.
1.3	Monitoring Well Installation- Deep	5	EA	$ 3,750.00	$ 18,750	2-inch diameter; 75 ft deep.
1.4	Groundwater Sampling	30	EA	$ 1,500	$ 45,000	
1.5	Pre-Construction Survey	1	LS	$ 5,500	$ 5,500	Aerial/Topographic Survey.
1.6	Aquifer Pump Test	1	LS	$ 25,000	$ 25,000	At 4 extraction wells, four location set ups, transducers, 72-hour test frac tank, discharge, and reporting.
1.7	Pilot Test	1	LS	$ 15,000	$ 15,000	Air stripper and carbon evaluation.
1.8	Data Reduction, Evaluation, and Reporting	1	LS	$ 15,000	$ 15,000	
1.9	IDW	1	LS	$ 20,000	$ 20,000	Soil cuttings and groundwater waste from well installation and pumping tests. Assumes discharge to sewer system.
	Sub-Total				**$ 161,250**	
2	**Mobilization and Demobilization**					
2.1	Construction Equipment and Personnel	1	LS	$ 50,000	$ 50,000	
2.2	Submittals/Implementation Plans	1	LS	$ 20,000	$ 20,000	QAPP, HASP, shop dwgs and work plans.
2.3	Post Construction Submittals	1	LS	$ 15,000	$ 15,000	As-builts, warranties, etc.
	Sub-Total				**$ 85,000**	
3	**Monitoring, Sampling, Testing and Analysis**					
3.1	Well Driller Mob/Demob	1	LS	$ 7,000	$ 7,000	
3.2	Extraction Well Installation - Shallow	6	EA	$ 4,950	$ 29,700	6-inch diameter to 25 ft bgs. Stainless steel well screens.
3.3	Extraction Well Installation - Deep	2	EA	$ 15,750	$ 31,500	6-inch diameter to 75 ft bgs. Stainless steel well screens.
3.4	Performance Well Installation - Shallow	20	EA	$ 2,000	$ 40,000	2-inch diameter to 25 feet bgs.
3.5	Performance Well Installation - Deep	4	EA	$ 3,750	$ 15,000	2-inch diameter to 75 feet bgs.
3.6	Extraction Pump, Transducer, Concrete Vault	8	LS	$ 2,000	$ 16,000	
3.7	IDW	1	LS	$ 20,000	$ 20,000	Soil cuttings and groundwater waste from well installations and development.
3.8	Well Survey	2	Day	$ 1,500	$ 3,000	
	Sub-Total				**$ 162,200**	
4	**Conveyance Piping**					
4.1	Trenching, Bedding, Pipe	4,000	LF	$ 150	$ 600,000	3-inch HDPE double walled pipe.
4.2	Vaults at Junctions	3	EA	$ 2,000	$ 6,000	
4.3	Surface Restoration	1,400	SY	$ 40	$ 56,000	
4.4	Effluent Discharge Pipe	300	LF	$ 150	$ 45,000	
4.5	Soil Disposal	450	Tons	$ 100	$ 45,000	1 foot x 2 foot wide by total length x 1.5 tons/CY.
	Sub-Total				**$ 752,000**	
5	**Treatment System**					
5.1	Equalization Tank	1	EA	$ 7,500	$ 7,500	
5.2	Transfer Pumps	2	EA	$ 2,500	$ 5,000	
5.3	Bag Filter	2	EA	$ 1,500	$ 3,000	
5.4	Air Stripper	1	EA	$ 10,000	$ 10,000	
5.5	Interconnection Piping and Valves	1	LS	$ 12,000	$ 12,000	
5.6	Meters and Instrumentation	1	LS	$ 16,000	$ 16,000	
5.7	PLC and SCADA System	1	LS	$ 22,000	$ 22,000	
5.8	Blower	1	EA	$ 30,000	$ 30,000	1,800 cfm.
5.9	Vapor GAC	2	EA	$ 12,000	$ 24,000	
5.10	Training	1	LS	$ 22,000	$ 22,000	
	Sub-Total				**$ 151,500**	

Table 14
Cost Estimate for Alternative 4 - Groundwater Pump and Treat

Site: Peninsula Boulevard Groundwater Plume
Location: Town of Hempstead, Village of Hewlett
Phase: Feasibility Study (-30% - +50%)
Base Year: 2011
Date: April 26, 2011

Description: Alternative G6 consists of pumping groundwater to remove mass from high concentration areas of the aquifer and to establish hydraulic control of the aquifer to minimize off-Site migration of the groundwater plume. Extracted groundwater will be treated via an air stripper prior to discharge to adjacent surface water. The air stream will be treated using vapor phase GAC.

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
6	**Treatment Plant Building**						
	6.1	Concrete Foundation	1	LS	$ 25,000	$ 25,000	
	6.2	Steel Building	1	LS	$ 50,000	$ 50,000	50 ft x 50 ft building
	6.3	HVAC System	1	LS	$ 30,000	$ 30,000	
	6.4	Windows and Doors	1	LS	$ 20,000	$ 20,000	
	6.5	Electrical Power and Lighting	1	LS	$ 20,000	$ 20,000	
		Sub-Total				**$ 145,000**	
7	**System Start-up and Prove-out**						
	7.1	System Start-up	1	LS	$ 25,000	$ 25,000	
		Sub-Total				**$ 25,000**	
8	**LTM and Institutional Controls**						
		Institutional Controls					
	8.1	Institutional Control and Site Management Plan	1	EA	$ 60,000	$ 60,000	Environmental easement/deed restriction, legal fees.
	8.2	Site Information Database	1	LS	$ 25,000	$ 25,000	Setup data management system.
		LTM					
	8.3	Sampling and Reporting	80	EA	$ 1,500	$ 120,000	Semi-annually for 40 wells.
	8.4	Fate and Transport Modeling/Calculation	1	LS	$ 25,000	$ 25,000	
	8.5	Reporting and Monitoring Program Development	1	LS	$ 25,000	$ 25,000	
		Sub-Total				**$ 255,000**	
	Sub-Total					**$ 1,736,950**	Sub-Total All Construction Costs.
		Contingency	25%			$ 434,000	10% scope + 15% bid.
	Sub-Total					**$ 2,170,950**	
	Project Management		5%			$ 109,000	
	Remedial Design		10%			$ 217,000	
	Permitting		5%			$ 109,000	
	Construction Management		8%			$ 174,000	
	Construction Oversight		10%			$ 217,000	
	TOTAL CAPITAL COST					**$ 2,996,950**	

Table 14
Cost Estimate for Alternative 4 - Groundwater Pump and Treat

Site: Peninsula Boulevard Groundwater Plume
Location: Town of Hempstead, Village of Hewlett
Phase: Feasibility Study (-30% - +50%)
Base Year: 2011
Date: April 26, 2011

Description: Alternative G6 consists of pumping groundwater to remove mass from high concentration areas of the aquifer and to establish hydraulic control of the aquifer to minimize off-Site migration of the groundwater plume. Extracted groundwater will be treated via an air stripper prior to discharge to adjacent surface water. The air stream will be treated using vapor phase GAC.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
O&M COST:						
Item No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Notes**
1	**Operation**					
1.1	Electrical Usage	500,000	KW-Hr	$ 0.12	$ 60,000	
1.2	Vapor Carbon Usage	48,000	Lb	$ 1.20	$ 57,600	Carbon regeneration.
1.3	Plant Operator	2,080	HR	$ 100.00	$ 208,000	Full time (40 hr/week; 52 weeks;yr).
1.4	Effluent Sampling - Air	24	EA	$ 550	$ 13,200	Monthly, VOCs
1.5	Reporting	12	Month	$ 7,500	$ 90,000	Monthly.
1.6	Effluent Sampling - Water	24	EA	$ 550	$ 13,200	Monthly, VOCs
1.7	Permitting and Disposal Fee for Discharging to POTW	1	yearly	$ 8,500	$ 8,500	Yearly includes disposal fee of $1500 per year and $7000 per year for permitting.
	Sub-Total				**$ 450,500**	
	Project Management	10%			$ 45,000	
	Technical Support	8%			$ 36,000	
	Contingency	15%			$ 68,000	5% scope + 10% bid.
					$ 599,500	
2	**Maintenance**					
2.1	Repair/Replacement of Equipment	1	LS	$ 60,000	$ 60,000	
2.2	Well Repair and Maintenance	1	LS	$ 10,000	$ 10,000	
	Sub-Total				**$ 70,000**	
	Project Management	10%			$ 7,000	
	Technical Support	8%			$ 6,000	
	Contingency	15%			$ 11,000	5% scope + 10% bid.
					$ 94,000	
3	**LTM and Institutional Controls**					
3.1	Maintain Institutional Controls	1	LS	$ 12,000	$ 12,000	
3.2	Groundwater Sampling	60	LS	$ 950	$ 57,000	Quarterly for 5 years; semi for years 0-30.
3.3	Groundwater Sample Laboratory Analysis	60	EA	$ 550	$ 33,000	Total VOCs analysis.
3.4	Data Reduction, Evaluation and Reporting	2	EA	$ 25,000	$ 50,000	2 reports per year.
	Sub-Total				**$ 152,000**	
	Project Management	10%			$ 15,000	
	Technical Support	8%			$ 12,000	
	Contingency	15%			$ 23,000	5% scope + 10% bid.
					$ 202,000	
4	**Performance Sampling**					
4.1	Performance Sampling and Analysis	46	EA	$ 1,500	$ 69,000	23 performance wells, VOCs analysis only, semi-annually every year from 0-30.
4.2	Data Reduction, Evaluation, Reporting	2	LS	$ 20,000	$ 40,000	Two reports per year.
	Sub-Total				**$ 109,000**	
	Project Management	10%			$ 11,000	
	Technical Support	8%			$ 9,000	
	Contingency	15%			$ 16,000	5% scope + 10% bid.
					$ 145,000	

Table 14
Cost Estimate for Alternative 4 - Groundwater Pump and Treat

Site: Peninsula Boulevard Groundwater Plume
Location: Town of Hempstead, Village of Hewlett
Phase: Feasibility Study (-30% - +50%)
Base Year: 2011
Date: April 26, 2011

Description: Alternative G6 consists of pumping groundwater to remove mass from high concentration areas of the aquifer and to establish hydraulic control of the aquifer to minimize off-Site migration of the groundwater plume. Extracted groundwater will be treated via an air stripper prior to discharge to adjacent surface water. The air stream will be treated using vapor phase GAC.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	1	LS	$ 50,000	$ 50,000	Every 5 years through year 30.
1.2	Update Institutional Controls	5	1	LS	$ 25,000	$ 25,000	Every 5 years through year 30.
	Sub-Total					**$ 75,000**	
2	**Treatment Plant**						
2.1	Demobilize Treatment Plant	30	1	LS	$ 50,000	$ 50,000	
2.2	Well Abandonment	30	62	LS	$ 1,500	$ 93,000	
2.3	Injection Piping Removal	30	1	LS	$ 50,000	$ 50,000	
2.4	Permitting and Reporting	30	1	LS	$ 25,000	$ 25,000	
	Sub-Total					**$ 218,000**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0	$ 2,996,950	**$ 2,996,950**	
2	**O & M Cost**				
2.1	Performance Sampling		$ 109,000	$ -	
2.2	LTM/ICs		$ 202,000	$ -	
2.3	Operation		$ 599,500	$ -	
2.4	Maintenance		$ 94,000	$ -	
	Sub-Total			**$ 18,249,633**	
3	**Periodic Costs**				
3.1	5 Year Review		$ 75,000	$ -	
3.2	System Decommissioning		$ 218,000	$ -	
	Sub-Total			**$ 312,945**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 21,560,000**	

PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX V

RESPONSIVENESS SUMMARY

SUMMARY OF DOCUMENTS

Section V-a: July28, 2011 Proposed Plan

Section V-b: August 13, 2010 Public Notice

Section V-c: August 3, 2011 Public Meeting Sign-In Sheet

Section V-d: August 3, 2011 Public Meeting Transcript

Section V-e: Correspondence Received During the Comment Period

RESPONSIVENESS SUMMARY
FOR THE
RECORD OF DECISION
PENINSULA BOULEVARD GROUNDWATER CONTAMINATION SUPERFUND SITE
VILLAGE OF HEWLETT, TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK

INTRODUCTION

This Responsiveness Summary provides a summary of citizens' comments and concerns received during the public-comment period related to the Peninsula Boulevard Groundwater Contamination Superfund Site (Site) groundwater remedy Proposed Plan, and it provides the U.S. Environmental Protection Agency's (EPA's) responses to those comments and concerns. All comments summarized in this document have been considered in EPA's final decision in the selection of a groundwater remedy.

SUMMARY OF COMMUNITY RELATIONS ACTIVITIES

The 2011 RI/FS report and the Proposed Plan for the contaminated groundwater at the Site were released to the public for comment on July 28, 2011. These documents were made available to the public at information repositories maintained at the Hewlett Library in Hewlett, New York and the EPA Region II Office in New York City. The notice of availability for the above-referenced documents was published in the South Shore Herald on July 28, 2011. The public comment period ran from July 28, 2011 to August 27, 2011. On August 3, 2011, EPA conducted a public meeting at the Hewlett High School to inform local officials and interested citizens about the Superfund process, to present the Proposed Plan for the Site, including the preferred groundwater remedial alternative, and to respond to questions and comments from the approximately 10 attendees (see Appendix V-c for a copy of the sign-in sheet for the meeting). On the basis of comments received during the public comment period, the public generally supports the selected remedy

SUMMARY OF COMMENTS AND RESPONSES

Comments were received at the public meeting and in writing via e-mail and letters. Written comments were received from:

- Joseph DeFranco, Nassau County Department of Health, August 11, 2011 letter,
- Jeffrey Solomon, Hewlett, NY, August 16, 2011 e-mail,
- Judith and Gary Baum, Hewlett, NY, August 15, 2011 e-mail,
- Denise Cohen-Kronfeld, DMD, Hewlett, NY, August 19, 2011 e-mail,
- Paolo Sapienza, Hewlett, NY, August 18, 2011 e-mail,
- Anthony Giordano, Hewlett, NY, August 21, 2011 e-mail,
- Ken Crystal, Hewlett, NY, August 25, 2011 e-mail,

The transcript from the public meeting can be found in Appendix V-d.

The written comments submitted during the public comment period can be found in Appendix V-e.

A summary of the comments provided at the public meeting and in writing, as well as EPA's responses to them, are provided below.

***Comment #1**:* Mr. DeFranco of the Nassau County Department of Health stated in his comment letter that the primary source of drinking water for this area comes from the Long Island American Water Corporation's well field located at Starfire Court (LIAWC Well Field #5) which is located hydraulically down gradient and in close proximity to the Site. Mr. DeFranco also mentioned that this well field has approximately 75 active water supply wells that are screened between 20 – 160 feet below ground surface and that the daily pumping rate for the well field is approximately 8 million gallons per day. Mr. DeFranco opines that this pumping rate most likely has an influence on the groundwater flow anomaly observed in the study area. The regional groundwater flow would be expected to be southwest and the observed flow direction at the site is northwest, towards the well field.

The Starfire Court well field also treats its water for voc's prior to distribution. These voc's are primarily, tetrachloroethene, trichloroethene and 1, 2 dichloroethene, at concentrations generally below 10 ppb in the raw water.

Mr. DeFranco stated that Ms. Sosa mentioned in the public meeting that the public water supply comes from the Jameco aquifer and this aquifer is separated from the Upper Glacial Aquifer by a clay layer protecting it from site-related contamination. Mr. DeFranco declares that statement is not completely accurate, nor is the assumption that site-related contamination is not affecting the LIAWC Well Field #5.

***Response to Comment #1**:* As discussed in the RI and ROD, the Jameco aquifer, despite its limited extent in this area of Long Island, is a water-bearing zone of primary importance, due to hydraulic conductivity values on the order of 200 ft per day. The LIAWC Well Field #5 adjacent to the Site utilizes the Jameco as its source aquifer. North of the Site the UGA directly overlies the Jameco. Given the similar hydraulic properties of the UGA and Jameco there is the potential for significant hydraulic connection between the two units, with data from a broader area of Long Island indicating that to be the case. However, data obtained during the RI indicate that the Gardiners Clay acts as a confining unit in the localized area of the Site and the LIAWC Well Field.

In October 2010, EPA collected a total of five groundwater samples from new production wells (re-drills) in the LIAWC Plant #5 Well Field. The following VOCs were detected in the analysis of these samples: chloromethane, chloroform, MTBE, PCE, and

toluene. None of the concentration detected exceeding groundwater criteria or drinking water standards.

Information obtained from LIAWC and the results of EPA sampling at new production wells on LIAWC Plant #5 property in October 2010 indicate that the Plant #5 Well Field has contamination similar to that found in the Site plume and, therefore, may have been impacted by the contamination from the Site.

During the pre-design phase, EPA intends to collect additional groundwater quality data from the Jameco aquifer. EPA will continue to coordinate and exchange information with the LIAWC.

***Comment #2**:* Several commenters stated their support for the placement of the Peninsula Boulevard Groundwater Contamination Superfund Site on the National Priorities List and the cleanup of the groundwater contamination.

***Response to Comment #2**:* The Site was included on the NPL on July 21, 2004. This decision documents presents the selected remedy to address contaminated groundwater at the Site.

***Comment #3**:* A commenter expressed concern about the Cedar Wood Cleaners located on West Broadway. They wanted to know if there is a study the EPA can perform to ensure that no groundwater or adjacent property owner is at risk of any carcinogenic contaminants being discharged by the cleaner?

***Response to Comment #3**:* EPA is currently conducting an investigation (Remedial Investigation, Operable Unit 2) to identify the potential sources of groundwater contamination at the Site. As part of this investigation, EPA intends to collect environmental samples at several dry cleaners in the area. The results of this sampling will assist EPA in determining if operations or activities at these dry cleaners have contributed to the groundwater contamination at the Site.

Comments received during the public meeting:

Harold Kislak

***Comment #4*:** Is there any contamination in the aquifer that Long Island American draws from their site just north (Well Field #5).

Response to Comment #4: LIAWC operates its Well Field #5 on property located within approximately 1,000 feet of the northern boundary of the study area. Well Field #5 has been impacted by VOC contamination, including chlorinated VOCs, which have

been detected at levels exceeding health-based criteria prior to treatment, as evidenced by sampling dating back to the late 1970's (i.e., pre-treatment samples collected of blended raw water from the manifolded pumping wells). Since April 1991, the Plant #5 source water has been treated for PCE contamination via a packed tower aeration system (i.e., air strippers). This engineering control has been effective in reducing VOC levels in the raw water (pre-treatment) to comply with drinking water standards. PCE has been detected in quarterly raw water samples collected at the Plant #5 since 1979, at concentrations ranging from 0.5 to 34 ug/l. TCE and cis-1,2-DCE were also detected in some raw water samples. LIAWC has noted that the PCE concentrations observed in the Plant #5 raw water have generally been trending downward over time.

Comment #5: Did you find evidence that the plume is moving or expanding?

Response to Comment #5*:* The results of the environmental sampling performed during the RI indicate that the groundwater plume appears fairly stable and still exists in the same general area where it was originally delineated.

Comment #6**:** I'm just wondering also if you have a sense of how much PCE would have to have been released, assuming it was all in one place, but just to create the kind of plume and the density that we see here?

Response to Comment #6*:* The amount of PCEreleased at the Site is unknown.

Comment #7*:* What were the results of the air contamination study, did you find contamination?

Response to Comment #7: EPA conducted vapor intrusion sampling at fifteen residences at the Site. The results of the analyses indicated that one residence had concentrations of VOCs at or above EPA region 2 screening levels in the sub slab and indoor air. As a result, EPA installed a sub-slab depressurization system at this residence to mitigate the impacts of soil vapor intrusion by reducing or eliminating vapor entry into the building. EPA intends to continue to investigate the soil vapor intrusion pathway at the Site.

Comment #8**:** And some point, you made the statement that there was no unacceptable risk – is that based on particular data?

Response Comment #8*:* EPA documents in the RI that there are no current unacceptable risks to human health at the Site. There are no complete routes of exposures from human receptors to the groundwater contamination because private wells are not utilized for drinking water in the area. Residences and businesses in the

area are connected to the public water supply. The public-water supply does not have contamination above drinking-water standards.

Jenn Henick

***Comment #9*:** Will EPA still be testing indoor air quality.

Response to Comment #9: EPA will continue to investigate the vapor intrusion pathway in buildings at the Site . If results of sampling indicate the presence of Site-related vapors above protective levels, EPA will implement the appropriate measures.

Comment #10*:* What is our obligation as homeowners in terms of the disclosure for the Superfund site?

Response to Comment #10: New York State is a full disclosure state and it is the responsibility of a homeowner when selling a home to disclose known information with respect to the results of any environmental sampling that was performed.

Joe Whitney

Public Meeting Comment #11*:* Roughly, what timeline on the project from start to finish?

***Response to Comment #11*:** The Remedial Design phase, which is anticipated to beginin 2011, is estimated to take approximately 1.5 years to complete. The construction time for the selected remedy will take approximately 9 to 12 months.

Comment #12: What will be the physical location of any holding tanks for the groundwater pump and treat remedial alternative (preferred remedy).

Response to *Comment #12*: The exact physical location of a treatment facility or any utilities associated with the treatment plant will be determined by EPA during the remedial design phase.

Comment #13*:* As a member of the fire department, are there any concerns that we (the fire department) might have responding to a potential incident that may occur either at a holding tank or in a building where there may be vapor or a vapor build-up?

Response Comment #13*:* During each phase of the remedial process EPA develops a comprehensive health and safety plan for the protection of the community as well as the on-site workers. As part of this effort, EPA will develop a health and safety plan for the

remedial design,construction, and operationphases. EPA will coordinate with the local authorities to ensure that this plan is distributed to the fire department and any other local emergency agencies..

Morris Kramer

Comment #14: We are in a hurricane zone. What precautions will EPA take in case there is a hurricane and what damage might a hurricane do to EPA activities?

Response to Comment #14: During each phase of the remedial process, EPA develops the appropriate plans to ensure that Site-related activities are conducted in a manner that are protective of human health and the environment. These Site-specific plans include a description of the necessary precautions that should be taken in the event of severe weather, such as a hurricane. .

RESPONSIVENESS SUMMARY

APPENDIX V-a

AUGUST 2010 PROPOSED PLAN

RESPONSIVENESS SUMMARY

APPENDIX V-b

PUBLIC NOTICE PUBLISHED IN THE *SOUTH SHORE STANDARAD ON JULY 28, 2011*

RESPONSIVENESS SUMMARY

APPENDIX V-c

AUGUST 23, 2010 PUBLIC MEETING SIGN-IN SHEET

RESPONSIVENESS SUMMARY

APPENDIX V-d

AUGUST 23, 2010 PUBLIC MEETING TRANSCRIPT

RESPONSIVENESS SUMMARY

APPENDIX V-e

CORRESPONDENCE RECEIVED DURING THE COMMENT PERIOD

EDWARD P. MANGANO
COUNTY EXECUTIVE

LAWRENCE E. EISENSTEIN, M.D., F.A.C.P.
ACTING COMMISSIONER

NASSAU COUNTY
DEPARTMENT OF HEALTH
106 CHARLES LINDBERGH BLVD.
UNIONDALE, NEW YORK 11553

August 11, 2011

Ms. Gloria M. Sosa
Remedial Project Manager
USEPA Region 2
290 Broadway
New York, NY 10007

Re: Peninsula Blvd. Groundwater Contamination Superfund site
Hewlett, NY
Proposed Remedial Action Plan

Dear Ms. Sosa,

I would like to take this opportunity to thank you for your presentation on August 3rd, 2011 at Hewlett High School. I would also like to take this opportunity to clarify an issue that was brought up at this meeting regarding the source of the public water supply in the Hewlett area.

The primary source of drinking water for this area comes from the Long Island American Water Corporation's well field located at Starfire Court which is located hydraulically down gradient and in close proximity to the above-referenced site. I would also like to mention that this well field has approximately 75 active water supply wells that are screened between 20' and 160' Below Ground Surface. The daily pumpage rate for this well field is approximately 8 Million Gallons per Day and most likely has an influence on the groundwater flow anomaly observed in the study area – regional groundwater flow would be expected to be southwest and the observed flow direction at the site is northwest, towards the well field.

The Starfire Court well field also treats its water for voc's prior to distribution. These voc's are primarily, tetrachloroethene, trichloroethene and 1, 2 dichloroethene, at concentrations generally below 10 ppb in the raw water. As you are aware, these contaminants are the same contaminants found at the above-referenced site.

While you mentioned that the public water supply comes from the Jameco aquifer and this aquifer is separated from the above Glacial aquifer by a clay layer protecting it from site-related contamination, that statement is not completely accurate. Nor is the assumption that site-related contamination is not affecting the Starfire Court well field.

In conclusion, unless additional monitoring data can prove there is either another source of voc contamination or there is no connection between the Peninsula Blvd. Groundwater Contamination site and the Starfire Court well field, it cannot be concluded that this site is not the primary or a contributing source of voc contamination at the well field.

Very truly yours,

Signed 8/11/11

Joseph DeFranco
Director, Office of Soil and Groundwater Remediation

Cc: Susan G. King, Director – Div. of Env Health, NCDH
Donald Irwin, Director – BEEI, NCDH
Brian Devine, Director, MARO - NYSDOH
Steven M. Bates, Charlotte Bethoney, Steven Karpinski, NYSDOH - BEEI
Melissa Sweet, John Swartwout, NYSDEC- Central Office
Walter Parish, NYSDEC – Region 1

PB E-MAIL COMMENTS RECEIVED

Please add Hewlett, NY to the superfund list. I live nearby, shop nearby and there is a school located close by.
Jeffrey Solomon
From: Home <jeffsolly@aol.com>
To: Gloria Sosa/R2/USEPA/US@EPA
Date: 08/16/2011 03:48 PM
Subject: Hewlett NY plume

Ms Sosa-
We sincerely request that the contaminated water at 1274 Peninsula Blvd, Hewlett, New York be treated very soon. I don't really understand how this instance of water pollution was not acknowledged until now. I see there are three options for cleaning up this dangerous water. I hope that the one used will not be the most expedient but rather the one that will benefit the health and well being of the residents who will have to drink this water.
The Environmental Protection Agency is supposed to oversee potential hazards that effect our quality of life. This matter is very important.
Thank you.
Judith and Gary Baum
From: Judith Baum <baum.judith@gmail.com>
To: Cecilia Echols/R2/USEPA/US@EPA
Date: 08/15/2011 05:07 PM
Subject: Water pollution, Hewlett NY
Sent by: judith BAUM <judydb@gmail.com>

Dear Ms. Echols,
Please give Hewlett, NY the "Superfund" status to clean up our water supply. As a resident of this neighborhood, it is of utmost importance that our drinking water be contaminant free.
Thank you for your attention to this matter.
Sincerely
Denise Cohen-Kronfeld, DMD
From: smileyf949@aol.com
To: Cecilia Echols/R2/USEPA/US@EPA
Date: 08/19/2011 01:54 PM
Subject: Hewlett, NY Water

Dear Ms. Cecilia Echols,
I am writing to you as a resident of Hewlett, NY. Please give 1274 Peninsula Blvd in Hewlett, NY "Superfund" status. This location is near Woodmere Middle School and is approximately 1000 feet south of a Long Island American Water Company water well that provides drinking water to our community. Thank you.
Paolo Sapienza
From: P S <paolosap@yahoo.com>

To: "echols.cecelia@epa.gov" <echols.cecelia@epa.gov>
Sent: Thursday, August 18, 2011 1:01 PM
Subject: Hewlett superfund

Hi Sosa,
I recently read in the local paper the EPA's plan to clean the Hewlett Superfund site which I found to be terrific news however, what steps are being taken to ensure this doesn't happen at other dry cleaner locations in the area? It took decades before anyone knew that the old Grove Cleaners was the cause of the current superfund site. I'm a 30 year Hewlett resident living on Hamilton Ave and I have reservations about Cedar Wood Cleaners located on West Broadway. Is there a study the EPA can perform to ensure that no groundwater or adjacent property owner is at risk of any carinogenic contaminents are being discharged by the cleaner? Your response would be greatly appreciated.
Anthony Giordano
From: Anthony Giordano <anthonyggiordano@yahoo.com>
To: Gloria Sosa/R2/USEPA/US@EPA
Date: 08/21/2011 11:43 AM
Subject: Hewlett Superfund

Dear Ms. Echols, thank you for taking the time to talk with me.
We live at 1095 Fordham Lane, Woodmere, New York on the Motts Creek extension of Doxey Brook.
Attached is the letter from Howard Kopel, our local legislator.
As residents we feel that it is important to clean this problem up.
If you would like to speak to me, my telephone number is (212) 508-0440.
Thank you very much for your help.
Ken Crystal
From: "Kenneth R. Crystal" <KCrystal@phillipslytle.com>
To: "echols.cecilia@epa.gov" <'echols.cecilia@epa.gov'>
Date: 08/25/2011 01:51 PM
Subject: FW: Peninsula Plvd in Woodmere NY

Ms Echols,

After reading the attached letter, I fully support federal cleanup of this Hewlett site and urge you to give it "Superfund" status
immediately.

Thanking you in advance,
Megan Maguire
From: Megan Maguire <megela87@yahoo.com>
To: Cecilia Echols/R2/USEPA/US@EPA
Date: 09/02/2011 01:40 PM
Subject: Hewlett Superfund

Ms Echols,
After reading the attached letter, I fully support federal cleanup of this Hewlett site and urge you to give it "Superfund" status immediately.
Thanking you in advance,
Elizabeth Chiari
From: "Liz Chiari" <Liz_Chiari@qintl.com>
To: Cecilia Echols/R2/USEPA/US@EPA
Date: 09/02/2011 01:24 PM
Subject: Hewlett Superfund