GEI Consultants

Geotechnical
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Engineering

Quarterly Operations, Maintenance & Monitoring Report
Second Quarter (Q2) 2009

Bay Shore/Brightwaters Former MGP Site

Town of Islip
NYSDEC Consent Index No. D1-0001-98-11

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1. Introduction

This report presents the second quarter 2009 (Q2 2009) operations, maintenance and monitoring (OM&M) results for the Bay Shore/Brightwaters Former Manufactured Gas Plant (MGP) Site located in Bay Shore, Suffolk County, New York (the Site). This report has been prepared in accordance with the requirements of Section 6 of DER-10, Technical Guidance for Site Investigation and Remediation, Order on Consent, Index No. D1-0001-98-11 signed by KeySpan Corporation (KeySpan) (currently know as National Grid) and the New York State Department of Environmental Conservation (NYSDEC), and the Operable Unit 2 Remedial Decision Document.

In 2003, the Site was divided into four operable units to more effectively manage investigation and remediation activities (**Figure 1**). The OM&M results of all four operable units have been combined in this report in order to present an overall picture of trends relating to effectiveness of the dense non-aqueous phase liquid (DNAPL) recovery, groundwater treatment systems operating at the Site, and remedial activities on groundwater quality in the upper glacial aquifer. The locations of the DNAPL recovery and groundwater treatment systems are presented on **Figure 1** and descriptions are presented in the applicable sections for each operable unit.

OM&M activities include maintenance and monitoring of the DNAPL recovery and groundwater treatment systems, quarterly and monthly groundwater monitoring, and monitoring of soil vapor and ambient air. The OM&M results for each operable unit are presented in the following sections of the report: Section 2 - Operable Unit 1 (OU-1); Section 3 - Operable Unit 2 (OU-2); Section 4 - Operable Unit 3 (OU-3); and Section 6 - Operable Unit 4 (OU-4). In February 2009, NYSDEC approved the reconfiguration of the boundaries of OU-1 to include the portions of National Grid-owned properties north of Union Boulevard once designated as part of OU-2. This change was designed to refine the areas where OU-1 and OU-2 overlapped and designate areas involved with portions of the OU-1 remedy (i.e., subsurface barrier wall installation, in-situ chemical oxidation) as part of OU-1 and not OU-2. The soil vapor and ambient air results contain data for all operable units and are presented in Section 5.

Significant remedial activities conducted during Q2 2009 include the startup of three additional oxygen injection systems within the OU-2 groundwater plume. Information pertaining to the operation and monitoring data from these systems is included in this report.

Starting with the Q1 2009 report, the graphical depiction and discussion of much of the data associated with the site operable units, especially for OU-2 and OU-3, provided in this Q2

2009 OM&M report, have been modified from previous reports with the intent of facilitating the interpretation and understanding of the data. These modified data and graphics presentations involved input from NYSDEC, and Bay Shore and Brightwaters community members, including their independent environmental consultant. The modifications primarily involve the graphical presentation of groundwater quality data using maps to depict the distribution of specific constituents, as well as trends of constituent concentrations (including both statistical trends and graphical trends). The details of these modifications are described in the appropriate sections of this report.

1.1 Background

The former MGP operations began in the late 1880s and continued into the 1970s. Most of the MGP facilities were demolished in 1973. Various remedial investigation activities have been completed at the Site. The results of the investigations and discussion of the Site history are presented in the Remedial Investigation Report (Dvirka and Bartilucci Consulting Engineers [D&B], 2002) and the Final Remedial Investigation Report (D&B, 2003). Several Interim Remedial Measures (IRMs) have been conducted since 1999 in OU-2, OU-3, and OU-4. A brief description of each IRM is presented for each operable unit below.

OU-1 consists of the Bay Shore Site, formerly the main operations area of the MGP, which is currently owned by National Grid. The following remedial actions, IRM and pilot studies have been performed in OU-1:

- DNAPL Recovery IRM: A DNAPL recovery system was installed in the off-Site area south of the Long Island Railroad (LIRR) (GEI, 2006).
- In-Situ Chemical Oxidation (ISCO) Pilot Studies: Three pilot studies were conducted at the Site in 2004 utilizing Activated Persulfate, Modified Fenton’s Reagent and Activated Fenton’s Reagent (GEI, 2005).
- Surfactant-Enhanced In-Situ Chemical Oxidation (S-ISCO) Pilot Study: A pilot study was conducted in 2006 utilizing a surfactant to solubilize MGP-related impacts and Sodium Persulfate to oxidize those impacts (GEI, 2007a).
- OU-1 Southern Cell Excavation (February 2007 through April 2007). This excavation consisted of the removal of source material to a maximum depth of 25 feet below ground surface (bgs). The excavation was completed in support of the utility relocation in association with the excavation of source material in OU-1 located north of the LIRR tracks (GEI, 2004c).
- Subsurface Barrier Wall Installation (April 2007 through April 2008). The installation of the subsurface barrier wall commenced in April of 2007 and was completed in April 2008. The barrier was installed as part of the Remedial Action Plan (RAP) for OU-1 (GEI, 2004c).

- Oxygen Injection System: An oxygen injection system was installed along the downgradient edge of OU-1 in February 2008 as an interim remedial measure to treat groundwater at the perforated portion of the subsurface barrier wall until the full scale groundwater treatment system is complete.
- Groundwater Treatment System: The groundwater treatment building that will house the treatment system equipment began construction in February 2009. Construction of the ozone injection wells and soil vapor extraction laterals began in July 2009. The ozone injection system equipment is currently being installed and the system will begin operation in Q4 2009.

OU-2 consists of the groundwater plume which extends south/southeast from OU-1. The following IRMs have been performed in OU-2:

- Oxygen Injection IRM: A groundwater treatment system utilizing oxygen injection technology was installed in Q4 2005 (GEI, 2006). The treatment system consists of two injection lines located along Montauk Highway and the intersection of Garner Lane and Manatuck Lane (**Figure 1**). The system injects oxygen into the upper glacial aquifer to increase aerobic biological activity and reduce the concentrations of MGP-related contaminants in groundwater prior to discharge into Lawrence Creek. MGP-related impacts are limited to the upper glacial aquifer. The underlying Magothy aquifer, which is the primary source of public water supply in Nassau and Suffolk Counties, is not impacted from former MGP operations.
- OU-2 Groundwater Treatment Remedy: In accordance with the OU-2 Remedial Decision Document (GEI, 2008), three additional groundwater treatment systems (**Figure 1**) utilizing oxygen injection technology were installed within the OU-2 groundwater plume. All three systems began operation during Q1 2009. A fourth system was being installed during Q2 2009 at the downgradient edge of the OU-2 plume, at Lawrence Creek.

OU-3 consists of the Brightwaters Yard, which is currently owned by National Grid, and the groundwater plume that extends south/southeast from the Brightwaters Yard. The following IRMs have been performed in OU-3:

- ISCO IRMs: Three rounds of ISCO by In-Situ Oxidative Technologies, Inc. (ISOTEC) were used to treat the Brightwaters Yard groundwater plume source area in May of 2001, September of 2001, and October of 2004. The treatment involved the injection of a chelated iron complex and stabilized hydrogen peroxide (H^2O^2) within the IRM area (Foster Wheeler Environmental Corporation [FW], 2000).

- Excavation IRM: A source area excavation was effective in removing 1,500 tons of source contaminated soils from May to July of 2004 (**Figure 1**) (Paulus, Sokolowski and Sartor Engineering, PC [PS&S], 2004).
- Oxygen Injection IRM: A groundwater treatment system utilizing oxygen injection technology was installed in Q3 2000 at the intersection of Union Boulevard and Lanier Lane (**Figure 1**). The treatment system consists of one injection line which injects oxygen into the upper glacial aquifer to increase aerobic biological activity and reduce the concentrations of MGP-related contaminants in groundwater prior to discharge into O-Co-Nee Pond. MGP-related impacts are limited to the upper glacial aquifer. The underlying Magothy aquifer, which is the primary source of public water supply in Nassau and Suffolk Counties, is not impacted from former MGP operations.
- Oxygen Injection IRM: A second groundwater treatment system utilizing oxygen injection technology was installed in Q4 2004 on the Brightwaters Yard adjacent to the LIRR (**Figure 1**). The treatment system consisted of three injection lines which injected oxygen into the upper glacial aquifer to increase aerobic biological activity and reduce the concentrations of MGP-related contaminants in groundwater leaving the Site boundary (PS&S, 2004). MGP-related impacts are limited to the upper glacial aquifer. The underlying Magothy aquifer, which is the primary source of public water supply in Nassau and Suffolk Counties, is not impacted from former MGP operations. The Brightwaters Yard oxygen injection system was abandoned in June of 2009 in support of the OU-3 LIRR Excavation/Temporary Track Relocation IRM.
- OU-3 Storm Sewer Rehabilitation IRM: Sections of the storm water collection network located within OU-3 were rehabilitated in Q4 2008. This included the replacement of catch basins and the cured in-place lining of drainage piping that is located within the OU-3 groundwater plume.
- OU-3 LIRR Excavation/Temporary Track Relocation IRM: Site preparation activities for the IRM were initiated in Q1 2009. Site preparation activities consisted of the relocation of high tension utility lines from the LIRR right-of-way to locations north of the proposed excavation area. Site preparation activities for the IRM continued in Q2 2009. These activities consisted of the relocation of fencing and the grading of staging and temporary track laydown areas.

OU-4 consists of a former cesspool, former pond area, and the headwaters of Watchogue Creek (a.k.a., Crum's Brook), located approximately 400 feet east of the Bay Shore Site. The following IRMs have been, or will be, performed in OU-4:

- Sediments in Watchogue Creek/Crum's Brook were removed and the channel was restored as part of an IRM performed in 2000 (FW, 2002).

- The former cesspool was excavated and shallow impacted soils (vadose zone soils) were removed and treated off-Site as part of an IRM performed in Q4 2005 (**Figure 1**) (GEI, 2004a). The remaining impacted materials below the water table at the former cesspool area are currently being treated using in-situ treatment technologies. The NYSDEC-approved OU-4 Cesspool Area S-ISCO Work Plan (VeruTEK, 2008) was submitted on February 19, 2008. Site preparation work including installation of the S-ISCO injection wells, monitoring wells and injection lines and mobilization of S-ISCO injection equipment was initiated in Q1 2009. S-ISCO injection was initiated on April 28, 2009. The final report for the OU-4 cesspool IRM will be submitted at the completion of the ISCO portion of the former cesspool IRM.
- In the former pond area, shallow impacted soils will be removed and treated off-Site as part of an IRM that was approved by the NYSDEC in April 2006 (GEI, 2006a). Impacted soils below the water table will be treated using in-situ methods following the results of the S-ISCO implementation on OU-4 and/or through excavation.

2. Operable Unit 1 – Bay Shore Site, Bay Shore West Parcel and Adjacent Off-Site Areas

2.1 DNAPL Recovery System and NAPL Monitoring

2.1.1 Program Scope and Purpose

A DNAPL recovery system was installed in recovery well BBRW-02 in January 2006. The DNAPL recovery system consists of a Blackhawk Electric Anchor Piston Pump which recovers DNAPL from BBRW-02 and discharges to a United States Department of Transportation/United Nations (USDOT/UN) approved 55-gallon steel drum. The DNAPL system is currently operated approximately once every three weeks. Historically, the recovery system was operated once every two weeks. The DNAPL system operation schedule was revised in March 2008 due to decreasing DNAPL recovery observed in the well. Allowing more time in-between recovery operations enables the DNAPL to settle into a discrete layer which allows for more efficient recovery.

The presence and thickness of light non-aqueous phase liquids (LNAPL) and/or DNAPL is gauged in wells BBRW-02, BBRW-05, BBMW-05D, and BBMW-22D on a weekly basis. BBMW-20D was damaged in Q1 2008 during construction activities on OU-1 and has not been gauged since. BBRW-01 was abandoned in support of the OU-1 Southern Cell Excavation in Q1 2007. RW-03 and RW-04 were abandoned on April 1, 2009 to facilitate construction of the ozone injection system in OU-1 South. These wells are located in OU-1 south of the LIRR (**Figure 1**).

2.1.2 Current Site Activity

The following DNAPL recovery and non-aqueous phase liquids (NAPL) monitoring events occurred during Q2 2009.

- **DNAPL Recovery:** The DNAPL recovery system in BBRW-02 was operated on the following dates:
  - April 3, 2009 – DNAPL Recovery, Scheduled Operation 57
  - April 24, 2009 – DNAPL Recovery, Scheduled Operation 58
  - May 15, 2009 – DNAPL Recovery, Scheduled Operation 59
  - June 8, 2009 – DNAPL Recovery, Scheduled Operation 60
  - June 29, 2009 – DNAPL Recovery, Scheduled Operation 61

- **NAPL Gauging:** Wells BBRW-02, BBRW-05, BBMW-05D, and BBMW-22D were gauged for the presence of LNAPL and DNAPL on the following dates:
  - April 3, 10, 17, and 24, 2009
  - May 1, 8, 26, and 29, 2009
  - June 8, 12, 19, and 26, 2009

2.1.3 DNAPL Recovery and NAPL Monitoring Data

The DNAPL recovery system and NAPL monitoring data are provided on the following tables and figure.

- **Table 2-1 Summary of DNAPL Removal for Recovery Well BBRW-02** – provides DNAPL thickness prior to and after pumping events and volume of DNAPL recovered from BBRW-02. Approximately 16 gallons of DNAPL were recovered during Q2 2009. Approximately 297 gallons of DNAPL have been recovered since the beginning of DNAPL recovery operations.
- **Table 2-2 Summary of Measured DNAPL Thickness** – provides NAPL thickness in existing NAPL gauging wells BBRW-02, BBRW-05, BBMW-05D, BBMW-20D, and BBMW-22D. Measured DNAPL thickness has remained consistent between Q1 2009 and Q2 2009.
- **Figure 2 DNAPL Recovery Data BBRW-02** – illustrates historical pre- and post-DNAPL recovery thickness and volume of DNAPL recovered from BBRW-02. The operational schedule of the DNAPL recovery system was changed from operating once every two weeks to approximately once every three weeks in Q2 2008 due to decreasing recovery. DNAPL recovery thickness and the amount of DNAPL recovered have been inconsistent since the change in operational schedule.

2.1.4 Future Plans

- The DNAPL recovery system will continue to be manually operated at a frequency of once every three weeks.
- The pumping interval will continue to be evaluated on a quarterly basis.
- The operational schedule will be adjusted if a significant change in the DNAPL recovery rate continues.
- The DNAPL/aqueous solution will be removed and disposed of by a licensed liquid hazardous waste transporter to a treatment, storage and disposal facility (TSDF) capable of receiving the specific waste material. The schedule of removal will be

established such that DNAPL storage time on-Site does not exceed 90 days from the start of accumulation in a drum.

- A permanent enclosure to house the pump, well, and control panel will be installed at the completion of the portion of the OU-1 remedy that will take place in this area.

2.2 Oxygen Injection System

2.2.1 Program Scope and Purpose

An oxygen injection system was installed downgradient of the perforated portion of the subsurface barrier wall at the downgradient edge of OU-1 in February 2008. This system is currently being used to treat groundwater at the perforated portion of the subsurface barrier wall until the full scale groundwater treatment system is complete. The location of the oxygen injection system is illustrated on **Figure 1**.

2.2.2 Current Site Activity

The following OU-1 oxygen injection system monitoring and system operation activities were performed in Q2 2009.

- **Monthly Groundwater Parameter Monitoring:** On a monthly basis, four monitoring wells downgradient of the oxygen injection line (OZMW-17S, OZMW-17I, OZMW-17I2, and OZMW-17D) are monitored for Dissolved Oxygen Content (DO), Oxidation Reduction Potential (ORP), pH, Conductivity, and Temperature. Monthly Groundwater Parameter Monitoring was performed on the following dates:
  - May 1 and 27, 2009
  - June 29 and 30, 2009

- **System Operation Monitoring:** The oxygen injection groundwater treatment system is monitored on a monthly basis to ensure effective continued operation. During each monitoring event, system parameters relating to system operational and equipment readiness are recorded and adjusted as necessary to optimize system performance. System Operation Monitoring was performed on the following dates:
  - April 15, 2009
  - May 5, 2009
  - June 2009 – The system was not inspected. The system was brought off-line for 12 days in June to adjust the elevation of the system to match the future grade of the site.

- **Quarterly Groundwater Sampling:** Select monitoring wells upgradient and downgradient of the oxygen injection system located in OU-1 are sampled quarterly for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Groundwater quality parameters (DO, pH, temperature, conductivity and ORP) are also recorded for each well during the quarterly sampling. Details on the groundwater sampling program are provided in Subsection 2.3 below.

2.2.3 Oxygen Injection System OM&M Data

The OM&M data collected for the OU-1 oxygen injection system is provided in the following table, figure and appendix:

- **Table 2-3 Summary of Groundwater Parameter Data – OU-1 Oxygen Injection System -** provides data gathered at downgradient monitoring well clusters OZMW-16, OZMW-17, and OZMW-18. DO levels in all clusters have decreased from Q1 totals, but have remained elevated near Q4 2008 totals. The system was shut down for 12 days in June 2009, while the elevation of the system was lowered to accommodate the future grade of the site. The downtime associated with the event contributed to the decrease in DO concentrations.

  The data presented on this table indicate that for Q2 2009:

  - DO concentrations ranged between 0 and 19.6 milligrams per liter (mg/L) in all downgradient monitoring wells.
  - ORP values were elevated in several downgradient monitoring wells. ORP values ranged between -77and 207 millivolts (mV).
  - pH varied between 4.98 and 7.26 Standard Units (SU) in downgradient monitoring wells.
  - Conductivity in downgradient monitoring wells ranged between 0.092 and 1.59 milli-Siemen per centimeter (mS/cm).
  - Temperature ranged between 12.2 and 16.7 degrees Celsius (deg C), typical for Q2 conditions.

- **Figure 6 OU-1 Union Boulevard Oxygen Injection Line Groundwater Data –** provides a graphical depiction of DO levels, total benzene, toluene, ethylbenzene and xylenes (BTEX) and total polycyclic aromatic hydrocarbon (PAH) concentrations over time for wells located downgradient of the OU-1 oxygen injection line. **Figure 6** provides data for the monitoring well clusters OZMW-16, OZMW-17, OZMW-18, OZMW-22, BBMW-01, and BBWM-23. Significant decreases of MGP-related contaminants have been observed downgradient of the OU-1 oxygen injection line at monitoring wells where effects of the oxygen injection system have been noted

(OZMW-16S, OZMW17S, OZMW-17I, OZMW-18S, OZMW-18I, and BBMW-01S). Further groundwater trend analysis is discussed in Subsection 2.3.4.1.

- **Appendix A OU-1 Oxygen Injection System OM&M Data –** provides data collected during system operation monitoring. The data provided in **Appendix A** indicate that:
  - Approximately 388 lbs of oxygen have been injected during Q2 2009 and a total of 1,769 lbs of oxygen have been injected since the initial start-up period.
  - The OU-1 oxygen injection system operated for 79 out of a possible 91 days during Q2 2009. The oxygen injection system was shut down for 12 days while the grade of the system was lowered to accommodate the future grading of the Site.

2.2.4 Future Plans

- Continue monthly system inspections, groundwater monitoring and quarterly sampling for contaminants of concern (COC).
- Continue to conduct weekly system inspections.
- Conduct labor intensive maintenance on the system.

2.3 Groundwater Monitoring

2.3.1 Program Scope and Purpose

Groundwater monitoring is conducted within OU-1 to aid in monitoring the groundwater plume (OU-2), and establishing baseline conditions against which the effectiveness of the planned ozone injection system and other remedial activities can be evaluated. Sixteen monitoring wells at four well cluster locations (OZMW-16S, I, I2, D; OZMW-17S, I, I2, D; OZMW-18S, I, I2, D and OZMW-22S, I, I2, D) were installed at the downgradient boundary of OU-1 in Q1 2008. The wells were installed to monitor the performance of the ozone injection system which will be installed at the perforated portion of the subsurface barrier wall. The wells are currently being used to monitor the performance of the oxygen injection system installed at this location. The well locations and geographic boundaries of OU-1 are illustrated on **Figure 1**. The wells sampled each quarter are selected based on previous analytical data and discussions with NYSDEC.

2.3.2 Current Site Activity

The following groundwater monitoring activities took place in OU-1 during Q2 2009.

- Depth to groundwater measurements were obtained on May 4 and 5, 2009 from 32 wells.
- Groundwater samples were collected from all of the 40 monitoring wells located in OU-1.
- Groundwater samples from 8 of the 40 wells were analyzed for total BTEX by United States Environmental Protection Agency (EPA) Method 8260 and for PAHs by EPA Method 8270. Groundwater samples from the remaining 32 wells were analyzed for an expanded list of VOCs (EPA Method 8260) and PAHs (EPA Method 8270).

2.3.3 Groundwater Elevation Data

The depth to groundwater and groundwater elevation data for OU-1 are provided on the following tables and figures.

- **Table 2-4 Water Level Measurements and Calculated Groundwater Elevations –** provides depth to water measurements and calculated groundwater elevation data for OU-1 wells measured in Q2 2009. The elevation data presented on this table is in reference to the North American Vertical Datum (NAVD) 88 datum.
- **Table 2-5 Historic Calculated Groundwater Elevations –** provides historic groundwater elevations for existing OU-1 groundwater monitoring wells. All historic groundwater elevation data presented has been recalculated based on the November 2007 survey data and the NAVD88 datum.
- **Figure 3 On-Site Shallow Groundwater Contour Map –** provides the Q2 2009 shallow groundwater elevation contours for OU-1 and OU-3.
- **Figure 4 Shallow Groundwater Contour Map –** provides the Q2 2009 shallow groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.
- **Figure 5 Deep Groundwater Contour Map –** provides the Q2 2009 deep groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.

The groundwater flow direction in OU-1 is towards the south/southeast. The shallow groundwater hydraulic gradient is approximately 0.0026 feet/foot and the deep groundwater hydraulic gradient is approximately 0.0027 feet/foot. The groundwater elevation in OU-1 monitoring wells during the Q2 2009 event were an average of approximately 0.17 feet higher than the Q1 2009 groundwater elevations and an average of approximately 0.16 feet lower than the Q2 2008 groundwater elevations.

2.3.4 Groundwater Analytical Data

The groundwater analytical results for groundwater monitoring wells located in OU-1 and sampled in Q2 2009 are provided on the following tables and appendix:

- **Table 2-6 Summary of Historic Total BTEX Groundwater Analytical Results –** provides a summary of historical total BTEX results for existing OU-1 groundwater monitoring wells.
- **Table 2-7 Summary of Historic Total PAH Groundwater Analytical Results –** provides a summary of historical total PAH results for existing OU-1 groundwater monitoring wells.
- **Table 2-8 Summary of BTEX, MTBE and PAH Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-1 for each of the analyzed compounds detected..
- **Table 2-9 Summary of Expanded Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-1 that were analyzed for the expanded list of VOCs for each compound detected..
- **Table 2-10 Summary of Total BTEX Statistical Trends –** provides statistical trends of concentrations beginning when the upgradient oxygen injection system was installed or the subsurface barrier wall was completed, through Q2 2009.
- **Table 2-11 Summary of Total PAH Statistical Trends –** provides statistical trends of concentrations beginning when the upgradient oxygen injection system was installed or the subsurface barrier wall was completed, through Q2 2009.
- **Appendix E –** presents time series plots of groundwater monitoring well analytical data for total BTEX and total PAH.

2.3.4.1 Downgradient Groundwater Analytical Data Trend Analysis

Analysis of the trends of constituent concentrations for OU-1 groundwater monitoring wells was conducted on two levels: statistical and graphical. The focused period for these trends is the operational period of the OU-1 Union Boulevard oxygen injection system line.

A statistical analysis typically used to assess trends in groundwater monitoring well concentration data is the Mann-Kendall method (Gilbert, 1987). This is a non-parametric statistical method that evaluates concentration trends over time, by comparing the relative difference in magnitude of data over time and assigning probability for the trends. One limitation of this statistical method exists for interpretation of remediation monitoring data sets of limited events. The graphical trend analysis of groundwater monitoring well concentrations considers all of the concentrations for the same oxygen injection period as the statistical period.

The OU-1 Union Boulevard oxygen injection system began operation in February 2008. Considering a groundwater flow rate for the upper glacial aquifer of 1 to 2 feet per day, the trends of the wells immediately downgradient of the system, within the area where the oxygen front has passed through, were conservatively evaluated.

Three well clusters (OZMW-16, OZMW-17, and OZMW-18) are located approximately 50 feet downgradient of the OU-1 Union Boulevard oxygen injection line. Groundwater monitoring wells OZMW-16S, OZMW-16I, OZMW-16I2, OZMW-16D, OZMW-17S, OZMW-17I, OZMW-17I2, OZMW-17D, OZMW-18S, OZMW-18I, OZMW-18I2, and OZMW-18D were installed immediately downgradient of the oxygen injection line located, downgradient of the perforated portion of the subsurface barrier wall in OU-1. These wells were first sampled in Q1 2008, prior to operation of the oxygen injection system.

Statistical Trend Analysis

For perspective of this statistical trends discussion, the highest historical median concentrations in groundwater upgradient of the OU-1 Union Boulevard oxygen injection system, during its operational period, were 12,077 microgram per liter (ug/L) of total BTEX in MW-05S and 5,681 ug/L total PAH in BBMW-22D.

For the three immediate downgradient well clusters located adjacent to the Union Boulevard oxygen injection line, no statistical trends were identified for total BTEX. A statistical decreasing trend was associated with well BBMW-01S, located approximately 170 feet downgradient of the barrier wall and the adjacent well clusters. A decreasing trend was also identified in well BBMW-23S, located approximately 100 feet downgradient of the western end of the Union Boulevard oxygen injection system.

Three decreasing trends for PAHs were identified in the wells immediately downgradient of the oxygen injection line (OZMW-16S, OZMW-17S, and OZMW-18S). The lack ofstatistical trends in the majority of wells did not factor in initial significant high pre-injection concentrations which ranged as high as 4,685 ug/L for total BTEX and 8,178 ug/L for total PAH.

Review of data and Mann-Kendall results for downgradient wells indicating no trend in total BTEX or total PAH concentrations identified that approximately 70% the wells in the downgradient area for BTEX and PAH had a negative Mann-Kendall Statistic (S) associated with them. This negative statistic parameter value indicates a decreasing trend to exist, even though it was not significant at a 95% confidence interval. Many wells indicated with no trend had a limited number of sampling events (six) or high number of non-detect results (up to 13).

Graphical Trend Analysis

A review of the groundwater quality data from the OU-1 Union Boulevard oxygen injection system monitoring wells indicates that the elevated total BTEX and total PAH concentrations are generally located in the intermediate depth zone of the upper glacial aquifer.

For total BTEX, decreasing graphical trends, with concentration ranges greater than an order-of-magnitude, were identified in OZMW-16S, OZMW-16I, OZMW-17S, OZMW-17I, OZMW-18S and OZMW-18I. No increasing trends, with concentration ranges greater than one order-of-magnitude or with concentrations above 100 ug/l, for total BTEX were identified in the downgradient wells (**Figure 6** and **Appendix E**). The total BTEX trends in further downgradient well clusters BBMW-01 and BBMW-23 exhibit continuing decreasing or low stable trends.

The graphical trends of total PAH in the downgradient wells in the vicinity of the OU-1 Union Boulevard oxygen injection system line are similar to those for total BTEX described above with general decreasing trends for concentration variations greater than an order-of – magnitude or concentrations greater than 100 ug/l.

2.3.5 Future Plans

- Continue annual and quarterly groundwater monitoring at selected wells.
- Continue construction of the ozone injection groundwater treatment system and begin operation of system in Q4 2009.

2.4 Institutional Controls/Engineering Controls (IC/EC)

There has been no activity this quarter.

3. Operable Unit 2 – Bay Shore Groundwater Plume

3.1 Oxygen Injection Systems

3.1.1 Program Scope and Purpose

Four oxygen injection groundwater treatment systems have been installed within OU-2 to mitigate dissolved-phase groundwater impacts migrating from OU-1. The first oxygen injection groundwater treatment system, comprised of two injection lines located along Montauk Highway, and at the intersection of Manatuck and Garner Lanes, was installed in November of 2005. Three supplemental oxygen injection systems were installed in 2008/2009 in compliance with the requirement of the OU-2 Remedial Decision Document. These systems affect multiple portions of the OU-2 groundwater plume at 33 North Clinton Avenue, 34 North Clinton Avenue, and 9 North Clinton Avenue (**Figure 1**). All three systems were brought on-line in Q1 2009. The oxygen injection systems inject oxygen into the upper glacial aquifer to increase DO concentrations in groundwater and enhance biological breakdown of dissolved constituents in the groundwater plume in OU-2.

3.1.2 Current Site Activity

The following OU-2 oxygen injection system monitoring and system operation activities were performed in Q2 2009.

- **Monthly Groundwater Parameter Monitoring:** On a monthly basis, nine monitoring wells downgradient of the Montauk Highway and Manatuck Lane oxygen injection lines (OU2MW-06, OU2MW-07, BBMW-25S, BBMW-25I, BBMW-25D, OU2MW-01S, OU2MW-01I, OU2MW-01I2, and OU2MW-01D) are monitored for DO, ORP, pH, conductivity, and temperature. Monthly Groundwater Parameter Monitoring was performed on the following dates:
  - April 23 and 27, 2009
  - May 1, 13, 14, 18, and 19, 2009
  - June 29 and 30, 2009
- **Targeted Monitoring Well and Soil Vapor Sampling for Supplemental Oxygen Injection Systems:** For the first year of operation, targeted monitoring wells located downgradient of the supplemental oxygen injection systems are sampled on a monthly basis.

- Targeted monitoring well clusters located downgradient of the 34 North Clinton Avenue oxygen injection system (OU2MW-45, 46 and 47) were sampled on:
  - April 28-30, 2009
  - May 27 and 28, 2009
  - June 22, 2009
- Targeted monitoring well clusters located downgradient of the 9 North Clinton Avenue oxygen injection system (OU2MW-28, 29, 30, 31, and 32) were sampled on:
  - April 28-30, 2009
  - May 27 and 28, 2009
  - June 22, 2009
- Targeted monitoring well clusters located downgradient of the 33 North Clinton Avenue oxygen injection system (OU2MW-35, 36, 37, 39, and 42) were sampled on:
  - April 14-17, 2009
  - May 11-13, 2009
  - June 15-17, 2009

- **System Operation Monitoring:** The oxygen injection systems are monitored on a monthly basis to ensure effective continued operation. During each monitoring event, system parameters related to system operational and equipment readiness are recorded and adjusted, as necessary, to optimize system performance. System Operation Monitoring was performed on the following dates:
  - April 15, 22, and 30, 2009
  - May 4, 15, and 18, 2009
  - June 10, 19, and 30, 2009

- **Quarterly Groundwater Sampling:** Select monitoring wells upgradient and downgradient of the oxygen injection systems located in OU-2 are sampled quarterly for VOCs and SVOCs. Groundwater quality parameters (DO, pH, temperature, conductivity, and ORP) are also recorded for each well during the quarterly sampling. Details on the groundwater sampling program are provided in Subsection 3.2.

3.1.3 Oxygen Injection System OM&M Data

The OU-2 Oxygen Injection System OM&M data are provided on the following tables and appendix.

- **Table 3-1 Summary of Groundwater Parameter Data – Montauk Highway Oxygen Injection Line –** provides the historical conductivity, DO, ORP, pH and temperature data for monitoring wells downgradient of the Montauk Highway oxygen injection line. The data presented on this table indicate that for Q2 2009:

  - DO concentrations remained elevated in downgradient monitoring wells. Monitoring wells OU2MW-02I, I2, D, OU2MW-03S, D, OU2MW-04I, I2, and D all showed elevated DO levels. DO concentrations ranged between 0 and 23 mg/L at these locations. Dissolved oxygen concentrations dropped off at monitoring well clusters BBMW-25 and OU2MW-01 due to the downtime associated with the mechanical fault of the refrigerator/dryer of the system.
  - ORP remained elevated in select downgradient monitoring wells. ORP ranged between -116 and 261 mV.
  - pH remained consistent. pH varied between 4.02 and 6.78 SU in downgradient monitoring wells.
  - Conductivity in downgradient monitoring wells remained consistent and has ranged between 0.042 and 2.11mS/cm.
  - Temperature ranged between 11.6 and 22.4 deg C, typical for Q2 conditions.

- **Table 3-2 Summary Groundwater Parameter Data – Manatuck Lane Oxygen Injection Line –** provides the historical conductivity, DO, ORP, pH and temperature data for wells downgradient of the Manatuck Lane oxygen injection line. The data presented in this table indicate that for Q2 2009:

  - DO concentrations decreased in downgradient monitoring wells. The decrease is due to the downtime associated with the mechanical fault of the refrigerator/dryer. DO concentrations ranged between 0 and 24 mg/L.
  - ORP remained elevated in a number of downgradient monitoring wells. ORP ranged between 115 and 371 mV.
  - pH remained consistent. pH varied between 5.47 and 6.49 SU in downgradient monitoring wells.
  - Conductivity in downgradient monitoring wells remained consistent. Conductivity ranged between 0.232 and 0.721 mS/cm.
  - Temperature ranged between 9.5 and 23.7 deg C, typical for Q2 conditions.

- **Table 3-3 Summary Groundwater Parameter Data – Targeted Monitoring Wells for Supplemental Oxygen Injection Systems –** provides the system start-up conductivity, DO, ORP, pH and temperature data for wells downgradient of the 33 North Clinton Avenue, 34 North Clinton Avenue, and 9 North Clinton Avenue oxygen injection lines. All three systems were brought online in Q1 2009. In a short period of time, DO concentrations have increased in monitoring well clusters downgradient of both the 34 North Clinton Avenue (OU2MW-45, OU2MW-46 and OU2MW-47), and the 9 North Clinton Avenue (OU2MW-28, OU2MW-29, OU2MW-30, and OU2MW-31) oxygen injection systems. The 33 North Clinton Avenue system was started at the end of the Q1 so no monitoring data was recorded in the previous quarter, but during Q2, almost all of the 33 North Clinton Avenue wells contained dissolved oxygen at several depths. System start-up dates are presented below.

- 34 North Clinton Avenue – January 20, 2009
- 9 North Clinton Avenue – February 16, 2009
- 33 North Clinton Avenue – March 31, 2009

34 North Clinton Avenue

- DO concentrations remained elevated in downgradient monitoring wells. DO concentrations ranged between 5.2 and 42.0 mg/L.
- ORP remained elevated in a number of downgradient monitoring wells. ORP ranged between 18 and 345 mV.
- pH remained consistent. pH varied between 4.13 and 6.52 SU in downgradient monitoring wells.
- Conductivity in downgradient monitoring wells remained consistent. Conductivity ranged between 0.160 and 0.788mS/cm.
- Temperature ranged between 11.9 and 16.1 deg C, typical for Q2 conditions.

9 North Clinton Avenue

- DO concentrations remained elevated in downgradient monitoring wells. DO concentrations ranged between 0 and 45 mg/L.
- ORP remained elevated in a number of downgradient monitoring wells. ORP ranged between -135 and 348 mV.
- pH remained consistent. pH varied between 4.72 and 7.36 SU in downgradient monitoring wells.
- Conductivity in downgradient monitoring wells remained consistent. Conductivity ranged between 0.254 and 0.748 mS/cm.
- Temperature ranged between 11.4 and 20.2 deg C, typical for Q2 conditions.

33 North Clinton Avenue

- DO concentrations were elevated in several downgradient monitoring wells. DO concentrations ranged between 0 and 54 mg/L.
- ORP was elevated in a number of downgradient monitoring wells. ORP ranged between -109 and 386 mV.

- o pH was similar to other monitoring wells. pH varied between 4.09 and 6.79 SU in downgradient monitoring wells.
- o Conductivity in downgradient monitoring varied across the wells. Conductivity ranged between 0.018 and 1.310 mS/cm.
- o Temperature ranged between 8.9 and 15.8 deg C, typical for Q2 conditions.

- **Table 3-4 Summary of Heterotrophic Plate Count Results –** provides a summary of heterotrophic plate count (HPC) results for select wells located downgradient of the OU-2 oxygen injection systems. HPC results varied between 1 and 145,000 colony forming units per milliliter (cru/ml).

- **Appendix B OU-2 Oxygen Injection System OM&M Data –** provides data collected during system operation monitoring. **Table B-1** provides the Garner Lane oxygen injection line operational data, **Table B-2** provides the 34 North Clinton Avenue oxygen injection system operational data, **Table B-3** provides the 9 North Clinton Avenue oxygen injection system operational data, and **Table B-4** provides the 33 North Clinton Avenue oxygen injection system operational data.

  The results provided in **Table B-1** for the injection system located at the corner of Garner Lane and Montauk Highway (which feeds the Montauk Highway and Manatuck Lane injection lines) indicate:

  - o Approximately 768 lbs of oxygen have been injected during Q2 2009 and a total of 10,740 lbs of oxygen have been injected since the initial start-up period.
  - o The OU-2 oxygen injection system operated for 67 out of a possible 91 days during Q2 2009. The system was down for 20 days in April of 2009. A problem was encountered with the refrigerator/dryer. An internal line froze and restricted air flow to the system. This problem was first encountered in March of 2009 and continued into April of 2009. The refrigerator/dryer was taken off-site to be inspected and fixed. The system was taken off-line on April 1, 2009 and brought back online on April 21, 2009. The problem re-occurred in May and the system was shut down for four days while the refrigerator/dryer was replaced. This was the first period of significant downtime during the lifespan of this system.

  The results provided in **Table B-2** for the 34 North Clinton Avenue system (which feeds the 34 North Clinton Avenue Injection Line) indicate:

  - o Approximately 621 lbs of oxygen were injected during Q2 2009.
  - o During Q2 2009, the system operated for 83 out of a possible 91 days. The system was shut down for a total of 8 days in June of 2009 because of an electrical

problem within the compressor. The compressor was inspected and fixed by a KAESER representative and the system was brought back online.

The results provided in **Table B-3** for the 9 North Clinton Avenue system (which feeds the 9 North Clinton Avenue Injection Line) indicate:

- Approximately 397 lbs of oxygen were injected during Q2 2009.
- During Q2 2009, the system operated for 89 out of a possible 91 days. The oxygen system was down for one day in May and one day in June due to electrical power failure. In both instances, power was restored and the system was brought back online.

The results provided in **Table B-4** for the 33 North Clinton Avenue system (which feeds the 33 North Clinton Avenue Injection Line) indicate:

- Approximately 594 lbs of oxygen were injected during Q2 2009.
- During Q2 2009, the system operated for all 91 days.

- **Figure 7 - 33 N. Clinton Avenue Oxygen Injection Line Groundwater Data –** provides a graphical depiction of DO levels, total BTEX and total PAH concentrations over time for wells located downgradient of the 33 North Clinton Avenue oxygen injection system. **Figure 7** provides data for the monitoring well clusters OU2MW-35, OU2MW-36, OU2MW-37, OU2MW-39, and OU2MW-42. Although the system has only been running since March 31, 2009, elevated DO concentrations have already been observed in downgradient monitoring well clusters OU2MW-35, OU2MW-37, OU2MW-39, and OU2MW-42. Decreases of MGP-related contaminants are beginning to be noticed in monitoring well clusters OU2MW-35, OU2MW-36, OU2MW-37, and OU2MW-39. Monitoring well cluster OU2MW-42 was installed after the system start-up, andtherefore, a true baseline value was not established at this well cluster. Further groundwater trend analysis is discussed in Subsection 3.2.4.2.

- **Figure 8 - 34 N. Clinton Avenue Oxygen Injection Line Groundwater Data –** provides a graphical depiction of DO levels, total BTEX and total PAH concentrations over time for wells located downgradient of the 34 North Clinton Avenue oxygen injection system. **Figure 8** provides data for the monitoring well clusters OU2MW-45, OU2MW-46, and OU2MW-47. Elevated DO concentrations have been observed in downgradient monitoring well clusters OU2MW-45, OU2MW-46, and OU2MW-47. Significant decreases of MGP-related contaminants have been observed in monitoring wells located downgradient of the oxygen injection system at wells where effects of the oxygen injection system have been noted (OU2MW-45S, OU2MW-

45I2, OU2MW-46S, OU2MW-46I, OU2MW-47S, OU2MW-47I, and OU2MW-47I2). Further groundwater trend analysis is discussed in Subsection 3.2.4.2.

- **Figure 9 - 9 N. Clinton Avenue Oxygen Injection Line Groundwater Data –** provides a graphical depiction of DO levels, total BTEX and total PAH concentrations over time for wells located downgradient of the 9 North Clinton Avenue oxygen injection system. **Figure 9** provides data for the monitoring well clusters OU2MW-28, OU2MW-29, OU2MW-30, OU2MW-31, and OU2MW-32. Elevated DO concentrations have been observed in downgradient monitoring well clusters OU2MW-28, OU2MW-29, OU2MW-30, and OU2MW-31. OU2MW-32 is located directly upgradient of the oxygen injection line. DO has not been observed within OU2MW-32. Decreases in MGP-related contaminants are beginning to be observed in downgradient monitoring wells OU2MW-28I, OU2MW-28I2, OU2MW-30I, OU2MW-30I2, OU2MW-30I3, and OU2MW-30D2. Further groundwater trend analysis is discussed in Subsection 3.2.4.2.

- **Figure 10 - Montauk Highway Oxygen Injection Line Groundwater Data –** provides a graphical depiction of DO levels, total BTEX and total PAH concentrations over time for wells located downgradient of the Montauk Highway oxygen injection line. **Figure 10** provides data for the monitoring well clusters BBMW-25, OU2MW-01, OU2MW-02, OU2MW-03, OU2MW-04 and OU2MW-08. Historically, elevated DO concentrations have been observed in downgradient monitoring wells. However, during Q2, DO concentrations dropped off significantly in some wells due to the mechanical failure of the refrigerator/dryer and the associated system down time. Significant decreases of MGP-related contaminants have been observed in monitoring wells located downgradient of the Montauk Highway injection line at wells where effects of the oxygen injection system have been noted (BBMW-25S, BBMW-25I, OU2MW-01S, OU2MW-01I, OU2MW-01I2, and OU2MW-04I). The decrease in DO concentrations in some of the wells had little effect on the overall total BTEX and total PAH concentrations. Further groundwater trend analysis is discussed in Subsection 3.2.4.2.

- **Figure 11 - Manatuck Lane Oxygen Injection Line Groundwater Data –** provides graphical depiction of DO levels, total BTEX and total PAH concentrations over time for monitoring wells located downgradient of the Manatuck Lane oxygen injection line. Significant decreases of MGP-related contaminants have been observed in monitoring wells located downgradient of the Manatuck Lane injection line at wells where effects of the oxygen injection system have been noted (OU2MW-06, OU2MW-07, OU2MW-12D, GMP-02 and GMP-04). Further groundwater trend analysis is discussed in Subsection 3.2.4.2.

3.1.4 Future Plans

- Continue monthly system inspections, groundwater monitoring and quarterly sampling for COCs.
- Continue sampling of permanent soil vapor points.
- Continue weekly system inspections.
- Conduct labor intensive maintenance on the system.

3.2 Groundwater Monitoring

3.2.1 Program Scope and Purpose

Groundwater monitoring is conducted within OU-2 to aid in monitoring the groundwater plume, the effectiveness of remedial activities, the effectiveness of the oxygen injection systems, and to assist in remedy planning. The well locations and geographic boundaries of OU-2 are illustrated on **Figure 1**. The majority of OU-2 monitoring wells are sampled quarterly with the exception of groundwater monitoring wells BBMW-01S, I, and D and BBMW-23S, I, D and D2, which have been sampled on a monthly basis since Q2 2007, and wells installed to monitor new oxygen injection systems which are sampled monthly. Wells BBMW-01S, I, and D and BBMW-23S, I, D, and D2 are located approximately 100 to 200 feet downgradient of OU-1 and will continue to be monitored on a monthly basis to measure the influence of the OU-1 excavations and subsurface barrier wall installation on the OU-2 groundwater plume. The wells sampled each quarter are determined based on previous analytical data and discussions with NYSDEC.

3.2.2 Current Site Activity

The following groundwater monitoring activities took place in OU-2 during Q2 2009.

- Depth to groundwater measurements were obtained on May 4 through 6, 2009 from 106 monitoring wells located within, sidegradient and downgradient of OU-2.
- Surface water elevations were obtained on May 5, 2009 from surface water gauges located within Lawrence Lake (BBSW-07) and Lawrence Creek (OU2SW-01 and BBSW-06).
- Groundwater samples were collected from 191 monitoring wells located within, sidegradient and downgradient of OU-2. A total of 307 groundwater samples from all of the 191 wells were analyzed for expanded VOCs (EPA Method 8260) and PAHs (EPA Method 8270).

3.2.3 Groundwater Elevation Data

The depth to groundwater, groundwater elevation and surface water elevation data for OU-2 are provided on the following tables and figures.

- **Table 3-5 Water Level Measurements and Calculated Groundwater Elevations –** provides depth to water measurements and calculated groundwater and surface water elevation data for OU-2 wells and surface water bodies measured in Q2 2009.
- **Table 3-6 Historic Calculated Groundwater Elevations –** provides historic groundwater elevations for existing OU-2 groundwater monitoring wells.
- **Figure 4 – Shallow Groundwater Contour Map –** provides the Q2 2009 shallow groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.
- **Figure 5 – Deep Groundwater Contour Map –** provides the Q2 2009 deep groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.

The groundwater flow direction in OU-2 is toward the south/southeast. The shallow groundwater hydraulic gradient ranges from approximately 0.0035 feet/foot in the upgradient portion of the plume to approximately 0.0051 feet/foot in the downgradient portion of the plume. The deep groundwater hydraulic gradient ranges from approximately 0.003 feet/foot to 0.005 feet/foot. The groundwater elevation in OU-2 monitoring wells during the Q2 2009 event were an approximate average of 0.30 feet higher than the Q1 2009 groundwater elevations and an approximate average of 0.15 feet lower than the Q2 2008 groundwater elevations.

3.2.4 Groundwater Analytical Data

The OU-2 groundwater analytical data are presented on the following tables, figures and appendix.

- **Table 3-7 Summary of Historic Total BTEX Groundwater Analytical Results – Upgradient of Montauk Highway Oxygen Injection Line –** presents a summary of historical total BTEX results for existing OU-2 groundwater monitoring wells upgradient of the Montauk Highway Oxygen Injection Line.
- **Table 3-8 Summary of Historic Total PAH Groundwater Analytical Results – Upgradient of Montauk Highway Oxygen Injection Line –** presents a summary of historical total PAH results for existing OU-2 groundwater monitoring wells upgradient of the Montauk Highway Oxygen Injection Line.
- **Table 3-9 Summary of Historic Total BTEX Groundwater Analytical Results – Downgradient of Montauk Highway Oxygen Injection Line –** presents a summary

of historical total BTEX results for existing OU-2 groundwater monitoring wells downgradient of the Montauk Highway Oxygen Injection Line.

- **Table 3-10 Summary of Historic Total PAH Groundwater Analytical Results – Downgradient of the Montauk Highway Oxygen Injection Line –** presents a summary of historical total PAH results for existing OU-2 groundwater monitoring wells downgradient of the Montauk Highway Oxygen Injection Line.
- **Table 3-11 Summary of Historic Total BTEX Groundwater Analytical Results – Downgradient of Manatuck Lane Oxygen Injection Line –** presents a summary of historical total BTEX results for existing OU-2 groundwater monitoring wells downgradient of the Manatuck Lane Oxygen Injection Line.
- **Table 3-12 Summary of Historic Total PAH Groundwater Analytical Results – Downgradient of the Manatuck Lane Oxygen Injection Line –** presents a summary of historical total PAH results for existing OU-2 groundwater monitoring wells downgradient of the Manatuck Lane Oxygen Injection Line.
- **Table 3-13 Summary of Monthly Total BTEX Groundwater Analytical Results – Targeted Monitoring Wells for Supplemental Oxygen Injection Systems –** presents monthly downgradient analytical results for total BTEX.
- **Table 3-14 Summary of Monthly Total PAH Groundwater Analytical Results – Targeted Monitoring Wells for Supplemental Oxygen Injection Systems –** presents monthly downgradient analytical results for total PAH.
- **Table 3-15 Summary of Expanded Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-2 for each compound detected during the Q2 2009 sampling event.
- **Table 3-16 Summary of Total BTEX Statistical Trends –** provides statistical trends of concentrations beginning near the date when the nearest upgradient oxygen injection system was installed, through Q2 2009. The table is set up to include wells for all of the existing oxygen injection systems; however, many of the wells installed to monitor the new systems do not have sufficient data to evaluate concentration trends. Future quarterly OM&M reports will evaluate the trends for these wells.
- **Table 3-17 Summary of Total PAH Statistical Trends –** provides statistical trends of concentrations beginning near the date when the nearest upgradient oxygen injection system was installed, through Q2 2009. The table is set up to include wells for all of the existing oxygen injection systems; however, many of the wells installed to monitor the new systems do not have sufficient data to evaluate concentration trends. Future quarterly OM&M reports will evaluate the trends for these wells.

- **Figure 12 Water Table Groundwater BTEX Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total BTEX in the water table portion of the upper glacial aquifer for OU-1.
- **Figure 13 Intermediate Groundwater BTEX Iso-Concentration Map 10-50 Feet (bgs) – Q2 2009 Data –** depicts the horizontal extent of total BTEX in the 10 to 50 depth zone of the upper glacial aquifer for OU-1.
- **Figure 14 Deep Groundwater BTEX Iso-Concentration Map (Below 50 Feet bgs) – Q2 2009 Data** – depicts the horizontal extent of total BTEX in the deeper than 50-foot depth zone of the upper glacial aquifer for OU-1.
- **Figure 15 Water Table Groundwater PAH Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total PAH in the water table portion of the upper glacial aquifer for OU-1.
- **Figure 16 Intermediate Groundwater PAH Iso-Concentration Map 10-50 Feet (bgs) – Q2 2009 Data –** depicts the horizontal extent of total PAH in the 10 to 50 depth zone of the upper glacial aquifer for OU-1.
- **Figure 17 Deep Groundwater PAH Iso-Concentration Map (Below 50 Feet bgs) – Q2 2009 Data** – depicts the horizontal extent of total PAH in the deeper than 50 feet within the upper glacial aquifer.
- **Appendix E** – presents time series plots of historical concentrations in groundwater monitoring wells.

3.2.4.1 Distribution of Total BTEX and Total PAH in the Upper Glacial Aquifer

Prior to the Q1 2009 OM&M report, the horizontal extent of the OU-2 plume within the upper glacial aquifer, based on greater than 100 ug/L of total BTEX and total PAH, was based on the results of the 2004 Remedial Investigation (RI) and depicted on the quarterly report figures. Starting with the Q1 2009 report, the horizontal extent of total BTEX and total PAH concentrations for quarterly monitoring events will be depicted using iso-concentration maps. The iso-concentration maps prepared for this Q2 2009 OM&M report also include the 2004 depiction of the plume extent for historical reference, as well as the Q1 2009 plume extent for remediation evaluation purposes.

The most significant change to the overall outline of the groundwater BTEX/PAH plume from the 2004 depiction is the significant reduction in the downgradient extent of the plume from Lawrence Creek in 2004 to near Manatuck Lane. The internal configuration of the plume within the upper glacial aquifer has been refined based on the addition of a greater number of monitoring points and associated data, as well as in response to the ongoing remediation at the site. This remediation includes the installation of the oxygen injection systems, the OU-1 excavation, and the installation of the subsurface barrier wall (**Figure 1**).

The outline of the plumes for Q1 2009 and Q2 2009 generally indicate a slight reduction in extent. The changes from the 2004 outline to the current plume outline are summarized as follows:

- The downgradient edge of the plume does not extend to Lawrence Creek, and ends at the Manatuck Lane oxygen injection line.
- The plume is slightly narrower near the downgradient area of OU-1, continuing to the upgradient area of OU-2 and eastern edge of the downgradient portion of the plume.
- The plume is shallower adjacent to the downgradient side of the subsurface barrier wall.
- The eastern edge of the central portion of the plume extends slightly further to the east. This was primarily established by the installation of additional groundwater monitoring wells installed as part of the oxygen injection system monitoring network for the 33 North Clinton Avenue property. It is noted that the oxygen injection system line for 33 N. Clinton Avenue extends to this eastern edge of the plume.

The distribution of total BTEX and total PAH for Q2 2009 within the upper glacial aquifer is depicted on **Figures 12 through 14** and **Figures 15 through 17**, respectively. The horizontal distribution of the constituent groups in each map is depicted as lines of equal concentration (iso-concentration lines). The iso-concentration lines were generated using a combination of applied methods. Initially, the lines were created by direct graphical interpolation between concentrations. These lines were then modified to factor in groundwater flow, taking into account the southeasterly flow direction and the low transverse dispersion of the upper glacial aquifer. For areas where the groundwater monitoring well density was low, historical water quality from existing wells and groundwater quality data from previous groundwater probes were utilized.

The vertical distribution of the total BTEX and total PAH concentrations are depicted by the iso-concentration maps for three groundwater horizons: the water table zone (up to the approximate upper 5 feet of the upper glacial aquifer); an intermediate depth zone from approximately 10 to 50 feet below land surface; and a deep zone below 50 feet, to the top of the underlying low permeability surface unit of the Magothy aquifer. The iso-concentration maps include the historical 2004 RI total BTEX and total PAH plume outline, as well as the previous Q1 2009 and new Q2 2009 plume outlines showing total BTEX and total PAH contours for each respective groundwater depth horizon.

It is noted that the iso-concentration maps include maximum concentrations for the quarter for the wells that were sampled more than once. This primarily applies to the monthly monitoring conducted for the oxygen systems-related groundwater monitoring wells.

Total BTEX

The depth series iso-concentration maps show that near the source area of OU-1, the total BTEX impacts are primarily shallow, with concentrations up to 7,820 ug/L (**Figure 9**). The contamination (above 100 ug/L) within this water table zone extends to approximately 200 feet downgradient of the OU-1 Union Boulevard oxygen injection system and the OU-1 boundary. The width of the plume is fairly narrow, less than an average of 250 feet.

With depth, in the intermediate zone, total BTEX concentrations up to 3,791 ug/L are present in a localized area to the east of the shallow plume, in the vicinity of South Union Boulevard and Jan Court. The downgradient edge of this area is defined by the newly installed oxygen injection line at 33 North Clinton Avenue. Another elevated area of total BTEX concentrations, with a maximum concentration of 5,013 ug/L, was present in the central portion of the downgradient area of OU-1 (**Figure 13**). The downgradient edge of this area is generally defined at the line of the oxygen injection line installed at Montauk Highway. Further downgradient of this area, the total BTEX plume concentrations decrease up to two orders-of-magnitude, to concentrations of between 15 ug/L and 891 ug/L, and extend to the oxygen injection line at Manatuck Lane. Excluding a small localized area at OU2MW-52I, the total BTEX concentrations are below 100 ug/L, in the remaining area downgradient of this system and to Lawrence Creek. The total BTEX concentration at OU2MW-52I was 128 ug/L. It is noted that an oxygen injection line was being installed along Lawrence Creek during Q2 2009.

In the lower portion of the upper glacial aquifer zone, below a depth of approximately 50 feet, total BTEX concentrations between 100 ug/L and 695 ug/L are present in a narrow discontinuous band (less 200 feet wide). The first segment of the band begins near Cooper Lane and terminates at the 9 North Clinton Avenue oxygen injection line, which began operation during Q1 2009. A second segment is a localized area to the south of the oxygen injection line located on Montauk Highway and is defined by a single concentration exceeding 100 ug/L (**Figure 14**).

Total PAH

The vertical distribution of total PAH concentrations within the upper glacial aquifer is generally similar to that of total BTEX described above (**Figures 15 through 17**). The primary differences are:

- Maximum concentrations were slightly higher than those of total BTEX concentrations.
- The areas of elevated PAH concentrations are larger and greater in length than corresponding areas of elevated BTEX concentrations.

- Downgradient of OU-1, the elevated concentrations were primarily present in the intermediate and deep zones of the upper glacial aquifer and extended to the Manatuck Lane oxygen injection line.
- The downgradient edges of the areas of elevated concentrations are generally defined by the oxygen injection lines transecting the longitudinal axis of the plume.

Focused and Expedited Plume Remediation

The locations of the existing oxygen injection systems and planned remediation systems depicted on **Figure 1** allows for the effective and comprehensive remediation of the plume. The figure illustrates that the entire width of the plume, and up to approximately 20 feet beyond, is being or will be remediated by oxygen injection lines. The figure also depicts that the remediation of the plume along its longitudinal, downgradient axis is occurring at several transects at various locations. The existing groundwater data shows that the existing oxygen injection systems have been successful in reducing concentrations of total BTEX and total PAH. The addition of the oxygen injection systems started during Q1 2009 and Q3 2009 enable the injection to occur at shorter distances along the plume axis, thereby, accelerating the remediation of the plume.

3.2.4.2 Groundwater Analytical Data Trend Analysis

The groundwater analytical data were reviewed to identify any trends in data, with the focus on data collected during the operational injection period of the various oxygen injection systems at the Site. The analysis of the data focuses on the downgradient areas of four oxygen injection systems and five lines installed within OU-2 and operating by Q2 2009. These systems include the oxygen injection lines installed at Montauk Highway and Manatuck Lane, 34 North Clinton Avenue and the newly installed lines at 9 North Clinton Avenue and 33 North Clinton Avenue. The trend analysis presented below includes the previously existing systems, in addition to the 9 North Clinton Avenue and 33 North Clinton Avenue systems which have sufficient post-startup groundwater quality data.

Analysis of the trends of constituent concentrations for OU-2 groundwater monitoring wells was conducted on two levels: statistical and graphical. The period of these trends focus on the operational periods of each oxygen injection system or line with at least two quarterly sampling events.

A statistical analysis typically used to assess trends in groundwater monitoring well concentration data is the Mann-Kendall method (Gilbert, 1987). This method is a non-parametric statistical that evaluates concentration trends over time, by comparing the relative difference in magnitude of data over time and assigning probability for the trends. One limitation of this statistical method exists for interpretation of remediation monitoring data sets of limited events. The graphical trend analysis of groundwater monitoring well concentrations considers all of the concentrations for the same oxygen injection period as the statistical period.

Downgradient of the 33 North Clinton Avenue Oxygen Injection Line

The 33 North Clinton Avenue oxygen injection system began operation on the last day of Q1 2009 (March 31, 2009). The total BTEX and total PAH concentrations in the groundwater immediately upgradient of the 33 North Clinton Avenue oxygen injection system were primarily present in the intermediate upper glacial aquifer zone. The highest median total BTEX and total PAH concentrations since the system was installed were found in wells located immediately upgradient of the 33 North Clinton Avenue system (5,201 ug/L in 4,932 ug/L in OU2MW-18I). A discussion of the statistical and graphical concentration trends is presented below.

Statistical Trend Analysis

In the five well clusters located adjacent to, or immediately downgradient of the oxygen injection line (OU2MW-35, OU2MW-36, OU2MW-37, OU2MW-38 and OU2MW-39), one significant decreasing statistical trend of total BTEX was identified in well OU2MW-36I. For total PAH concentration trends in these same adjacent downgradient wells, statistical decreasing trends were identified in OU2MW-36I and OU2WM-39I. The indication of no trend identified for most of the adjacent downgradient wells of the oxygen injection system occurs for several reasons. The Mann-Kendall method may not utilize the initial high concentration found prior to oxygen injection remediation effects because it considers it anomalous to the subsequent significant lower consistent post-remediation concentrations.

Review of data and Mann-Kendall results for downgradient wells indicating no trend identifies that 50% of the total BTEX results and approximately 75% of the total PAH results had a negative Mann-Kendall Statistic (S). This negative statistic indicates a decreasing trend to exist, even though it was not significant at a 95% confidence interval. Many wells indicated with no trend had a limited number of sampling events (five) or high number of non-detect results (up to four).

Graphical Trend Analysis

For the time series plots (**Figure 7**) of the five well clusters located immediately adjacent and downgradient of the oxygen injection system (OU2MW-35, OU2MW-36, OU2MW-37, OU2MW-38 and OU2MW-39), the Q2 2009 total BTEX concentrations were below 100 ug/L in all of the wells except OU2MW-38I. In well OU2MW-38I, total BTEX concentrations significantly decreased several orders-of-magnitude from a high of 4,001 ug/L prior to the system start-up, to 204 ug/L in Q2 2009. Decreasing or stable PAH concentration trends were identified in all of the wells in the clusters listed above with the exceptions of OU2MW-37I and OU2MW-39I2. In well OU2MW-37I, the overall trend has been slightly increasing; however, the concentration decreased from 216 ug/L in Q1 2009 to 67 ug/L in Q2 2009. In well OU2MW-39I, total PAH concentrations, since the installation of the well and operation of the oxygen injection system, have been below 100 ug/L.

The above data indicate that there have been significant decreases of MGP-related contaminants in groundwater monitoring wells located downgradient of the 33 North Clinton Avenue oxygen injection system line since the system was started.

Downgradient of 34 North Clinton Avenue Oxygen Injection Line

Total BTEX and total PAH concentrations in the groundwater immediately upgradient of the 34 North Clinton Avenue oxygen injection system were primarily present in the intermediate and deep upper glacial aquifer zones. The highest median concentrations, since the system was installed, in wells located immediately upgradient of the 34 North Clinton Avenue system (BBMW-02, OU2MW-19 and OU2MW-20) were approximately 1,600 ug/L total BTEX in well OU2MW-19I and 6,811 ug/L total PAH in monitoring well OU2MW-19I2. A discussion of the statistical and graphical concentration trends is presented below.

Statistical Trend Analysis

In the three well clusters located adjacent to, or immediately downgradient of, the oxygen injection line (OU2MW-45, OU2MW-46 and OU2MW-47), significantly decreasing statistical trends of total BTEX were identified in OU2MW-45S, OU2MW-46I, OU2MW-47S, and OU2MW-47I2. For total PAH concentration trends in these same adjacent downgradient wells, statistical decreasing trends were identified in OU2MW-45I2, OU2WM-46 I and OU2MW-47I2.

The indication of no trend identified for most the adjacent downgradient wells of the oxygen injection system occurs for several reasons. The Mann-Kendall method does not utilize the initial high concentration found prior to oxygen injection remediation effects because it considers it anomalous to the subsequent significant lower consistent post-remediation concentrations.

Review of data and Mann-Kendall results for downgradient wells indicating no trend, identifies that 40% of the total BTEX and 65% of the total PAH trends values have a negative Mann-Kendall Statistic (S) associated with them. This negative statistic indicates a decreasing trend to exist, even though it was not significant at a 95% confidence interval. Many wells indicated with no trend had a limited number of sampling event (five) or high number of non-detect results (up to four).

Graphical Trend Analysis

For the time series plots (**Appendix E**) of the three well clusters located immediately adjacent or downgradient of the oxygen injection system (OU2MW-45, OU2MW-46 and OU2MW-47), total BTEX concentrations in all of the wells were below 100 ug/L, excluding OU2MW-46I2 and OU2MW-47D. Total BTEX concentrations in these wells significantly decreased up to two orders-of-magnitude during the system operational period. In well OU2MW-46I2, the total BTEX concentration decreased from 375 ug/L in Q1 2009 to 185 ug/L in Q2 2009. Monitoring well cluster OU2MW-46 is located adjacent to the oxygen injection line. The trend in OU2MW-47D continues to slightly increase for the relatively short system monitoring period.

Elevated system operational period concentrations of total PAH for the wells within these clusters significantly decreased from a high of approximately 6,200 ug/L in OU2MW-47I2 to near detection levels. Currently, only one of the wells noted above (OU2MW-47D) has a total PAH concentration above 100 ug/L. The trend in this well continues to slightly increase for the relatively short system monitoring period.

The above data indicate that there generally have been significant decreases of MGP-related contaminants in groundwater monitoring wells located downgradient of the 34 North Clinton Avenue oxygen injection system line.

Downgradient of 9 North Clinton Avenue Oxygen Injection Line

The 9 North Clinton Avenue oxygen injection system began operation in Q1 2009 (February 16, 2009). Total BTEX and total PAH concentrations in the groundwater immediately upgradient of the 9 North Clinton Avenue oxygen injection system were primarily present in the intermediate and deep upper glacial aquifer zone. The highest median concentration, since the system was installed, immediately north of the 9 North Clinton Avenue system, was 4,029 ug/L (OU2 MW-32I). A discussion of the statistical and graphical concentration trends is presented below.

Statistical Trend Analysis

In the four well clusters located immediately downgradient of the oxygen injection line (OU2MW-28, OU2MW-29, OU2MW-30 and OU2MW-31), significantly decreasing statistical trends of total BTEX were identified in OU2MW-28I, OU2MW-29I2, OU2MW-30S, and OU2MW-30D. An increasing statistical trend of total BTEX was identified at OUMW-31I2. However, there is a fairly limited number of sampling events for this well and two concentrations below detection levels. The indication of no trend being identified for most of the adjacent downgradient wells of the oxygen injection system may occur because the Mann-Kendall method may not utilize the initial high concentration found prior to oxygen injection remediation effects because it considers it anomalous to the subsequent significant lower consistent post-remediation concentrations.

For total PAH concentration trends in these same adjacent downgradient wells, statistical decreasing trends were identified in OU2MW-28I, OU2WM-30 I OU2MW-30I2 and OU2MW-31I. No trends were identified for the remaining wells in these clusters.

Review of data and Mann-Kendall results for downgradient wells indicating no trend, identifies that 55% of the total BTEX and 70% of the total PAH values had a negative Mann-Kendall Statistic (S) associated with them. This negative statistic indicates a decreasing trend to exist, even though it was not significant at a 95% confidence interval.

Graphical Trend Analysis

For the time series plots (**Appendix E**) of the four well clusters located immediately downgradient of the oxygen injection system (OU2MW-28, OU2MW-29, OU2MW-30 and OU2MW-31), decreasing trends in total BTEX concentrations were identified in wells OU2MW-28I, OU2MW-29I, OU2MW-29I2, OU2MW-30S, OU2MW-30I2 and OU2MW-30D. The concentrations have decreased up to two orders-of-magnitude during the system operational period. Increases in total BTEX concentrations have been observed in wells OU2MW-31I2 and OU2MW32I, although the most latest concentration in OU2MW-31I2 of approximately 300 ug/L decreased from the previous concentration of approximately 400 ug/L, which was the highest historical concentration detected in the well. Similarly, in well OU2MW-32I, total BTEX decreased from approximately 5,000 ug/L to approximately 3,000 ug/L from Q1 2009 to Q2 2009. The total BTEX concentration trends in the remaining wells were generally stable with associated relative low levels.

Total PAH concentrations in the nearby downgradient wells (OU2MW-28I, OU2MW-28I2, OU2MW-29I, OU2MW-29I2, OU2MW-29D, OU2MW-30S, OU2MW-30I, OU2MW-30I2, OU2MW-30D2, and OU2MW-31I) generally decreased during the operational period. Increasing total PAH concentration trends were observed in wells OU2MW-3I2 and OU2MW-32I.

The above data indicate that there have been significant decreases of MGP-related contaminants in groundwater monitoring wells located downgradient of the 9 North Clinton Avenue oxygen injection system line.

Downgradient of Montauk Highway Oxygen Injection Line

The highest total BTEX and total PAH concentrations immediately upgradient of the Montauk Highway oxygen injection line were present in the intermediate upper glacial aquifer zone. The highest median concentrations during the oxygen injection system operational period in upgradient wells located closest to the Montauk Highway injection line were 7,615 ug/L total BTEX in well OU2MW-08I and 898 ug/L total PAH in monitoring well OU2MW-08S.

Statistical Trend Analysis

In the three well clusters located immediately downgradient of the oxygen injection line, OU2MW-01, OU2MW-02 and BBMW-25, three statistical trends of total BTEX were identified as decreasing (OU2MW-01S, OU2MW-01I and OU2MW-012). For total PAH concentration trends, statistical decreasing trends were identified in all five wells where trends were identified. Review of data and Mann-Kendall results for downgradient wells in these clusters indicating no trend identifies that approximately 60% of the total BTEX and 98% of the total PAH values had a negative Mann-Kendall Statistic (S) associated with them indicating a decreasing trend, even though it was not significant at a 95% confidence level.

Graphical Trend Analysis

Significant decreases of MGP-related contaminants have been observed in monitoring wells located downgradient of the Montauk Highway injection line where effects of the oxygen injection system have been noted. Plots of total BTEX, total PAH concentrations and DO over time are presented on **Figure 10** for wells located downgradient of the Montauk Highway injection line. The pre- and post-oxygen injection total BTEX and total PAH concentrations are presented in **Tables 3-9 and 3-10**, respectively.

Total BTEX and total PAH concentrations in the all of the adjacent downgradient wells of the Montauk Highway oxygen injection line continue to constitute decreasing trends during the oxygen injection system operational period. The operational period trends for the downgradient wells are decreasing, except for total PAH in well OU2MW-01S and OU2MSW-02I which have stable trends. The Q2 2009 concentrations for these wells are within the range of historical concentrations.

Downgradient of Manatuck Lane Oxygen Injection Line

Elevated total BTEX and total PAH concentrations upgradient of the Manatuck Lane oxygen injection line have been present in the intermediate depth zone of the upper glacial aquifer. The highest median concentrations since the system began operation in September 2005, in upgradient wells located closest to the Manatuck Highway oxygen injection line, were 406 ug/L total BTEX and 3,967 ug/L total PAH in monitoring well GMP-01.

Statistical Trend Analysis

Statistical trends were evaluated for wells located downgradient of the Manatuck Lane oxygen injection line operating period. No wells downgradient of the Manatuck Lane oxygen injection system had median total BTEX and total PAH concentrations above 100 ug/l during the system operational period. Two decreasing trends were identified in wells GMP-02 and GMP-04. For total BTEX, an increasing trend was identified in well OUMW2-10D, but the median concentration was near detection levels. Generally, statistical trends for total PAH were similar.

Graphical Trend Analysis

Significant decreases of MGP-related contaminants have been observed in monitoring wells located downgradient of the Manatuck Lane injection line at wells where effects of the oxygen injection line have been noted. Plots of total BTEX, total PAH concentrations and DO over time are presented on **Figure 11** for the eight well clusters located adjacent to and downgradient of the Manatuck Lane injection line. The pre- and post-oxygen injection total BTEX and total PAH concentrations are presented in **Tables 3-11 and 3-12**, respectively. The only well in which Q2 2009 concentrations of total BTEX or total PAH were above 100 ug/L was in OU2MW-52I with concentrations of 128 ug/L and 101 ug/L, respectively. No historical results are available to compare these results since this well was installed during Q2 2009.

The above data indicate that there have been significant decreases of MGP-related contaminants in the majority of groundwater monitoring wells located downgradient of the Manatuck Lane oxygen injection line.

3.2.5 Future Plans

- Continue annual and quarterly groundwater monitoring at selected wells.
- Operate the oxygen injection system installed during Q2 2009.

4. Operable Unit 3 – Brightwaters Yard & Groundwater Plume

4.1 Oxygen Injection Systems

4.1.1 Program Scope and Purpose

Two oxygen injection groundwater treatment systems have been installed at the Site to mitigate dissolved-phase groundwater impacts migrating from the OU-3 Brightwaters Yard to O-Co-Nee Pond. The first system was installed in Q3 2000, as part of an IRM at the intersection of Union Boulevard and Lanier Lane. This treatment system consists of one injection line intended to reduce the concentrations of MGP-related contaminants in groundwater prior to discharge to O-Co-Nee Pond. A second oxygen injection groundwater treatment system was installed in Q4 2004, as part of an IRM on the Brightwaters Yard. This treatment system consisted of three injection lines intended to reduce the concentrations of MGP-related contaminants in groundwater leaving the Site boundary. The Brightwaters Yard Oxygen Injection System was taken offline on June 1, 2009 in support of the OU-3 LIRR IRM. The system and nine associated monitoring wells (PDMW-01, PDMW-02, PDMW-03, MW-02S/SR, MW-02I-R, MW-26D, MW-59, MW-16, and MW-16S/SR) were abandoned in June of 2009.

4.1.2 Current Site Activity

The following OU-3 oxygen injection system monitoring and system operation activities were performed in Q2 2009.

- **Monthly Groundwater Parameter Monitoring:** On a monthly basis, ten groundwater monitoring wells downgradient of the oxygen injection systems (MW-65, MW-75, MW-82, PDMW-01, IO-10, MW-34S, MW-34I, MW-34D, MW-46WR, and MW-70/70S) were monitored for DO, ORP, pH, Conductivity, and Temperature. Monitoring well PDMW-01 was abandoned in June of 2009. Monthly Groundwater Parameter Monitoring was completed at these wells on the following dates:
  - April 20, 21, and 22, 2009
  - May 20, 26, and 28, 2009
  - June 16, 26, and 29, 2009
- **System Operation Monitoring:** The groundwater treatment systems are monitored on a monthly basis to ensure effective continued operation. During each monitoring event, system parameters relating to system operational and equipment readiness are recorded

and adjusted as necessary to optimize system performance. System Operation Monitoring was completed for the Brightwaters Yard System and the Union Boulevard System on the following dates:

- April 23, 2009
- May 12 and 29, 2009
- June 22, 2009

- **Quarterly Groundwater Sampling:** Select monitoring wells upgradient and downgradient of the oxygen injection system located in OU-3 are sampled quarterly for VOCs and SVOCs. Groundwater quality parameters (DO, pH, temperature, conductivity and ORP) are also recorded for each well during the quarterly sampling. Details on the groundwater sampling program are provided in Subsection 4.2 below.

4.1.3 Oxygen Injection System OM&M Data

The OU-3 Oxygen Injection System OM&M data are provided on the following tables, figures and appendix.

- **Table 4-1 Summary of Groundwater Parameter Data – Union Boulevard Oxygen Injection System –** provides the historical conductivity, DO, ORP, pH and temperature data for wells downgradient of the Union Boulevard oxygen injection system. The data provided on this table indicate that for Q2 2009:
  - DO concentrations remained elevated in downgradient monitoring wells IO-10, MW-46/WR, and MW-70/70S. DO increased significantly in MW-34I from 0 mg/L in Q1 to 18 mg/L in Q2 2009. DO concentrations ranged between 0 and 39 mg/L at these locations.
  - ORP remained elevated in downgradient monitoring well IO-10, and increased at MW-34D and MW-34I. ORP ranged between -26 and 185 mV at these locations.
  - pH ranged between 5.65 and 6.61 SU in downgradient monitoring wells.
  - Conductivity in downgradient monitoring wells remained consistent. Conductivity ranged between 0.0.295 and 2.770 mS/cm.
  - Temperature ranged between 9.9 and 20.3 deg C, typical for Q2 conditions.

- **Table 4-2 Summary of Groundwater Parameter Data – Brightwaters Yard Oxygen Injection System –** provides the historical conductivity, DO, ORP, pH and temperature data for wells downgradient of the Brightwaters Yard oxygen injection system. The data provided on this table indicate that for Q2 2009:

- DO concentrations were elevated at monitoring wells MW-65, MW-79, MW-81, MW-82, MW-83, SV-02, and PDMW-01. DO concentrations ranged between 1.1 and 27 mg/L at these locations.
- ORP remained elevated in select downgradient monitoring wells. ORP ranged between -252 and 142 mV.
- pH remained consistent; pH ranged between 5.74 and 6.62 SU in downgradient monitoring wells.
- Conductivity in downgradient monitoring wells remained consistent. Conductivity ranged between 0.0.321 and 1.16 mS/cm.
- Temperature ranged between 10 and 17.7 deg C, typical for Q2 conditions.

- **Table 4-3 Summary of Heterotrophic Plate Count Results –** provides a summary of HPC results for select wells located downgradient of the OU-3 oxygen injection systems. HPC results varied between 55 and 16,000 colony forming units per milliliter (cfu/ml).

- **Figure 18 OU-3 Union Boulevard Oxygen Injection System Groundwater Data –** provides graphical depiction of DO measurements, total BTEX and total PAH concentrations over time for wells located downgradient of the Union Boulevard oxygen injection system. Decreases in total BTEX and total PAH concentrations are evident historically in monitoring wells (MW-46WR, IO-10, and MW-34I) in the vicinity of the Union Boulevard injection system. Further groundwater trend analysis is discussed in Subsection 4.2.4.2.

- **Figure 19 OU-3 Brightwaters Yard Oxygen Injection System Groundwater Data –** provides graphical depiction of DO measurements, total BTEX and total PAH concentrations over time for monitoring wells located downgradient of the Brightwaters Yard oxygen injection system. Potential impacts on the Long Island Railroad (LIRR) property make it difficult to evaluate the effectiveness of the Brightwaters Yard oxygen injection system. However, decreasing total BTEX concentrations are associated with monitoring wells (SV-03, MW-78, and MW-79). Further groundwater trend analysis is discussed in Subsection 4.2.4.2.

- **Appendix C OU-3 Oxygen Injection System OM&M Data –** provides data collected during system operation monitoring. Table C-1 provides the Union Boulevard oxygen injection system operational data and Table C-2 provides the Brightwaters Yard oxygen injection system operational data.

  The results provided in Table C-1 for the Union Boulevard system indicate:

  - Approximately 372 lbs of oxygen were injected during Q2 2009.
  - A total of 4,804 lbs of oxygen have been injected since the initial start-up period.

- The system operated for 91 days during Q2 2009.

The results provided in Table C-2 for the Brightwaters Yard system indicate:

- Approximately 283 lbs of oxygen were injected during Q2 2009.
- A total of 7,187 lbs of oxygen have been injected since the initial start-up period.
- The system operated for 60 out of a possible 91 days during Q2 2009. The system was taken offline and abandoned in June of 2009. The system was also offline on May 5, 2009 due to a problem with the incoming voltage. LIPA was notified and the problem was fixed.

4.1.4 Future Plans

- Continue monthly system inspections, groundwater monitoring and quarterly sampling for COCs.
- Continue weekly system checks.
- Conduct labor intensive maintenance on the systems.

4.2 Groundwater Monitoring

4.2.1 Program Scope and Purpose

Groundwater monitoring is conducted within OU-3 to monitor the groundwater plume, to evaluate the effectiveness of remedial activities and the effectiveness of the oxygen injection systems, and to aid in remedy planning. There are currently approximately 70 monitoring wells located on OU-3. The well locations and geographic boundaries of OU-3 are depicted on **Figure 1**. The number of wells sampled each quarter is determined based on previous analytical data and discussions with NYSDEC.

4.2.2 Current Site Activity

The following groundwater monitoring activities took place in OU-3 during Q2 2009:

- Depth to groundwater measurements were obtained on May 5, 2009 from 36 monitoring wells located within, sidegradient and downgradient of OU-3.
- The surface water elevation was obtained May 5, 2009 from a surface water gauge located within the headwaters of O-Co-Nee Pond (BBSW-13).
- Groundwater samples were collected from 52 of the 67 monitoring wells located within OU-3. Twenty five of the groundwater samples were analyzed for total BTEX and MTBE via EPA method 8260, and PAHs via EPA Method 8270, and 27 of the

groundwater samples were analyzed for an expanded list of VOCs (EPA Method 8260) and PAHs (EPA Method 8270).

4.2.3 Groundwater Elevation Data

The depth to groundwater, groundwater elevation and surface water elevation data for OU-3 are provided on the following tables and figures.

- **Table 4-4 Water Level Measurements and Calculated Groundwater Elevations –** provides depth to water measurements and calculated groundwater and surface water elevation data for OU-3 wells measured in Q2 2009.
- **Table 4-5 Historic Calculated Groundwater Elevations –** provides historic groundwater elevations for OU-3 for existing groundwater wells.
- **Figure 4 Shallow Groundwater Contour Map –** provides the Q2 2009 shallow groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.
- **Figure 5 Deep Groundwater Contour Map –** provides the Q2 2009 deep groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.

The groundwater flow direction in OU-3 is toward the south/southeast. The shallow groundwater hydraulic gradient in OU-3 is approximately 0.0034 feet/foot. The deep groundwater hydraulic gradient is approximately 0.0035 feet/foot. The groundwater elevation in OU-3 monitoring wells during the Q2 2009 event were an approximate average of 0.3 feet higher than the Q1 2009 groundwater elevations and an approximate average of 0. 02 feet lower than the Q2 2008 groundwater elevations.

4.2.4 Groundwater Analytical Data

The OU-3 groundwater analytical data is presented in the following tables, figures and appendix.

- **Table 4-6 Summary of Historic Total BTEX Groundwater Analytical Results -** presents a summary of historical total BTEX results for existing OU-3 groundwater monitoring wells.
- **Table 4-7 Summary of Historic Total PAH Groundwater Analytical Results –** presents a summary of historical total PAH results for existing OU-3 groundwater monitoring wells.
- **Table 4-8 Summary of BTEX, MTBE and PAH Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-3 for each compound detected during the Q2 2009 sampling event.

- **Table 4-9 Summary of Expanded Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-3 for each compound detected during the Q2 2009 sampling event.
- **Table 4-10 Summary of Total BTEX Statistical Trends –** provides statistical trends of concentrations beginning near the date when the nearest upgradient oxygen injection system began operation, through Q2 2009. The table is set up to include wells for all of the existing oxygen injection systems, however, the systems for which the nearest downgradient groundwater monitoring wells have sufficient sampling data to evaluate concentration trends are discussed. Future quarterly OM&M reports will evaluate the trends for these wells.
- **Table 4-11 Summary of Total PAH Statistical Trends –** provides statistical trends of concentrations beginning near the date when the nearest upgradient oxygen injection system began operation, through Q2 2009. The table is set up to include wells for all of the existing oxygen injection systems, however, the systems for which the nearest downgradient groundwater monitoring wells have sufficient sampling data to evaluate concentration trends are discussed. Future quarterly OM&M reports will evaluate the trends for these wells.
- **Figure 12 Water Table Groundwater Total BTEX Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total BTEX in the water table portion of the upper glacial aquifer for OU-3.
- **Figure 15 Water Table Groundwater Total PAH Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total PAH in the water table portion of the upper glacial aquifer for OU-3.
- **Appendix E –** presents time series plots of the groundwater monitoring wells.

4.2.4.1 Distribution of Total BTEX and Total PAH in the Upper Glacial Aquifer

The distribution of total BTEX and total PAH for Q2 2009 within the upper glacial aquifer is depicted on **Figures 12 through 14**, and **Figures 15 through 17**, respectively. The horizontal distribution in each map is depicted as lines of equal concentration (iso-concentration lines).

The iso-concentration lines were generated using a combination of applied methods. Initially, the lines were created by direct graphical interpolation between concentrations. These lines were then modified to factor in groundwater flow, taking into the southeasterly flow direction and the low transverse dispersion of the upper glacial aquifer. For areas where the groundwater monitoring well density was low, historical water quality from existing wells and groundwater quality data from previous groundwater probes were utilized.

The vertical distribution of the total BTEX and total PAH concentrations are depicted by iso-concentration maps for three aquifer horizons: the water table zone (to approximate upper 5 feet of the upper glacial aquifer); an intermediate depth zone from approximately 10 to 50 feet below land surface; and a deep zone below 50 feet to the top of the underlying low permeability surface unit of the Magothy aquifer.

For OU-3, total BTEX and total PAH concentrations in groundwater above 100 ug/L were only detected in the water table zone of the upper glacial aquifer. The distribution of these constituent groups is presented below.

Total BTEX

As depicted on **Figure 12**, a plume of total BTEX concentrations above 100 ug/L for Q2 2009 is present in the southern area of the Brightwaters Yard, just north of the LIRR tracks. The plume extends downgradient (south-southeastward) approximately 100 feet beyond Union Boulevard and the oxygen injection line located along its downgradient edge. The plume can be considered as one with two sections, a northern and a southern section. The highest concentrations (greater than 10,000 ug/L) were present in a narrow band (less than 50 feet in width) within the center of the plume. The northern section extends from the Brightwaters Yard to approximately 30 feet south of the LIRR tracks. The highest concentration in this area was 46,350 ug/L. The southern section of the band of elevated concentrations begins just to the south of the northern section and extends to the upgradient edge of the Union Boulevard oxygen injection line. The concentrations in this band ranged from 62,600 ug/L at the northern end to 15,700 ug/L at the upgradient side of the Union Boulevard oxygen injection line.

Total PAH

The total PAH plume (**Figure 15**) is generally oriented similar to the total BTEX plume but is less concentrated. The maximum total PAH concentrations at the southern end of the Brightwaters Yard was 3,206 ug/L at PDMW-02 and near the Union Boulevard oxygen injection system was 1,308 ug/L at MW-73.

4.2.4.2 Groundwater Analytical Data Trend Analysis

Analysis of data trends has been conducted on the two areas of the OU-3 plume described above: the southern area of the Brightwaters Yard located downgradient of the former oxygen injection lines, and the area downgradient of the Union Boulevard oxygen injection system.

Analysis of the trends of constituent concentrations for OU-3 groundwater wells was conducted on two levels: statistical and graphical. The periods of these trends focus on the operation periods of each oxygen injection system.

A statistical analysis typically used to assess trends in groundwater monitoring well concentration data is the Mann-Kendall method (Gilbert, 1987). This method is a non-parametric statistical that evaluates concentration trends over time, by comparing the relative difference in magnitude of data over time and assigning probability for the trends. One limitation of this statistical method exists for interpretation of remediation monitoring data sets of limited events. The graphical trend analysis of groundwater monitoring well concentrations considers all of the concentrations for the same oxygen injection period as the statistical period.

Downgradient of the Brightwaters Yard Former Oxygen Injection System

The highest historical median concentrations in wells in the vicinity of the Brightwaters Yard former oxygen injection system during the operational period were 67,760 ug/L for total BTEX and 2,418 ug/L for total PAH in PDMW-02.

The oxygen injection system on the Brightwaters Yard site consisted of three injection lines installed parallel to the LIRR property. As discussed in Subsection 4.1.3, the oxygen injection system has significantly affected groundwater concentrations downgradient of the injection lines. However, impacted material beneath the LIRR property is contributing to groundwater impacts downgradient of the treatment system making evaluation of the system effectiveness difficult. Excavation of these impacts is being coordinated with LIRR and is planned to begin in Q4 2009. The groundwater analytical trends as they relate to observed groundwater quality parameters and system effectiveness are discussed in Subsection 4.1.3. An analysis of overall groundwater quality trends downgradient of this treatment system is provided below.

<u>Statistical Trend Analysis</u>

The statistical trends of total BTEX for wells at the area of the former oxygen injection lines in the Brightwaters Yard identify significant decreasing trends in monitoring wells MW-16SR, MW-64, MW-78, MW-79, MW-81, MW-82 and SV-03.

The statistical trends of total PAH for wells within the area identify significant decreasing trends in wells MW-16SR, MW-73, MW-78, MW-79, MW-80, MW-81, MW-82 and SV-03. For four wells (MW-64, MW-75, PDMW-02 and PDMW-03) with elevated total PAH concentrations, no statistical trend was identified.

<u>Graphical Trend Analysis</u>

Plots of total BTEX and total PAH concentrations over time are presented in Appendix E for wells located downgradient of the Brightwaters Yard former oxygen injection system lines. As described above, the groundwater impacts at OU-3 are primarily BTEX. Significant decreasing trends in total BTEX were identified in 75% of the 26 wells reviewed. It is noted that total BTEX concentrations during the system operational period have significantly fluctuated.

Concentrations as high as approximately 300,000 ug/L have decreased up to five orders-of-magnitude through the system operational period. A significant increase for Q2 2009 total BTEX occurred in well MW-73 where the concentration of 62,600 ug/L represents the second highest total BTEX concentration during the system operational period.

Downgradient of the oxygen injection system, significantly elevated total PAH concentrations, for Q2 2009 relative to the operational period, were identified in two wells, MW-80 at 568 ug/L and MW-73 at 1,308 ug/L. The Q2 2009 concentration in MW-80 is below the historical average for this well of 1,143 ug/L. The Q2 2009 concentration in well MW-73 is near the maximum concentration for the well during the system operational period.

The above analysis indicates that reductions in total BTEX and total PAH concentrations have generally been observed in wells affected by the former oxygen injection system; however, the concentrations have fluctuated in some of the wells. The variations in total BTEX and total PAH concentrations are attributed to remaining source material located downgradient of the former Brightwaters Yard oxygen injection system on the Brightwaters Yard property and within the LIRR right-of-way.

Downgradient of Union Boulevard Oxygen Injection System

The oxygen injection system located along Union Boulevard consists of one injection line installed on the downgradient, southern side of Union Boulevard (**Figure 1**). The oxygen injection system has affected groundwater concentrations downgradient of the injection line, but past system component failures have reduced the overall system efficiency. New OM&M procedures have increased system efficiency over the last nine quarters (since Q1 2007). The groundwater analytical trends as they relate to observed groundwater quality parameters and system effectiveness are discussed in Subsection 4.1.3 and presented on **Figure 18**.

Statistical Trend Analysis

In OU-3 wells located downgradient of the Union Boulevard oxygen injection system, statistical decreasing trends for total BTEX were identified in two wells (MW-32W/W-R and MW-34I) (**Table 4-10).** No statistical trends were identified in the remaining wells. Although no statistical trends were identified in the remaining wells, 11 of the 14 wells had a negative Mann-Kendall Statistic (S) for total PAH, and 5 of 11 wells had a negative statistic for total BTEX. These negative statistics indicate decreasing trends even though they were not significant at a 95% confidence interval.

Graphical Trend Analysis

The effectiveness of the Union Boulevard oxygen injection system was evaluated by examining the trends of the monitoring wells located downgradient of the Union Boulevard oxygen injection line. Decreasing trends in total BTEX and total PAH concentrations were noted in seven and four of the 12 wells reviewed, respectively. Total BTEX and total PAH concentrations in those wells that have remained at or near detection levels throughout the monitoring period include BBMW-29, MW-11W, MW-34I, MW-34D (total PAH only) and MW-30W/W-R (total BTEX only).

For the three wells with total BTEX operational period average concentrations above 100 ug/L, MW-32W/WR (91 ug/L in Q2 2009), MW34S (2,310 ug/L in Q2 2009), and MW-70/70S (621 ug/L in Q2 2009), concentrations decreased from Q1 2009 to Q2 2009. The concentrations in all three wells have significantly varied from maximum concentrations of 74,400 ug/L, 35,100 ug/L, and 57,000 ug/L, respectively, apparently dependent on seasonal water level fluctuations.

Four wells (MW-70/70S, MW-30W/W-R, MW-32W/W-R and MW-34S) have historical average total PAH concentrations above 100 ug/L and range between 103 ug/L and 296 ug/L. The Q2 2009 total PAH concentrations in these wells are well below the historical average concentrations.

In addition to the wells listed above, the concentrations in wells further downgradient in the vicinity of O-Co-Nee Pond were also reviewed. Total BTEX concentrations were below detection limits at MWBS-02S and MWBS-02D in Q2 2009. The total BTEX concentration in MWBS-02I was 3 ug/L in Q2 2009. The concentration was only the second value recorded above the detection levels in the last 20 quarters. Total BTEX was last detected in MWBS-02I at a concentration of 17 ug/L in Q3 2008. The total BTEX concentration in MWBS-02S was 98 ug/L in Q1 2008, however, prior to that, concentrations have been below detection units for 13 of the last 15 quarters. Total BTEX was not present above detection limits in MWBS-02D in nine of the last ten quarters. Total BTEX at a concentration of 17 ug/L was last detected in MWBS-02D in Q1 2008.

The total PAH concentrations in wells MWBS-02I and MWBS-02D were below detection limits in Q2 2009. Concentrations in wells MWBS-02I and MWBS-02D have been below detection limits for nine consecutive quarters. PAH were last detected in Q1 2007 at a concentration of 10 ug/L in MWBS-02I and at 22 ug/L in MWBS-02D. The total PAH concentration at MWBS-02S in Q2 2009 was 1 ug/L, and has been below detection limits for 13 out of the last 15 quarters. Total PAH concentrations were last detected in MWBS-02S, at a concentration of 3 ug/L, in Q1 2009.

4.2.5 Future Plans

- Continue annual and quarterly groundwater monitoring at selected existing and newly installed wells.
- Excavate source material in the vicinity of the LIRR tracks.

4.3 Institutional Controls/Engineering Controls (IC/EC)

- There has been no activity this quarter.

5. Soil Vapor and Ambient Air Sampling

5.1 Program Scope and Purpose

National Grid has conducted quarterly and monthly soil vapor and ambient air sampling events to evaluate the potential contribution of COC from the OU-2 dissolved phase groundwater plume to soil vapor. Sampling events have been completed between May 2005 and June 2009. The first five sampling events (Q2 2005 through Q3 2006) were conducted using temporary soil vapor drive points in accordance with the NYSDEC-approved *Soil Gas Sampling Work Plan for the OU-2 Treatment Area*, dated May 15, 2005. Based on the soil vapor and equipment blank analytical results presented in the Q3 2006 OM&M report, all future sampling events were conducted using permanent soil vapor points in accordance with the NYSDEC-approved *Permanent Soil Vapor Point Installation Final Work Plan, Operable Unit No. 2 (OU-2) and Operable Unit No. 3 (OU-3), Bay Shore/Brightwaters Former Manufactured Gas Plant Site,* dated January 31, 2007 (GEI, 2007b).

5.2 Current Site Activity

In the previous quarter, Q1 2009, three additional injection lines were installed in OU-2 as required in the OU-2 Remedial Decision Document. Per the requirements of the January 2009 Remedial Design Document, a number of additional soil vapor points were installed downgradient of and adjacent to the new injection lines. A number of the points were sampled at varying frequencies from daily to weekly to monthly during Q1 and into Q2 2009. Four additional soil vapor points were installed in OU-4, in Q2 2009, to monitor soil vapor during the S-ISCO injection. The following soil vapor and ambient air sampling activities were conducted as part of the OM&M program in Q2 2009.

- 189 samples (including 9 duplicate samples) were collected from 51 soil vapor locations and 5 samples were collected from 5 ambient air locations in Q2 2009.
- The soil vapor and ambient air sample locations represent 14 distinct areas as described below.

Soil Vapor/Ambient Air Sample Areas	Soil Vapor/Ambient Sample IDs
Upgradient of Operable Unit No. 1	OU1SG06, OU1SG07, OU1SG08
Upgradient of OU-1 Oxygen Injection Line	OZSG04, OZSG05
Downgradient of OU-1 Oxygen Injection Line/ Upgradient of 33 N. Clinton/Cooper Lane Injection Line	OZSG01, OZSG02, OZSG03[1], OU2SG14, OU2SG15
Downgradient of 33 N. Clinton Avenue Injection Line/ Upgradient of 9 N. Clinton Avenue Injection Line	OU2SG32, OU2SG20, OU2SG31, OU2SG19, OU2SG28, OU2SG21
Upgradient of 34 N. Clinton Avenue Injection Line	OU2SG16, OU2SG17, OU2SG18,
Downgradient of 34 N. Clinton Avenue Injection Line/ Upgradient of 9 N. Clinton Avenue Injection Line	OU2SG12, OU2SG22, OU2SG23, OU2SG38, OU2SG39, Ambient Air OU2AA04
Downgradient of 9 N. Clinton Avenue Injection Line/ Upgradient of Montauk Highway Injection Line	OU2SG24, OU2SG25, OU2SG26, OU2SG27, OU2SG29, OU2SG30, OU2SG06, Ambient Air OU2AA05
Upgradient of the Montauk Highway Oxygen Injection Line	OU2SG24, OU2SG25, OU2SG26, OU2SG29, OU2SG30, OU2SG06, Ambient Air OU2AA05
Downgradient of the Montauk Highway Injection Line/ Upgradient of Manatuck Lane Injection Line	OU2SG03, OU2SG04, OU2SG05, OU2SG10, OU2SG01, OU2SG02, OU2SG07 Ambient Air OU2AA01 and OU2AA02
Downgradient of the Manatuck Lane Injection Line	OU2SG08, OU2SG09 Ambient Air OU2AA03
Sidegradient of the Manatuck Lane Injection Line along Garner Lane	OU2SG13[2]
Downgradient of the Brightwaters Yard Injection System and Upgradient of the Union Boulevard Oxygen Injection System	OU3SG01
Background Location West of Lawrence Lake and Outside the Influence of the OU-2 and OU-3 Groundwater Plumes	OU2SG11
Downgradient of OU-4 S-ISCO Injection	OU4SV-1, OU4SV-2, OU4SV-3, OU4SV-4, OU4SV-5, OU4SV-6, OU4SV-7, OU4SV-8

Notes:

1. OZSG01-OZSG05 were destroyed during the installation of the barrier wall on OU-1 and subsequent activities. The points have been collected as temporary points and will be replaced at the completion of construction activities.
2. OU2SG13 was damaged during Q2 2007 and was replaced prior to the Q3 2007 sampling event.

5.3 Soil Vapor and Ambient Air Sampling Data

The Q2 2009 soil vapor and ambient air data are provided on the following tables and appendix.

- **Table 5-1 Summary of Soil Vapor Results for OU-1, OU-2, OU-3, and OU-4 –** presents the historical soil vapor data from the 44 permanent soil vapor points and the soil vapor data from the 189 samples collected during Q2 2009.
- **Table 5-2 Ambient Air Analytical Data** – presents the historic and Q2 2009 ambient air data.
- **Appendix D, Soil Vapor Analytical Results –** contains historical graphs of the soil vapor concentrations of analytes detected at any soil vapor point, as well as total BTEX and Naphthalene historical plots. The periods when a treatment system was in operation are identified on each graph.

Soil vapor concentrations have varied widely between 2005 and 2009 at all locations monitored. The variations in concentrations have occurred both before the systems were installed and after the systems were in operation. These fluctuations occurred in the areas downgradient of the oxygen injection lines, upgradient of the injection lines, and west of Lawrence Lake outside of the influence of the groundwater plume. During Q2 2009, the concentrations detected at each soil vapor point were generally consistent with previous sampling events with these exceptions:

- The concentrations of 1,2,3-trimethylbenzene and Indan significantly increased on 5/11/09 at location OU2SG-12. The concentrations in the other samples during Q2 2009 were consistent with previous sampling results. This location is downgradient of the 34 North Clinton Avenue oxygen injection system.
- Carbon disulfide increased at OU2SG-17. This is upgradient of the 34 North Clinton Avenue oxygen injection system.
- Butane increased at OU2SG-25 compared to the previous few quarters, but still remains much lower than Q2 2008 values. Butane is not a component of MGP-related waste, but is a common ingredient found in gasoline.
- Several concentrations, including n-decane, nonane, and n-undecane, were elevated at OU2SG-26 on 5/22/09. OU2SG-26 is downgradient from 9 North Clinton Avenue. All concentrations returned to levels consistent with Q1 2009 values at the next sampling event.
- Naphthalene increased at OU2SG-30. This location is upgradient of the Montauk Highway oxygen injection system.
- The toluene concentration increased significantly on 4/4/09 at OU2SG-31. All other 11 samples taken this quarter at this location were below the NYSDOH 95th percentile of typical background values for outdoor air. OU2SG-31 is located downgradient of the 33

North Clinton Avenue oxygen injection system. The other downgradient locations did not have any significant increases in toluene during the quarter. The concentration of n-dodecane increased sharply at OU4SG-3 on 4/27/09, but quickly returned to near zero at the next sampling event 2 days later. It remained near zero for the remainder of the quarter.

- The concentration of total BTEX increased slightly at monitoring point OU4SV-3, when compared to Q1 2009 sampling results. OU4SV-3 is downgradient of the S-ISCO injection area.

Low concentrations of VOCs were detected in ambient air before and after start-up of the OU-1 oxygen injection system. Ambient air concentrations have not varied significantly from quarter to quarter. Frequent detections (compounds detected in more than 30% of samples collected) have been limited to low concentrations of 18 VOCs: benzene, toluene, m,p-xylene, acetaldehyde, acetone, acrolein, 2-butanone, carbon disulfide, carbon tetrachloride, chlorobenzene, 2-chlortoluene, 1,1-diclorethane, 2-ethylthiophene, 2-hexanone, 2-propanol, 1,2,4-trichlorobenzene, 1,2,3-trimethylbenzene, and n-undecane. Benzene was detected in two of the five ambient air samples in Q2 2009 at concentrations ranging between 0.0.70 micrograms per cubic meter (ug/m^3) at OU2AA05 located upgradient of the OU-1 oxygen injection line, and 0.72 ug/m^3 at OU2AA03 located downgradient of OU-1 oxygen injection line. All benzene detections were below the NYSDOH 95th percentile of typical background values for outdoor air in the five ambient air samples (OU2AA01, OU2AA02, OU2AA03, OU2AA04, and OU2AA05).

5.3.1 Soil Vapor Fate and Transport

The fate and transport of soil vapor in the subsurface is dependent on various chemical and environmental conditions that directly affect the concentrations detected (United States Environmental Protection Agency, 1997). These include the vapor pressure and the Henry's law constant of the individual COC present, the temperature and barometric pressure at the surface, and the moisture content and porosity of the vadose zone soils. A description of each of these chemical and environmental conditions and their effects on soil vapor fate and transport have been presented in previous OM&M reports and are summarized below.

- The higher the vapor pressure of a COC, the more readily it evaporates into the vapor phase.
- COC with a greater tendency to exist in the vapor phase have a Henry's law constant greater than 1, and compounds with a greater tendency to exist in the dissolved phase have a Henry's law constant less than 1.
- Generally, the higher the pressure, the more COC would tend to remain in the dissolved phase and the lower the pressure, the more COC would tend to release to the vapor phase.

- The soil moisture decreases permeability because moisture trapped in the pore space of the soil matrix inhibits or blocks vapor flow.

In addition, several other soil factors can influence the distribution of COC in the soil vapor. Preferential pathways such as sub-surface utilities, tree roots, and backfilled areas can allow vapor migration away from a source area. Conversely, impervious zones or layers such as clay/peat/organic soil layers, foundations, buried structures, or perched groundwater can trap or inhibit the flow of soil vapors.

During the 2007 hydrologic study completed in OU-2, the sharp increases in groundwater elevations noted during the two rainfall events provide an approximate guideline for the effects of other rainfall events. Based on the timeframe and the magnitude of the rainfall events observed, significant precipitation events within the one-week preceding a soil vapor-sampling event were identified below. As discussed above, these are events that could significantly affect the concentrations of COC detected in soil vapor at the site.

Sample Date	Recent Precipitation Date	Magnitude of Precipitation (in./day)	Description of Significant Precipitation Events
5/5/2005	4/30/2005	1.12	April 2005 was a wetter than average month 4.87 in. recorded (normal 4.13 in.)
8/30/2005	--	--	A four-month drought occurred in the summer of 2005
6/14/2006	6/7/2006	1.27	June 2006 was a wetter than average month 5.34 in. recorded (normal 3.71 in.)
9/7/2006	8/25/2006	1.58	August 2006 was a wetter than average month 5.58 in. recorded (normal 4.48 in.)
2/22/2007	2/14/2007	1.05	Winter snow storm
5/24/2007	--	--	April 2007 was a wetter than average month 6.72 in. recorded (normal 4.13 in.)
7/25/2007	7/18/2007	3.34	Both events occurred during Week 2 of the Hydrologic Study
12/18-19/07	12/13/2007 12/16/2007	0.82 0.85	December 2007 was a wetter than average month 4.64 in. recorded (normal 4.13 in.)

Sample Date	Recent Precipitation Date	Magnitude of Precipitation (in./day)	Description of Significant Precipitation Events
2/6-7/08	2/6/2008	0.07	February 2008 was a wetter than average month 6.21 in. recorded (normal 3.33 in.)
	2/7/2008	0.14	
2/19/2008	2/18/2008	0.48	
3/17/2008	3/15/2008	0.25	March 2008 was a wetter than average month 5.89 in. recorded (normal 4.76 in.)
3/21/2008	3/19/2008	0.91	
	3/20/2008	0.3	
3/26-27/08	--	--	
6/13/2008	--	--	June 2008 was a dryer than average month 3.17 in. recorded (normal 3.71 in.)
6/18-20/08	8/16/2008	0.16	
	8/18/2008	0.15	
	8/20/2008	0.12	
6/23-25/08	8/21/2008	0.27	
	8/23/2008	0.05	
8/13/2008	8/11/2008	0.42	August 2008 was a dryer than average month 3.2 in. recorded (normal 4.48 in.)
9/16-19/08	9/9/2008	0.5	September 2008 was a wetter than average month 7.46 in. recorded (normal 3.39 in.)
	9/12/2008	0.59	
9/22-24/08	--	--	
9/30/2008	9/26/2008	2.39	
	9/27/2008	0.5	
	9/28/2008	0.2	
	9/29/2008	0.11	
12/23/2008	12/21/2008	0.41	December 2008 was a wetter than average month 6.68 recorded (normal 4.13 in.)
12/29-31/08	12/31/2008	0.17	
1/20-26/09	1/18/2009	0.13	January 2009 as a dryer than average month 3.2 in. recorded (normal 4.27 in.)
	1/19/2009	0.03	
1/30/2009	1/30/2009	1.12	
2/5/2009	2/3/2009	0.31	February 2009 as a dryer than average month 1.79 in. recorded (normal 3.33 in.)
2/13/2009	2/12/2009	0.19	
2/16-21/09	2/18/2009	0.69	
	2/19/2009	0.05	
2/23/2009	2/22/2009	0.31	
2/27/2009	2/27/2009	0.24	

Sample Date	Recent Precipitation Date	Magnitude of Precipitation (in./day)	Description of Significant Precipitation Events
3/5/2009	--	--	March 2009 as a dryer than average month 2.44 in. recorded (normal 4.76 in.)
3/12-13/09	--	--	
3/16-19/09	--	--	
3/23-24/09	--	--	
3/26/2009	--	--	
3/31/2009	3/29/2009	0.67	
4/1-6/09	4/2/2009	0.15	April 2009 was a wetter than average month 4.86 in. recorded (normal 4.13 in.)
4/10/2009	4/3/2009	0.63	
4/13-14/09	4/6/2009	0.7	
4/17/2009	4/11/2009	0.92	
	4/14/2009	0.11	
	4/15/2009	0.08	
4/24/2009	4/20/2009	1.01	
4/27-30/09	4/21/2009	0.95	
	4/22/2009	0.21	
5/1/2009	5/1/2009	0.47	May 2009 was a wetter than average month 5.88 in. recorded (normal 3.90 in.)
	5/2/2009	0.15	
	5/3/2009	0.32	
5/4-5/09	5/4/2009	0.41	
	5/5/2009	0.16	
	5/6/2009	0.83	
5/8/2009	5/7/2009	0.33	
5/11-13/09	5/9/2009	0.87	
5/15/2009	5/14/2009	0.33	
5/21-22/09	5/16/2009	0.09	
	5/17/2009	0.44	
	6/2/2009	0.05	June 2009 was a wetter than average month 7.71 in. recorded (normal 3.71 in.)
6/3/2009	6/3/2009	0.19	
	6/4/2009	0.67	
6/8/2009	6/5/2009	0.83	
6/16-6/17/09	6/9/2009	0.84	
6/19/2009	6/12/2009	1.04	
	6/15/2009	0.12	
6/25/2009	6/18/2009	1.78	
	6/20/2009	0.62	
	6/21/2009	0.3	

5.4 Future Plans

- Continued quarterly soil vapor and ambient air sampling.
- Continued daily/weekly/monthly soil vapor sampling per OU-2 OM&M Plan.

6. Operable Unit 4 – Watchogue Creek/Crum's Brook

6.1 Groundwater Monitoring

S-ISCO injection was initiated on April 28, 2009 in accordance with the NYSDEC-approved OU-4 Cesspool Area S-ISCO Work Plan (VeruTEK, 2008). Site preparation work including installation of the S-ISCO injection wells, monitoring wells and injection lines and mobilization of S-ISCO injection equipment was completed in Q2 2009. Groundwater monitoring is conducted within OU-4 to aid in monitoring groundwater contamination, to evaluate the effectiveness of remedial activities and to aid in remedy planning. The final report for the OU-4 cesspool IRM will be submitted at the completion of the ISCO portion of the IRM. There were 50 monitoring wells located in OU-4 during the Q2 2009 sampling event. The well locations and geographic boundaries of OU-4 are illustrated on **Figure 1**. The number of wells sampled each quarter is determined based on previous analytical data and discussions with NYSDEC.

6.1.1 Current Site Activity

The following groundwater monitoring activities took place in OU-4 during Q2 2009.

- Depth to groundwater measurements were obtained on May 5, 2009 from 41 monitoring wells located within, upgradient, sidegradient and downgradient of OU-4.
- The surface water elevation was obtained on May 5, 2009 from a surface water gauge located in Watchogue Creek/Crum's Brook at Union Boulevard (BBSW-14).
- Two rounds of groundwater sampling were conducted in OU-4 in Q2 2009 (April 2009 and June 2009). Groundwater samples were collected from 43 monitoring wells located within OU-4 during each of the two rounds. The groundwater samples were analyzed for an expanded list of VOCs (EPA Method 8260) and PAHs (EPA Method 8270).

6.1.2 Groundwater Elevation Data

The depth to groundwater, groundwater elevation and surface water elevation data for OU-4 are provided on the following tables and figures.

- **Table 6-1 Water Level Measurements and Calculated Groundwater Elevations –** provides depth to water measurements and calculated groundwater and surface water elevation data for OU-4 wells measured in Q2 2009.
- **Table 6-2 Historic Calculated Groundwater Elevations –** provides historic groundwater elevations for OU-4 for existing groundwater wells.

- **Figure 4 Shallow Groundwater Contour Map –** provides the Q2 2009 shallow groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.
- **Figure 5 Deep Groundwater Contour Map –** provides the Q2 2009 deep groundwater elevation contours for OU-1, OU-2, OU-3 and OU-4.

The groundwater flow direction in OU-4 is towards the southeast. The shallow groundwater hydraulic gradient is approximately 0.003 feet/foot. The deep groundwater hydraulic gradient is approximately 0.0036 feet/foot. The groundwater elevation in OU-4 monitoring wells during the Q2 2009 gauging event was an approximate average of 0.3 feet higher than the Q1 2009 groundwater elevations and an approximate average of 0.05 feet lower than the Q2 2008 groundwater elevations.

6.1.3 Groundwater Analytical Data

The OU-4 groundwater analytical data are presented on the following tables and figures.

- **Table 6-3 Summary of Historic Total BTEX Groundwater Analytical Results –** presents a summary of historical total BTEX results for existing OU-4 groundwater monitoring wells.
- **Table 6-4 Summary of Historic Total PAH Groundwater Analytical Results** – presents a summary of historical total PAH results for existing OU-4 groundwater monitoring wells. (Table 6-4 includes the most recent results for the two rounds of sampling conducted during Q2 2009).
- **Table 6-5 Summary of Expanded Groundwater Analytical Results –** provides the Q2 2009 groundwater analytical results for monitoring wells located in OU-4 for each compound detected.
- **Figure 15 Water Table Groundwater Total PAH Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total PAH in the water table portion of the upper glacial aquifer for OU-4.
- **Figure 16 Intermediate Groundwater Total PAH Iso-Concentration Map – Q2 2009 Data –** depicts the horizontal extent of total PAH in the intermediate depth portion of the upper glacial aquifer for OU-4.

6.1.4 Groundwater Analytical Data Trend Analysis

The evaluation of trend analysis for the two rounds of samples analyzed for OU-4 considered the most recent results of the two sets of samples. Impacts (concentrations greater than 100 ug/L) were only associated with total PAH and were present in the water table zone and intermediate depth zone of the upper glacial aquifer. In the water table zone, total PAH concentrations above 100 ug/L were found in three wells in the southern portion of the LIRR parking lot and the adjacent property to the west (ranging from 295 ug/L in WCMW-17S to 624 ug/L in WCMW-11S). In the intermediate depth zone, PAH concentrations above 100 ug/L occurred in four wells in the central and eastern portions of the LIRR parking lot (ranging from 108 ug/L in WCMW-04I to 1,146 ug/L in WCMW-11I).

Analysis of the trends of constituent concentrations for OU-4 groundwater wells was conducted on two levels: statistical and graphical. The periods of these trends cover the available historical data for past groundwater sampling events.

A statistical analysis typically used to assess trends in groundwater monitoring well concentration data is the Mann-Kendall method (Gilbert, 1987). This method is a non-parametric statistical that evaluates concentration trends over time, by comparing the relative difference in magnitude of data over time and assigning probability for the trends. One limitation of this statistical method exists for interpretation of remediation monitoring data sets of limited events. The graphical trend analysis of groundwater monitoring well concentrations considers all of the concentrations for the same period as for the statistical period.

Statistical Trend Analysis

Statistical trends for total PAH in wells located in OU-4 were identified as significantly decreasing in WCMW-03I and WCMW-03I2. An increasing trend was identified at WCMW-14S; however, previously, PAH had not been detected in WCMW-14S and the total PAH concentration detected in the Q2 2009 sampling event was at a low concentration of 6 ug/L. Additionally, 11 out of 38 wells that have been sampled prior to Q2 2009, had non-detect results for all sampling events. Many wells identified with no trend for total BTEX or total PAH had a limited number of sampling events (seven or less) or high number of non-detect results (up to six). Mann-Kendall results for downgradient wells indicating no trend in total BTEX or total PAH concentrations are influenced by several factors, such as a negative Mann-Kendall Statistic (S) (Tables 6-7 and 6-8). This negative statistic parameter value indicates a decreasing trend to exist, even though it was not significant at a 95% confidence interval and is reported as no trend.

Graphical Trend Analysis

For the water table zone, three wells had Q2 2009 total PAH concentrations greater than 100 ug/L. WCMW-17S was initially sampled in Q2 2009. The June 2009 concentration of 128 ug/L represents a decreased concentration from the April 2009 concentration of 295 ug/L. Well WCMW-11S was sampled four times with concentrations ranging from 590 ug/L to 1,037 ug/L.

For the intermediate groundwater depth zone, four wells (WCMW-03I, WCMW-04I, WCMW-5I and WCMW-17I) had Q2 2009 total PAH concentrations of 1,146 ug/L, 108 ug/L, 241 and 292 ug/L similar to the historic average concentrations of 916 ug/L, 104 ug/L and 229 ug/L, respectively, for the first three wells. WCMW-17I was initially sampled in Q2 2009. The June 2009 concentration in WCMW-17I of 292 ug/L represents an increase from the April 2009 concentration of 198 ug/L.

6.1.5 Future Plans

- Continue annual and quarterly groundwater monitoring at selected wells.
- Continue S-ISCO injection.

6.2 Institutional Controls/Engineering Controls (IC/EC)

- There has been no activity this quarter.

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Tables (electronic only)

Tables also available at www.bayshoreworksmgp.com

Figures

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
2. FIGURE 2, GROUNDWATER MONITORING WELL AND SURFACE WATER GAUGING STATION LOCATION MAP, BAY SHORE/BRIGHTWATERS FORMER MGP SITE, SCALE: 1"=200', DATED JANUARY 2004, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
3. DRAWING C-1, OFF-SITE SAMPLE LOCATION MAP, BAY SHORE/BRIGHTWATERS FINAL REMEDIAL INVESTIGATION, SCALE: 1"=200', DATED OCTOBER 15, 2003, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
4. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE AND MONITORING WELLS LOCATED NEAR OR AT PROPERTY BOUNDARIES DEPICTED ON THE MAP ARE WITHIN THE ROAD RIGHT-OF-WAY.

LEGEND:

GM-02AS	ACTIVE MONITORING WELL LOCATION
MW-67D	DESTROYED MONITORING WELL LOCATION
GM-03S	ABANDONED MONITORING WELL LOCATION
WCMW-07S*	CONDITION UNKNOWN
BBSW-06	SURFACE WATER GAUGING STATION LOCATION
	INSTALLED OXYGEN INJECTION LINE
	PLANNED OXYGEN INJECTION LINE
OU2MW-01S OU2MW-01I OU2MW-01I2 OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
(yellow line)	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(blue line)	OU-2 AND OU-3 EXTENTS FROM Q1 2009 BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(purple line)	OU-2, OU-3 AND OU-4 EXTENTS FROM Q2 2009 BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER

0 150 300
SCALE, FEET

BAY SHORE/BRIGHTWATERS
FORMER MGP SITE
BAY SHORE, NEW YORK

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Project 093180-5-1506

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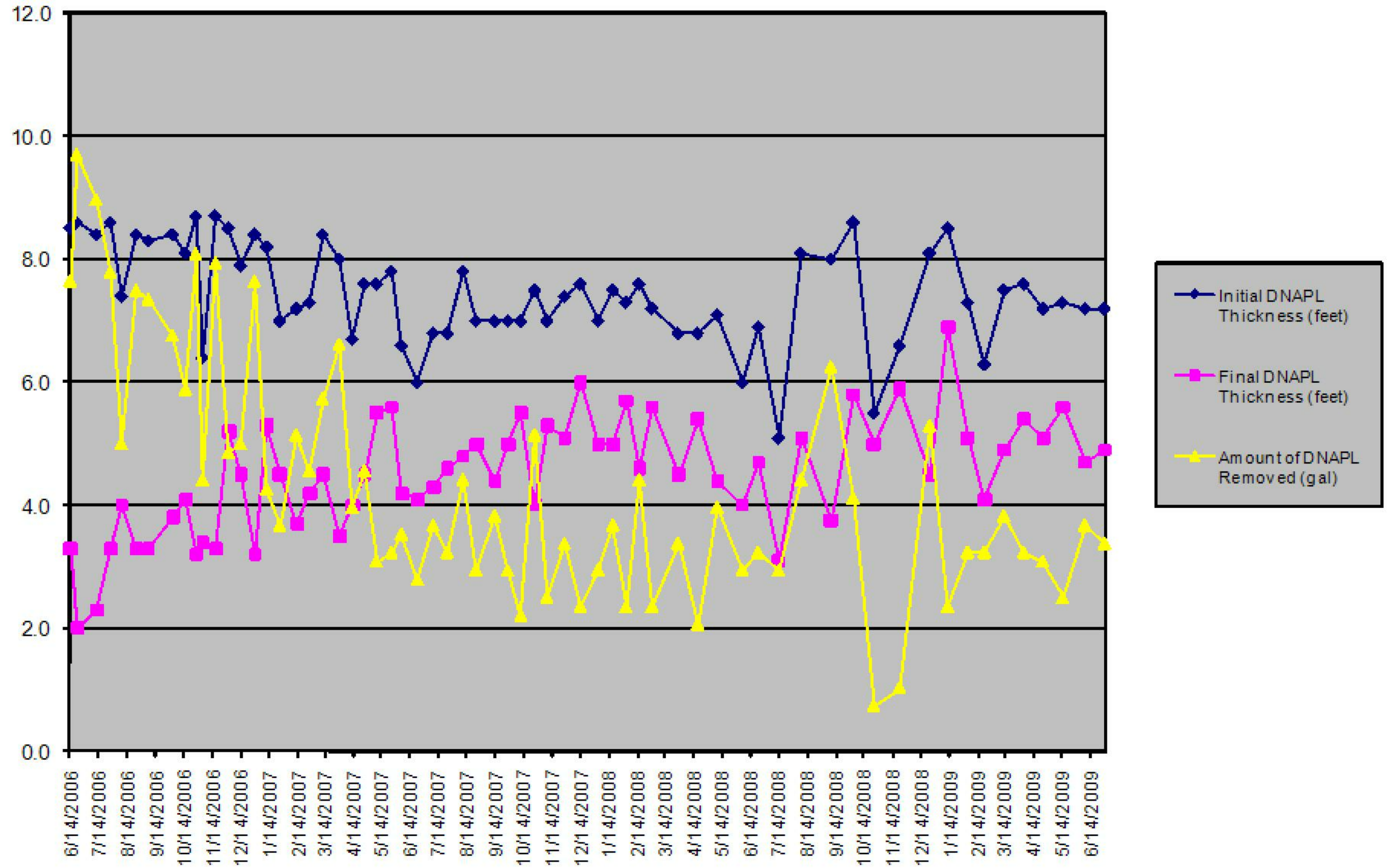
SUITE 204
HUNTINGTON STATION, NY 11746

MONITORING WELL AND SURFACE WATER GAUGING STATION LOCATION MAP

October 2009 Figure 1

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\FIGS\ Bay-wells PLATE Q2-09.dwg \Oct 22, 2009



BAY SHORE/BRIGHTWATERS
FORMER MGP SITE
BAY SHORE, NEW YORK

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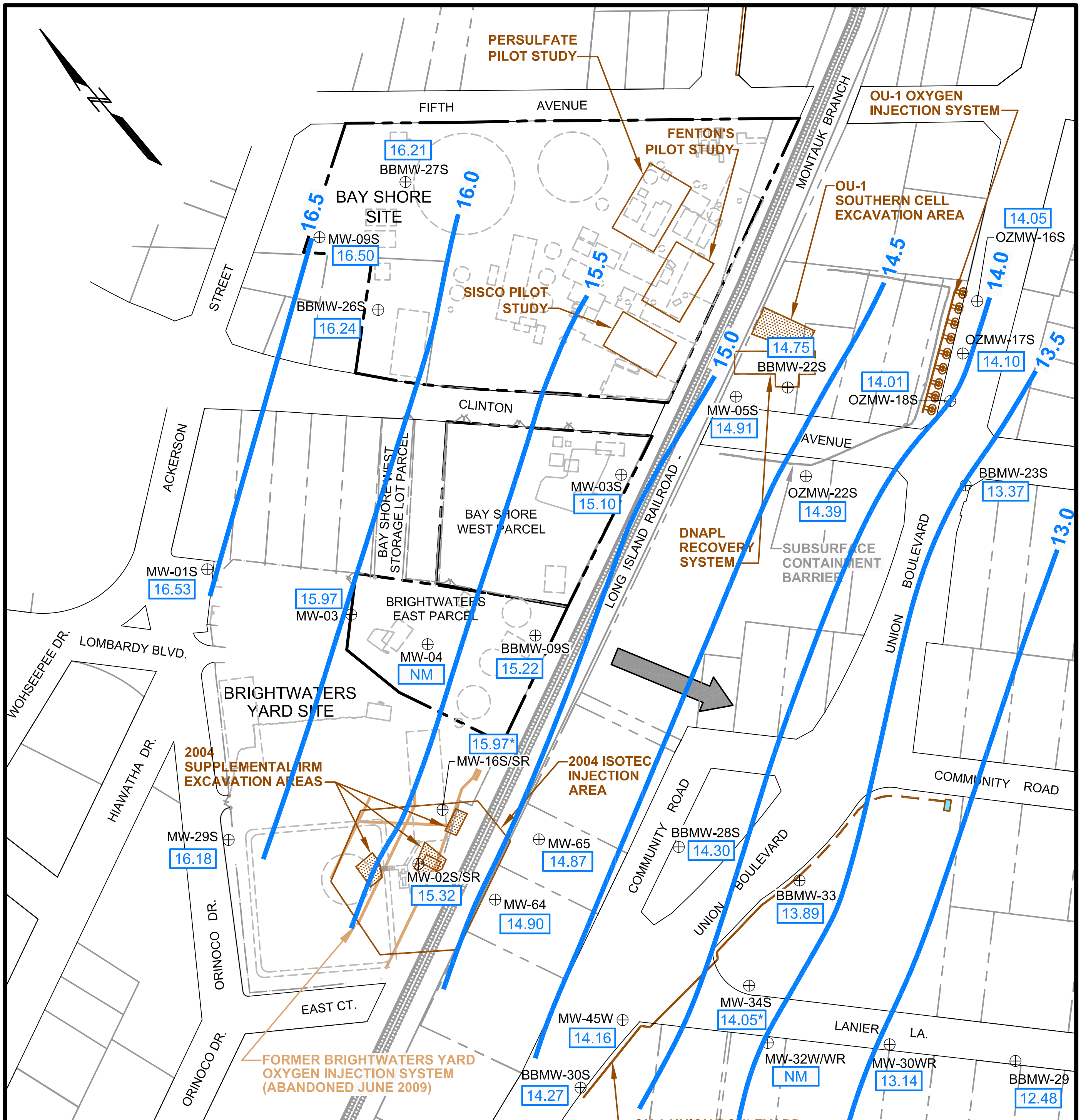
DNAPL RECOVERY DATA
BBRW-02

October 2009

Figure 2

C:\DOCUME~1\pheriot\LOCALS~1\Temp\AcPublish_3968\ Bay Shore-DNAPL Recovery Well Graph.dwg \Oct 12, 2009



LEGEND

BBMW-09S ⊕	GROUNDWATER MONITORING WELL LOCATION
14.0 ———	GROUNDWATER CONTOUR (FT)
➡	ESTIMATED GROUNDWATER FLOW DIRECTION
14.86	GROUNDWATER ELEVATION (MEASURED 5/04/09 - 5/06/09)
*	NOT USED TO CALCULATE CONTOURS
NM	NOT MEASURED DUE TO ACCESS RESTRICTIONS

0 200 400

SCALE, FEET

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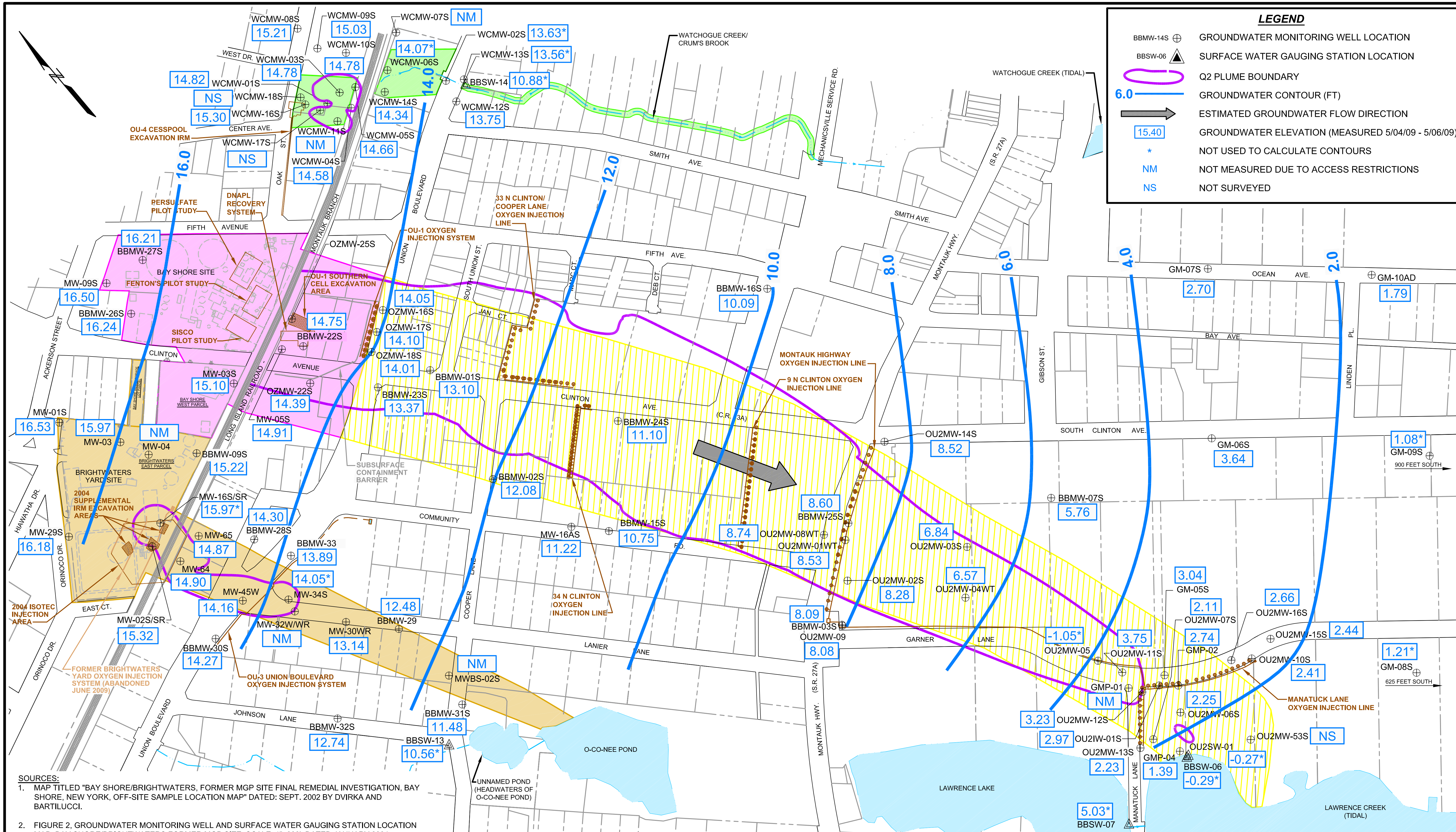
ON-SITE SHALLOW GROUNDWATER CONTOUR MAP

October 2009

Figure 3

KEYSPAN\BAYSHORE\GROUNDWATER\BAY-ONSITE-SGWC-7-07.dwg



SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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FORMER MGP SITE
BAY SHORE, NEW YORK

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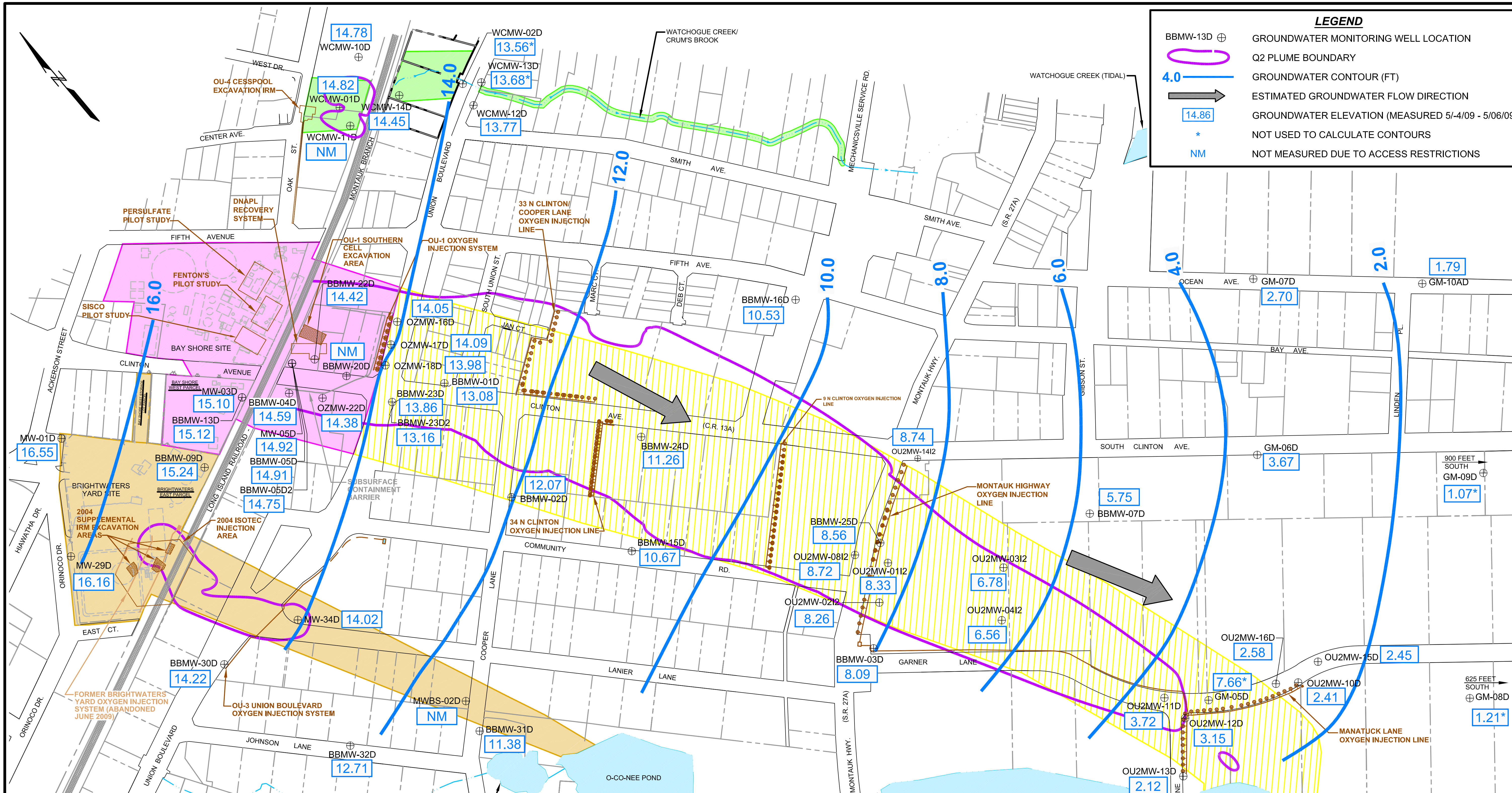
SHALLOW GROUNDWATER CONTOUR MAP

Project 093180-5-1506 | October 2009 | Figure 4

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\FIGS\ Bay-Shallow-GWCont-Q2-09.dwg \Oct 22, 2009



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0 300 600

SCALE, FEET

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BAY SHORE, NEW YORK

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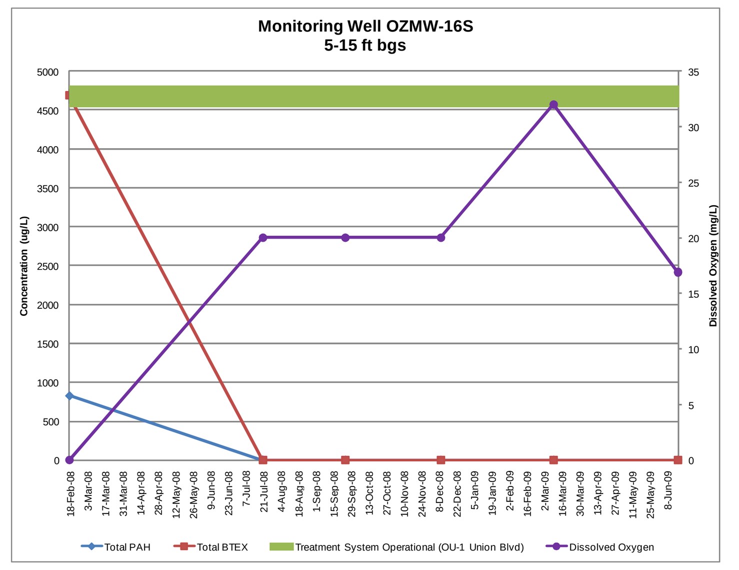
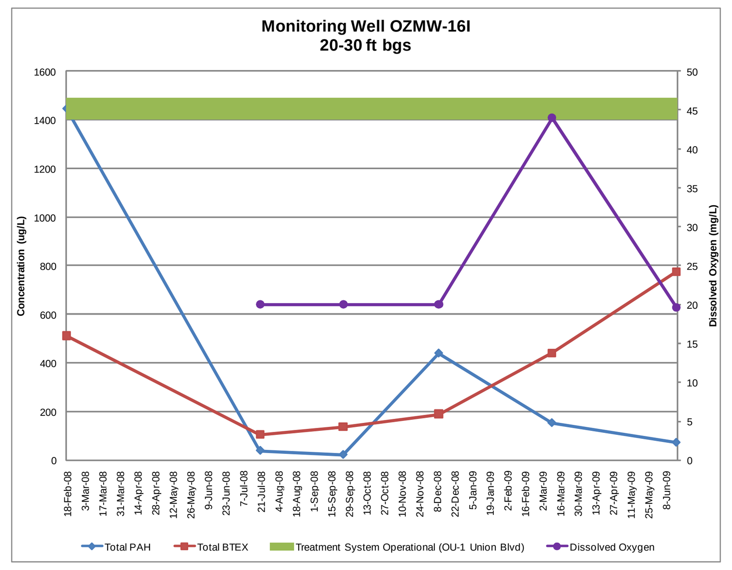
DEEP GROUNDWATER CONTOUR MAP

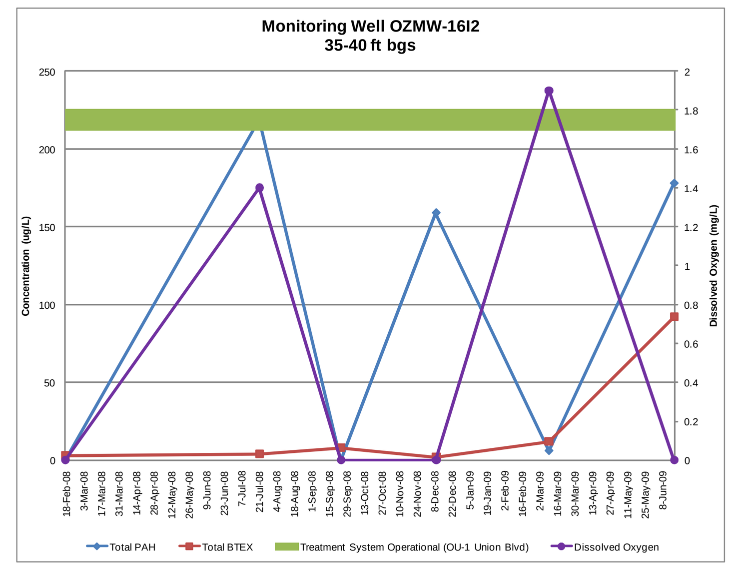
October 2009

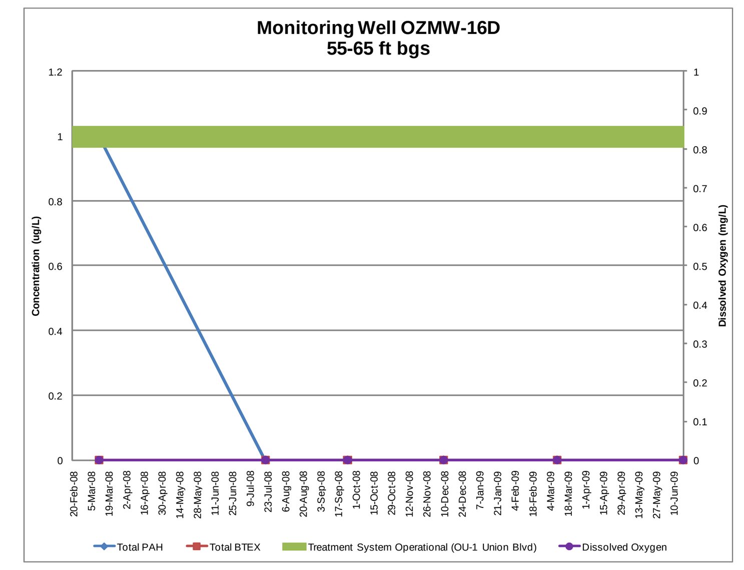
Figure 5

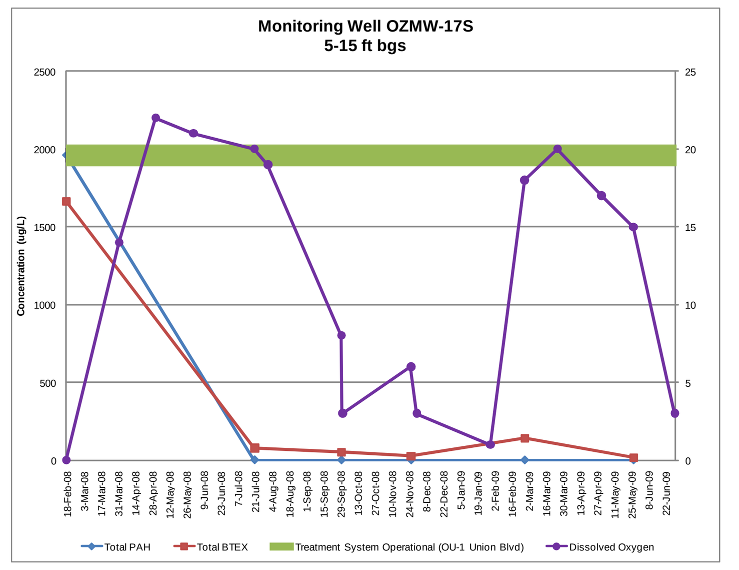
I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\FIGS\ Bay-Deep-GWCont-Q2-09.dwg \Oct 23, 2009

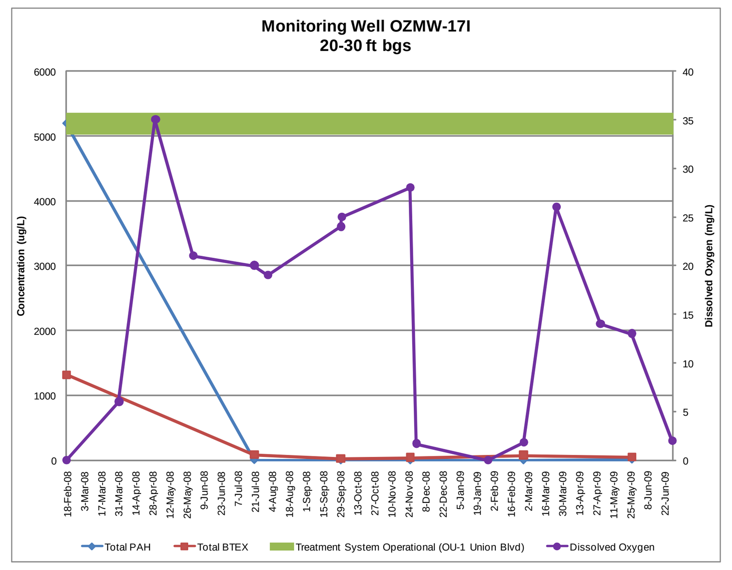


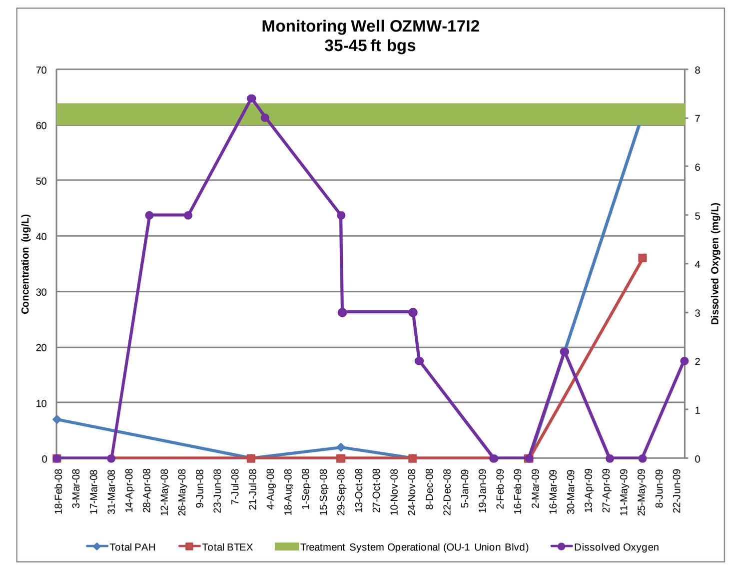


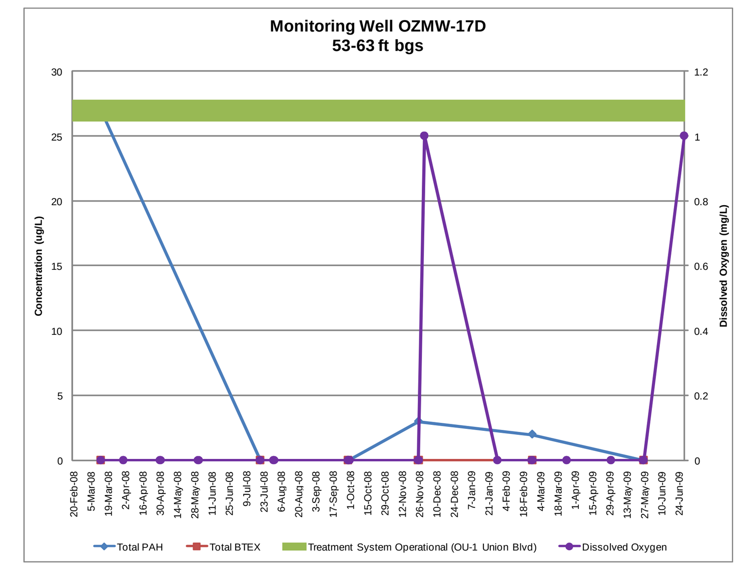


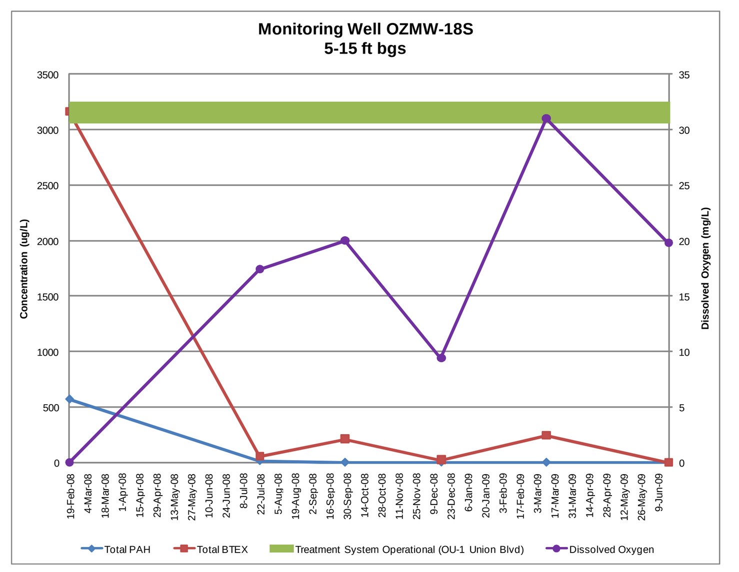


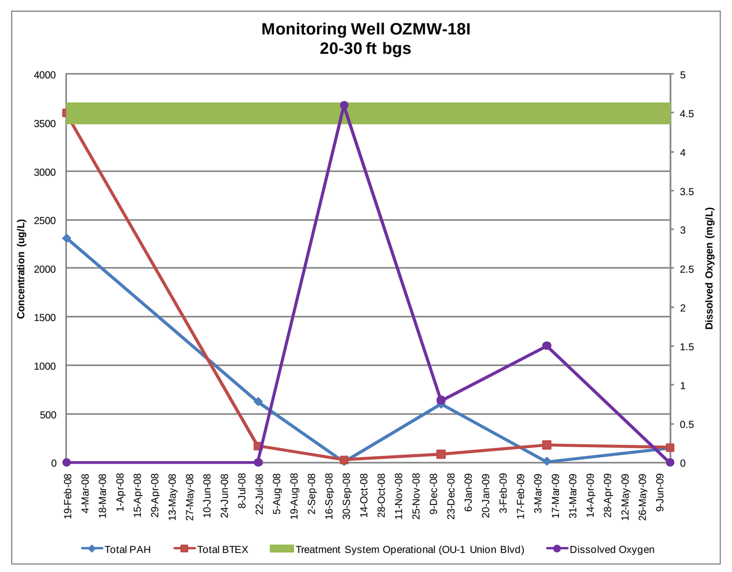


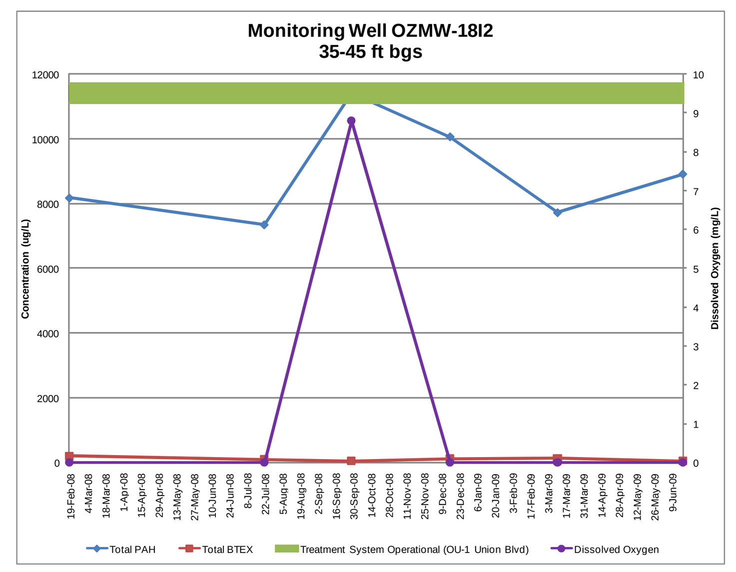


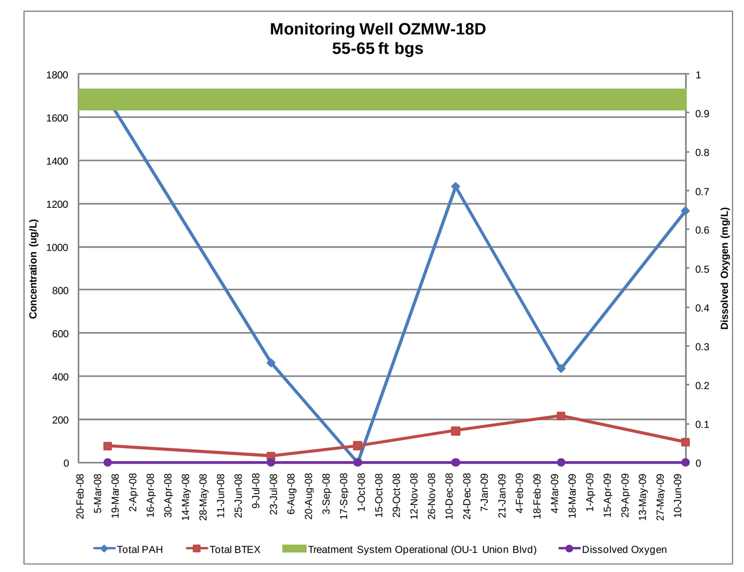


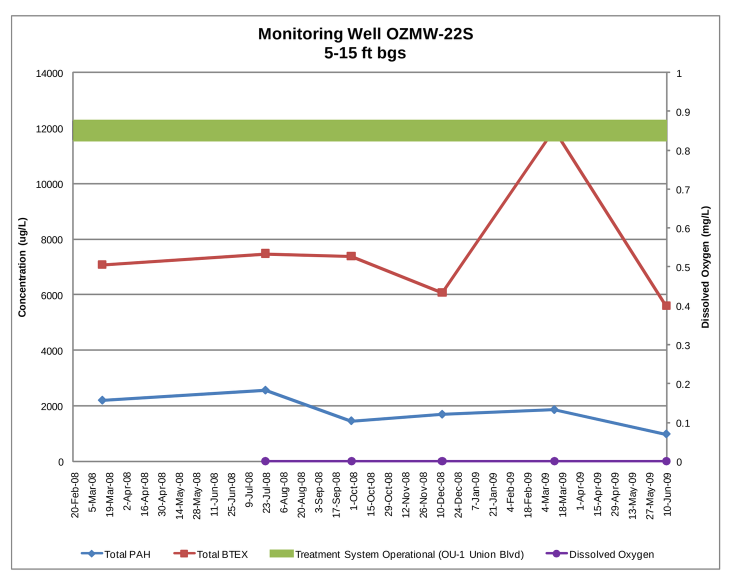


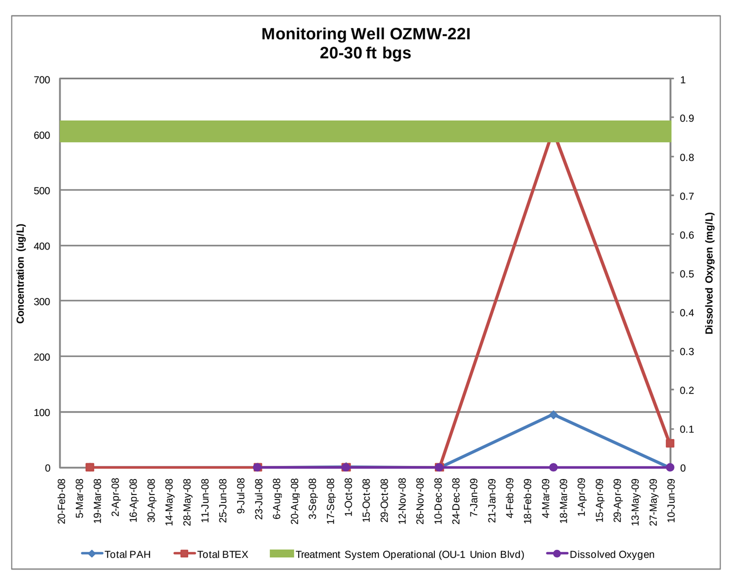


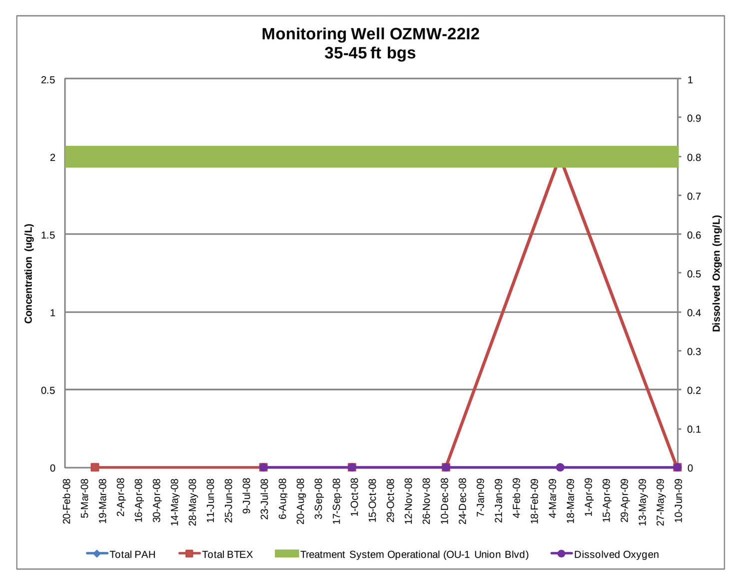


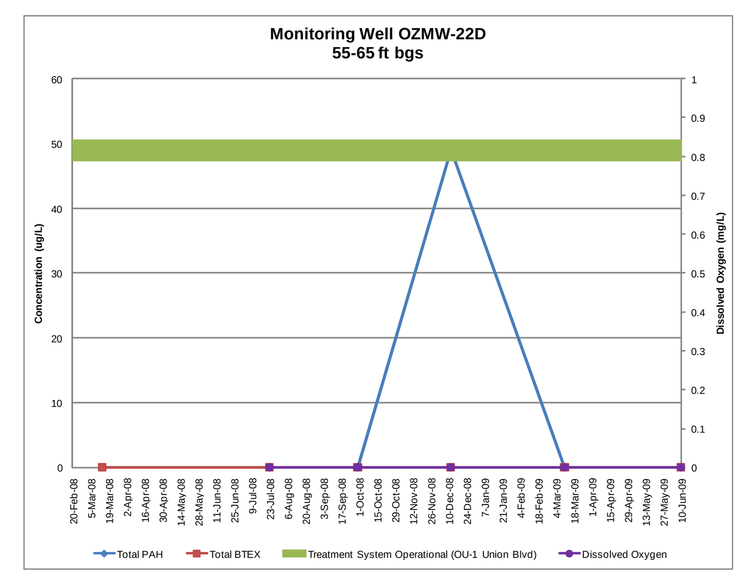


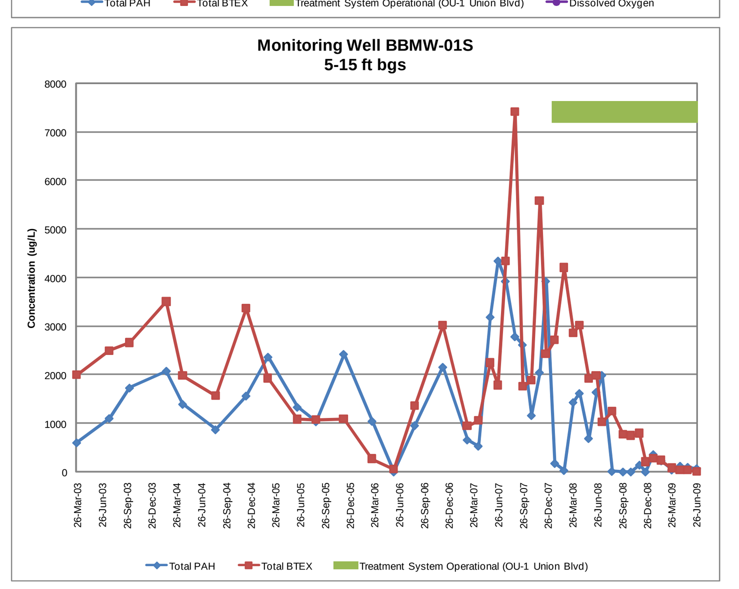


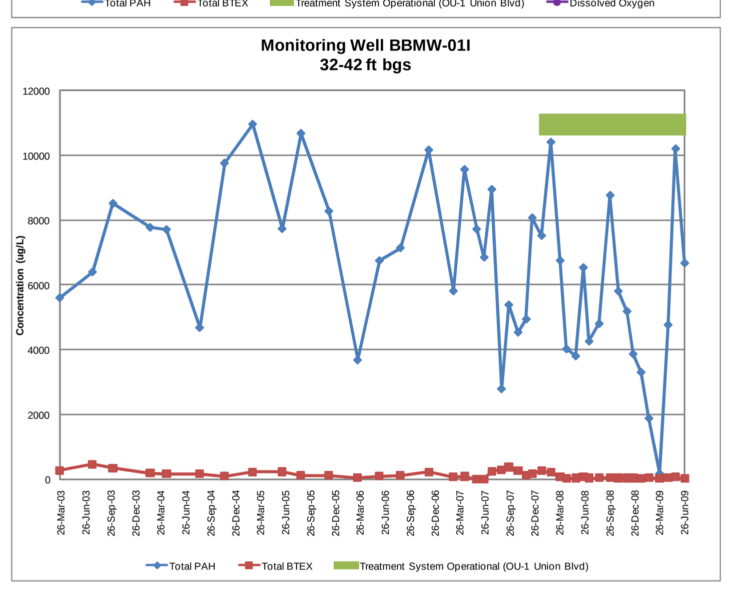


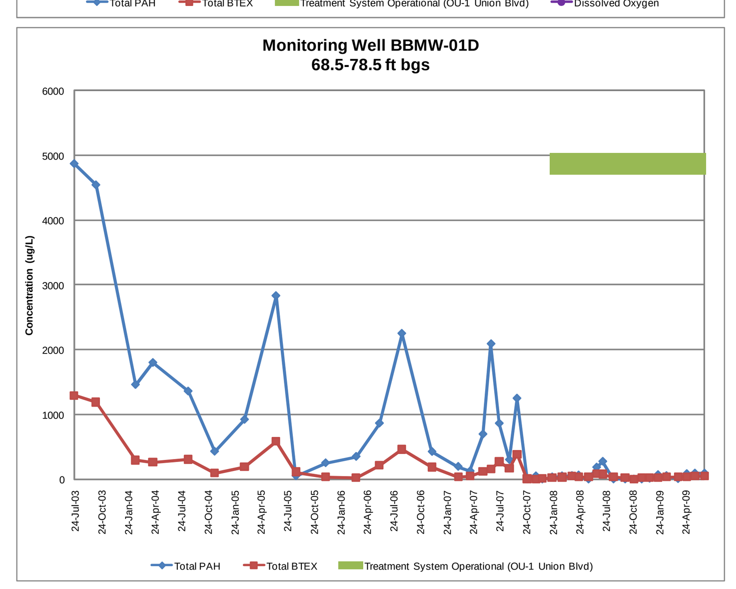


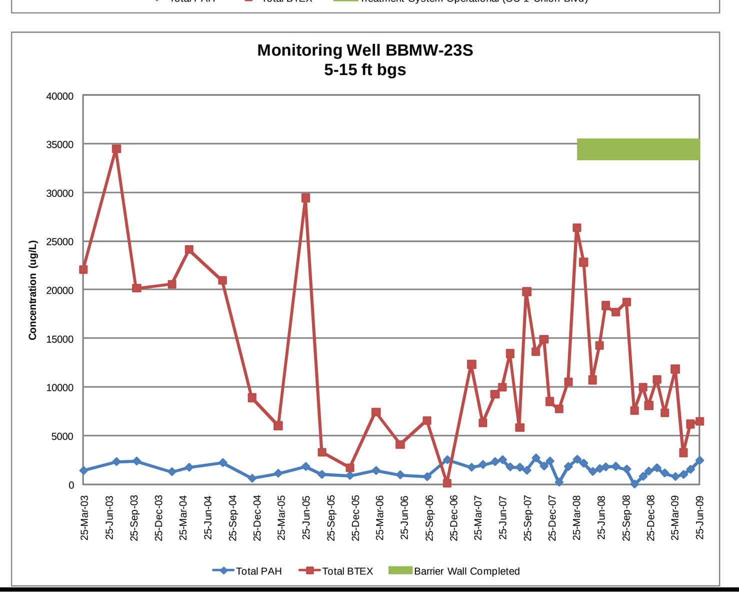


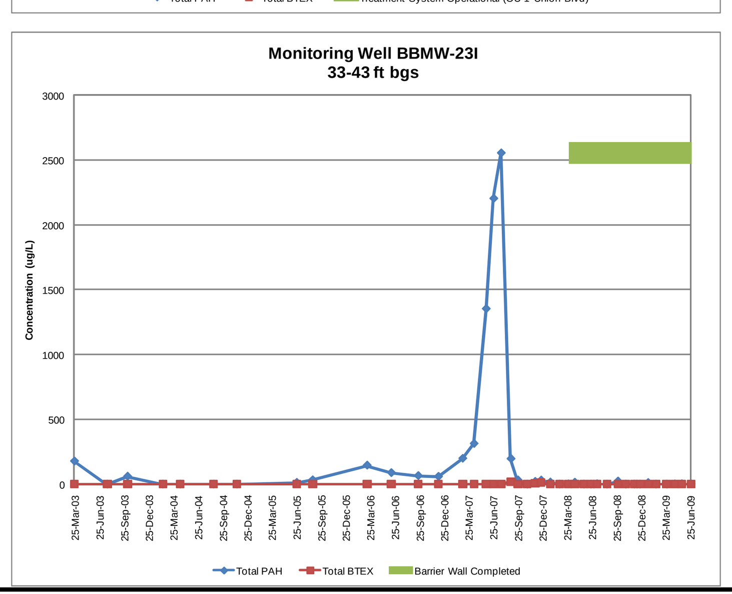


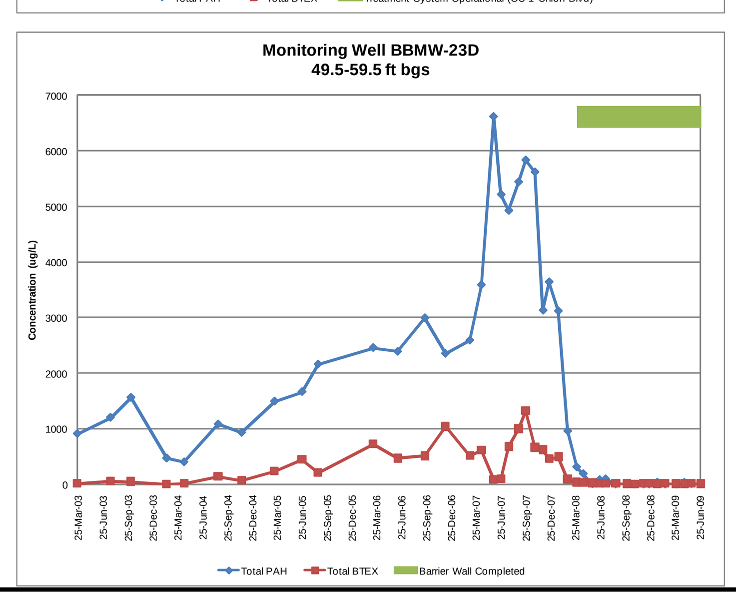


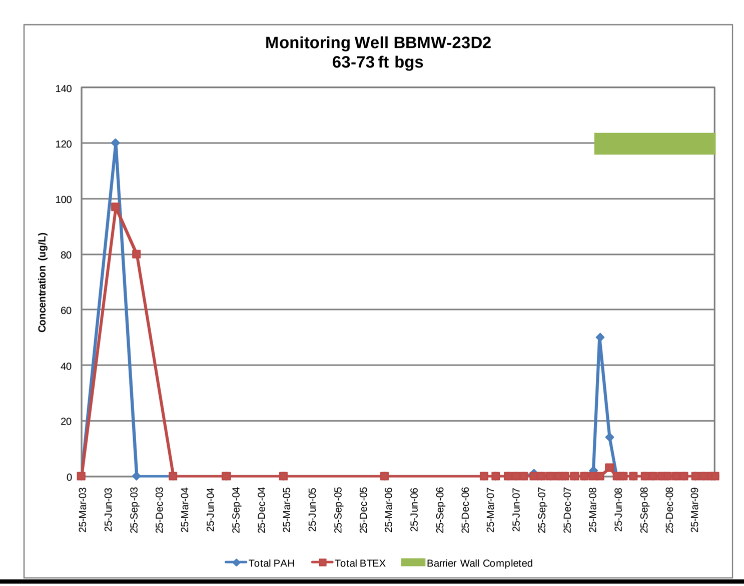


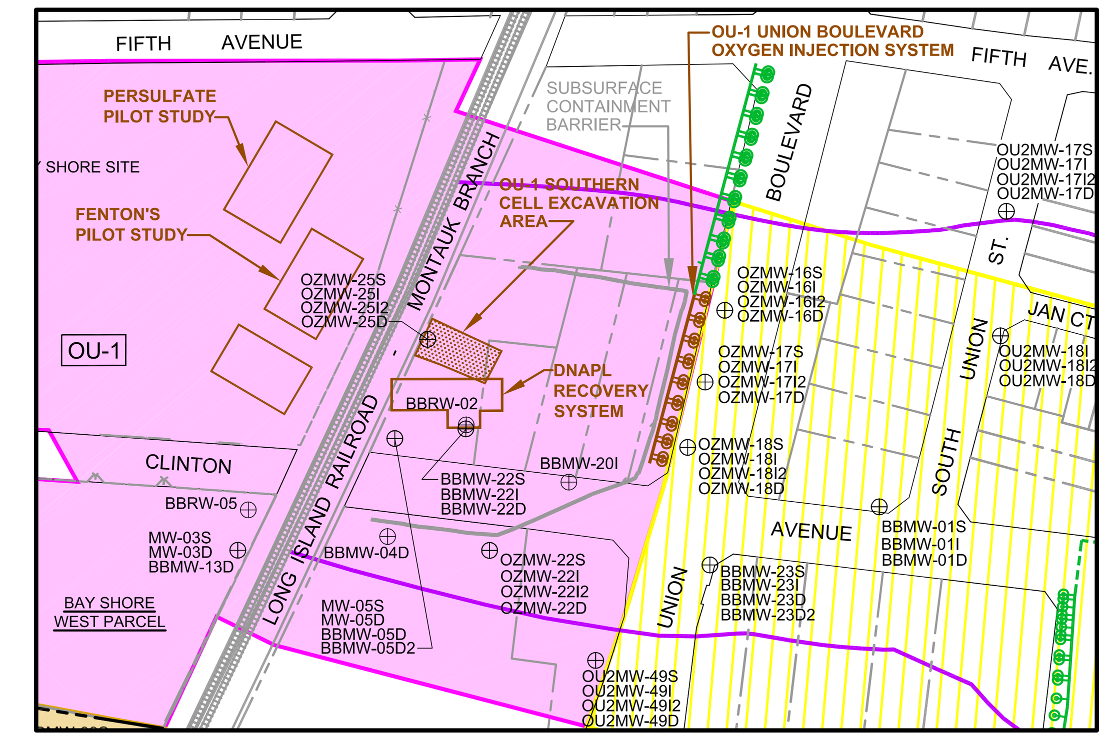


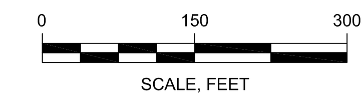












MAP LEGEND:

OZMW-17 S,I,I2,D — ACTIVE MONITORING WELL LOCATION SHALLOW, INTERMEDIATE, INTERMEDIATE 2, DEEP

Q2 PLUME BOUNDARY

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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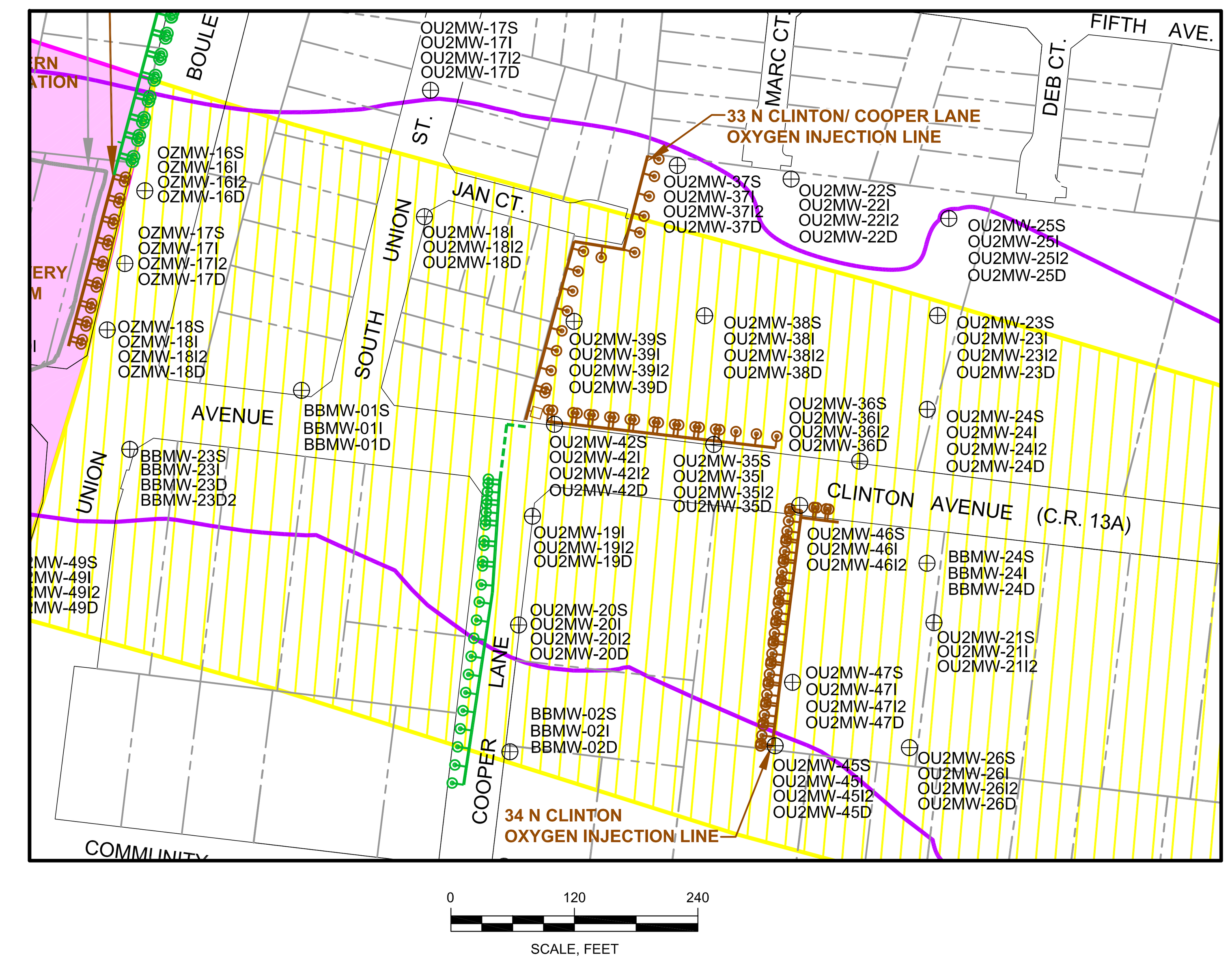
HUNTINGTON STATION, NY 11746

OU-1 UNION BOULEVARD OXYGEN INJECTION LINE GROUNDWATER DATA

October 2009 — Figure 6



LEGEND:

OU2MW-08 WT,S,I,I2,D	ACTIVE MONITORING WELL LOCATION WATER TABLE, SHALLOW, INTERMEDIATE, INTERMEDIATE 2, DEEP
	Q2 PLUME BOUNDARY

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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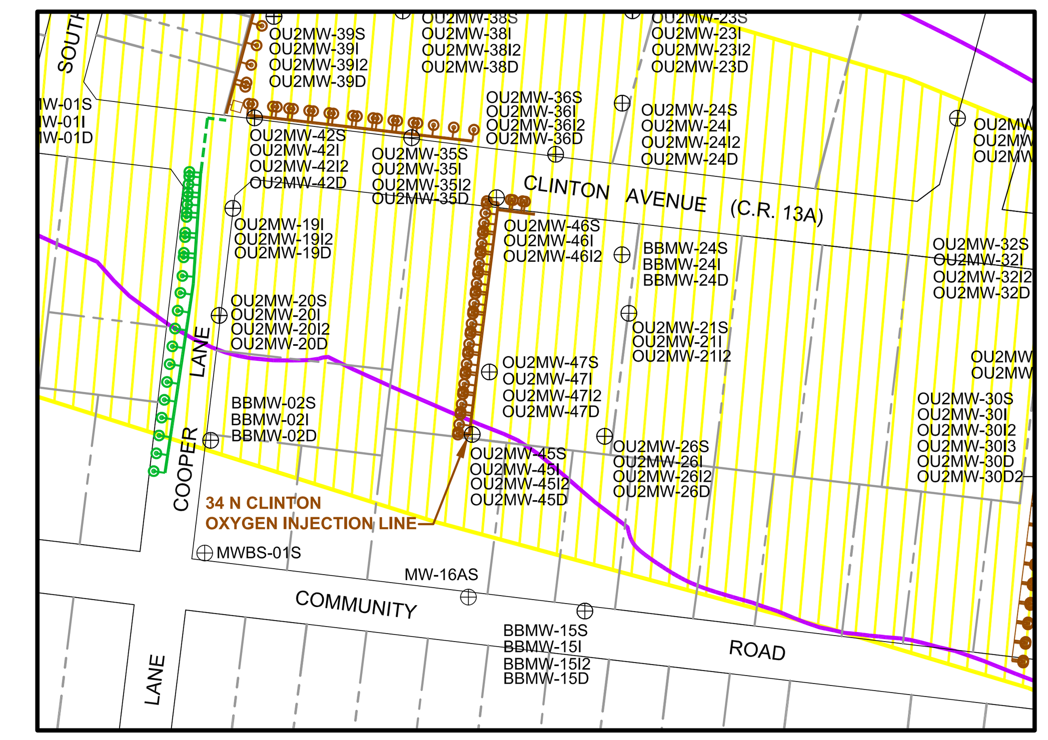
33 N. CLINTON AVENUE OXYGEN INJECTION LINE GROUNDWATER DATA

October 2009 Figure 7

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\OMM Graphs\ Bay Shore-Graphs Q-2 2009.dwg \Oct 23, 2009



0 150 300
SCALE, FEET

MAP LEGEND:

⊕ BBMW-30 S,I,D — ACTIVE MONITORING WELL LOCATION USED SHALLOW, INTERMEDIATE, DEEP

Q2 PLUME BOUNDARY

SOURCES:

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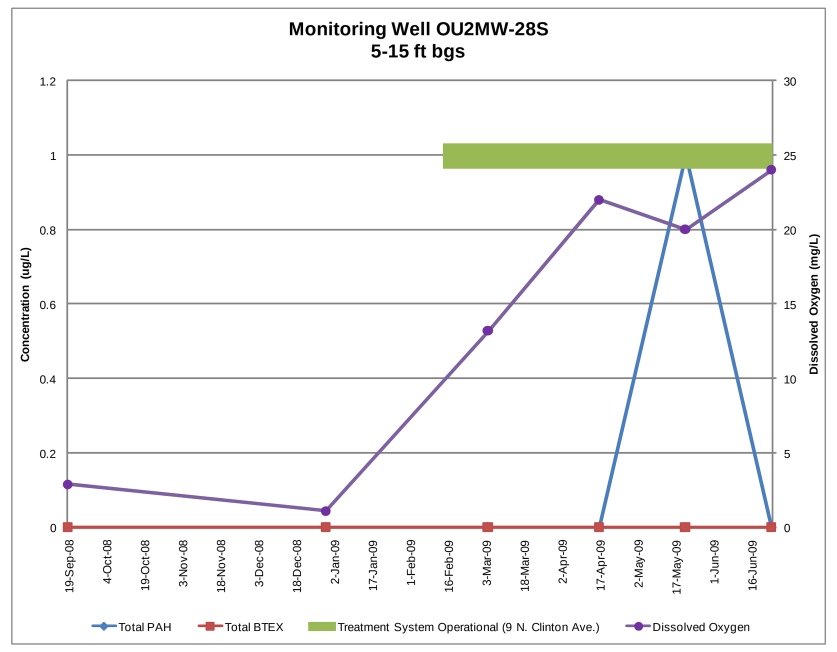
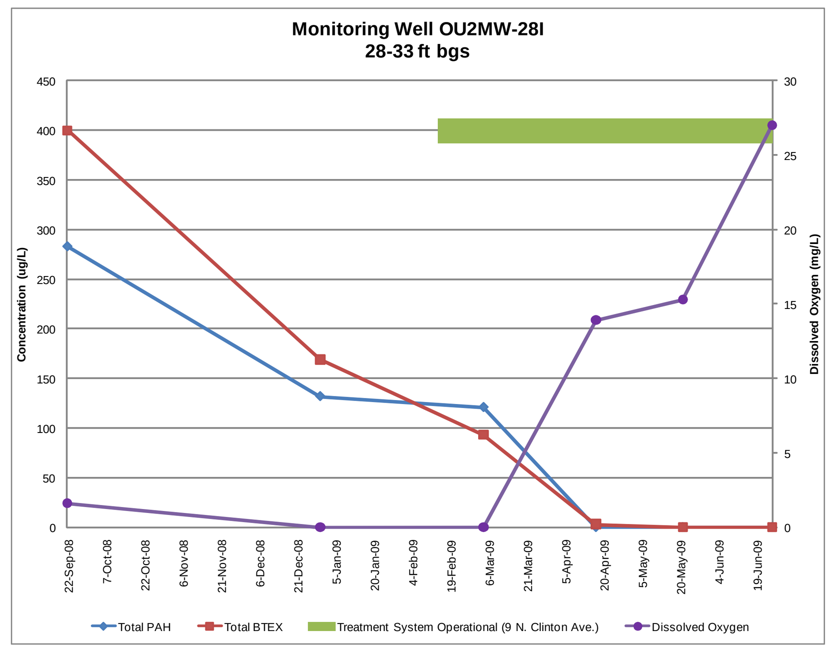
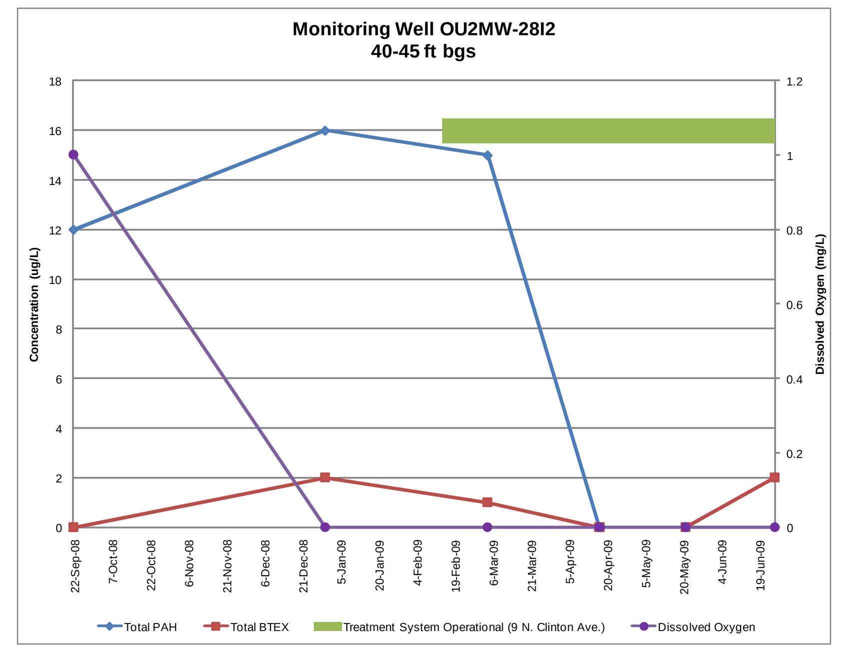
34 N. CLINTON AVENUE OXYGEN INJECTION LINE GROUNDWATER DATA

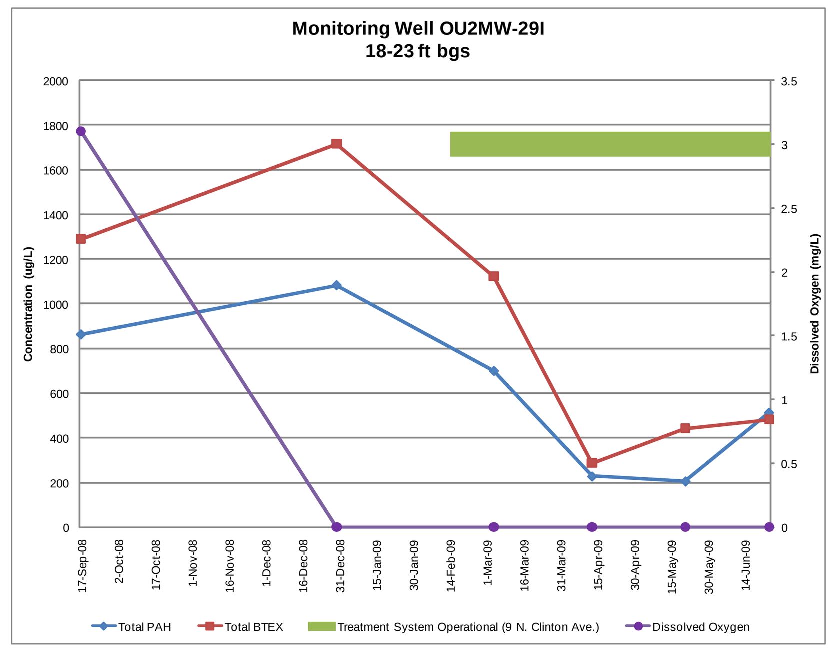
October 2009 — Figure 8

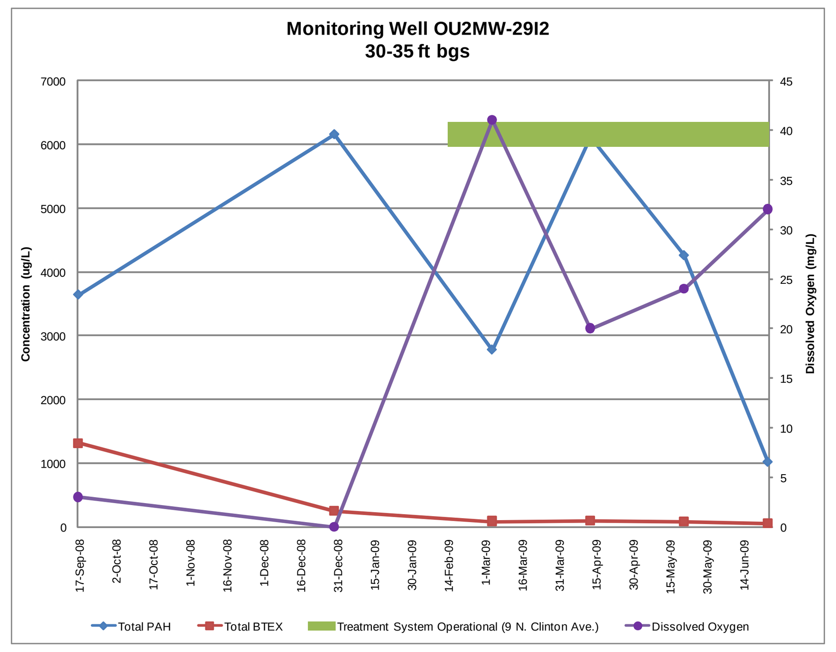
I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\OMM Graphs\ Bay Shore-Graphs Q-2 2009.dwg \Oct 15, 2009

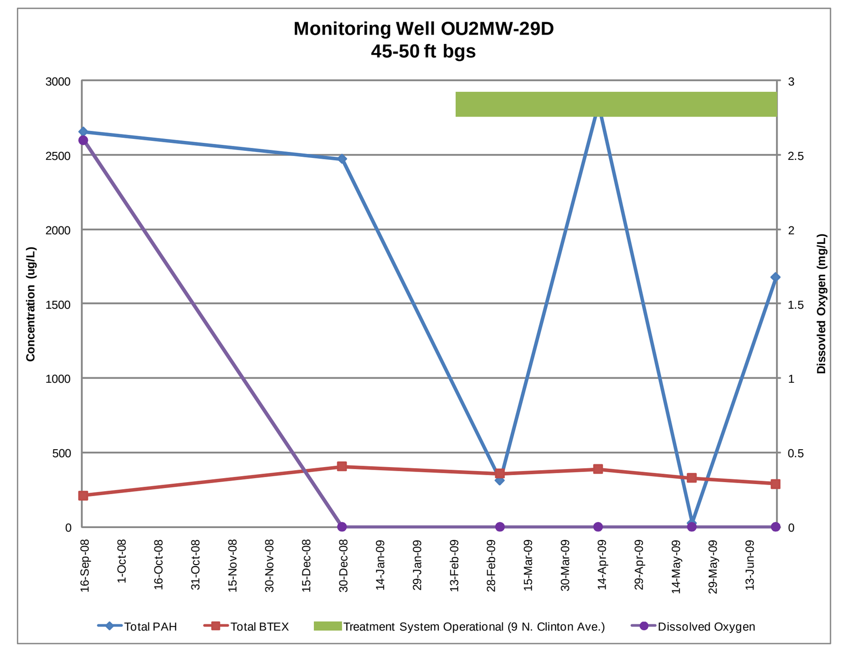


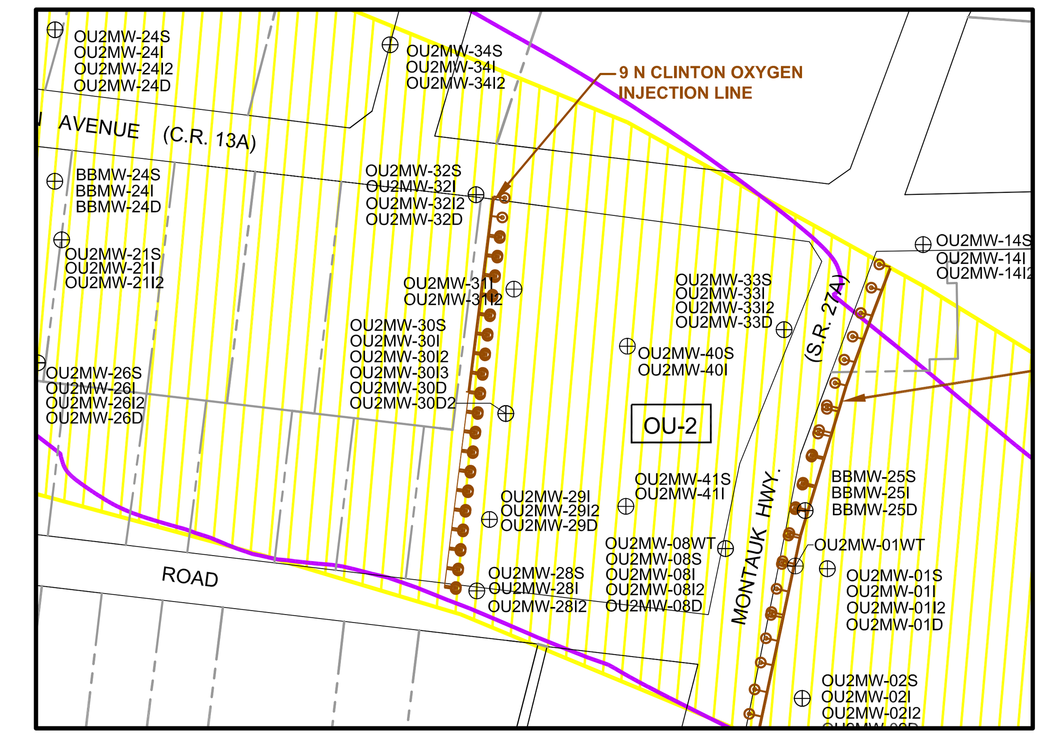










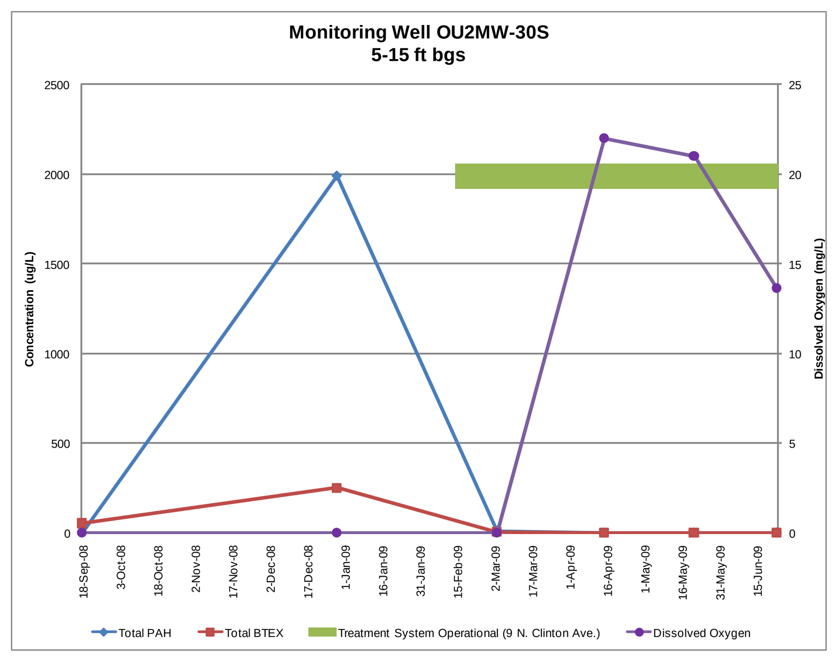


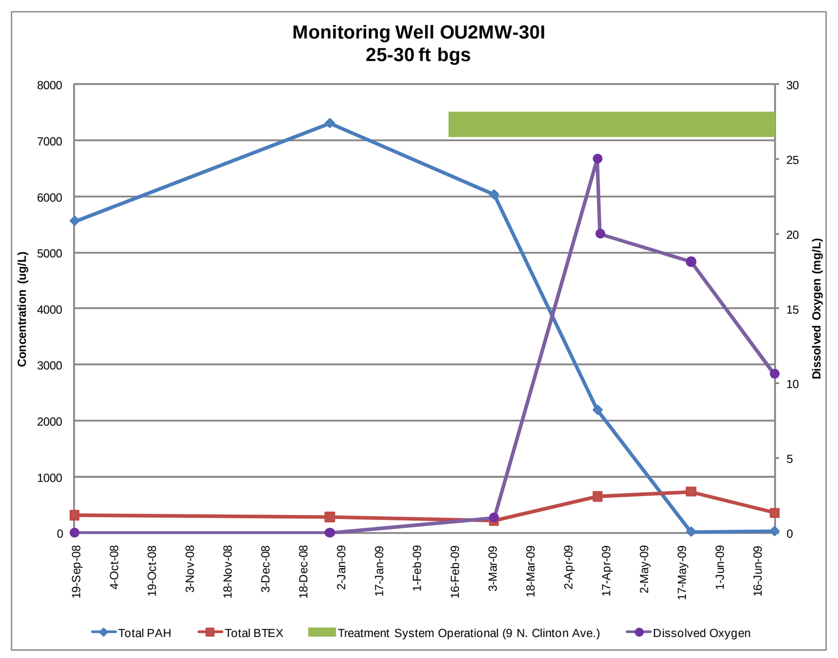
0 150 300

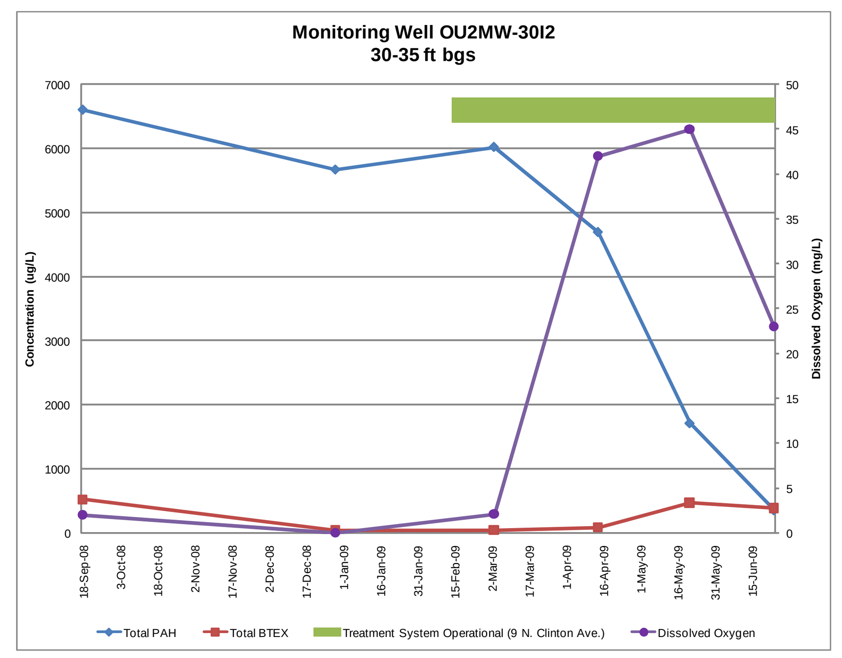
SCALE, FEET

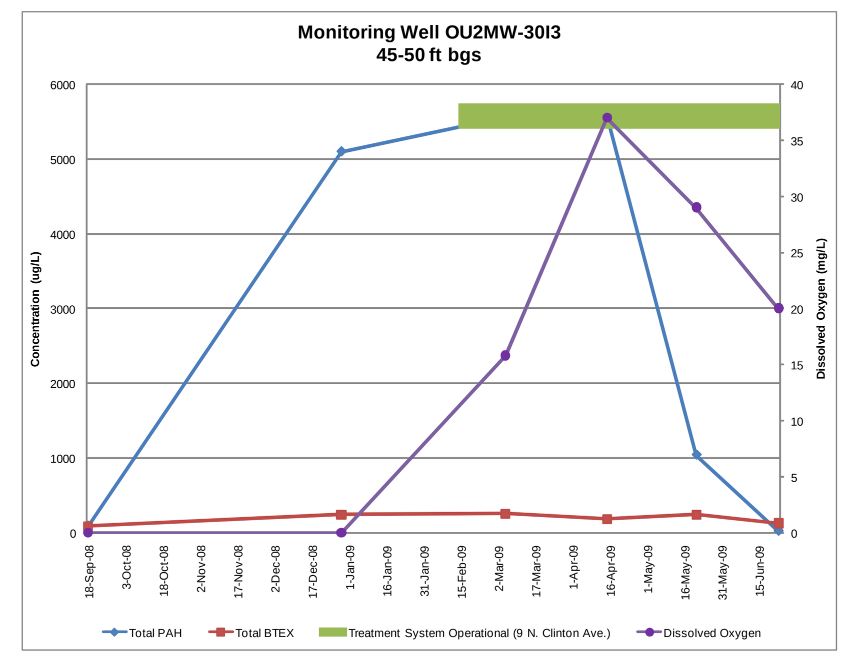
MAP LEGEND:

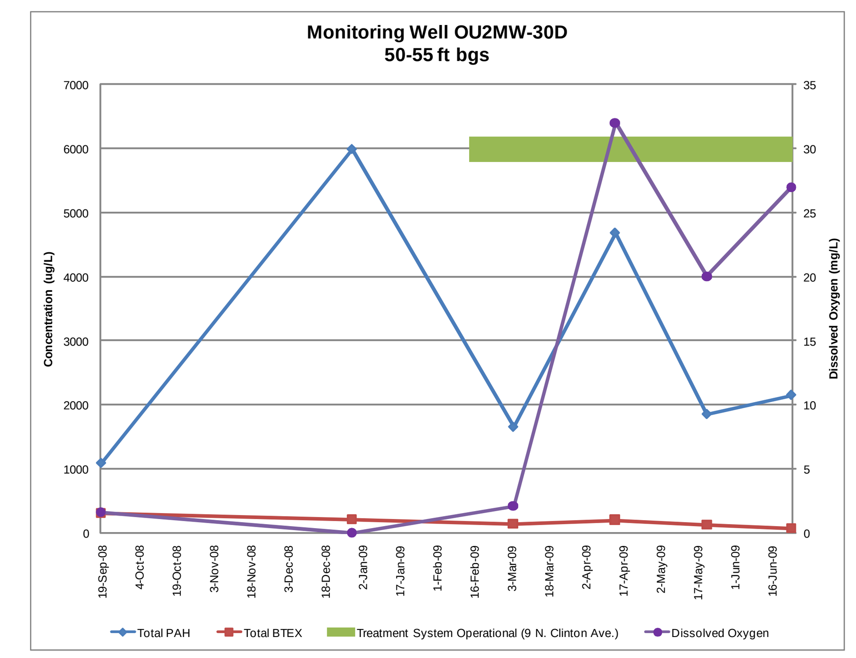
⊕ BBMW-30 S,I,D	ACTIVE MONITORING WELL LOCATION USED SHALLOW, INTERMEDIATE, DEEP
(magenta line)	Q2 PLUME BOUNDARY

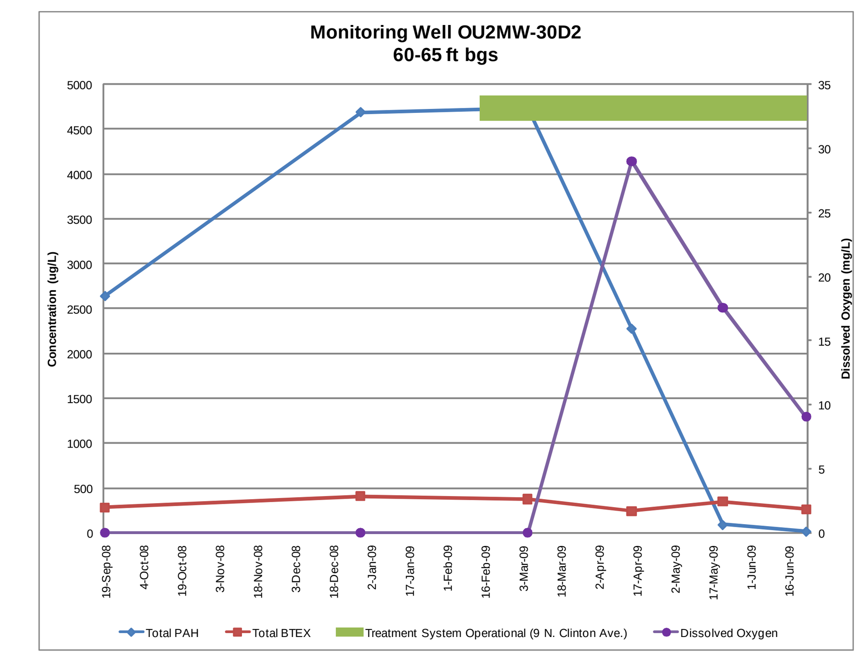


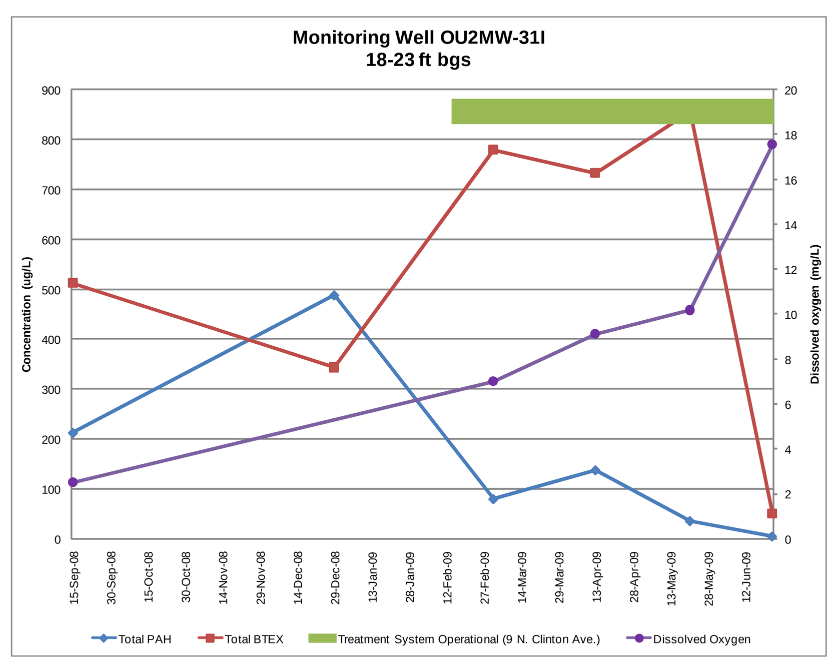


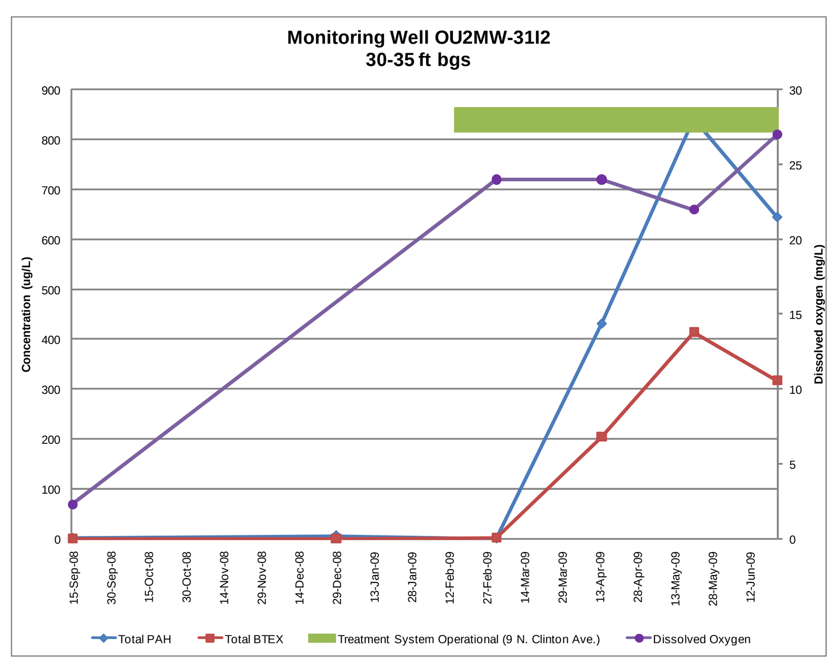












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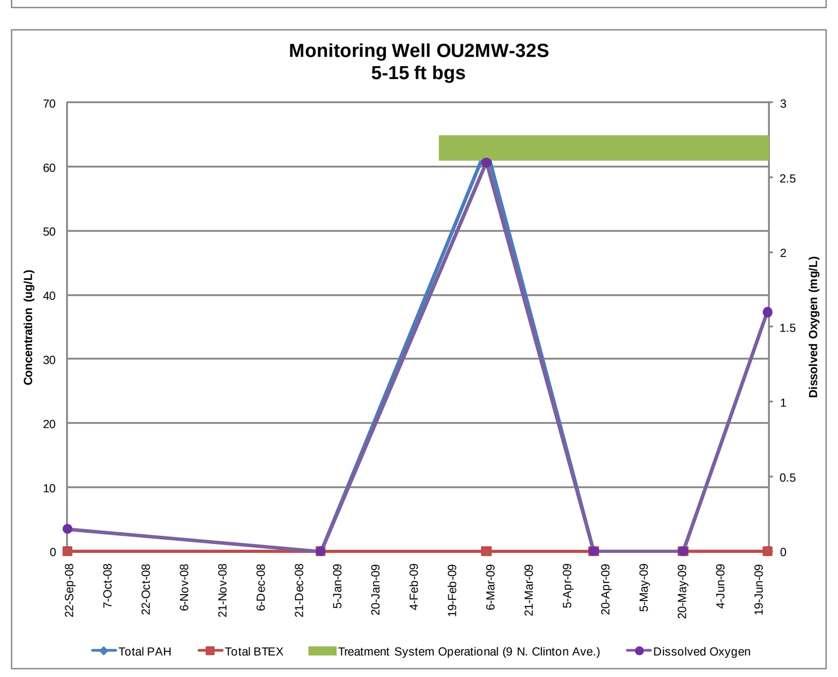
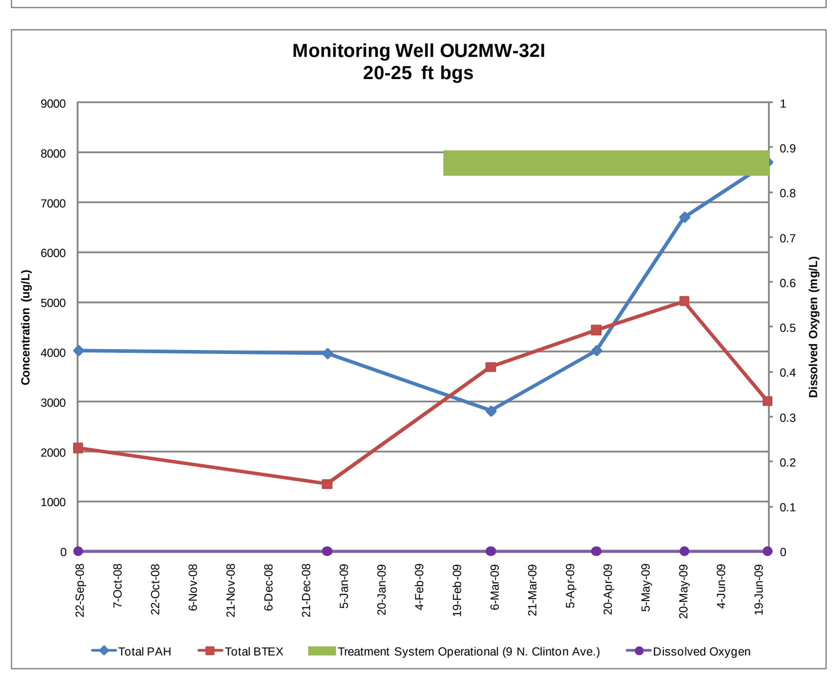
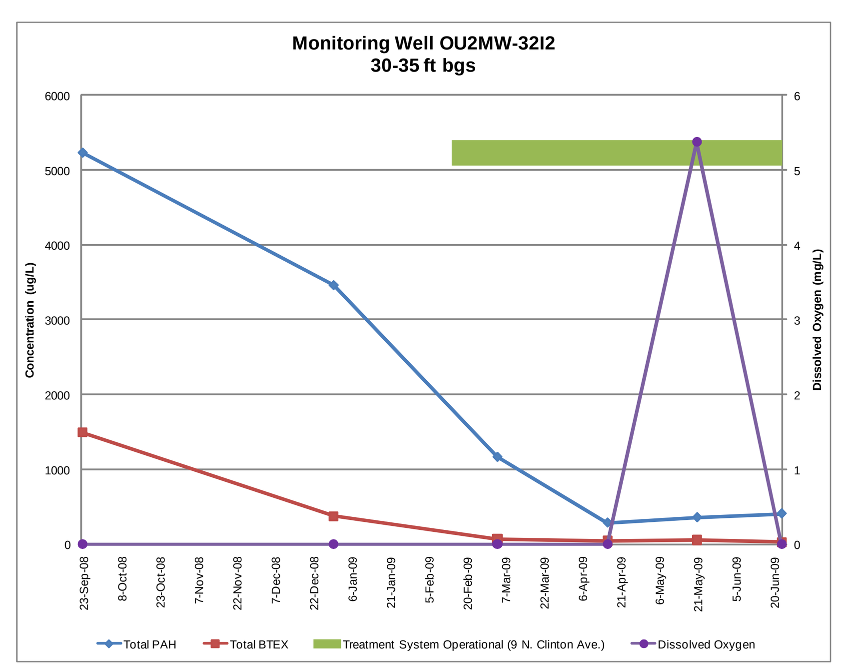
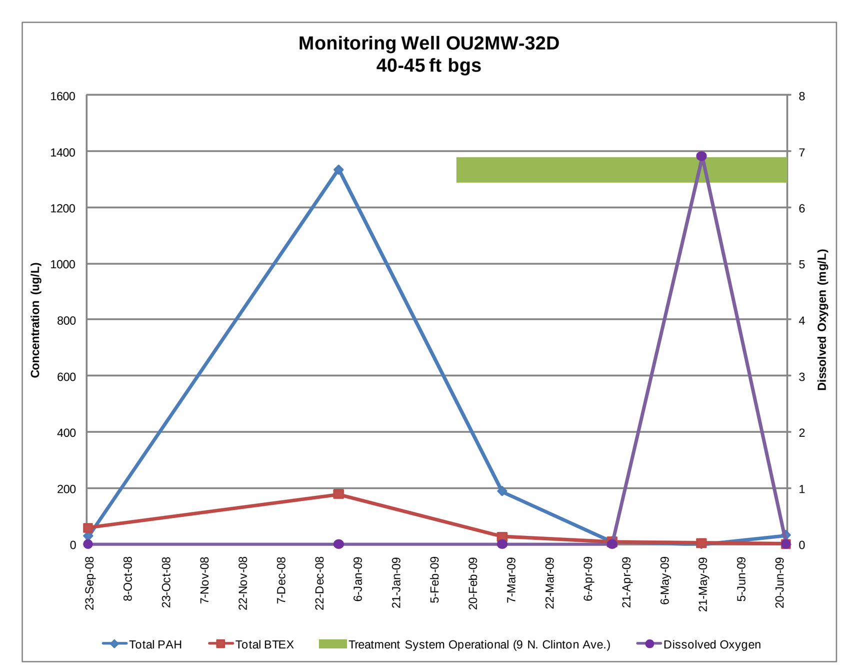


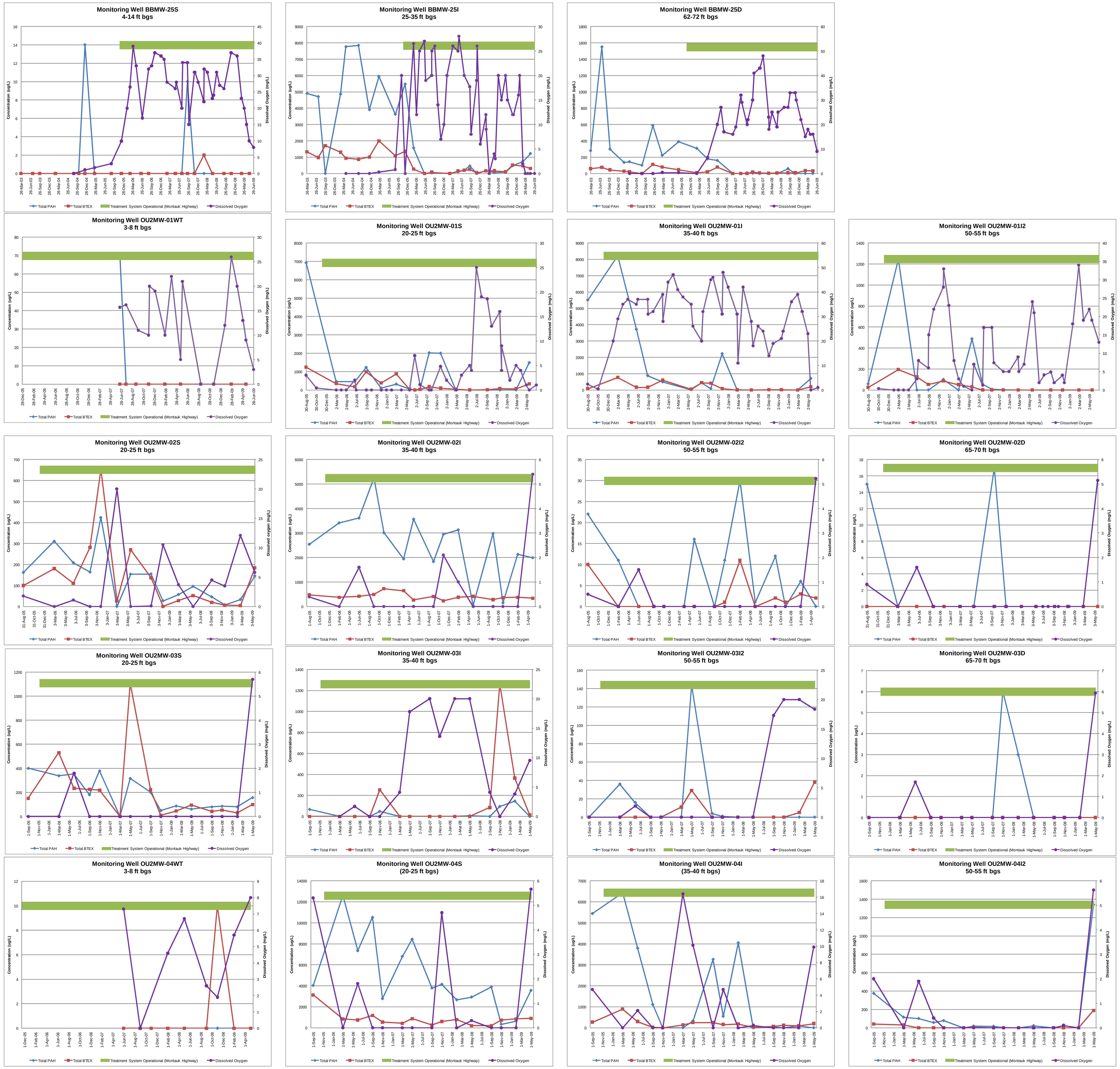


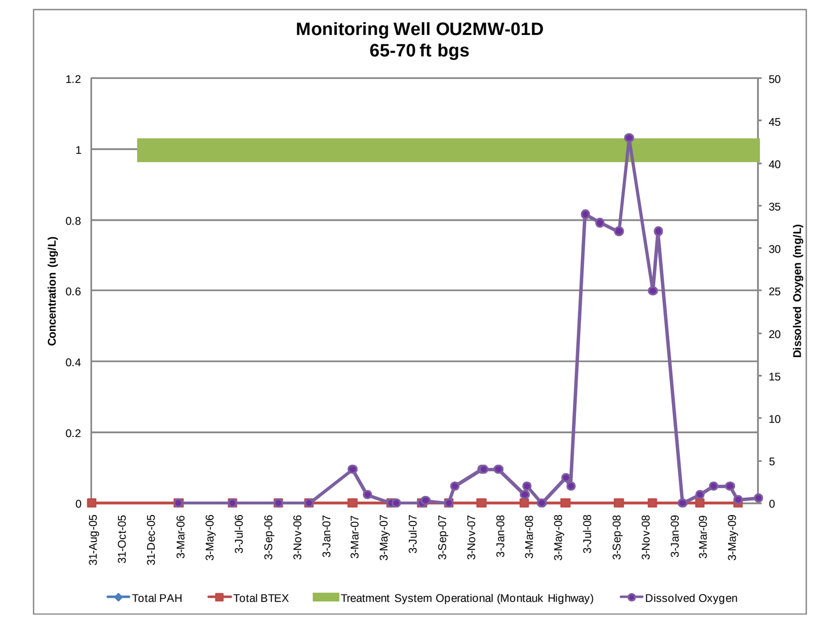


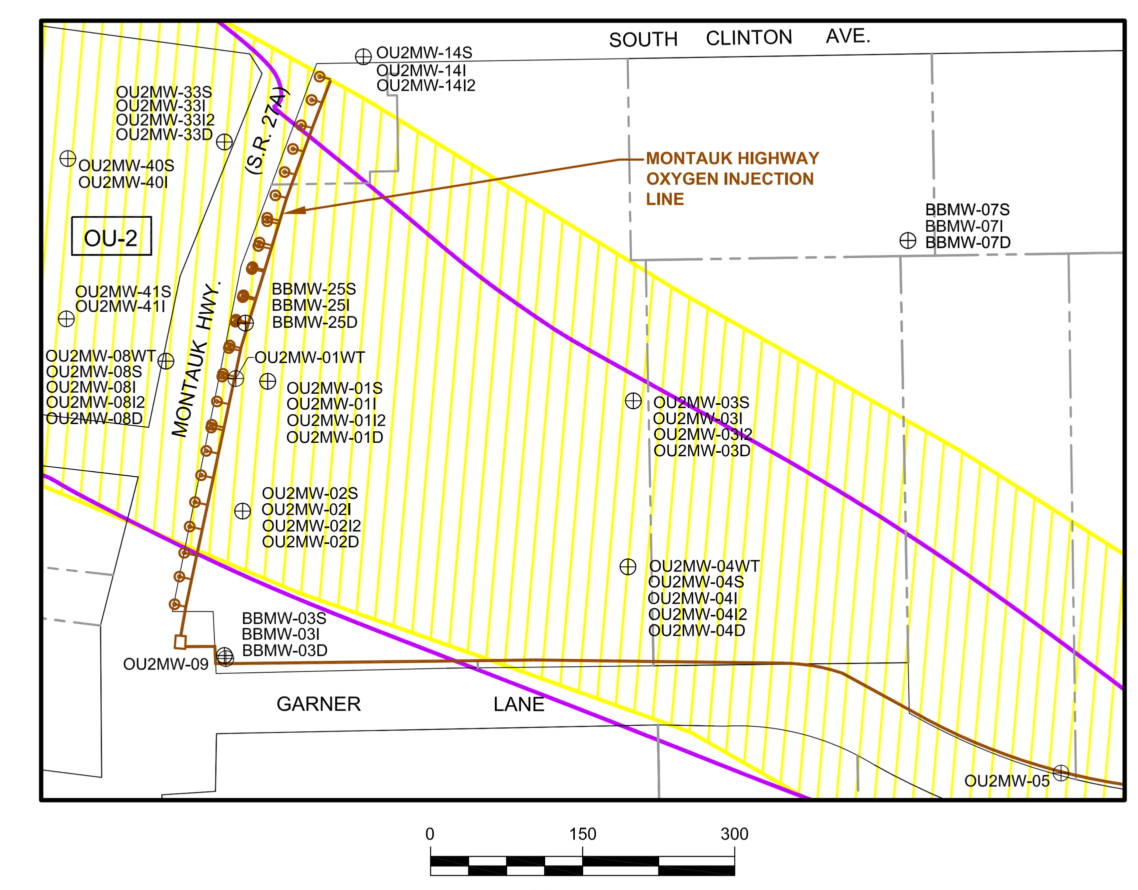


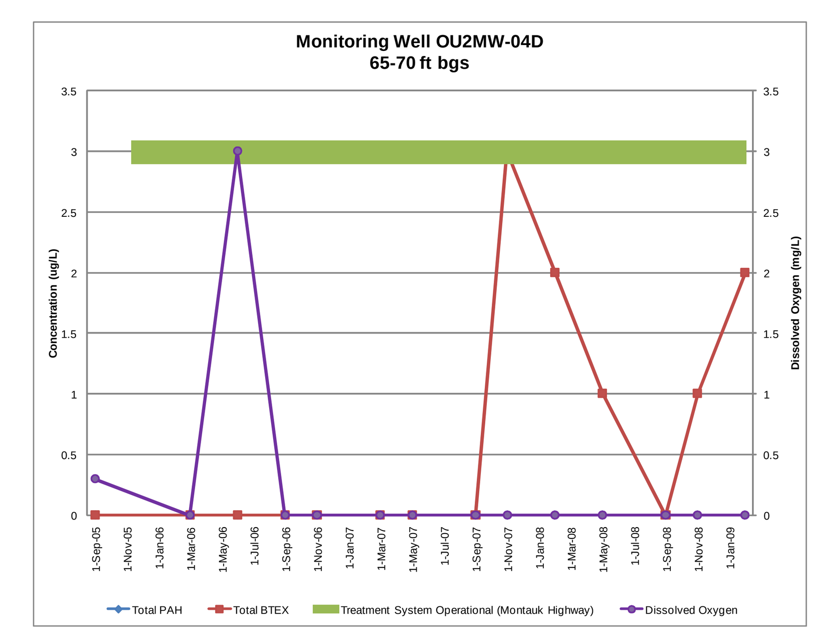
BAY SHORE/BRIGHTWATERS FORMER MGP SITE BAY SHORE, NEW YORK	GEI Consultants 110 WALT WHITMAN ROAD SUITE 204 HUNTINGTON STATION, NY 11746	9 N. CLINTON AVENUE OXYGEN INJECTION LINE GROUNDWATER DATA
nationalgrid		
Project 093180-5-1506		October 2009 Figure 9

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\OMM Graphs\ Bay Shore-Graphs Q-2 2009.dwg \Oct 15, 2009









MAP LEGEND:

OU2MW-08 WT,S,I,I2,D — ACTIVE MONITORING WELL LOCATION WATER TABLE, SHALLOW, INTERMEDIATE, INTERMEDIATE 2, DEEP

Q2 PLUME BOUNDARY

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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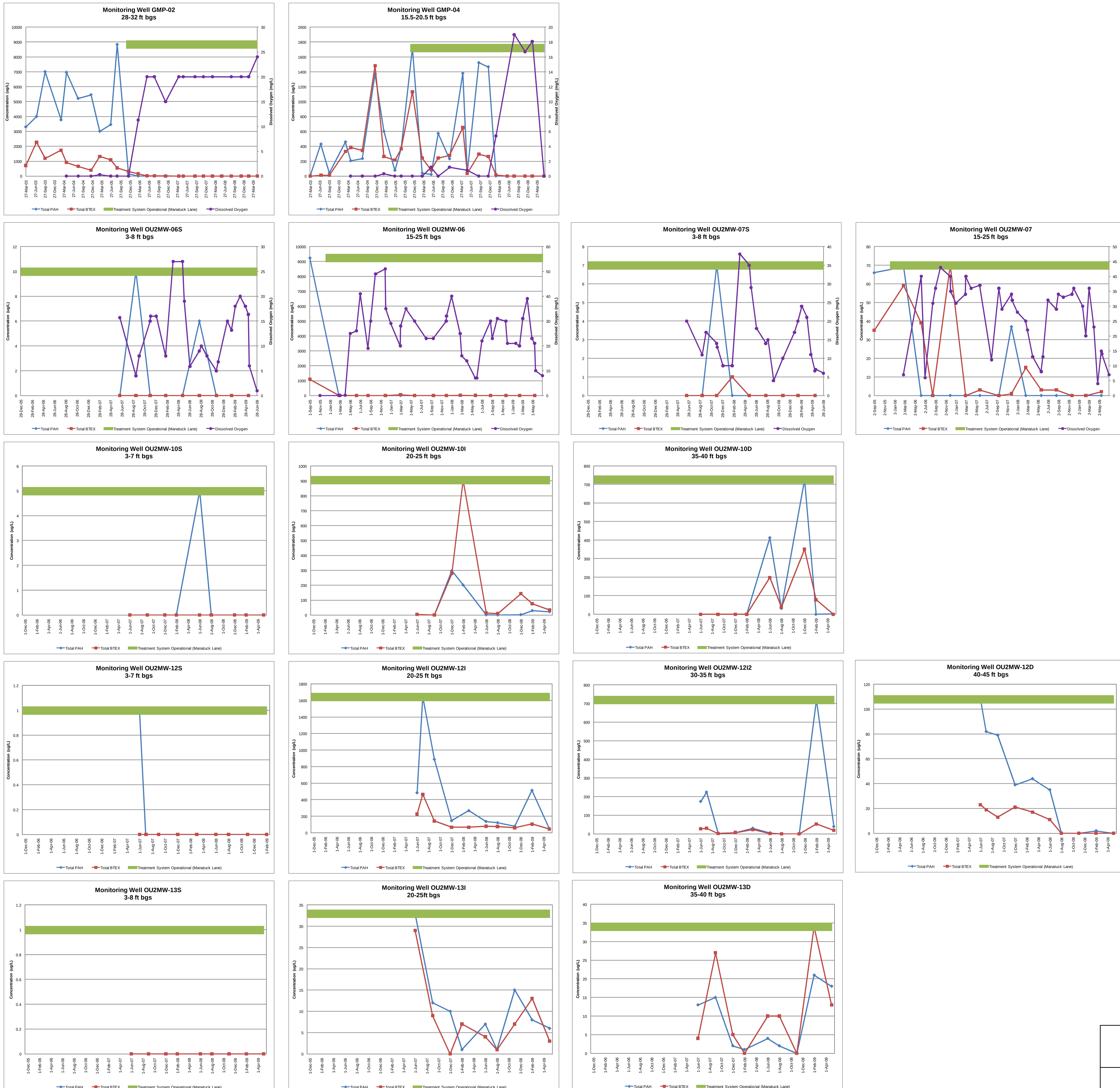
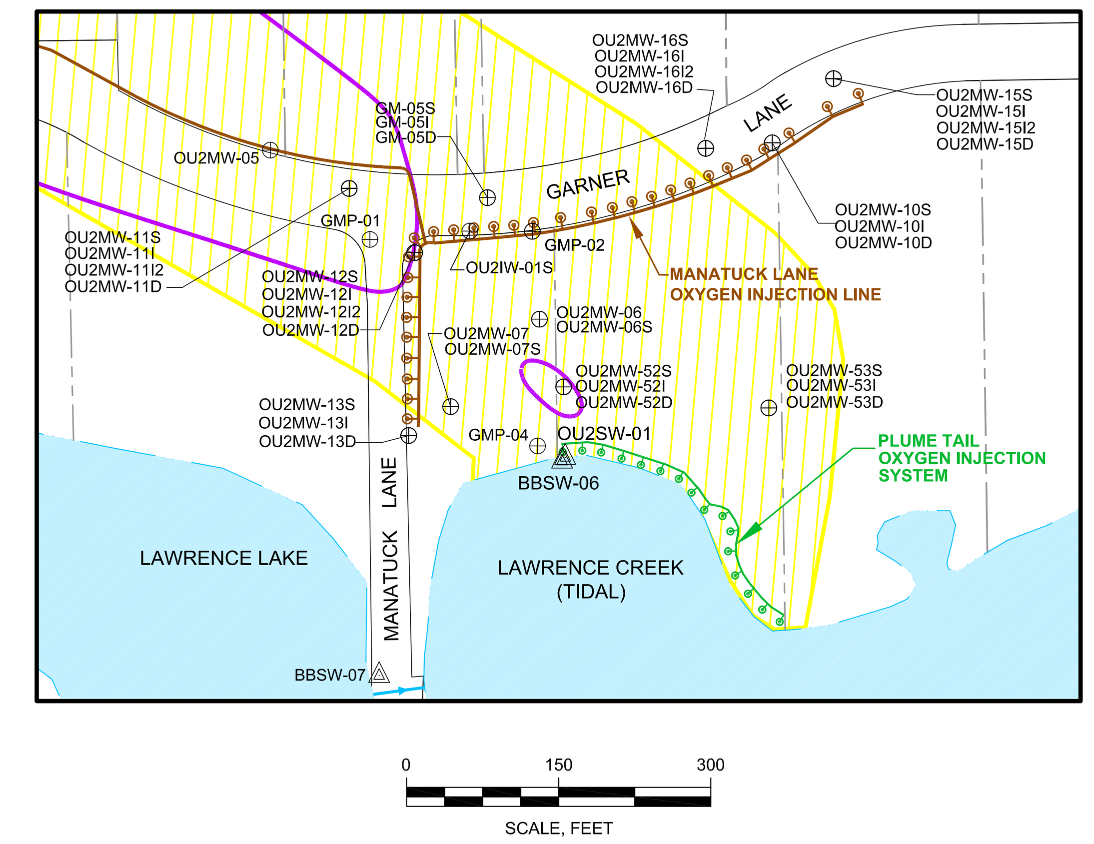
BAY SHORE/BRIGHTWATERS FORMER MGP SITE BAY SHORE, NEW YORK nationalgrid Project 093180-5-1506	GEI Consultants 110 WALT WHITMAN ROAD SUITE 204 HUNTINGTON STATION, NY 11746	**MONTAUK HIGHWAY OXYGEN INJECTION LINE GROUNDWATER DATA** October 2009 Figure 10

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\OMM Graphs\ Bay Shore-Graphs Q-2 2009.dwg \Oct 15, 2009





MAP LEGEND:

OU2MW-11 S,I,I2,D — ACTIVE MONITORING WELL LOCATION SHALLOW, INTERMEDIATE, INTERMEDIATE 2, DEEP

BBSW-06 — SURFACE WATER GAUGING STATION LOCATION

Q2 PLUME BOUNDARY

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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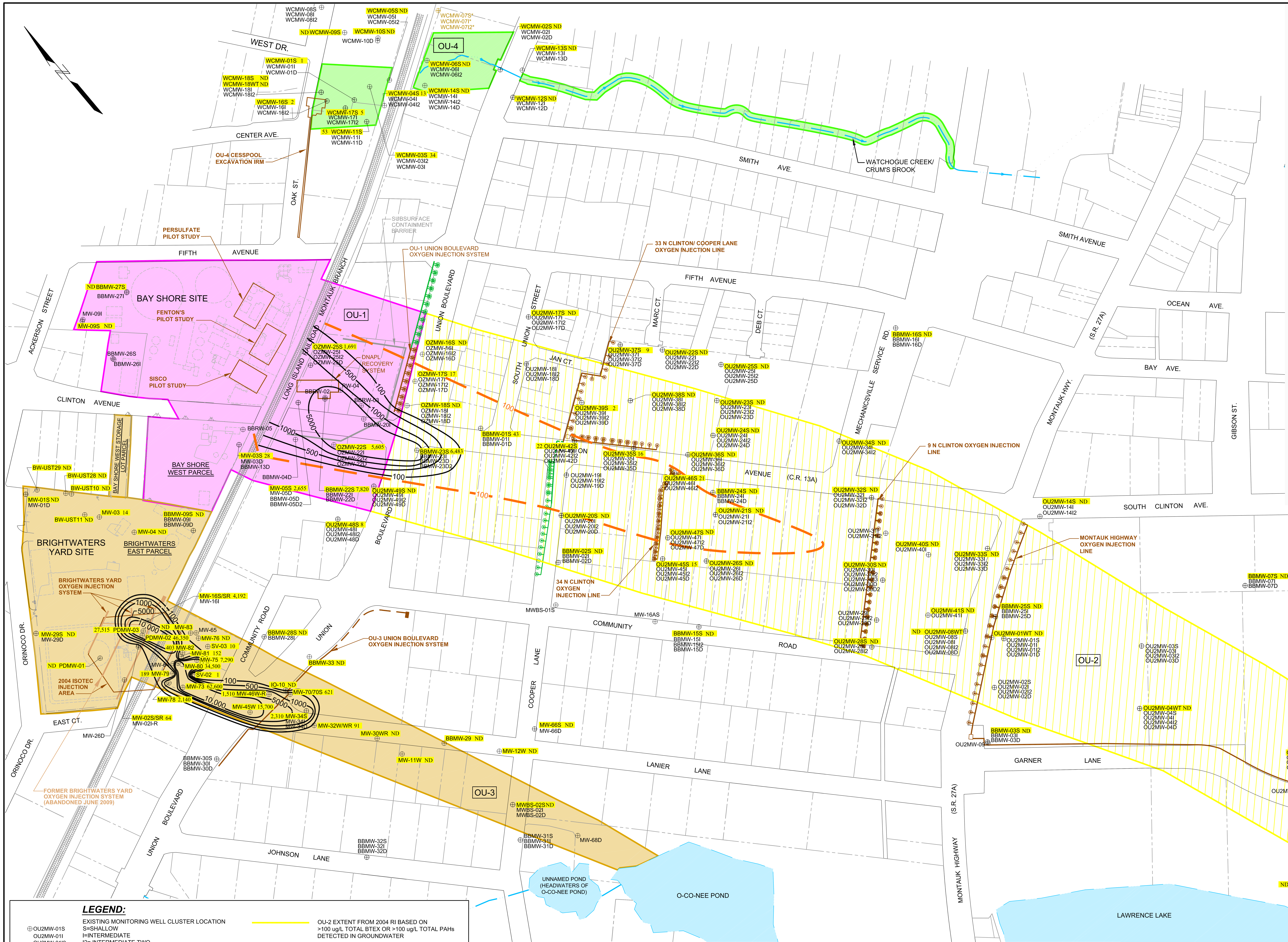
3. DRAWING C-1, OFF-SITE SAMPLE LOCATION MAP, BAY SHORE/BRIGHTWATERS FINAL REMEDIAL INVESTIGATION, SCALE: 1"=200', DATED OCTOBER 15, 2003, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
4. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE AND MONITORING WELLS LOCATED NEAR OR AT PROPERTY BOUNDARIES DEPICTED ON THE MAP ARE WITHIN THE ROAD RIGHT-OF-WAY.

BAY SHORE/BRIGHTWATERS FORMER MGP SITE BAY SHORE, NEW YORK	GEI Consultants 110 WALT WHITMAN ROAD SUITE 204 HUNTINGTON STATION, NY 11746	**MANATUCK LANE OXYGEN INJECTION LINE GROUNDWATER DATA**
nationalgrid		
Project 093180-5-1506		October 2009 — Figure 11



Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-3		
BBMW-09S	5-15	ND
BBMW-28S	2-12	ND
BBMW-29	2-9	ND
BBMW-33	7-12	ND
BW-UST-10	4.65-9.95	ND
BW-UST-11	4.4-9.4	ND
BW-UST-28	5-10	ND
BW-UST-29	5-10	ND
IO-10	6-16	ND
MW-01S	4-14	ND
MW-02S/SR	2-12	**64**
MW-03	4.94-14.94	**14**
MW-04	5.1-15.1	ND
MW-11W	2-10	ND
MW-12W	2-12	ND
MW-16S/SR	2-12	**4,192**
MW-29S	2-10	ND
MW-30WR	2-10	ND
MW-32W/WR	2-9	**91**
MW-34S	2-10	**2,310**
MW-45W	2-10	**15,700**
MW-46W-R	2-10	**1,510**
MW-66S	1.5-11.5	ND
MW-70/70S	2-12	**621**
MW-73	2-12	**62,600**
MW-75	2-12	**7,290**
MW-76	2-12	ND
MW-78	5-20	**2,140**
MW-79	5-20	**189**
MW-80	5-20	**34,500**
MW-81	5-20	**152**
MW-82	5-20	**403**
MW-83	5-20	ND
MW-BS-02S	5-15	ND
PDMW-01	5-20	ND
PDMW-02	5-20	**46,350**
PDMW-03	5-15	**27,515**
SV-02	2-12	**1**
SV-03	2-12	**10**
OU-4		
WCMW-01S	2-12	**1**
WCMW-02S	3-13	ND
WCMW-03S	4.83-9.83	**34**
WCMW-04S	1.6-11.6	**13**
WCMW-05S	1.15-11.15	ND
WCMW-06S	2-12	ND
WCMW-09S	5-15	ND
WCMW-10S	15-20	ND
WCMW-11S	5-15	**53**
WCMW-12S	3-13	ND
WCMW-13S	3-13	ND
WCMW-14S	2-12	ND
WCMW-16S	2-12	**2**
WCMW-17S	2-12	**5**
WCMW-18S	Water Table*	ND
WCMW-18WT	Water Table*	ND

Water Table* This exact well screen depth is unknown

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-1 and OU-2		
BBMW-01S	5-15	**43**
BBMW-02S	5-15	ND
BBMW-03S	3-13	ND
BBMW-07S	5-15	ND
BBMW-15S	5-15	ND
BBMW-16S	5-15	ND
BBMW-22S	5-10	**7,820**
BBMW-23S	5-15	**6,483**
BBMW-24S	4-14	ND
BBMW-25S	4-14	ND
BBMW-27S	5-15	ND
GM-05S	5.1-20.1	**36**
MW-03S	3-13	**28**
MW-05S	4-14	**2,655**
MW-09S	4-14	ND
OU2IW-01S	3-8	ND
OU2MW-01WT	3-8	ND
OU2MW-04WT	3-8	ND
OU2MW-06S	3-8	ND
OU2MW-07S	3-8	ND
OU2MW-08WT	3-8	ND
OU2MW-10S	3-7	ND
OU2MW-11S	3-8	ND
OU2MW-12S	3-7	ND
OU2MW-13S	3-8	ND
OU2MW-14S	3-8	ND
OU2MW-15S	3-8	ND
OU2MW-16S	3-8	ND
OU2MW-17S	5-10	ND
OU2MW-20S	4-9	ND
OU2MW-21S	5-15	ND
OU2MW-22S	5-15	ND
OU2MW-23S	5-15	ND
OU2MW-24S	5-15	ND
OU2MW-25S	5-15	ND
OU2MW-26S	6-11	ND
OU2MW-28S	5-15	ND
OU2MW-30S	5-15	ND
OU2MW-32S	5-15	ND
OU2MW-33S	5-15	ND
OU2MW-34S	5-15	ND
OU2MW-35S	5-15	**16**
OU2MW-36S	5-15	ND
OU2MW-37S	5-15	**9**
OU2MW-38S	5-15	ND
OU2MW-39S	5-15	**2**
OU2MW-40S	5-15	ND
OU2MW-41S	5-15	ND
OU2MW-42S	5-15	**22**
OU2MW-45S	5-15	**15**
OU2MW-46S	5-15	**21**
OU2MW-47S	5-15	ND
OU2MW-48S	3-13	**8**
OU2MW-49S	3-13	ND
OU2MW-52S	3-8	ND
OU2MW-53S	3-8	ND
OZMW-16S	5-15	ND
OZMW-17S	5-15	**17**
OZMW-18S	5-15	ND
OZMW-22S	5-15	**5,605**
OZMW-25S	5-15	**1,691**

LEGEND:

OU2MW-01S, OU2MW-01I, OU2MW-01I2, OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
(yellow line)	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(black line)	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
(orange dashed line)	100 ug/L TOTAL BTEX ISO-CONCENTRATION LINE FROM Q1 2009 WATER TABLE ZONE
(brown line)	INSTALLED OXYGEN INJECTION LINE
(green line)	PLANNED OXYGEN INJECTION LINE

NOTE: MW-81* AND SV-02* CONCENTRATIONS NOT USED FOR CREATING ISO-CONCENTRATION LINES.

0 120 240
SCALE, FEET

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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BAY SHORE/BRIGHTWATERS
FORMER MGP SITE
BAY SHORE, NEW YORK

nationalgrid

Project 093180-5-1506

GEI Consultants
110 WALT WHITMAN ROAD
SUITE 204
HUNTINGTON STATION, NY 11746

WATER TABLE GROUNDWATER BTEX ISO-CONCENTRATION MAP Q2 2009 DATA

October 2009 Figure 12

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\ISO-Concentrations\ BAY SHORE-BTEX & PAH PLUMES Q2 2009.dwg \Oct 23, 2009

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-3		
BBMW-28I	10-20	ND
MW-01D	35-45	ND
MW-02I-R	22.5-23.5	ND
MW-16I	14-19	ND
MW-26D	14-19	ND
MW-29D	14-19	ND
MW-34D	27.5-28.5	ND
MW-34I	18.5-19.5	ND
MW-64	19-24	ND
MW-65	11-16	ND
MW-66D	24-29	ND
MW-BS-02D	24.5-25.5	ND
MW-BS-02I	14.5-15.5	**3**
OU-4		
WCMW-01I	35-45	ND
WCMW-02I	34.5-44.5	ND
WCMW-03I	19.4-24.4	ND
WCMW-03I2	28.55-33.55	ND
WCMW-04I	19-24	ND
WCMW-04I2	29.85-34.85	ND
WCMW-05I	19.61-24.61	ND
WCMW-05I2	29.46-34.46	ND
WCMW-06I	19.55-24.55	ND
WCMW-06I2	29.83-34.83	ND
WCMW-10D	40-50	ND
WCMW-11I	25-35	ND
WCMW-12I	25-30	ND
WCMW-13I	25-30	ND
WCMW-14I	20-25	ND
WCMW-14I2	30-35	ND
WCMW-16I	20-25	**1**
WCMW-16I2	30-35	**2**
WCMW-17I	20-25	ND
WCMW-17I2	30-35	ND
WCMW-18I	INTERMEDIATE*	ND
WCMW-18I2	INTERMEDIATE*	ND

INTERMEDIATE* This exact well screen depth is unknown

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-1 and OU-2		
BBMW-01I	32-42	**66**
BBMW-02I	30-40	ND
BBMW-03I	30-40	ND
BBMW-07I	30-40	ND
BBMW-15I	23-28	ND
BBMW-15I2	35-45	ND
BBMW-16I	35-45	ND
BBMW-20I	35-45	**3**
BBMW-22I	30-40	**111**
BBMW-23I	33-43	ND
BBMW-24I	32-42	**394**
BBMW-25I	25-35	**301**
BBMW-27I	30-40	ND
GM-05I	35.05-48.05	ND
GMP-01	25-30	**869**
GMP-02	28-23	ND
GMP-04	15.5-20.5	ND
MW-03D	35-45	ND
MW-05D	35.5-45.5	**29**
OU2MW-01I	35-40	**195**
OU2MW-01S	20-25	**334**
OU2MW-02I	35-40	**335**
OU2MW-02S	20-25	**184**
OU2MW-03I	35-40	**15**
OU2MW-03S	20-25	**99**
OU2MW-04I	35-40	**198**
OU2MW-04S	20-25	**891**
OU2MW-05	25-35	**290**
OU2MW-06	15-25	ND
OU2MW-07	15-25	**2**
OU2MW-08I	35-40	**333**
OU2MW-08S	20-25	**898**
OU2MW-09	20-30	ND
OU2MW-10D	35-40	ND
OU2MW-10I	20-25	**33**
OU2MW-11D	40-45	**5**
OU2MW-11I	20-25	**132**
OU2MW-11I2	30-35	**25**
OU2MW-12D	40-45	ND
OU2MW-12I	20-25	**48**
OU2MW-12I2	30-35	**19**
OU2MW-13D	35-40	**13**
OU2MW-13I	20-25	**3**
OU2MW-14I	20-25	ND
OU2MW-14I2	45-50	ND
OU2MW-15D	40-45	ND
OU2MW-15I	20-25	**63**
OU2MW-15I2	30-35	ND
OU2MW-16D	35-40	**2**
OU2MW-16I	15-20	ND
OU2MW-16I2	25-30	ND
OU2MW-17I	13-23	**164**
OU2MW-17I2	35-40	ND
OU2MW-18I	13-23	**3,791**
OU2MW-18I2	35-45	ND
OU2MW-19I	13-23	**110**
OU2MW-19I2	35-45	**75**
OU2MW-20I	13-23	**158**
OU2MW-20I2	35-45	ND
OU2MW-21I	13-23	**195**
OU2MW-21I2	35-45	**99**
OU2MW-22I	25-30	**6**

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-1 and OU-2		
OU2MW-22I2	46-51	ND
OU2MW-23I	25-30	**117**
OU2MW-23I2	45-50	ND
OU2MW-24I	25-30	**197**
OU2MW-24I2	45-50	ND
OU2MW-25I	25-30	**138**
OU2MW-25I2	45-50	ND
OU2MW-26I	13-23	**4**
OU2MW-26I2	35-45	**26**
OU2MW-28I	28-33	**3**
OU2MW-28I2	40-45	**2**
OU2MW-29I	18-23	**480**
OU2MW-29I2	30-35	**96**
OU2MW-29D	45-50	**388**
OU2MW-30I	25-30	**729**
OU2MW-30I2	30-35	**471**
OU2MW-30I3	45-50	**248**
OU2MW-31I	18-23	**856**
OU2MW-31I2	30-35	**413**
OU2MW-32D	40-45	**8**
OU2MW-32I	20-25	**5,013**
OU2MW-32I2	30-35	**57**
OU2MW-33I	20-25	**63**
OU2MW-33I2	30-35	**2**
OU2MW-34I	25-30	**2,227**
OU2MW-34I2	45-50	ND
OU2MW-35I	25-30	**12**
OU2MW-35I2	45-50	ND
OU2MW-36I	25-30	**42**
OU2MW-36I2	45-50	ND
OU2MW-37I	25-30	**411**
OU2MW-37I2	45-50	**4**
OU2MW-38I	25-30	**204**
OU2MW-38I2	46-51	ND
OU2MW-39I	25-30	**5**
OU2MW-39I2	45-50	**1**
OU2MW-40I	18-23	**168**
OU2MW-41I	18-23	**585**
OU2MW-42I	25-30	**4**
OU2MW-42I2	45-50	ND
OU2MW-45I	20-25	**20**
OU2MW-45I2	40-45	ND
OU2MW-46I	20-25	**37**
OU2MW-46I2	40-45	**185**
OU2MW-47I	20-25	**40**
OU2MW-47I2	40-45	**7**
OU2MW-48I	25-30	ND
OU2MW-48I2	45-50	ND
OU2MW-49I	25-30	ND
OU2MW-49I2	45-50	ND
OU2MW-52I	20-25	**128**
OU2MW-53I	20-25	ND
OZMW-16I	20-30	**775**
OZMW-16I2	35-40	**92**
OZMW-17I	20-30	**42**
OZMW-17I2	35-45	**36**
OZMW-18I	20-30	**149**
OZMW-18I2	35-45	**50**
OZMW-22I	20-30	**43**
OZMW-22I2	35-45	ND
OZMW-25I	20-30	**198**
OZMW-25I2	35-45	**91**

LEGEND:

⊕ OU2MW-01S OU2MW-01I OU2MW-01I2 OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND (highlighted)	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
(yellow line)	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(black line)	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
(orange dashed line)	100 ug/L TOTAL BTEX ISO-CONCENTRATION LINE FROM Q1 2009 INTERMEDIATE ZONE
(brown line)	INSTALLED OXYGEN INJECTION LINE
(green line)	PLANNED OXYGEN INJECTION LINE

NOTE: BBMW-24I** (32-42' BGS) DOES NOT INTERCEPT THE DEPTH OF THE GROUNDWATER PLUME IN THIS AREA. THE PLUME IS LOCATED AT 25-30' BGS IN ADJACENT WELLS.

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
2. FIGURE 2, GROUNDWATER MONITORING WELL AND SURFACE WATER GAUGING STATION LOCATION MAP, BAY SHORE/BRIGHTWATERS FORMER MGP SITE, SCALE: 1"=200', DATED JANUARY 2004, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
3. DRAWING C-1, OFF-SITE SAMPLE LOCATION MAP, BAY SHORE/BRIGHTWATERS FINAL REMEDIAL INVESTIGATION, SCALE: 1"=200', DATED OCTOBER 15, 2003, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
4. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE AND MONITORING WELLS LOCATED NEAR OR AT PROPERTY BOUNDARIES DEPICTED ON THE MAP ARE WITHIN THE ROAD RIGHT-OF-WAY.

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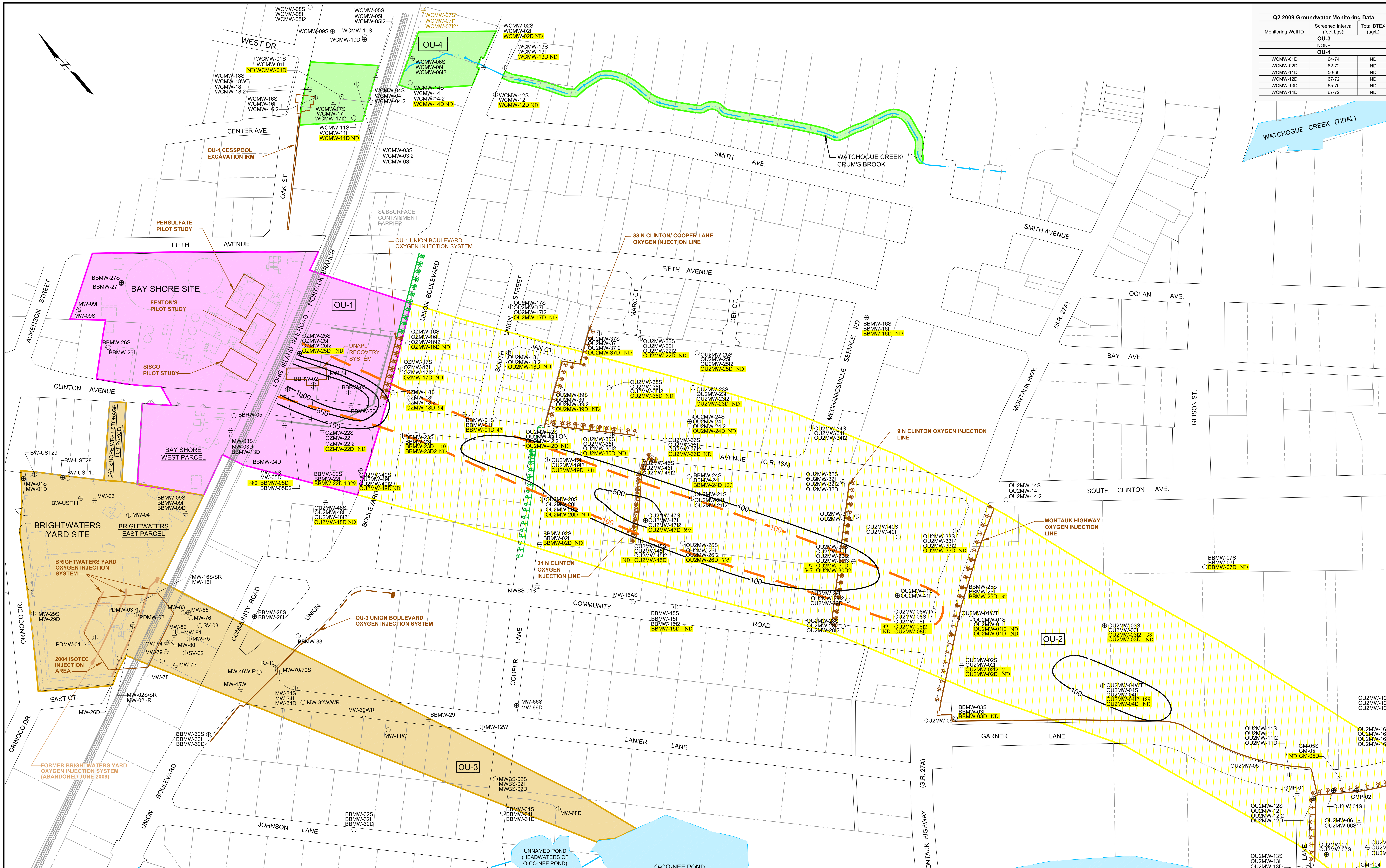
INTERMEDIATE GROUNDWATER BTEX ISO-CONCENTRATION MAP 10-50 FEET (bgs) Q2 2009 DATA

October 2009 — Figure 13

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\ISO-Concentrations\ BAY SHORE-BTEX & PAH PLUMES Q2 2009.dwg \Oct 23, 2009



LEGEND:

⊕ OU2MW-01S OU2MW-01I OU2MW-01I2 OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND (highlighted)	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
Yellow line	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
Black line	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
Orange dashed line	100 ug/L TOTAL BTEX ISO-CONCENTRATION LINE FROM Q1 2009 DEEP ZONE
Brown line	INSTALLED OXYGEN INJECTION LINE
Green line	PLANNED OXYGEN INJECTION LINE

Q2 2009 Groundwater Monitoring Data

Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-3		
NONE		
OU-4		
WCMW-01D	64-74	ND
WCMW-02D	62-72	ND
WCMW-11D	50-60	ND
WCMW-12D	67-72	ND
WCMW-13D	65-70	ND
WCMW-14D	67-72	ND

Q2 2009 Groundwater Monitoring Data

Monitoring Well ID	Screened Interval (feet bgs):	Total BTEX (ug/L)
OU-1 and OU-2		
BBMW-01D	68.5-78.5	**47**
BBMW-02D	73-83	ND
BBMW-03D	52-62	ND
BBMW-05D	64-74	**880**
BBMW-07D	55-65	ND
BBMW-15D	70-80	ND
BBMW-16D	68-78	ND
BBMW-22D	64-74	**4,329**
BBMW-23D	49.5-59.5	**10**
BBMW-23D2	63-73	ND
BBMW-24D	59.5-69.5	**107**
BBMW-25D	62-72	**32**
GM-05D	60.95-75.95	ND
OU2MW-01D	65-70	ND
OU2MW-01I2	50-55	ND
OU2MW-02D	65-70	ND
OU2MW-02I2	50-55	**2**
OU2MW-03D	65-70	ND
OU2MW-03I2	50-55	**38**
OU2MW-04D	65-70	ND
OU2MW-04I2	50-55	**189**
OU2MW-08D	65-70	ND
OU2MW-08I2	50-55	**39**
OU2MW-17D	60-70	ND
OU2MW-18D	60-70	ND
OU2MW-19D	65-70	**341**
OU2MW-20D	65-70	ND
OU2MW-22D	67-72	ND
OU2MW-23D	65-70	ND
OU2MW-24D	62-67	ND
OU2MW-25D	70-75	ND
OU2MW-26D	60-70	**335**
OU2MW-30D	50-55	**197**
OU2MW-30D2	60-65	**347**
OU2MW-33D	50-55	ND
OU2MW-35D	57-62	ND
OU2MW-36D	61-66	ND
OU2MW-37D	67-72	ND
OU2MW-38D	56-61	ND
OU2MW-39D	70-75	ND
OU2MW-42D	60-65	ND
OU2MW-45D	55-60	ND
OU2MW-47D	60-65	**695**
OU2MW-48D	65-70	ND
OU2MW-49D	63-68	ND
OZMW-16D	55-65	ND
OZMW-17D	53-63	ND
OZMW-18D	55-65	**94**
OZMW-22D	55-65	ND
OZMW-25D	55-65	ND

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
2. FIGURE 2, GROUNDWATER MONITORING WELL AND SURFACE WATER GAUGING STATION LOCATION MAP, BAY SHORE/BRIGHTWATERS FORMER MGP SITE, SCALE: 1"=200', DATED JANUARY 2004, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
3. DRAWING C-1, OFF-SITE SAMPLE LOCATION MAP, BAY SHORE/BRIGHTWATERS FINAL REMEDIAL INVESTIGATION, SCALE: 1"=200', DATED OCTOBER 15, 2003, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
4. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE AND MONITORING WELLS LOCATED NEAR OR AT PROPERTY BOUNDARIES DEPICTED ON THE MAP ARE WITHIN THE ROAD RIGHT-OF-WAY.

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DEEP GROUNDWATER BTEX ISO-CONCENTRATION MAP (BELOW 50 FEET bgs) Q2 2009 DATA

October 2009

Figure 14

I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\ISO-Concentrations\ BAY SHORE-BTEX & PAH PLUMES Q2 2009.dwg \Oct 23, 2009

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAH (ug/L)
OU-3		
BBMW-09S	5-15	ND
BBMW-28S	2-12	ND
BBMW-29	2-9	ND
BBMW-33	7-12	ND
BW-UST-10	4.65-9.95	ND
BW-UST-11	4.4-9.4	ND
BW-UST-28	5-10	ND
BW-UST-29	5-10	ND
IO-10	6-16	ND
MW-01S	4-14	ND
MW-02S/SR	2-12	ND
MW-03	4.94-14.94	ND
MW-04	5.1-15.1	ND
MW-11W	2-10	ND
MW-12W	2-12	ND
MW-16S/SR	2-12	**143**
MW-29S	2-10	ND
MW-30WR	2-10	ND
MW-32W/WR	2-9	**6**
MW-34S	2-10	**105**
MW-45W	2-10	**153**
MW-46W-R	2-10	**60**
MW-66S	1.5-11.5	ND
MW-70/70S	2-12	**8**
MW-73	2-12	**1,308**
MW-75	2-12	**101**
MW-76	2-12	ND
MW-78	5-20	**191**
MW-79	5-20	ND
MW-80	5-20	**562**
MW-81	5-20	ND
MW-82	5-20	ND
MW-83	5-20	ND
MW-BS-02S	5-15	**1**
PDMW-01	5-20	ND
PDMW-02	5-20	**3,206**
PDMW-03	5-15	**2,108**
SV-02	2-12	ND
SV-03	2-12	ND
OU-4		
WCMW-01S	2-12	**16**
WCMW-02S	3-13	**5**
WCMW-03S	4.83-9.83	**358**
WCMW-04S	1.6-11.6	**16**
WCMW-05S	1.15-11.15	**7**
WCMW-06S	2-12	ND
WCMW-09S	5-15	ND
WCMW-10S	15-20	ND
WCMW-11S	5-15	**624**
WCMW-12S	3-13	**13**
WCMW-13S	3-13	ND
WCMW-14S	2-12	**6**
WCMW-16S	2-12	**22**
WCMW-17S	2-12	**295**
WCMW-18S	Water Table*	ND
WCMW-18WT	Water Table*	ND

Water Table* This exact well screen depth is unknown

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAH (ug/L)
OU-1 and OU-2		
BBMW-01S	5-15	**119**
BBMW-02S	5-15	ND
BBMW-03S	3-13	ND
BBMW-07S	5-15	ND
BBMW-15S	5-15	ND
BBMW-16S	5-15	ND
BBMW-22S	5-10	**986**
BBMW-23S	5-15	**2,456**
BBMW-24S	4-14	ND
BBMW-25S	4-14	ND
BBMW-27S	5-15	ND
GM-05S	5.1-20.1	**19**
MW-03S	3-13	ND
MW-05S	4-14	**1**
MW-09S	4-14	ND
OU2IW-01S	3-8	ND
OU2MW-01WT	3-8	ND
OU2MW-04WT	3-8	ND
OU2MW-06S	3-8	ND
OU2MW-07S	3-8	ND
OU2MW-08WT	3-8	ND
OU2MW-10S	3-7	ND
OU2MW-11S	3-8	ND
OU2MW-12S	3-7	ND
OU2MW-13S	3-8	ND
OU2MW-14S	3-8	ND
OU2MW-15S	3-8	ND
OU2MW-16S	3-8	ND
OU2MW-17S	5-10	ND
OU2MW-20S	4-9	ND
OU2MW-21S	5-15	**9**
OU2MW-22S	5-15	ND
OU2MW-23S	5-15	ND
OU2MW-24S	5-15	ND
OU2MW-25S	5-15	ND
OU2MW-26S	6-11	ND
OU2MW-28S	5-15	**1**
OU2MW-30S	5-15	ND
OU2MW-32S	5-15	ND
OU2MW-33S	5-15	ND
OU2MW-34S	5-15	ND
OU2MW-35S	5-15	ND
OU2MW-36S	5-15	ND
OU2MW-37S	5-15	**3**
OU2MW-38S	5-15	ND
OU2MW-39S	5-15	ND
OU2MW-40S	5-15	ND
OU2MW-41S	5-15	ND
OU2MW-42S	5-15	**107**
OU2MW-45S	5-15	ND
OU2MW-46S	5-15	ND
OU2MW-47S	5-15	ND
OU2MW-48S	3-13	**3**
OU2MW-49S	3-13	ND
OU2MW-52S	3-8	ND
OU2MW-53S	3-8	ND
OZMW-16S	5-15	ND
OZMW-17S	5-15	ND
OZMW-18S	5-15	ND
OZMW-22S	5-15	**971**
OZMW-25S	5-15	**4,595**

LEGEND:

OU2MW-01S, OU2MW-01I, OU2MW-01I2, OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND (highlighted)	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
(yellow line)	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(black line)	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
(orange dashed line)	100 ug/L TOTAL PAH ISO-CONCENTRATION LINE FROM Q1 2009 WATER TABLE ZONE
(brown line)	INSTALLED OXYGEN INJECTION LINE
(green line)	PLANNED OXYGEN INJECTION LINE

SOURCES:
1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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WATER TABLE GROUNDWATER PAH ISO-CONCENTRATION MAP Q2 2009 DATA

October 2009

Figure 15

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAH (ug/L)
OU-3		
BBMW-28I	10-20	ND
MW-01D	35-45	ND
MW-02I-R	22.5-23.5	ND
MW-16I	14-19	ND
MW-26D	14-19	ND
MW-29D	14-19	ND
MW-34D	27.5-28.5	ND
MW-34I	18.5-19.5	ND
MW-64	19-24	**9**
MW-65	11-16	ND
MW-66D	24-29	ND
MW-BS-02D	24.5-25.5	ND
MW-BS-02I	14.5-15.5	ND
OU-4		
WCMW-01I	35-45	ND
WCMW-02I	34.5-44.5	ND
WCMW-03I	19.4-24.4	**1,146**
WCMW-03I2	28.55-33.55	**2**
WCMW-04I	19-24	**108**
WCMW-04I2	29.85-34.85	ND
WCMW-05I	19.61-24.61	**241**
WCMW-05I2	29.46-34.46	**48**
WCMW-06I	19.55-24.55	ND
WCMW-06I2	29.83-34.83	ND
WCMW-10D	40-50	ND
WCMW-11I	25-35	ND
WCMW-12I	25-30	**5**
WCMW-13I	25-30	ND
WCMW-14I	20-25	**50**
WCMW-14I2	30-35	**11**
WCMW-16I	20-25	**18**
WCMW-16I2	30-35	**4**
WCMW-17I	20-25	**292**
WCMW-17I2	30-35	ND
WCMW-18I	INTERMEDIATE*	ND
WCMW-18I2	INTERMEDIATE*	ND

INTERMEDIATE* This exact well screen depth is unknown

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAH (ug/L)
OU-1 and OU-2		
BBMW-01I	32-42	**10,202**
BBMW-02I	30-40	ND
BBMW-03I	30-40	ND
BBMW-07I	30-40	ND
BBMW-15I	23-28	ND
BBMW-15I2	35-45	ND
BBMW-16I	35-45	ND
BBMW-20I	35-45	**137**
BBMW-22I	30-40	**6,539**
BBMW-23I	33-43	**2**
BBMW-24I	32-42	**1,027**
BBMW-25I	25-35	**1,219**
BBMW-27I	30-40	ND
GM-05I	35.05-48.05	ND
GMP-01	25-30	**1,049**
GMP-02	28-23	ND
GMP-04	15.5-20.5	ND
MW-03D	35-45	ND
MW-05D	35.5-45.5	**9**
OU2MW-01I	35-40	**702**
OU2MW-01S	20-25	**1,487**
OU2MW-02I	35-40	**1,993**
OU2MW-02S	20-25	**146**
OU2MW-03I	35-40	ND
OU2MW-03S	20-25	**157**
OU2MW-04I	35-40	**2**
OU2MW-04S	20-25	**3,565**
OU2MW-05	25-35	**376**
OU2MW-06	15-25	ND
OU2MW-07	15-25	ND
OU2MW-08I	35-40	**7,615**
OU2MW-08S	20-25	**4,661**
OU2MW-09	20-30	ND
OU2MW-10D	35-40	**1**
OU2MW-10I	20-25	**22**
OU2MW-11D	40-45	ND
OU2MW-11I	20-25	**428**
OU2MW-11I2	30-35	**131**
OU2MW-12D	40-45	ND
OU2MW-12I	20-25	**53**
OU2MW-12I2	30-35	**39**
OU2MW-13D	35-40	**18**
OU2MW-13I	20-25	**6**
OU2MW-14I	20-25	ND
OU2MW-14I2	45-50	ND
OU2MW-15D	40-45	ND
OU2MW-15I	20-25	**1**
OU2MW-15I2	30-35	ND
OU2MW-16D	35-40	ND
OU2MW-16I	15-20	ND
OU2MW-16I2	25-30	ND
OU2MW-17I	13-23	**24**
OU2MW-17I2	35-40	ND
OU2MW-18I	13-23	**5,201**
OU2MW-18I2	35-45	ND
OU2MW-19I	13-23	**92**
OU2MW-19I2	35-45	**6,811**
OU2MW-20I	13-23	ND
OU2MW-20I2	35-45	ND
OU2MW-21I	13-23	**85**
OU2MW-21I2	35-45	**1,244**
OU2MW-22I	25-30	ND

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAH (ug/L)
OU-1 and OU-2		
OU2MW-22I2	46-51	ND
OU2MW-23I	25-30	**63**
OU2MW-23I2	45-50	ND
OU2MW-24I	25-30	**1,068**
OU2MW-24I2	45-50	ND
OU2MW-25I	25-30	**133**
OU2MW-25I2	45-50	ND
OU2MW-26I	13-23	ND
OU2MW-26I2	35-45	**26**
OU2MW-28I	28-33	ND
OU2MW-28I2	40-45	ND
OU2MW-29I	18-23	**513**
OU2MW-29I2	30-35	**6,117**
OU2MW-29D	45-50	**2,842**
OU2MW-30I	25-30	**2,186**
OU2MW-30I2	30-35	**4,696**
OU2MW-30I3	45-50	**5,586**
OU2MW-31I	18-23	**137**
OU2MW-31I2	30-35	**841**
OU2MW-32D	40-45	**32**
OU2MW-32I	20-25	**7,796**
OU2MW-32I2	30-35	**408**
OU2MW-33I	20-25	**158**
OU2MW-33I2	30-35	**14**
OU2MW-34I	25-30	**333**
OU2MW-34I2	45-50	ND
OU2MW-35I	25-30	**8**
OU2MW-35I2	45-50	ND
OU2MW-36I	25-30	**325**
OU2MW-36I2	45-50	ND
OU2MW-37I	25-30	**216**
OU2MW-37I2	45-50	**3**
OU2MW-38I	25-30	**206**
OU2MW-38I2	46-51	ND
OU2MW-39I	25-30	**3**
OU2MW-39I2	45-50	**55**
OU2MW-40I	18-23	**71**
OU2MW-41I	18-23	**540**
OU2MW-42I	25-30	**2**
OU2MW-42I2	45-50	ND
OU2MW-45I	20-25	**5**
OU2MW-45I2	40-45	ND
OU2MW-46I	20-25	**12**
OU2MW-46I2	40-45	**56**
OU2MW-47I	20-25	**4**
OU2MW-47I2	40-45	**8**
OU2MW-48I	25-30	ND
OU2MW-48I2	45-50	ND
OU2MW-49I	25-30	ND
OU2MW-49I2	45-50	ND
OU2MW-52I	20-25	**101**
OU2MW-53I	20-25	ND
OZMW-16I	20-30	**72**
OZMW-16I2	35-40	**178**
OZMW-17I	20-30	**12**
OZMW-17I2	35-45	**62**
OZMW-18I	20-30	**149**
OZMW-18I2	35-45	**8,917**
OZMW-22I	20-30	ND
OZMW-22I2	35-45	ND
OZMW-25I	20-30	**3,276**
OZMW-25I2	35-45	**29**

LEGEND:

OU2MW-01S OU2MW-01I OU2MW-01I2 OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
	100 ug/L TOTAL PAH ISO-CONCENTRATION LINE FROM Q1 2009 INTERMEDIATE ZONE
	INSTALLED OXYGEN INJECTION LINE
	PLANNED OXYGEN INJECTION LINE

0 120 240
SCALE, FEET

SOURCES:
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FORMER MGP SITE
BAY SHORE, NEW YORK

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INTERMEDIATE GROUNDWATER PAH ISO-CONCENTRATION MAP 10-50 FEET (BGS) Q2 2009 DATA

October 2009 Figure 16

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAHs (ug/L)
OU-3		
NONE		
OU-4		
WCMW-01D	64-74 ft	ND
WCMW-02D	62-72 ft	ND
WCMW-11D	50-60 ft	ND
WCMW-12D	67-72 ft	ND
WCMW-13D	65-70 ft	ND
WCMW-14D	67-72 ft	**2**

Q2 2009 Groundwater Monitoring Data		
Monitoring Well ID	Screened Interval (feet bgs):	Total PAHs (ug/L)
OU-1 and OU-2		
BBMW-01D	68.5-78.5 ft	**92**
BBMW-02D	73-83 ft	ND
BBMW-03D	52-62 ft	ND
BBMW-05D	64-74 ft	**2767**
BBMW-07D	55-65 ft	ND
BBMW-15D	70-80 ft	ND
BBMW-16D	68-78 ft	ND
BBMW-22D	64-74 ft	**8539**
BBMW-23D	49.5-59.5 ft	**31**
BBMW-23D2	63-73 ft	ND
BBMW-24D	59.5-69.5 ft	**13**
BBMW-25D	62-72 ft	ND
GM-05D	60.95-75.95 ft	ND
OU2MW-01D	65-70 ft	ND
OU2MW-01I2	50-55 ft	ND
OU2MW-02D	65-70 ft	ND
OU2MW-02I2	50-55 ft	ND
OU2MW-03D	65-70 ft	ND
OU2MW-03I2	50-55 ft	ND
OU2MW-04D	65-70 ft	ND
OU2MW-04I2	50-55 ft	**1340**
OU2MW-08D	65-70 ft	ND
OU2MW-08I2	50-55 ft	ND
OU2MW-17D	60-75 ft	ND
OU2MW-18D	60-70 ft	ND
OU2MW-19D	65-70 ft	**2841**
OU2MW-20D	65-70 ft	ND
OU2MW-22D	67-72 ft	ND
OU2MW-23D	65-70 ft	ND
OU2MW-24D	62-67 ft	ND
OU2MW-25D	70-75 ft	ND
OU2MW-26D	60-70 ft	**3482**
OU2MW-30D	50-55 ft	**4681**
OU2MW-30D2	60-65 ft	**2274**
OU2MW-33D	50-55 ft	ND
OU2MW-35D	57-62 ft	ND
OU2MW-36D	61-66 ft	ND
OU2MW-37D	67-72 ft	ND
OU2MW-38D	56-61 ft	ND
OU2MW-39D	70-75 ft	ND
OU2MW-42D	60-65 ft	**4**
OU2MW-45D	55-60 ft	ND
OU2MW-47D	60-65 ft	**6751**
OU2MW-48D	65-70 ft	ND
OU2MW-49D	63-68 ft	ND
OZMW-16D	55-65 ft	ND
OZMW-17D	53-63 ft	ND
OZMW-18D	55-65 ft	**1166**
OZMW-22D	55-65 ft	ND
OZMW-25D	55-65 ft	ND

LEGEND:

OU2MW-01S OU2MW-01I OU2MW-01I2 OU2MW-01D	EXISTING MONITORING WELL CLUSTER LOCATION S=SHALLOW I=INTERMEDIATE I2= INTERMEDIATE TWO D=DEEP
ND (highlighted)	INDICATES WELL AND CONCENTRATION (ug/L) USED FOR PLUME INTERVAL
ND	NON-DETECT
ug/L	MICROGRAMS PER LITER
BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
(yellow line)	OU-2 EXTENT FROM 2004 RI BASED ON >100 ug/L TOTAL BTEX OR >100 ug/L TOTAL PAHs DETECTED IN GROUNDWATER
(black line)	ISO-CONCENTRATION LINE BASED ON Q2 2009 DATA (ug/L)
(orange dashed line)	100 ug/L TOTAL PAH ISO-CONCENTRATION LINE FROM Q1 2009 DEEP ZONE
(brown line)	INSTALLED OXYGEN INJECTION LINE
(green line)	PLANNED OXYGEN INJECTION LINE

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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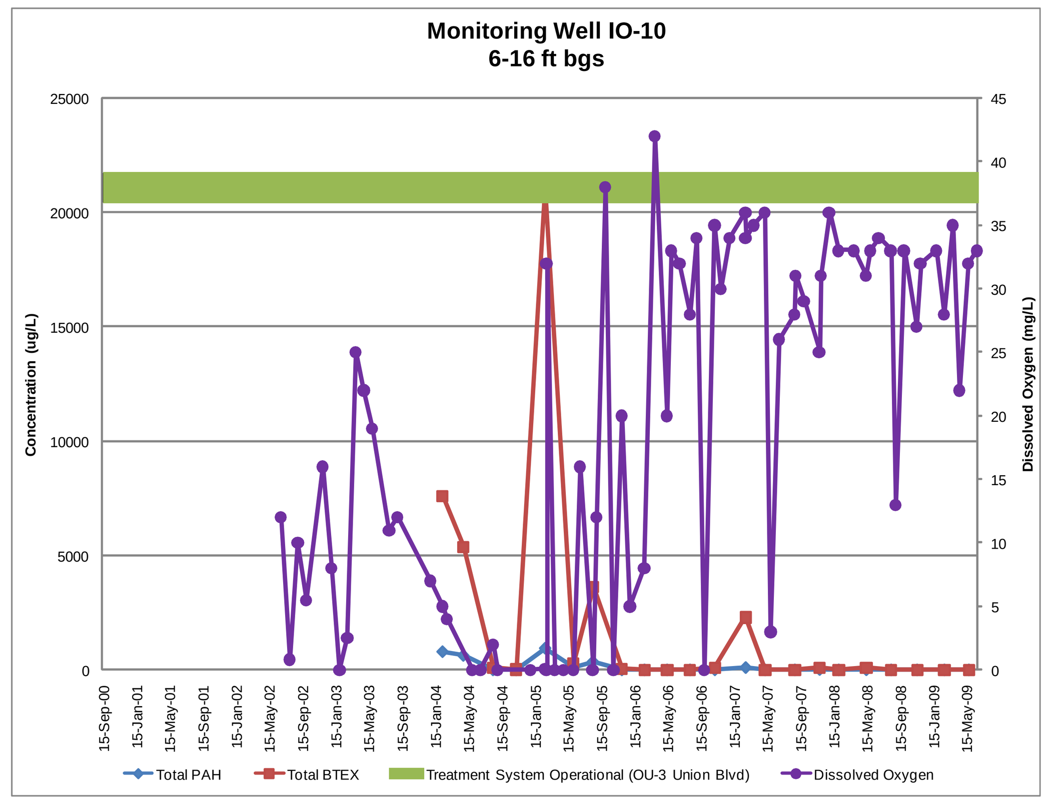
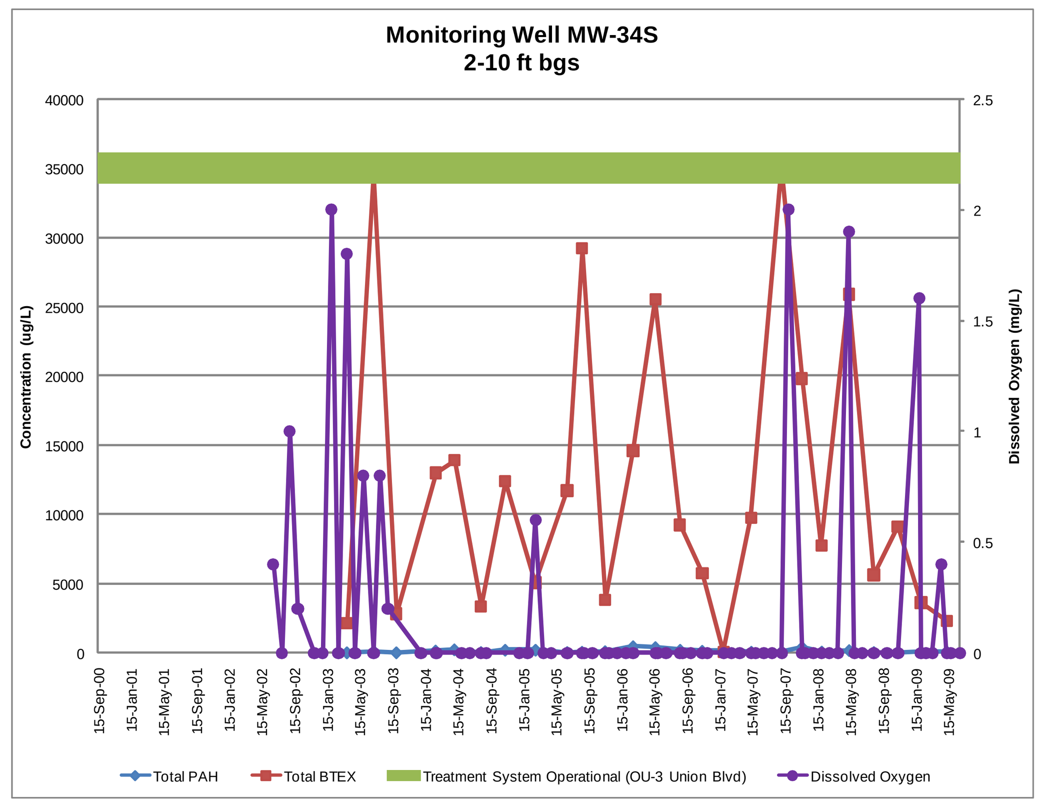
DEEP GROUNDWATER PAH ISO-CONCENTRATION MAP (BELOW 50 FEET bgs) Q2 2009 DATA

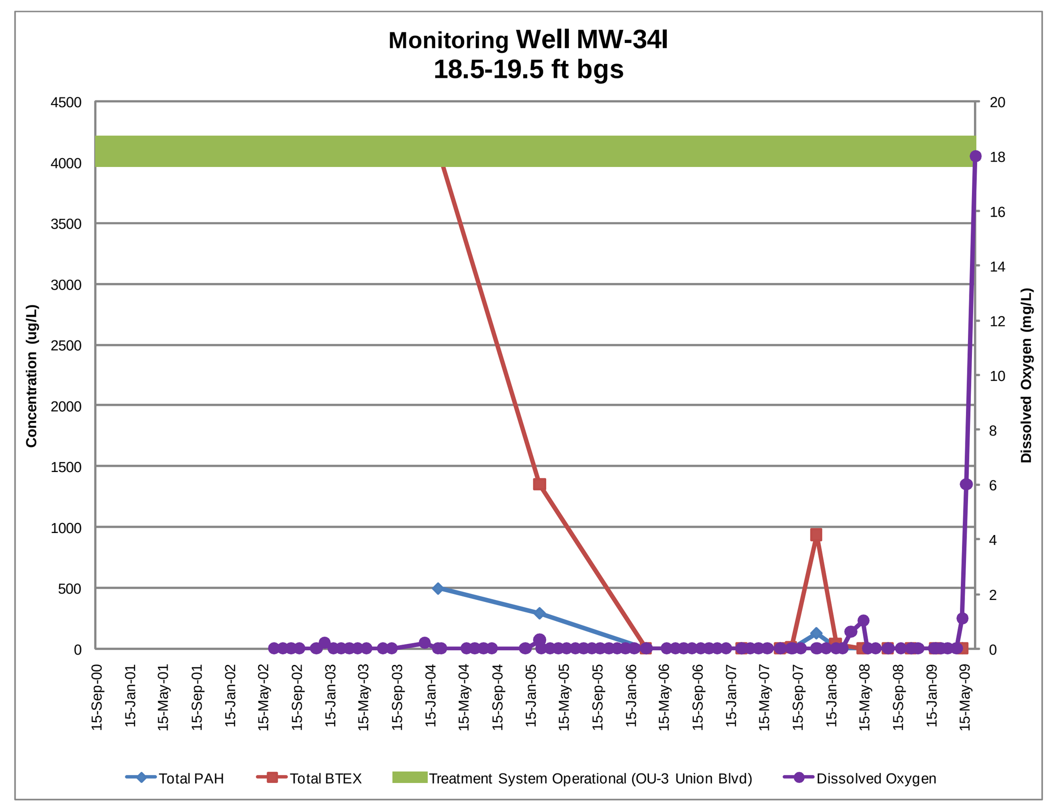
October 2009

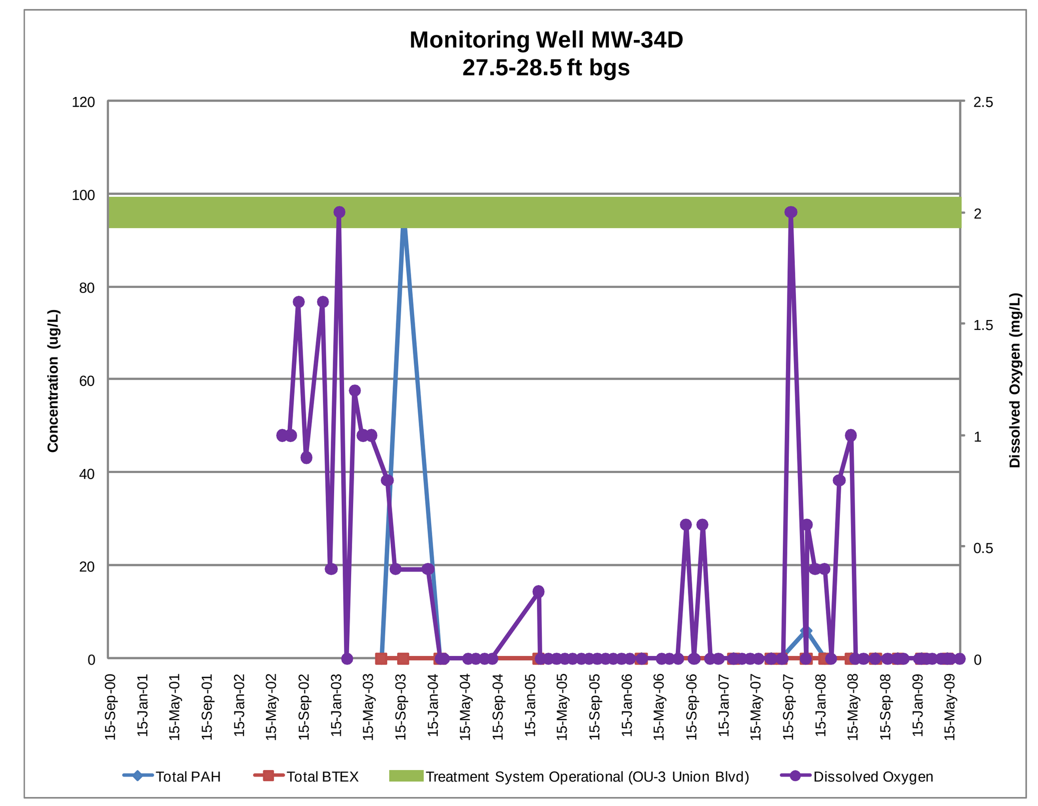
Figure 17

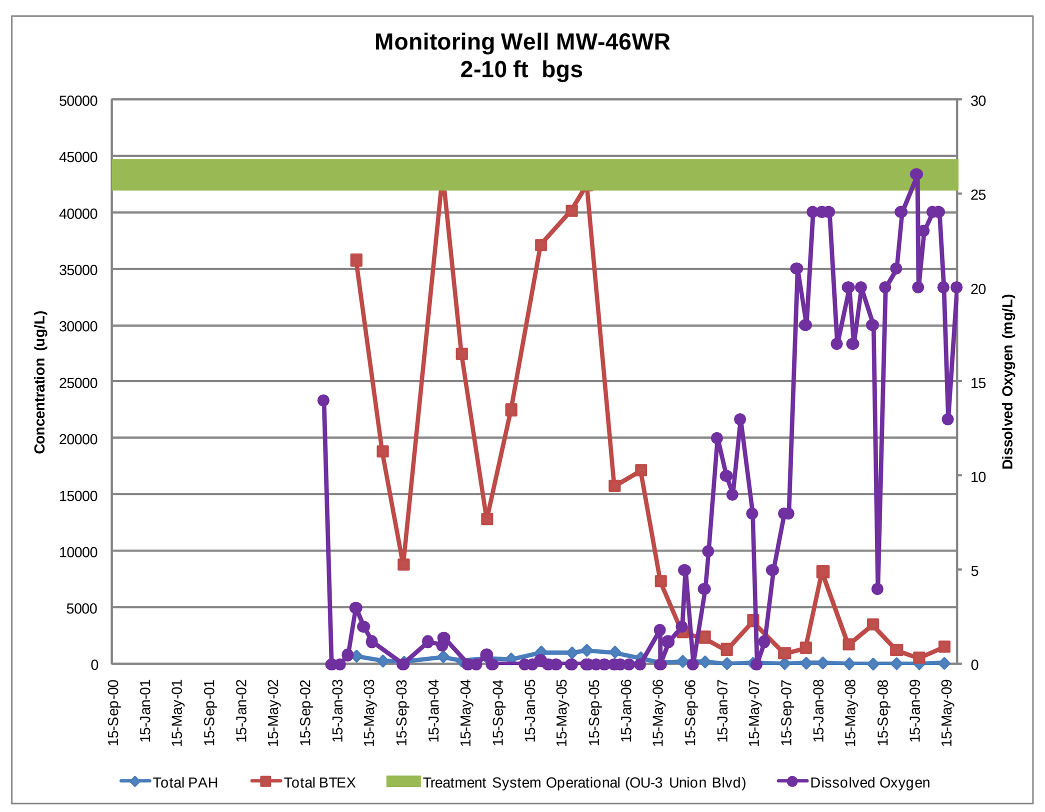
I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\ISO-Concentrations\ BAY SHORE-BTEX & PAH PLUMES Q2 2009.dwg \Oct 23, 2009

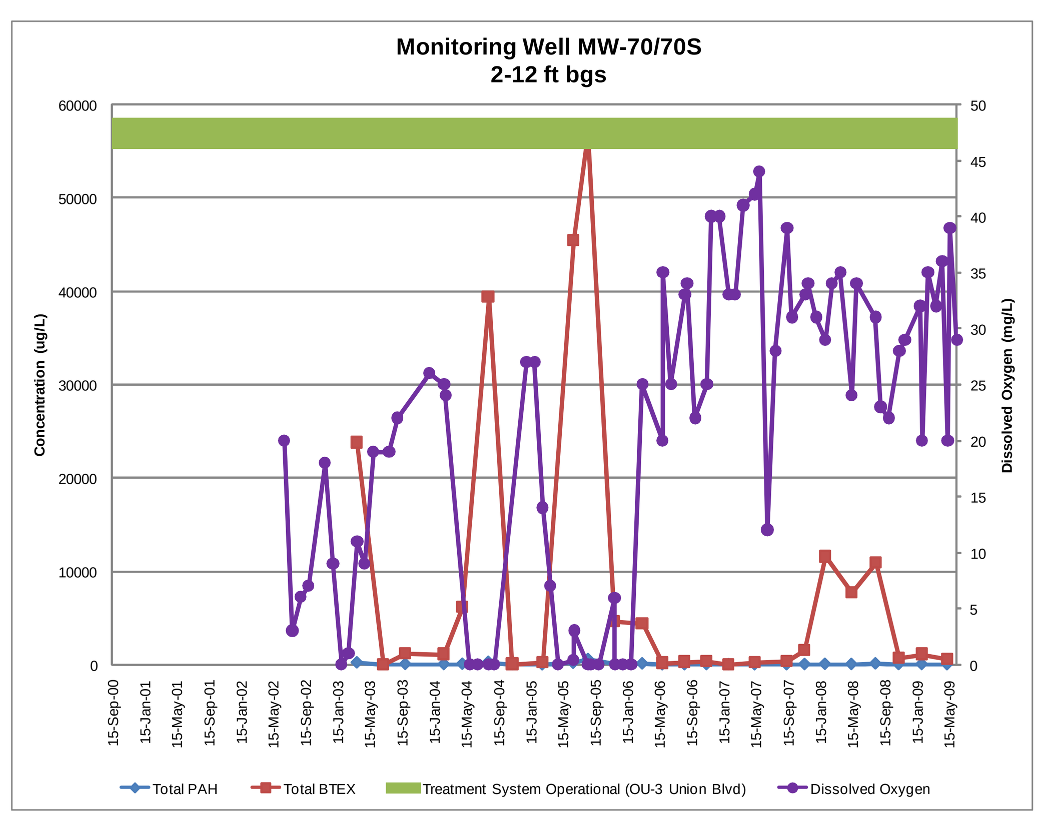


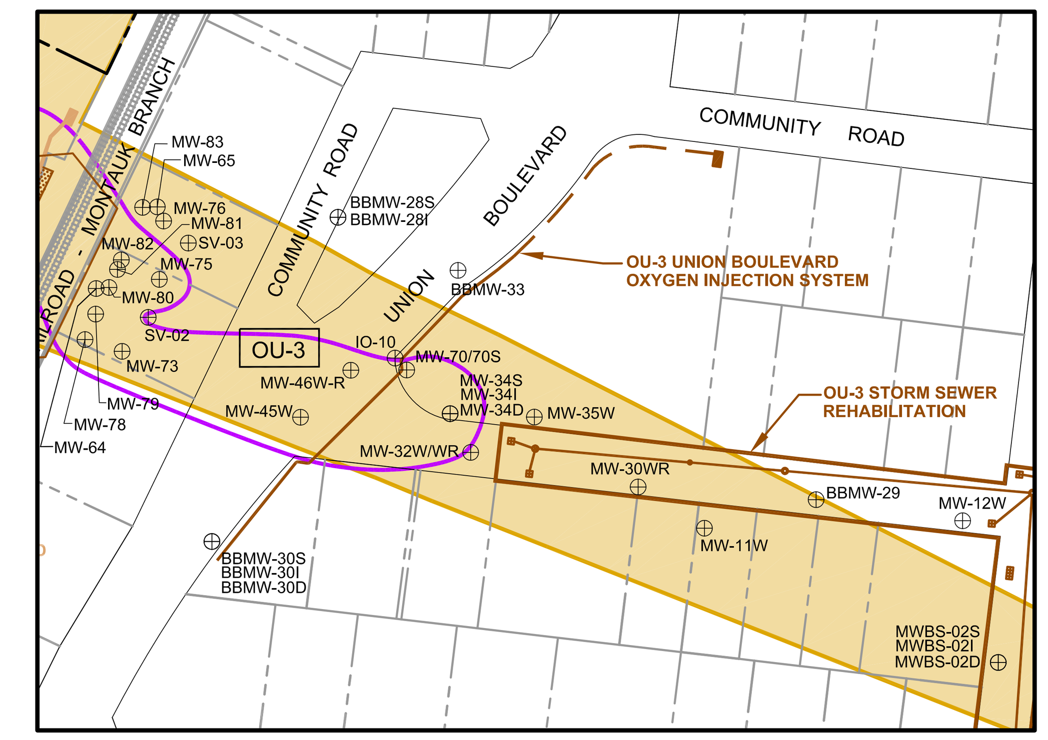












0 150 300
SCALE, FEET

MAP LEGEND:

BBMW-30 S,I,D	ACTIVE MONITORING WELL LOCATION USED SHALLOW, INTERMEDIATE, DEEP
	Q2 PLUME BOUNDARY

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1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
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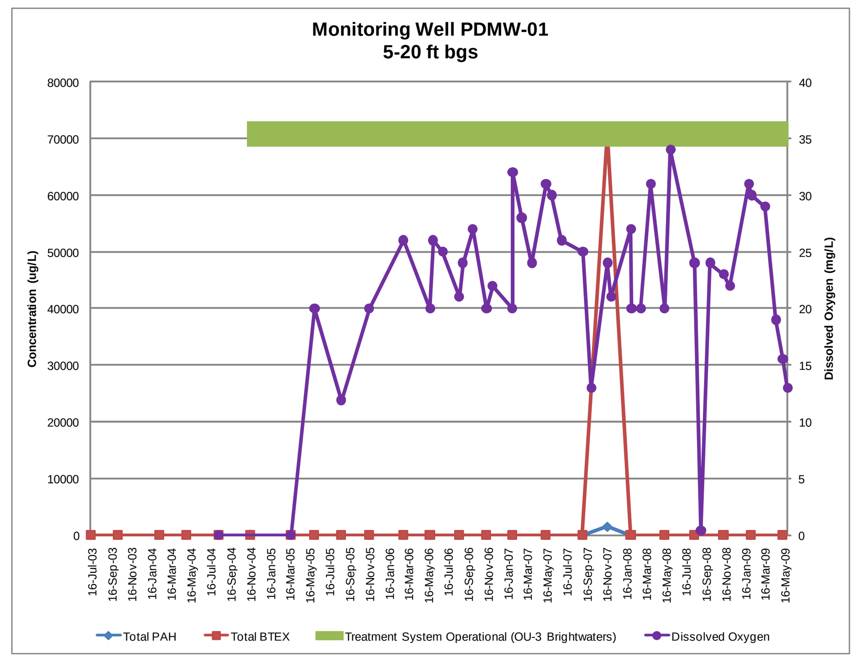
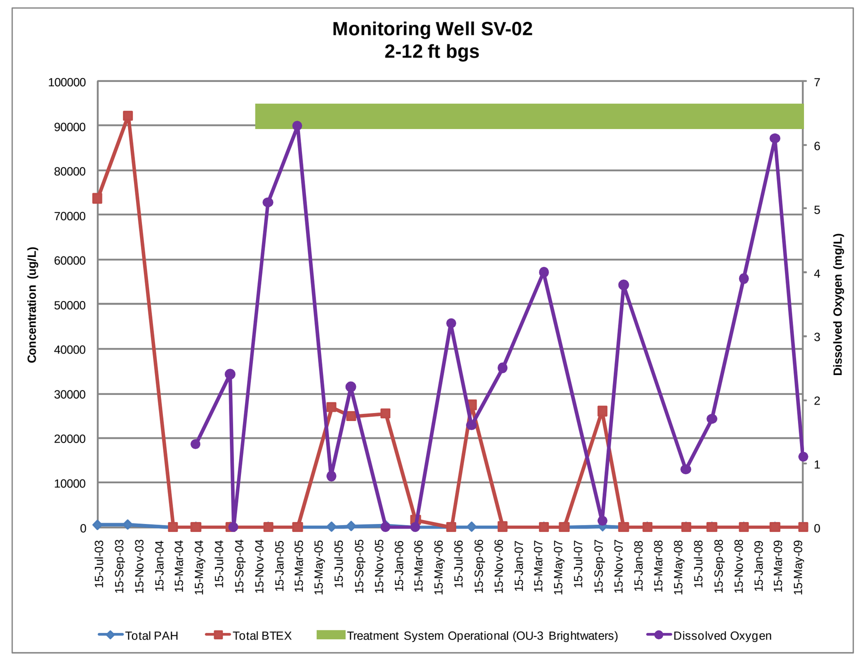
OU-3 UNION BOULEVARD OXYGEN INJECTION SYSTEM GROUNDWATER DATA

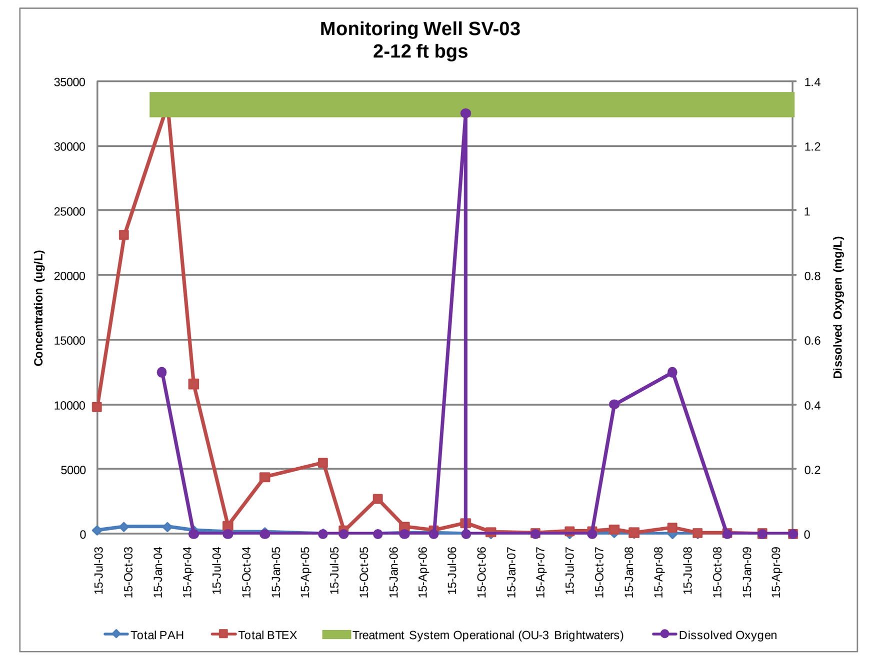
October 2009

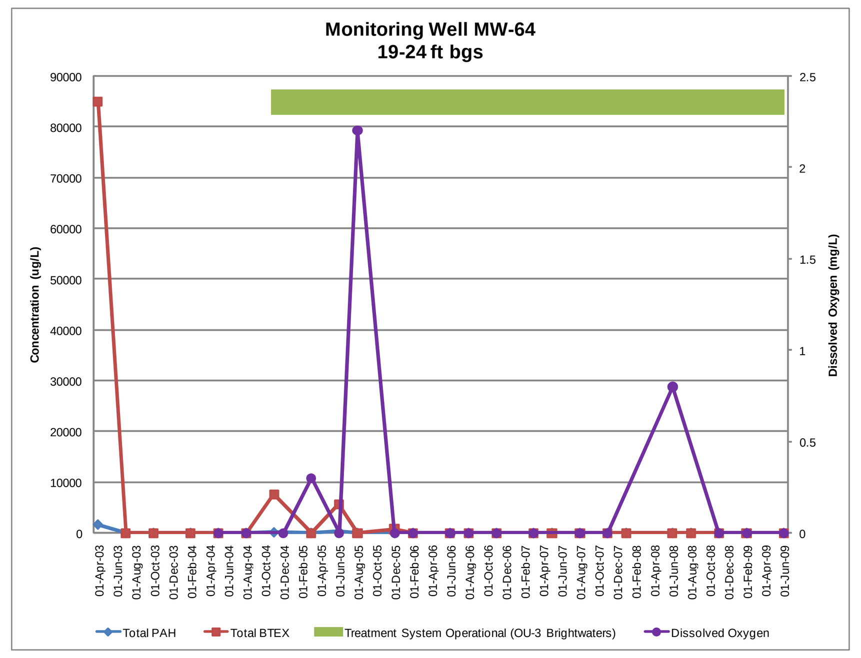
Figure 18

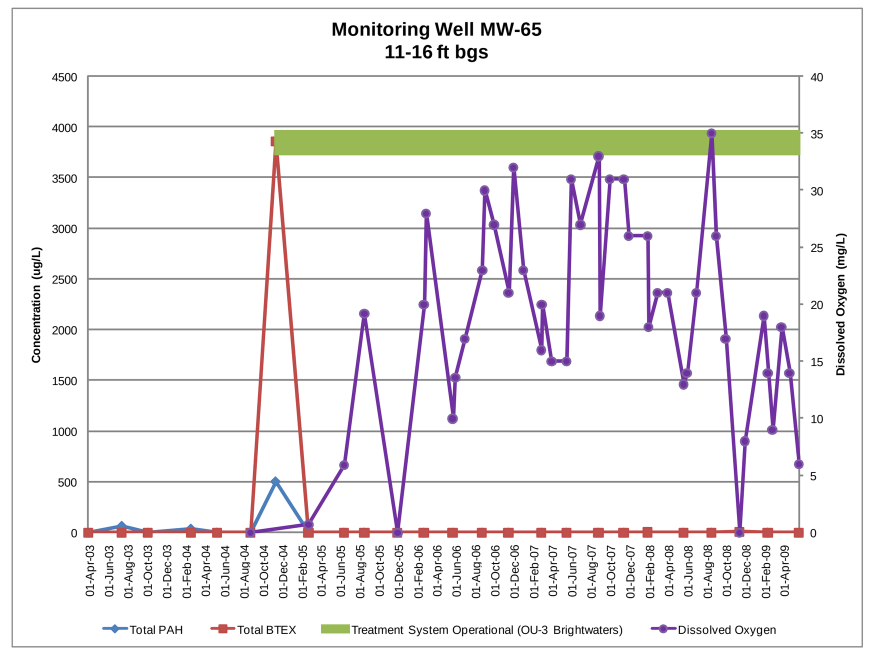
I:\GEI\National Grid\Bay Shore\Groundwater-Quarterly Monitoring\2009\OMM Graphs\ Bay Shore-Graphs Q-2 2009.dwg \Oct 15, 2009

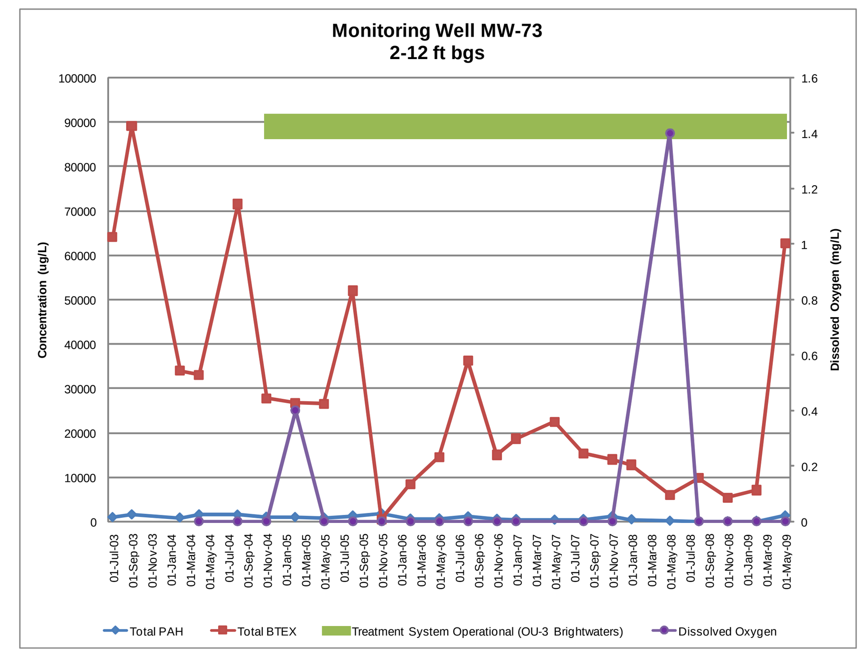


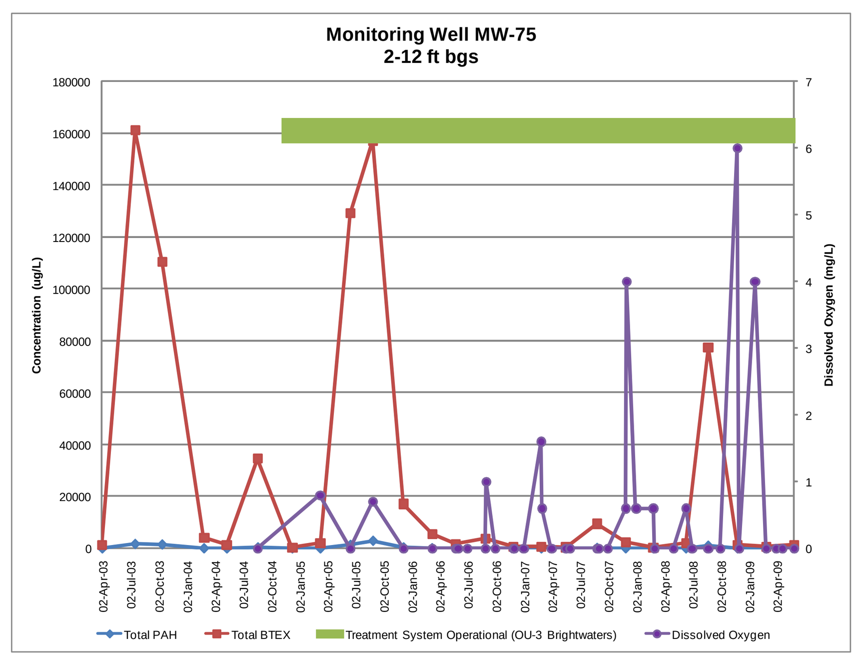


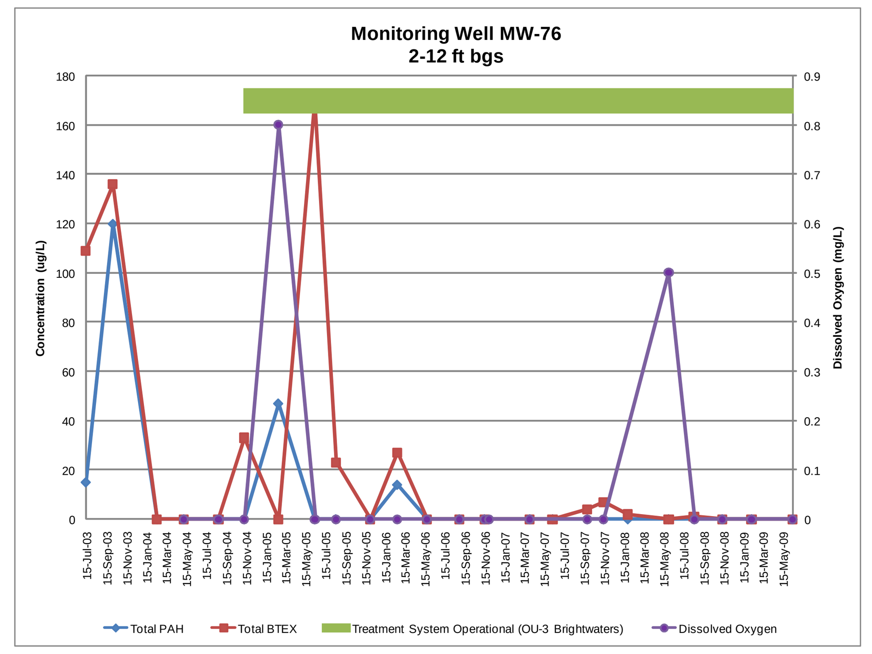


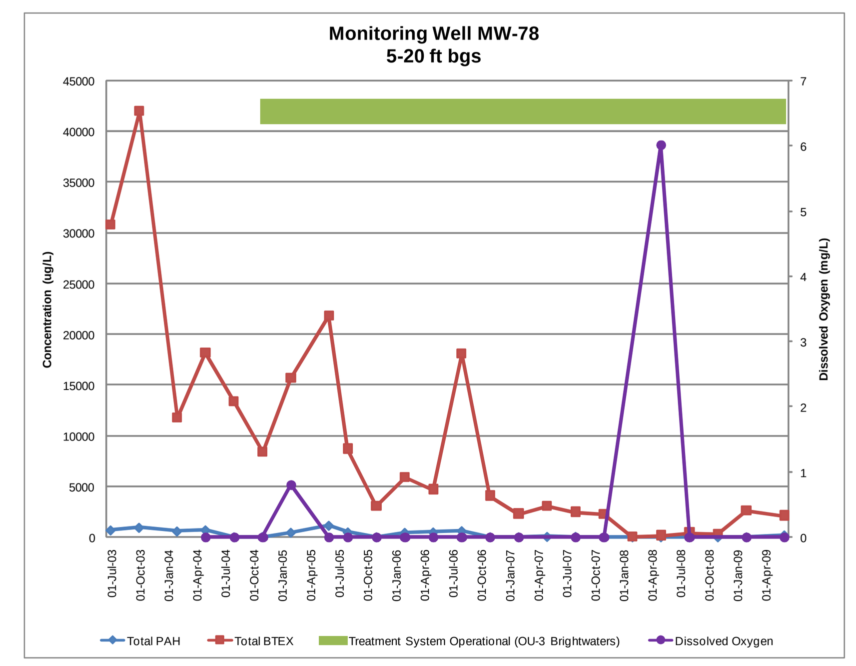


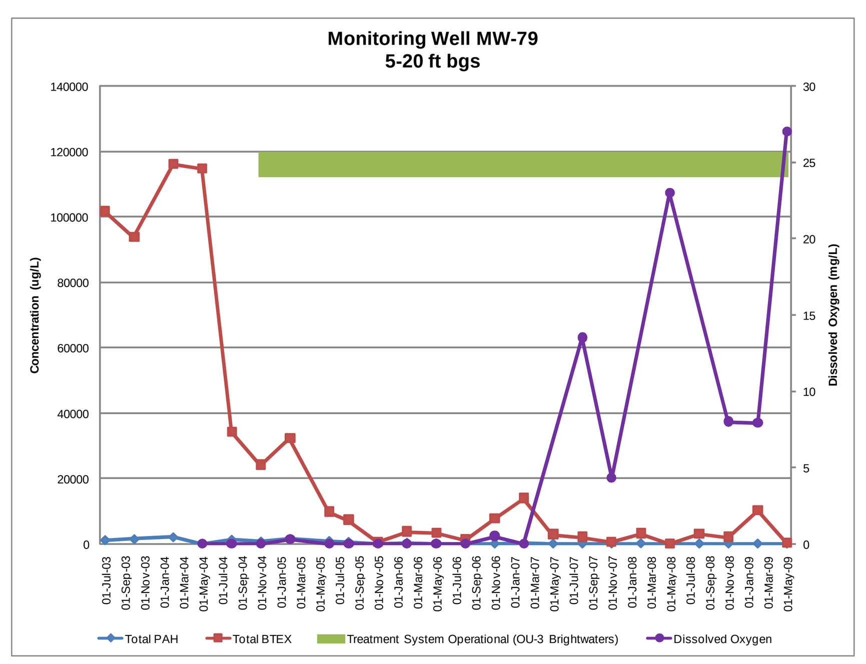


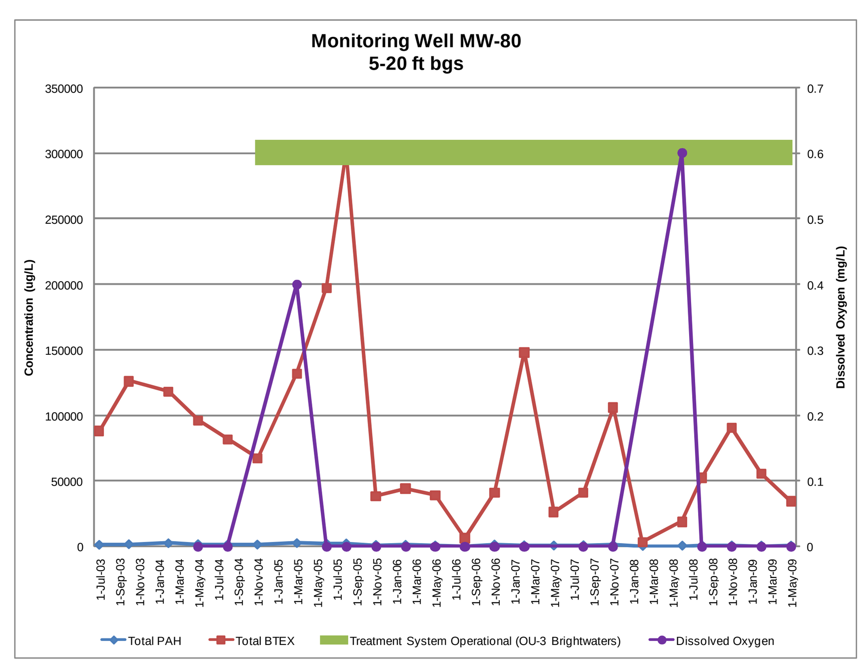


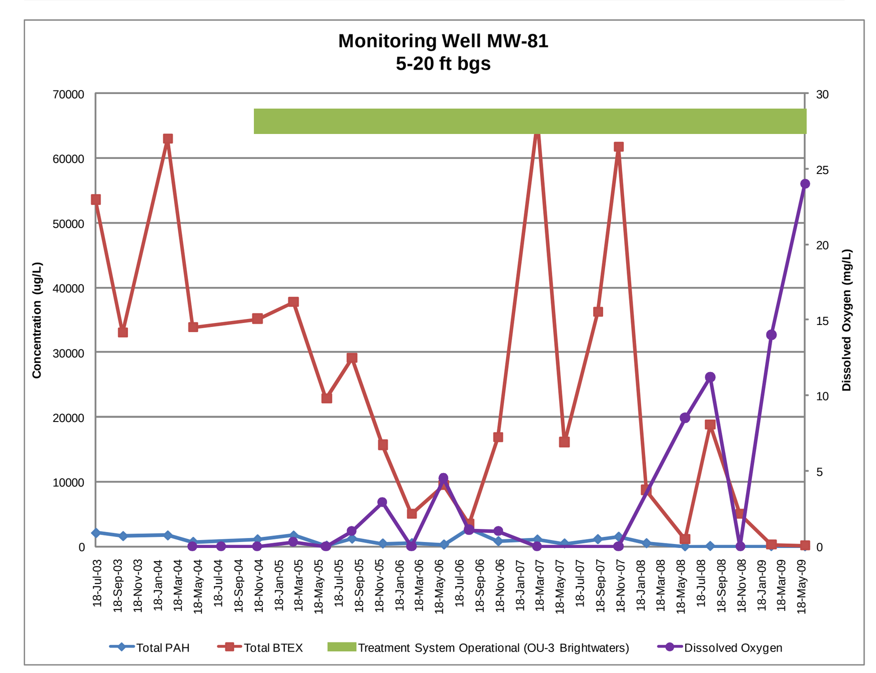


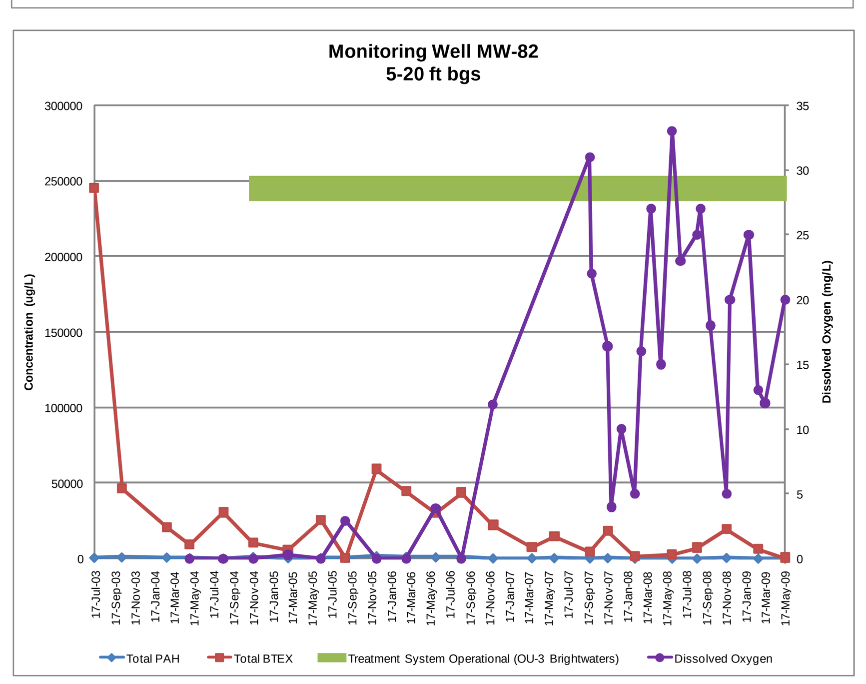


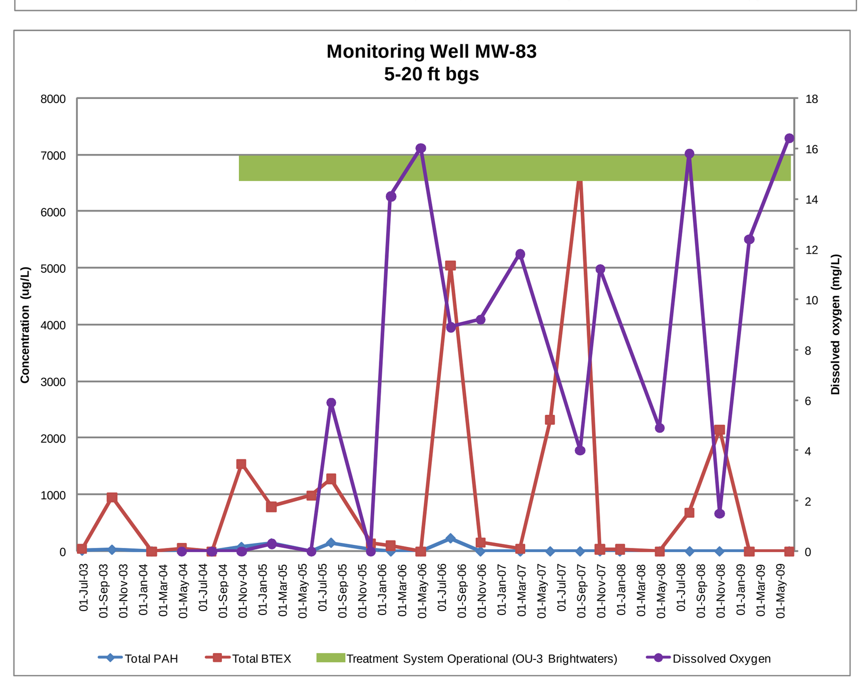


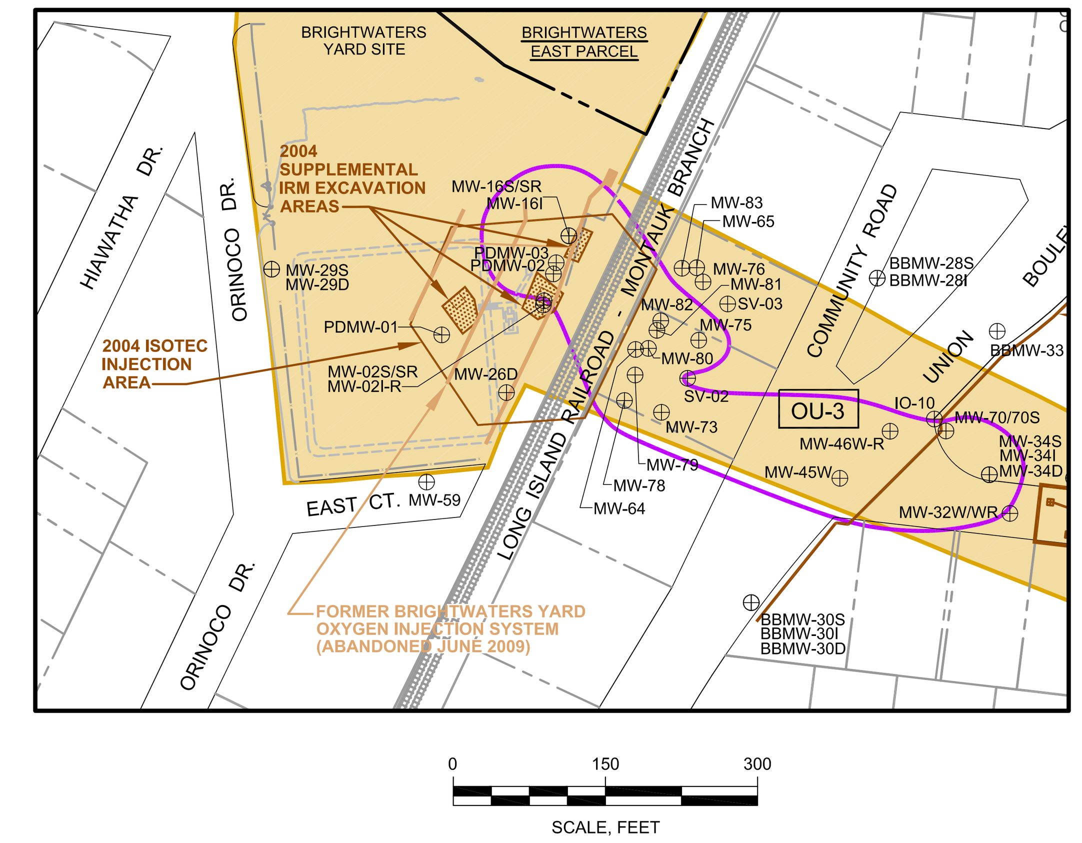












MAP LEGEND:

MW-34 S,I,D — ACTIVE MONITORING WELL LOCATION SHALLOW, INTERMEDIATE, DEEP

Q2 PLUME BOUNDARY

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BAY SHORE/BRIGHTWATERS FORMER MGP SITE BAY SHORE, NEW YORK nationalgrid Project 093180-5-1506	GEI Consultants 110 WALT WHITMAN ROAD SUITE 204 HUNTINGTON STATION, NY 11746	**OU-3 BRIGHTWATERS YARD OXYGEN INJECTION SYSTEM GROUNDWATER DATA** October 2009 Figure 19

Appendices A, B, C, D and E (electronic only)

Appendix A: OU-1 Oxygen Injection System OM&M Data

Appendix B: OU-2 Oxygen Injection System OM&M Data

Appendix C: OU-3 Oxygen Injection Systems OM&M Data

Appendix D: Soil Vapor Analytical Results

Appendix E: Time Series Plots of Analytical Results for Groundwater Monitoring Wells