

Prepared for

DuPont Corporate Remediation Group
Wilmington, Delaware

**INTERIM REMEDIAL MEASURE WORK
PLAN FOR GROUNDWATER
NEAR WELL 128
POMPTON LAKES WORKS
POMPTON LAKES, NEW JERSEY**

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TABLE OF CONTENTS

1. INTRODUCTION1

 1.1 Site Conditions.....2

 1.1.1 Site Hydrogeology3

 1.1.2 Groundwater Chemistry3

 1.2 Objectives4

 1.3 Implementation Steps.....4

2. IMPLEMENTATION.....6

 2.1 Overview.....6

 2.2 Permits6

 2.3 Install Extraction and Injection Wells.....6

 2.4 Install Multilevel Monitoring Wells and Soil Gas Probe.....7

 2.5 Hydraulic Assessments8

 2.5.1 Hydraulic Conductivity (Slug Testing).....8

 2.5.2 Hydraulic Conductivity (Short Duration Pump Testing).....8

 2.5.3 Hydraulic Tomography8

 2.5.4 Tracer Testing9

 2.6 Numerical Simulation10

 2.7 Evaluation Metric.....10

 2.8 Operate IRM10

 2.8.1 Finalize Operating Conditions for the IRM.....11

 2.8.2 Baseline Sampling Event11

 2.8.3 Amend with Selected EAB Substrate11

 2.8.4 Operate Extraction Well to Induce Hydraulic Gradient12

 2.8.5 Operation, Monitoring and Reporting.....13

 2.9 Health and Safety14

 2.10 Waste Management.....14

3. REFERENCES15

LIST OF TABLES

Table 1:	Summary of Hydraulic Assessment Testing
Table 2:	Summary of Field and Laboratory Analyses
Table 3:	Proposed Well Configuration

LIST OF FIGURES

Figure 1:	Site Location Map
Figure 2:	Proposed Interim Measure Layout
Figure 3:	Generic Well Detail for Extraction and Injection Wells
Figure 4:	Generic Well Detail for Multilevel Wells

APPENDICES

Appendix A:	Summary of Groundwater VOC Results from 128 IRM Characterization
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LIST OF ABBREVIATIONS

cis-DCE	cis-1,2-dichloroethene
CGMP	Comprehensive Groundwater Monitoring Program
CMT	continuous multichannel tubing
CT	carbon tetrachloride
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,1-DCE	1,1-dichloroethene
<i>Dhc</i>	<i>Dehalococcoides</i>
DHGs	dissolved hydrocarbon gases (i.e., ethane, ethane, methane)
DO	dissolved oxygen
DuPont	DuPont Corporate Remediation Group
EAB	Enhanced Anaerobic Bioremediation
EVO	emulsified vegetable oil
ft	feet
ft bgs	feet below ground surface
Geosyntec	Geosyntec Consultants, Inc.
HASP	health and safety plan
IRM/FPS	Interim Remedial Measure / Field Pilot Study
IRMWP	Interim Remedial Measure Work Plan
ISCO	in situ chemical oxidation
mg/L	milligrams per liter
ML	multilevel monitoring well
NELAP	National Environmental Laboratory Accreditation Program
ORP	oxidation reduction potential
Parsons	Parsons Corporation
PCE	tetrachloroethene
PLW	Pompton Lakes Works
qPCR	quantitative polymerase chain reaction
SiREM	SiREM Laboratory
Site	Pompton Lakes Works, Pompton Lakes, New Jersey
SGP	soil gas probe
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TOC	total organic carbon
trans-DCE	trans-1,2-dichloroethene
TTA	target treatment area
UIC	underground injection control
VC	vinyl chloride
VFA	volatile fatty acid
VOC	volatile organic compound

1. INTRODUCTION

This interim remedial measure work plan (IRMWP) has been prepared by Geosyntec Consultants, Inc. (Geosyntec) for the DuPont Corporate Remediation Group (DuPont). It presents the proposed approach to conducting an Interim Remedial Measure/Field Pilot Study (IRM/FPS) at the former E. I. du Pont de Nemours and Company (DuPont) Pompton Lakes Works (PLW) site (the Site) to address elevated chlorinated volatile organic compound (VOC) concentrations in off-site groundwater. The location of the Site is presented in Figure 1.

The IRM will be conducted in the vicinity of well 128, in a portion of the off-site plume. Since the prevailing geochemical conditions at depth are generally reducing and the distribution of VOCs (predominantly partially dechlorinated) suggests some native microbial activity, the preferred technology for the IRM is Enhanced Anaerobic Bioremediation (EAB). However, the implementation sequence is such that In Situ Chemical Oxidation (ISCO) may be selected for the active remediation phase. The first steps of the IRM design will be to confirm the effects that conductivity and permeability may have on an injection-based remedial approach, as this will directly impact the implementability of a selected remedial technology.

Given the current understanding of site conditions and the site constraints (limited street access and residential zone) it was proposed that a groundwater extraction and re-injection loop be installed on Barbara Drive to further assess the ability to extract, inject and control amendment additions so that larger scale design information can be obtained. The proposed layout of the IRM is presented in Figure 2. Depending on the results of the hydraulic testing, recirculation between extraction and injection wells may be included as part of the IRM. This recirculation component would only be included so that the effects of amendment addition (e.g., electron donor) can be observed within a reasonable time frame and should not be considered as a necessary component of future activities.

Successful application of either remedial technology in the off-site plume is contingent upon achieving delivery of reagent chemicals throughout the treatment zone. Hence, understanding the aquifer hydraulic properties is key to designing the IRM and interpreting the resulting data.

The EAB technology consists of in situ treatment of contaminated groundwater through EAB, which relies on anaerobic reductive dechlorination, a metabolic process in which bacteria gain energy and grow as one or more chlorine atoms on a chlorinated hydrocarbon are replaced with hydrogen. Certain bacterial species are known to use the VOCs metabolically, but only *Dehalococcoides (Dhc)* species are known to convert them completely to ethene and/or ethane. Chloride is produced in a sequence of successive dechlorination steps. Other bacteria, such as sulfate-reducing bacteria are known to dechlorinate certain VOCs in cometabolic processes, which although generally slower may contribute to the overall removal.

Treatment by EAB consists of introduction of an amendment to enhance and/or promote reductive dechlorination of the VOCs. The amendment will consist of an electron donor, an organic carbon compound that undergoes oxidation as the microbes utilize the substrate to cause reduction of the target VOCs. The amendment will also include a consortium of bacterial cultures to ensure that the chlorinated ethenes are completely and rapidly degraded to ethane, ensuring that the system does not stall at the lesser-chlorinated species cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC).

The remainder of this introductory section presents the site conditions (Section 1.1), objectives of the IRM (Section 1.2), and a summary of the implementation steps (Section 1.3). The rest of this report describes implementation of the IRM, including an overview (Section 2.1), permitting (Section 2.2), extraction and injection well installation (Section 2.3), multilevel well and soil gas probe installation (Section 2.4), hydraulic assessments (Section 2.5), numerical simulation (Section 2.6), metric evaluation (Section 2.7), operation of the IRM (Section 2.8), health and safety (Section 2.9) and waste management (Section 2.10). References cited are listed at the end (Section 3).

1.1 Site Conditions

The Remedial Technology Evaluation for Off-Site Groundwater Contamination (Parsons Corporation [Parsons], 2010) and the Characterization Work-Plan for Off-Site Groundwater (Geosyntec, 2010a) describes the geology, hydrogeology, and distribution of contaminants at the Site.

The Facility is situated within the Highlands Physiographic Province adjacent to the northwestern boundary of the Newark Basin. Two primary geologic units, crystalline bedrock and alluvial deposits consisting of colluviums and stratified glacial drift, underlie the Site.

The alluvial deposits in the Acid Brook Valley are up to 170 feet (ft) thick and have been described as a fining downward stratified glacial sequence without distinct lithologic contacts. It has been divided into three zones in past reports, termed shallow, intermediate and deep.

The shallow alluvial zone is composed of colluvium, fill and glacial till deposits, which are generally poorly sorted coarse- to medium-grained sand and gravel, and may contain layers of very coarse gravel. This zone ranges from 5 to 20 ft thick. The existing shallow monitoring wells include 20 ft screens that span the shallow alluvium.

The intermediate alluvial zone consists of glacial fluvial deposits, which are generally very fine- to medium-grained sand, and ranges from 15 to 80 ft thick.

The deep alluvial zone consists of glacial lacustrine deposits, which are generally very fine-grained silty sand and very fine-grained sandy silt. The thickness of the deep zone varies widely and may be up to 90 ft thick where the bedrock surface is structurally low.

The Off-Site Groundwater IRM Characterization Report (Geosyntec 2010b) contains a summary of the lithology in the vicinity of well 128. In general, the upper 20 ft of alluvium consists of light olive brown, generally poorly sorted sand. This is underlain by an olive brown poorly to moderately well sorted sand between 20 and 38 feet below ground surface (ft bgs). Together these sands comprise the shallow zone; well 128-S is screened across this zone, from about 7 to 27 ft bgs. The intermediate zone at this location spans the interval from about 38 ft bgs to about 78 ft bgs and is composed of olive and dark gray, moderately well-sorted sand containing silt layers. In the upper portion of this interval (approximately 38 to 48 ft bgs), the sands are gray-brown and poorly sorted. Well 128-I is screened in the lower portion of the intermediate zone, from 62 to 72 ft bgs. The deep zone at this location is below about 78 ft bgs and composed of dark gray-brown silt with some clay and dark brown interbeds; well 128-D is screened from 126 to 146 ft bgs.

1.1.1 Site Hydrogeology

Water depths in wells in the Acid Brook Valley at Facility range from approximately 3 to 25 ft bgs under natural conditions. The saturated thickness of the alluvial aquifer ranges from approximately 5 ft in the northern operating valley to 165 ft near the Pompton Lake shore. At location 128-I, the depth to water is approximately 10 ft bgs. The alluvial deposits appear to respond to pumping as a single unit aquifer system. The pump-and-treat system is currently operating to prevent off-site migration of VOCs. Therefore, the pattern of groundwater flow on-site indicates a south to southeasterly flow with cones of depression locally at the recovery wells and water table mounds at the injection beds.

1.1.2 Groundwater Chemistry

Site investigations have shown that there is VOC-impacted groundwater both on- and off-site at the Facility (Parsons, 2010). As stated in the Comprehensive Groundwater Monitoring Program (CGMP), the following contaminants are regularly monitored: tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (TCA) 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), 1,1-dichloroethene (1,1-DCE), cDCE, trans-1,2-dichloroethene (trans-DCE), carbon tetrachloride (CT) and VC. As outlined in the 2009 annual report, many of these contaminants (PCE, TCE, 1,2-DCA, 1,2-DCA, 1,1-DCE, cis-DCE, trans-DCE and VC) are above the New Jersey standard for Class IIA (GWIIA) in wells 128, 128-I and 128-D. The Off-Site Groundwater IRM Characterization Report (Geosyntec, 2010b) presented the findings of the detailed characterization of the 128 area and confirmed that the highest concentrations of VOCs

are present in the intermediate zone. A summary of the target VOC concentrations reported from the recent IRM Characterization activities is provided in Table A-1 (Appendix A).

1.2 Objectives

The primary objectives of the proposed IRM are to:

- Conduct Site-specific tests of hydraulic conductivity and pumping rates to ensure delivery of amendments to the full thickness (approximately 40 ft) of the VOC-impacted zone that overlies the lower permeability glaciolacustrine soils (silt and silty fine sand).
- Remove VOC mass from within the target treatment area (TTA) for the IRM through addition of amendment (donor) and bacterial cultures.
- Collect design data for potential expansion of the treatment zone (e.g., flow rates, well spacing, operational periods, amendment concentration and re-amendment frequency, etc.).

1.3 Implementation Steps

Implementation of this IRM will proceed as follows:

1. Obtain Permits for
 - Street work;
 - Well installation; and
 - Groundwater re-injection (underground injection control, [UIC]).
2. Install wells
 - Groundwater extraction and re-injection loop.
3. Assess aquifer hydraulics
 - Slug tests to estimate well transmissivity / hydraulic conductivity at each well (distinguish by screen interval);
 - Short term pump tests to further assess hydraulic conductivity and determine flow rates at each well (distinguish by screen interval);
 - Hydraulic tomography; and
 - Tracer tests.

4. Numerical simulation (groundwater model).
5. Evaluation Metric – decision based on projected delivery of amendments
 - Select EAB substrate/donor and concentration for application.
6. Operate IRM
 - Finalize operating conditions for the IRM;
 - Install multilevel monitoring wells and soil gas probe;
 - Sample to establish baseline conditions;
 - Amend with selected EAB substrate (i.e., add electron donor);
 - Semi-active operation of extraction well to induce hydraulic gradient; and
 - Conduct 6 months of operation and monitoring with the option to extend another 6 months (total of 12 months) and reporting.

2. IMPLEMENTATION

2.1 Overview

The IRM will be conducted in the vicinity of well 128-I, south of the Facility at the corner of Barbara Drive and Schuyler Avenue (Figure 2). Wells will be installed during business hours (i.e., 8 AM to 5 PM). After the wells are installed hydraulic assessment will be completed. The field program will be conducted over a three to four week period, during standard business hours. The table below shows the anticipated schedule of field activities.

Task	Q1			Q2			Q3			Q4			Q5			Q6			Q7		
Permits & Well Install	X																				
Hydraulic Assessment		X	X	X																	
Evaluation					X																
Supplemental Hydraulic Assessment						E	E														
Evaluation/Finalize Donor Application*								X	X												
Amend Donor**										X	X	X	X	X	X	E	E	E	E	E	E
Evaluation										X	X	X	X	X	X	E	E	E	E	E	E
Reporting																X					

Notes:

* Includes update with agencies on implementation design.

** Donor addition may be extended for up to 12 months, if required.

E - extra field work in case additional evaluation is deemed necessary

Q - quarter

X - anticipated field work

2.2 Permits

Prior to performing field work to implement the IRM, all necessary permits will be obtained. This includes, but is not limited to, permits to perform work in city streets and rights-of-way, utility clearances, well construction permits, and a permit for groundwater re-injection (discharge to groundwater or underground injection control permits, as applicable).

2.3 Install Extraction and Injection Wells

A state-licensed driller will be retained to install one extraction well and three injection wells. These wells will be built with two separate screened intervals defining an upper and lower zone. The screened sections will be connected by a segment of blank casing, as shown in the generic well detail in Figure 3. This construction will allow the wells to operate either as nested wells with an upper and lower zone, or as single long-screened well. To isolate the upper and lower zones, an inflatable packer would be installed within the casing. This would allow independent

control of the groundwater extraction and re-injection rates in the upper and lower zones and ensure that amendments were delivered to the targeted interval of the aquifer. At this time addition of amendments will not be applied to the shallow water table (from about 10 to 25 ft bgs). If the addition of electron donor to the lower portions of the aquifer is successful and effective shallow injection wells could be installed and amendments added.

Each injection and extraction well will be constructed as depicted in Figure 3. Details of the construction, such as borehole diameter, casing diameter, screen slot size and filter pack grain size distribution will be selected for each well type. The wells will be installed directly above the glaciolacustrine silt that underlies the intermediate aquifer in this area of the Site. Each borehole will be advanced until the silt horizon is encountered, nominally to 80 ft bgs (the silt contact was observed in soil cores at 78 ft bgs at well 128-D; was estimated to occur at about 76 ft bgs and 75 ft bgs in WP-04 and WP-01, respectively, based on the index of hydraulic conductivity and the sample collection rate; but was not clearly observed to a depth of 79 ft bgs in soil boring DP-01). Each well will be built up from the depth of this contact, installing the lower screen at the base of the intermediate aquifer, directly above the silt.

2.4 Install Multilevel Monitoring Wells and Soil Gas Probe

Four multilevel monitoring wells (MLs) and a soil gas probe (SGP) will be installed to monitor the performance of the IRM. Approximate locations for these monitoring points are shown in Figure 2. Each ML will be constructed as depicted in Figure 4. Two MLs will be installed prior to hydraulic testing and two additional locations for MLs will be selected once operation of the IRM is simulated with the numerical model. MLs will be positioned at a suitable distance (and thus travel time) from the injection well array, so that IRM performance can be effectively monitored. The aim will be to have a transect of three MLs, forming a ‘fence’ downgradient of the injection wells to assess performance of plume treatment across a segment of the TTA. A fourth ML will be installed downgradient of the fence, roughly on the centerline of the TTA, to provide a sampling location at greater distance (and travel time) with which to assess rates of removal. Each ML will be completed with at least 7 discrete sampling depth intervals; three in the lower zone, three in the upper zone and one shallow zone above the target depth interval of the IRM. The MLs may be constructed as nested wells in which multiple small-diameter wells (0.5 to 1 inch diameter) are constructed within a single borehole, or using off-the-shelf multilevel technology such as continuous multichannel tubing (CMT – e.g., Solinst CMT Model 403) or the Waterloo Multichannel System.

An SGP will also be installed within the TTA, to assess the effects of groundwater treatment in the vadose zone. The SGP will be monitored for potential changes in VOC concentrations, if present, in the unsaturated soils overlying the TTA, as well as for potential production of byproducts of microbial activity, such as methane and hydrogen sulfide. The SGP would be installed adjacent to the ML in the middle of the TTA, to provide a relative point of comparison between soil gas and groundwater concentrations.

Following drilling and well installation, and after allowing sufficient time (48 hours) for the well seals to set and harden, the wells will be developed to remove fines and ensure proper communication with the aquifer.

2.5 Hydraulic Assessments

The newly-installed wells will be used to assess the hydraulic properties of the aquifer in the TTA. A sequence of tests is proposed, as listed in Table 1. These tests are designed to obtain relevant data about the hydraulic conductivity distribution within the TTA and determine achievable pumping rates to inform equipment selection, planned operations and the final IRM implementation design. Each phase of testing is described below.

2.5.1 Hydraulic Conductivity (Slug Testing)

The hydraulic conductivity for each screened interval at each well location will be evaluated using a pneumatic slug test technique. The method utilizes air pressure to disturb the water column and measures the response to the perturbation with a pressure transducer. This time-response data is then analyzed to yield an estimate of the hydraulic conductivity.

These data will allow comparison of the hydraulic conductivity estimates for the upper and lower screened zones. Differences in transmissivity will provide information to clarify design operational time frames for the upper and lower zones.

2.5.2 Hydraulic Conductivity (Short Duration Pump Testing)

Slug testing evaluates the aquifer properties immediately adjacent to the well screen. Pump testing interrogates a larger volume of the formation, yielding more representative estimates of aquifer characteristics. Stepped-rate pump tests will be conducted to assess individual well (for each screened-interval) performance (and yield) and generate estimates of the hydraulic conductivity, transmissivity and storage coefficient of the aquifer. The step tests will also provide an estimate of the greatest flow rate that may be sustained by the pumped well. Knowledge of these flow rates will be useful for design of the IRM, including determining the size of pumps to be used. At select time points in the step tests VOC samples will be collected to evaluate changes in VOC concentrations at the pumping rates.

2.5.3 Hydraulic Tomography

Hydraulic tomography may be a suitable method to assess, in high resolution, the hydraulic conditions in the vicinity of the injection wells. If the well layout proposed for the IRM is deemed suitable for application of hydraulic tomography (well locations and construction have been selected for application of the remedial technology, not necessarily for optimal hydraulic

characterization), this technique may be applied at the Site. Hydraulic tomography has the potential to provide detailed characterization of the distribution of hydraulic conductivity while requiring less time and effort than tracer testing. This technique involves a sequence of cross-hole hydraulic tests with subsequent inversion of the data to map the distribution of aquifer hydraulic properties (Illman *et al.*, 2007). In hydraulic tomography, each well is partitioned into several intervals using packers. A sequential aquifer test at selected intervals is then conducted by applying a short duration stress (i.e., pumping or withdrawal of water) at one interval and monitoring pressure response at the other depth intervals at this well and other wells. This test produces a set of pressure response data of the subsurface. Once a test is completed, the pump is moved to another interval and the test is repeated to collect another set of data. This process is repeated for the intervals at the other wells. After data collection is complete, all of the data sets are processed with a mathematical model to estimate the spatial distribution of hydraulic properties of the aquifer. Each set of data resulting from one pumping event provides a ‘snapshot’ of subsurface heterogeneity around the pumped location. Repeating the process at different intervals provides ‘snapshots’ of the heterogeneity from different locations. The inverse model then synthesizes the set of ‘snapshots’ to create a three-dimensional distribution of the hydraulic conductivity in the test area.

2.5.4 Tracer Testing

Tracer testing is proposed to determine travel times between injection and extraction wells for the upper and lower zones. Once the recirculation system was operational, conservative tracers would be introduced at the injection wells and samples would be collected at regular intervals at the extraction well. Differences in tracer breakthrough between upper and lower zones will inform decisions regarding operating conditions and parameters. If groundwater flow in the lower zone is found to be significantly slower, pumping rates and operating periods for the different zones will be adjusted to optimize reagent delivery and system operation.

Tracer testing would likely involve continuous groundwater extraction and re-injection, with routine sample collection for the duration of the test. Hence, the tracer tests will require greater effort and time to complete. However, if hydraulic tomography is successful in generating a detailed understanding of the distribution of hydraulic conductivity in the TTA, then the decision would be made to forego the tracer test. Instead the tomography results would be used as the basis of the groundwater modeling of the TTA. Tracers would still be introduced along with the first remediation amendments, as a means to verify transport times. This would eliminate the time required to operate the tracer test as a preliminary activity, while preserving a primary benefit of collecting the tracer data.

2.6 Numerical Simulation

Once the aquifer hydraulic properties in the TTA have been evaluated, the results will be incorporated into a numerical model of groundwater flow. The flow model will then be used to assess the details of the IRM design, including well layout and operating parameters such as pump rates, duration of active recirculation and frequency of active phases (i.e., time between periods of active recirculation, where groundwater flow within the TTA occurs under natural gradient). The model will be used to generate estimates of travel time from the set of injection wells to the extraction well. Travel time estimates will be used to help refine the positions of the multilevel monitoring wells within the TTA and to guide frequency of sample collection. The model will also be used to assess different amendment delivery scenarios; for example, the model will be used to simulate recirculation solely from the extraction well to the injection wells during amendment addition, and compare that with recirculation between injection wells (i.e., pump from an injection well while injecting into others in order to induce flow transverse to the normal flow direction). Basically, the model will be used to evaluate several operation scenarios and aid in the selection of optimal operating conditions. The model will provide a reasonable projection of the delivery of amendments to the TTA, and allow an informed decision to be made about proceeding with the IRM.

2.7 Evaluation Metric

Before installing the remaining wells and building the recirculation system, elements of the proposed IRM design and operation will be reviewed. Although it is believed that the IRM can be designed to operate as intended, if the hydraulic assessment (or other information that becomes available) suggests that the delivery of amendments to the TTA will be technically infeasible due to geological conditions, the decision could be made to not proceed with the IRM as presented herein. It is more likely that the results of the hydraulic assessment can be used to adjust the design and proceed with the IRM.

Assuming that implementation of the IRM will proceed, the EAB substrate/donor amendment and target concentration for application will be selected. At present, a blend of fast-acting soluble donor (lactate) and slow-release donor (emulsified vegetable oil [EVO]) is proposed.

2.8 Operate IRM

The IRM will be operated semi-actively: periods of active groundwater recirculation and donor amendment will be separated by periods of passive operation, with no groundwater extraction and re-injection, during which groundwater will migrate under natural gradient. Several cycles of donor addition are envisioned. Details are provided below.

2.8.1 Finalize Operating Conditions for the IRM

The final decisions regarding operating conditions will be made following review of the hydraulic assessment data and groundwater flow simulations. For example, daylight-only operation versus 24-hour operation during active pumping will be evaluated in terms of practicality, cost to implement, duration of operations, frequency of re-amendment, etc. Presently, a model of operations in which the active phase lasts for a period of about one week per month is envisioned. However, the effectiveness of such an operating schedule will greatly depend on the achievable pumping rates and hydraulic conductivity distribution in the TTA.

An implementation work plan would be prepared which would present the operating conditions for the in situ test. Any additional infrastructure requirements will also be addressed at this time. This will include, but is not limited to, installing the pumps in the extraction well and configuring the injection wells with drop lines and packers, as appropriate. At present, it is envisioned that temporary groundwater recirculation lines will be used, with deployment and storage required each day. Alternately, it may be feasible to install recirculation piping in the road-bed; this option will be determined at this time. The use of recirculation would potentially accelerate the time frame for observation and evaluation of the technology.

2.8.2 Baseline Sampling Event

All of the newly-installed sampling locations will be sampled to establish baseline conditions prior to initiation of the IRM and the application of electron donor. The MLs will be sampled for VOCs at all intervals to produce a three-dimensional distribution of the contaminant plume. Select intervals will be sampled for total organic carbon (TOC) to establish baseline concentrations prior to electron donor (i.e. carbon substrate) addition. Select intervals may also be sampled for other parameters of interest, such as chloride, bromide, iodide, sulfate and dissolved hydrocarbon gases (DHGs). DHGs include ethane and ethene, which are breakdown products of the contaminants of concern, and methane, which can be produced by microbes under anaerobic conditions.

2.8.3 Amend with Selected EAB Substrate

Once the wells are built, initiation of the IRM will involve amending the TTA with the selected EAB substrate. As mentioned above, a blend of fast-acting soluble donor (lactate) and slow-release donor (EVO) is proposed. Preliminary estimates based on the observed concentrations of VOCs and reducible inorganic species (primarily sulfate) present suggest that the stoichiometric donor demand in the TTA groundwater is approximately 33 milligrams per liter (mg/L) of sodium lactate. Donor would be added with a safety factor to account for variations in VOC concentrations, desorption of VOCs sorbed to the aquifer matrix, subsurface heterogeneities, consumption of donor by other microbial processes, and the intent to extend the active treatment

zone within the TTA. Donor would be added in pulses, with each pulse delivering sufficient mass of donor to provide the desired time-weighted average concentration to the subsurface. The desire to add excess donor to extend the bioactive zone within the TTA and provide longevity between active amendment phases must be balanced against the need to prevent excessive methane production; this will be done through careful control of the donor blend to minimize methanogenesis due to fermentation of the EVO.

EAB substrate (donor) will be applied via groundwater recirculation. Basically, this will involve deploying a mobile unit (truck or trailer-mounted system) and connecting the extraction pumps to the trailer and the trailer to the injection wells using quick-connect hoses. The donor and dosing system will be housed in the trailer. Groundwater will be pumped from the extraction well, amended with the desired amount of donor, and returned to the subsurface. Rather than constantly adding donor to the groundwater stream, the desired dose of donor (i.e. sufficient to deliver the desired time-weighted average concentration) will be added in a pulse at the beginning, so that subsequent groundwater injection will flush the amendments out from the injection wells. This pattern could be followed daily (add some donor at the start of each day) or weekly (add donor at the start of weekly operation). Details of the operation will depend on the achievable flow rates and anticipated duration of each active phase.

A second recirculation and amendment phase will occur approximately two weeks after the initial phase (timing will be based on hydraulic assessment results), in order to bioaugment the TTA with KB-1[™], a microbial consortium capable of complete and rapid reductive dechlorination of chlorinated ethenes. Although there appears to be a native microbial community capable of reducing PCE and TCE to cis-DCE and VC, the natural degradation process appears to stall at the intermediate products cis-DCE and VC, which appear to have accumulated within the TTA. While the native microbial community might respond to stimulation alone (i.e., donor addition alone), augmentation with a culture known to produce the desired complete dechlorination will ensure that the process commences as quickly as possible and makes best use of the time and effort of operating the IRM.

2.8.4 Operate Extraction Well to Induce Hydraulic Gradient

Since the extraction well will not be in continuous operation during the IRM, full hydraulic control will not be possible. However, operation of the groundwater extraction-injection system will induce a hydraulic gradient across the TTA during donor amendment. The duration of the active phase can be selected and adjusted to ensure adequate distribution of amendments. If the numerical simulations or performance monitoring data suggest that a significant component of ambient groundwater flow occurs transverse to the centerline of the TTA, it may be desirable to increase the frequency of the active phase recurrence.

2.8.5 Operation, Monitoring and Reporting

The IRM will be operated for a period of 6 months with an option to continue for another 6 month period. Operation will involve periodic active phases of groundwater recirculation and donor amendment, as described above; at present, this active pumping and re-injection is suggested to operate for approximately one week each month. During recirculation, water level data will be collected to assess the effects of extraction and re-injection. System operating parameters, such as flow rates, injection time and volumes, line pressures, donor concentrations, etc. will be measured and recorded.

Routine monitoring will be performed by a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory, to assess IRM performance. System performance will primarily be based on VOC concentrations to assess the degree of removal and TOC to assess the amount of labile donor available. DHGs will be sampled at a subset of locations and/or occasions to confirm that decreases in chlorinated VOC concentrations are accompanied by increases in ethane and ethane, the end-products of dechlorination. Periodically, further characterization of the TOC may be undertaken using volatile fatty acid (VFA) analysis to confirm the composition of TOC. Other indicators of IRM performance will include field measurements of pH, oxidation reduction potential (ORP) and dissolved oxygen (DO). Sulfate concentrations will be monitored at a subset of locations to confirm removal (conversion to sulfide), since sulfate-reducing conditions are expected. Samples will be collected on a periodic basis to assess microbial activity using quantitative polymerase chain reaction (qPCR) analysis using the 16S rRNA gene (via the Gene-Trac-Dhc analysis offered by SiREM Laboratory [SiREM]), which detects the presence and abundance of *Dhc* organisms, and/or the *Dhc vcrA* gene (via SiREM's Gene-Trac-VC assay), the gene that codes for vinyl chloride reductase, the enzyme responsible for dechlorination of cis-DCE and VC to ethene.

Generally, performance monitoring will involve sample collection at the ML wells and at the extraction well. The network will be sampled monthly for three months. If the program is to be extended to 12 months then the subsequent sampling would be quarterly for the next nine months (i.e., at months 1, 2, 3, 6, 9 and 12). If the IRM only operates for a 6 month period, then a final sample event at 6 months would conclude the test.

Prior to commencing the IRM, the results of the hydraulic assessment and numerical simulations will be presented in a memorandum along with the proposed IRM implementation plan. This report will form the basis for discussion of the planned implementation and the evaluation decision. Results of the routine monitoring will be summarized and included in the quarterly site progress reports. A summary report would be prepared at the completion of the IRM.

2.9 Health and Safety

All work will be performed in accordance with the Site-specific health and safety plan (HASP), which will be modified to incorporate the activities of the IRM.

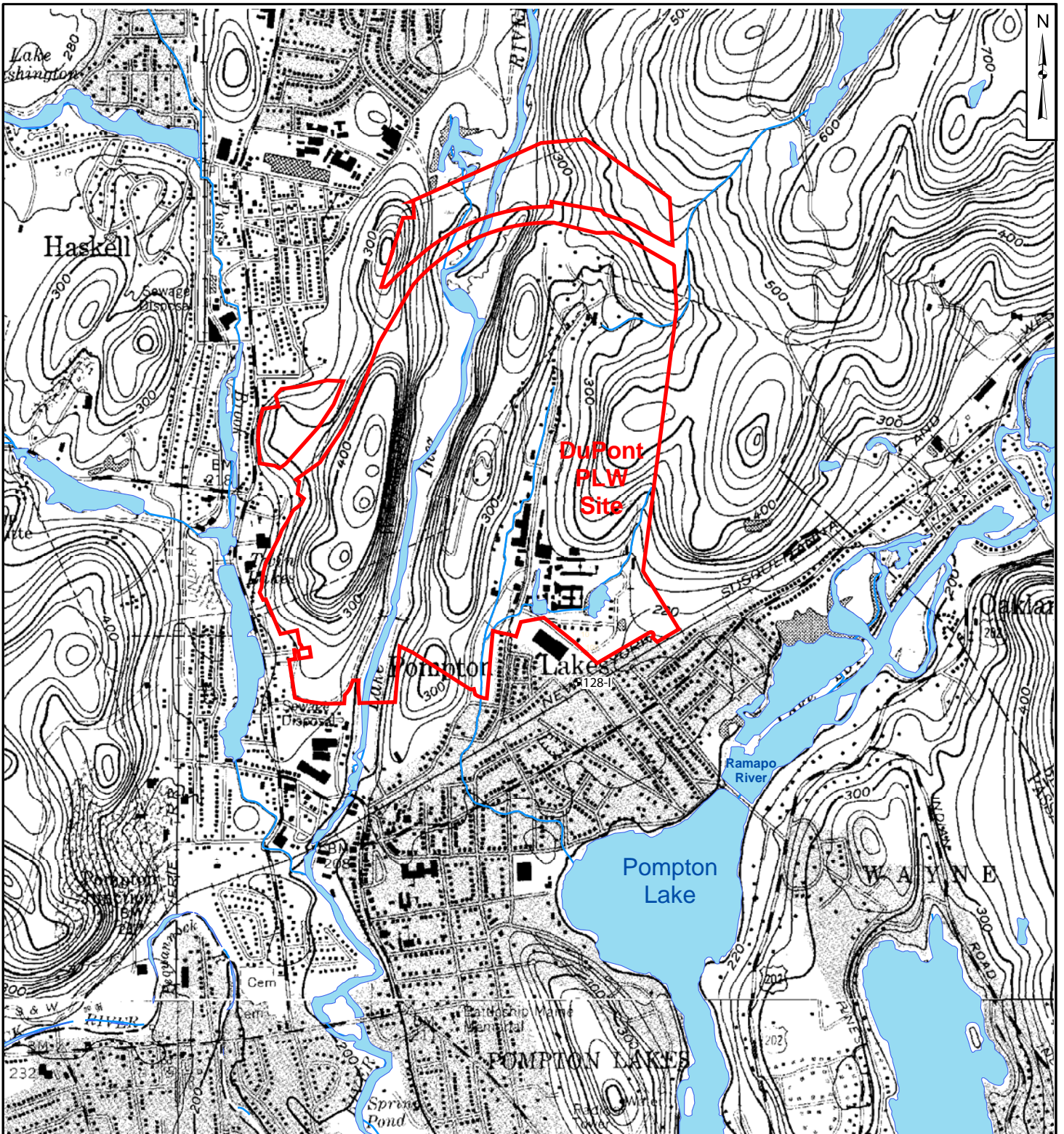
2.10 Waste Management

All investigation derived wastes will be handled and disposed of in accordance with the project-specific waste management plan (URS, 2008).

3. REFERENCES

- Geosyntec Consultants. 2010a. Interim Remedial Measure – Characterization Work Plan for Off-Site Groundwater, Pompton Lakes Works, Pompton Lakes, New Jersey. April 2010.
- Geosyntec Consultants. 2010b. Off-Site Groundwater IRM Characterization Report, Pompton Lakes Works, Pompton Lakes, New Jersey. 27 October 2010.
- Illman, W.A. A.J. Craig, A. Liu. 2007. Practical issues in imaging hydraulic conductivity through hydraulic tomography. *Groundwater* 46(1): 120-132.
- Parsons. 2010. Remedial Technology Evaluation for Off-Site Groundwater Contamination, Pompton Lakes Works, Pompton Lakes, New Jersey. January 2010.

FIGURES

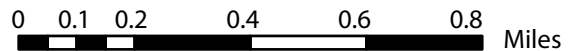


Legend:

- Site Areas
- Well Location

Notes:

Base is portions of the USGS Wanaque and Pompton Plains QUAD.
 Figure from Parsons (2010).



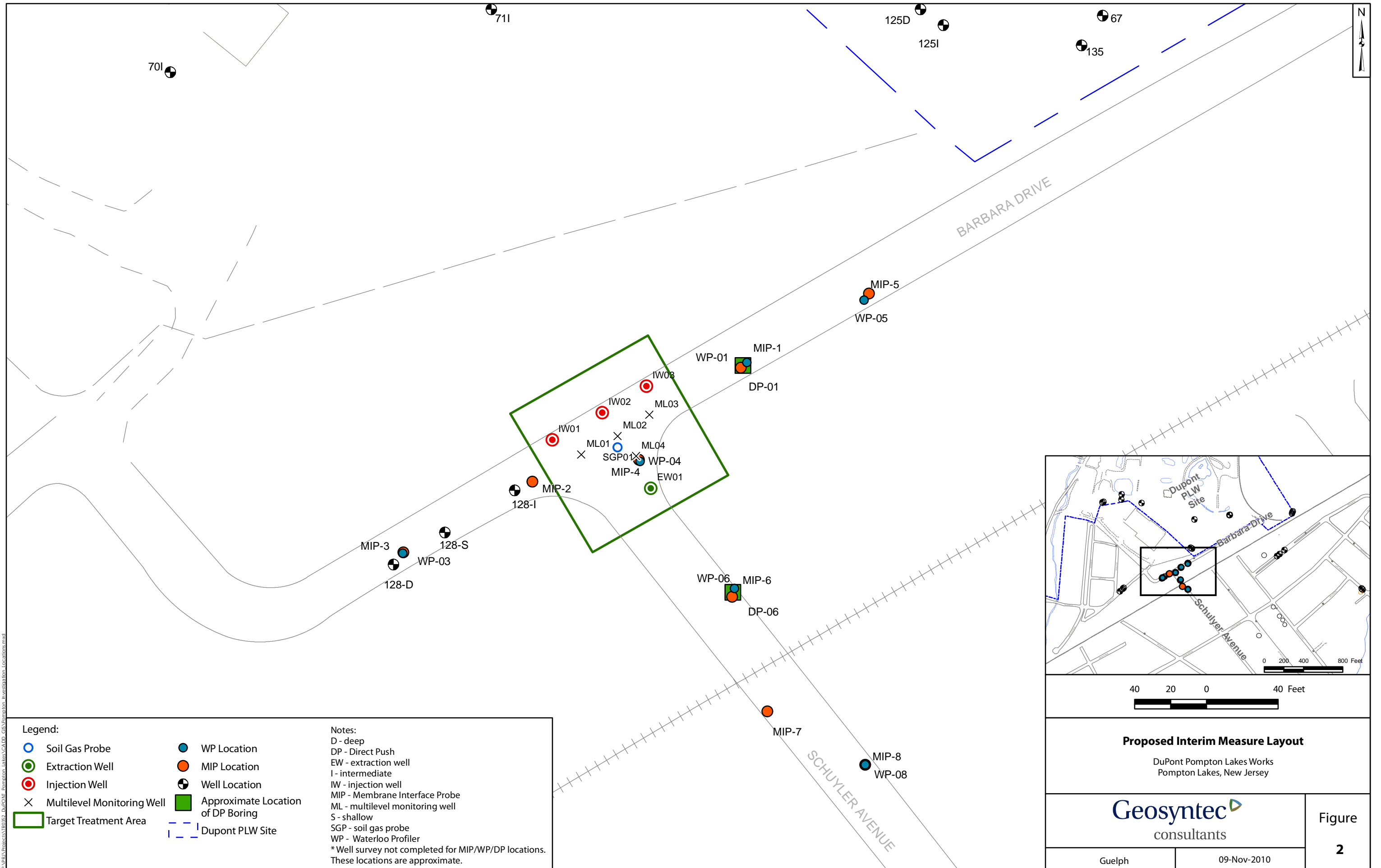
Site Location Map
 DuPont Pompton Lakes Works
 Pompton Lakes, New Jersey

Geosyntec
 consultants

Figure
1

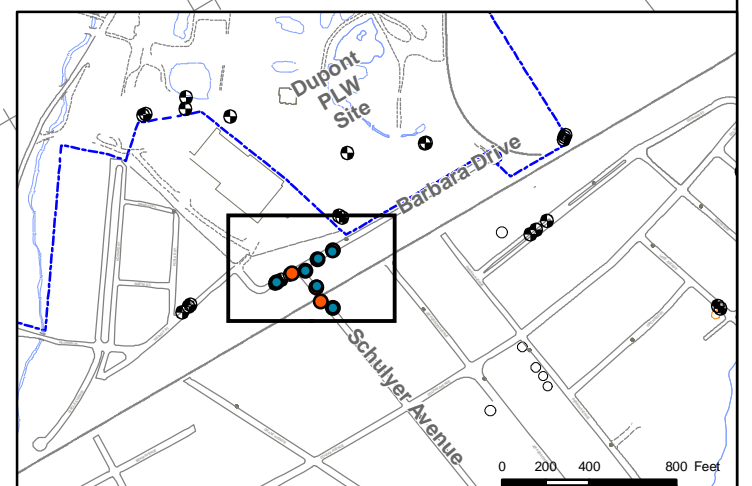
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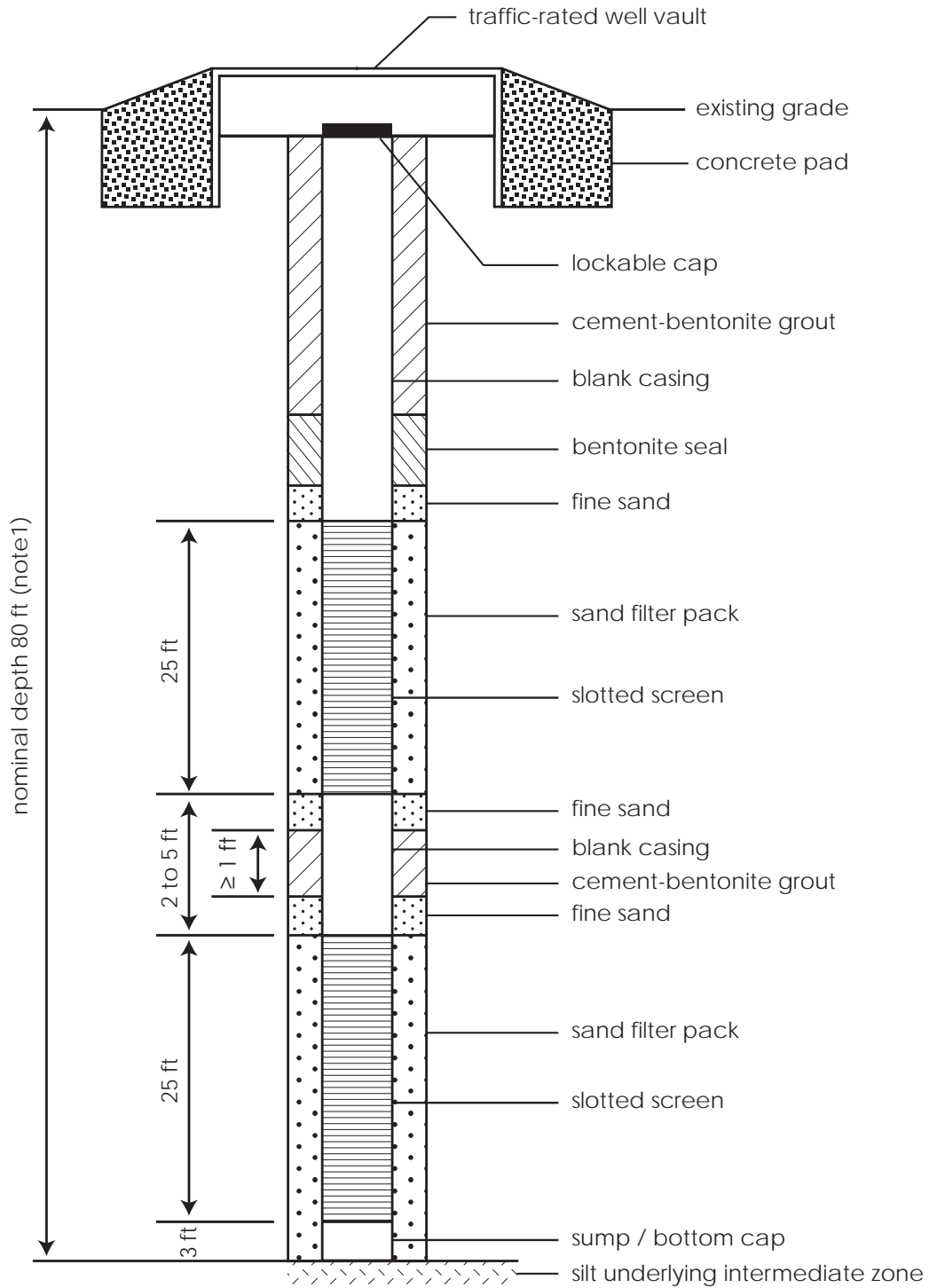


F:\PRA\Projects\130859_DuPont PLW\GIS\Map\Investigation Locations.mxd

Legend:		Notes: D - deep DP - Direct Push EW - extraction well I - intermediate IW - injection well MIP - Membrane Interface Probe ML - multilevel monitoring well S - shallow SGP - soil gas probe WP - Waterloo Profiler * Well survey not completed for MIP/WP/DP locations. These locations are approximate.
	Soil Gas Probe	
	Extraction Well	
	Injection Well	
	Multilevel Monitoring Well	
	Target Treatment Area	
	WP Location	
	MIP Location	
	Well Location	
	Approximate Location of DP Boring	
	Dupont PLW Site	



Proposed Interim Measure Layout DuPont Pompton Lakes Works Pompton Lakes, New Jersey	
Guelph	09-Nov-2010
Figure 2	



Note:

1. Borehole will be drilled to the top of the glaciolacustrine silt that underlies the intermediate aquifer, which is encountered at about 80 ft bgs. Well will be built up from this contact, such that the lower section is positioned directly above the silt horizon.

2. Appropriate borehole and casing diameters, screen slot size and filter pack grain size distribution will be selected for each type of well.

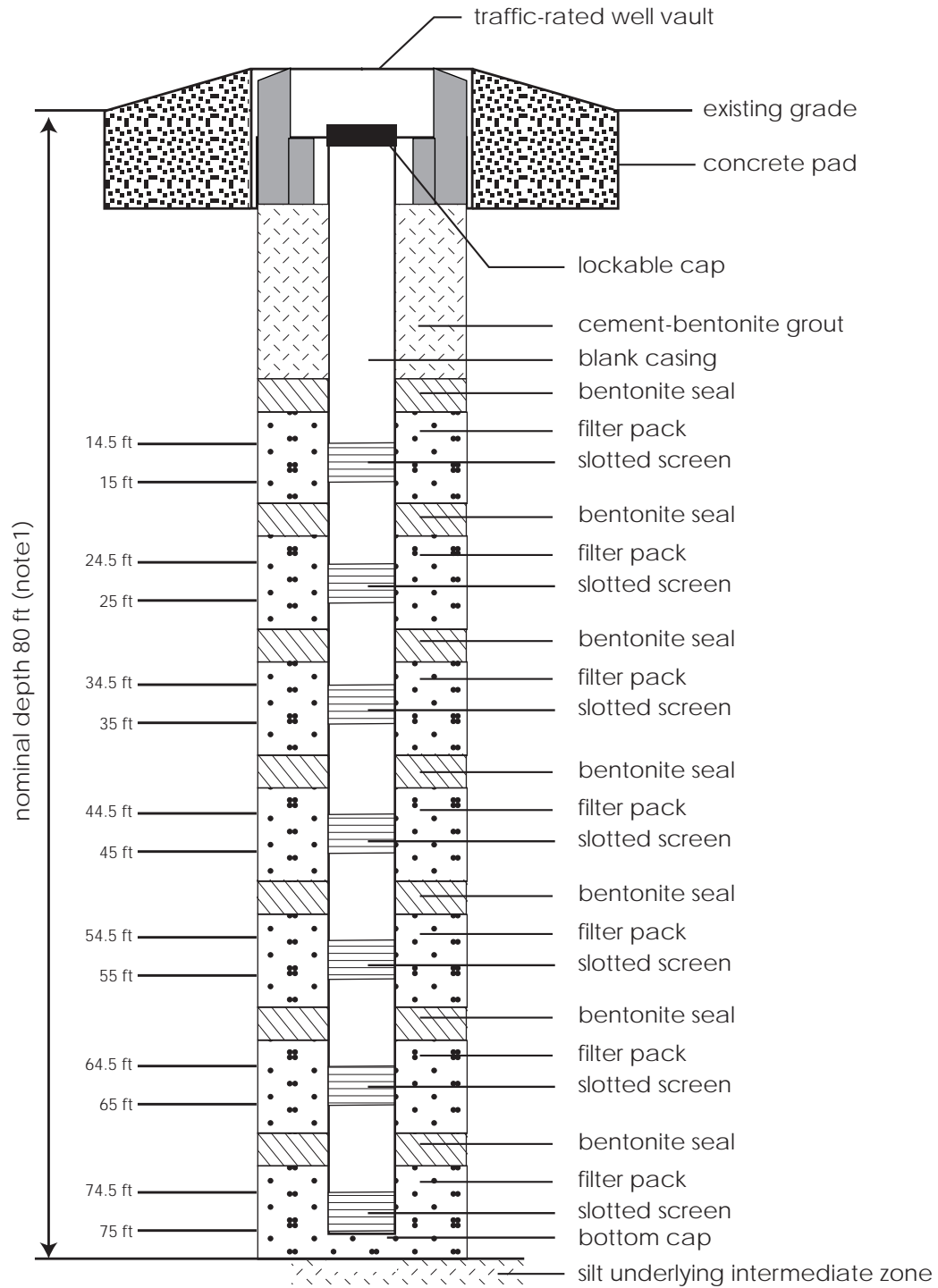
Generic Well Detail for Extraction and Injection Wells

Geosyntec
consultants

**Figure
3**

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09-Nov-2010



Note:

1. Borehole will be drilled to the top of the glaciolacustrine silt that underlies the intermediate aquifer, which is encountered at about 80 ft bgs. Well will be built up from this contact.

2. Appropriate borehole and casing diameters, screen slot size and filter pack grain size distribution will be selected.

Generic Well Detail for Multilevel Wells

Geosyntec
consultants

**Figure
4**

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09-Nov-2010

TABLES

TABLE 1
SUMMARY OF HYDRAULIC ASSESSMENT TESTING
Pompton Lakes Works, Pompton Lakes, New Jersey

Activity	Objective	Description	Outcome
Evaluate well transmissivity/hydraulic conductivity, for each screened interval, for the extraction well and each injection well	Evaluate and compare hydraulic conductivity for upper and lower screened zones	Pneumatic slug tests to determine hydraulic conductivity	Differences in transmissivity will provide information to clarify design operational time frames for upper and lower zones
Evaluate well hydraulics (distinguish by screen interval) for the extraction well and each injection well	Evaluate and compare achievable pumping rates	Short term pumping step tests to assess specific capacity	Achievable pumping rates will inform design (pump and equipment sizing, operational times, etc.)
Hydraulic tomography	Generate a more complete understanding of the hydraulic conductivity distribution of the aquifer	Series of short pumping (or injection) events in which the pumped location is varied spatially and with depth, with monitoring of hydraulic head responses at multiple other locations / intervals, yielding multiple sets of head/discharge data that are used in an iterative geostatistical inverse method to yield the hydraulic conductivity distribution of the aquifer	Thorough understanding of hydraulic conductivity distribution will support: - interpretation of monitoring data; - development of useful simulation tool; and - selection of appropriate depth intervals for groundwater monitoring at the multilevel wells Time required to complete is expected to be shorter than tracer testing
Tracer testing	Determine travel time between injection and extraction wells for upper and lower zones	Introduce different tracers at the injection wells and collect samples at regular intervals at the extraction well	Differences in tracer breakthrough between upper and lower zones will inform decisions regarding operating conditions and parameters; if the lower zone is significantly slower, flow rates and operating times for the upper and lower zones can be adjusted to optimize reagent delivery and system operation

TABLE 2
SUMMARY OF FIELD AND LABORATORY ANALYSES
Pompton Lakes Works, Pompton Lakes, New Jersey

Parameter	Sample Matrix	Analytical Method	Method Number*	Analytical Laboratory	Detection Limit	Sample Container	Sample Volume	Preservative	Holding Time
Field Parameters (pH, DO, ORP, temperature)	water	Ion Specific Electrode	Field	NA	Varies	NA	NA	NA	NA
Volatile Organic Compounds	water	GC/MS	8260B	Lancaster	0.1 to 1.0 µg/L	3 x 40 mL VOA	vials filled completely, no headspace or bubbles	HCl, cool to 4°C	14 days
Dissolved Gases (ethane, ethene, methane)	water	GC/ECD or FID	RSK-175	Lancaster	1 to 5 µg/L	2 x 40 mL VOA	vials filled completely, no headspace or bubbles	HCl, cool to 4°C	14 days
Inorganic Anions (bromide, chloride, sulfate)	water	Ion Chromatography	300.0	Lancaster	0.11 to 0.5 mg/L	500 mL plastic or glass	bottle filled to neck	non-preserved, cool to 4°C	28 days
Inorganic Anions (Iodide)	water	Liquid Chromatography	NA	SiREM	0.5 mg/L	250 mL plastic	bottle filled to neck	non-preserved, cool to 4°C	14 days
Dissolved Metals (arsenic, iron, manganese)	water	Lab-filtered, followed by HNO ₃ preservative, ICP	6010B	Lancaster	0.84 to 52 µg/L	500 mL plastic or glass	bottle filled to neck	non-preserved, cool to 4°C	6 months
Total Organic Carbon	water	Combustion or Oxidation	9060A	Lancaster	1 mg/L	4 x 125 mL amber glass	bottle filled to neck	H ₃ PO ₄ to pH<2, cool to 4°C	28 days
<i>Dehalococcoides ethenogenes</i>	water	PCR 16S rRNA	NA	SiREM	NA	1 L plastic	bottle filled to neck	non-preserved, cool to 4°C	14 days

Notes:

* - United States Environmental Protection Agency Method Number, unless otherwise indicated

°C - degrees Celsius

Custom - internal standard analytical method

DO - dissolved oxygen

ECD - electron capture detector

FID - flame ionization detector

GC - gas chromatography

H₃PO₄ - phosphoric acid

HCl - hydrochloric acid

HNO₃ - nitric acid

ICP - inductively coupled plasma-atomic emission spectrometry

IRM - interim remedial measure

L - liter

Lancaster - Lancaster Laboratories, Lancaster, Pennsylvania

µg/L - micrograms per liter

mg/L - milligrams per liter

mL - milliliter

MS - mass spectrometry

NA - not applicable

ORP - oxidation reduction potential

VOA - volatile organic analysis

**TABLE 3
PROPOSED WELL CONFIGURATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Location	Total Depth* (ft bgs)	Upper Screen Interval (ft bgs)				Lower Screen Interval (ft bgs)		
		Interval 1	Interval 2	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7
IW01	80	20 - 45				50 - 75		
IW02	80	20 - 45				50 - 75		
IW03	80	20 - 45				50 - 75		
EW01	80	20 - 45				50 - 75		
ML01	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
ML02	75	14.5 - 15	24.5 - 25	34.5 - 35	44.5 - 45	54.5 - 55	64.5 - 65	74.5 - 75
ML03	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
ML04	75	14.5 - 15	24.5 - 25	34.5 - 35	44.5 - 45	54.5 - 55	64.5 - 65	74.5 - 75
SGP01	7	5 - 7				--		

Notes:

* Estimated total depth

EW - extraction well

ft bgs - feet below ground surface

IW - injection well

ML - multilevel well

TBD - to be determined; ML will be installed following initial hydraulic testing, 7 intervals are planned

APPENDIX A

**SUMMARY OF GROUNDWATER VOC RESULTS FROM
128 IRM CHARACTERIZATION**

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01
Sample ID:	POM-G-WP01-023.20	POM-G-WP01-033.00	POM-G-WP01-033.00-FD	POM-G-WP-01(33.3)	POM-G-WP-01(39.3)	POM-G-WP01-039.30	POM-G-WP-01(44.8)	POM-G-WP01-044.80
Analytical Laboratory:	Stone	Stone	Stone	Lancaster	Lancaster	Stone	Lancaster	Stone
Date Sampled:	21-May-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10
QA/QC Sample Type:	--	--	Duplicate	--	--	--	--	--
Depth (ft bgs):	23.20	33.00	33.00	33.30	39.30	39.30	44.80	44.80
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<2	<2	<1	<1	<2	<1	<2
1,1-Dichloroethane	<2	<2	<2	<1	<1	<2	<1	<2
1,1-Dichloroethene	<2	<2	<2	<0.8	<0.8	<2	<0.8	<2
1,2-Dichloroethane	<2	<2	<2	<1	<1	<2	<1	<2
cis-1,2-Dichloroethene	0.79 J	2.1	2.3	3 J	3 J	2.5	8	6.2
trans-1,2-Dichloroethene	<2	<2	<2	1 J	<0.8	<2	3 J	2.0
Tetrachloroethene	12	26	23	37	43	27	70	46
1,1,1-Trichloroethane	<2	<2	<2	<0.8	<0.8	<2	<0.8	0.25 J
Trichloroethene	2.8	7.2	5.7	8	9	7.0	18	14
Vinyl Chloride	<2	<2	<2	<1	<1	<2	<1	<2
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	--	--	<1	--	--	<1	--
Ethene	--	--	--	<1	--	--	<1	--
Methane	--	--	--	<5	--	--	<5	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	41.8	--	--	103	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	<0.46	--	--	<0.46	--
Total Organic Carbon	--	--	--	0.85 J	--	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	--	--	14.7	--	--	10.6	--
Nitrate	--	--	--	0.59	--	--	<0.25	--
Nitrite	--	--	--	<0.4	--	--	<0.4	--
Sulfate	--	--	--	33	--	--	44.9	--
Arsenic	--	--	--	<0.0072	--	--	--	--
Iron	--	--	--	<0.0522	--	--	--	--
Manganese	--	--	--	0.0355	--	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01	WP-01
Sample ID:	POM-G-WP-01(48.1)	POM-G-WP01-048.10	POM-G-WP-01(50.15)	POM-G-WP01-050.15	POM-G-WP-01(54.5)	POM-G-WP01-054.50	POM-G-WP-01(59.15)	POM-G-WP01-059.15
Analytical Laboratory:	Lancaster	Stone	Lancaster	Stone	Lancaster	Stone	Lancaster	Stone
Date Sampled:	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	02-Jun-10	01-Jun-10	02-Jun-10	02-Jun-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	48.10	48.10	50.15	50.15	54.50	54.50	59.15	59.15
<u>Volatil Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<1	<2	<1	<2	<1	<2	<1	<2
1,1-Dichloroethane	<1	<2	<1	<2	1 J	1.1 J	1 J	1.2 J
1,1-Dichloroethene	<0.8	<2	2 J	1.3 J	3 J	2.3	6	4.5
1,2-Dichloroethane	<1	<2	<1	<2	<1	<2	<1	<2
cis-1,2-Dichloroethene	9	7.0	24	21	40	27	100	85
trans-1,2-Dichloroethene	3 J	2.0 J	5 J	4.1	6	4.2	21	17
Tetrachloroethene	76	44	140	92	200	140	170	130
1,1,1-Trichloroethane	<0.8	0.25 J	1 J	1.2 J	2 J	2.2	2 J	1.5 J
Trichloroethene	19	14	31	24	42	31	68	50
Vinyl Chloride	<1	0.47 J	3 J	3.1	3 J	2.8	6	6.6
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	--	<1	--	<1	--	--	--
Ethene	--	--	<1	--	<1	--	--	--
Methane	--	--	5.1 J	--	5.1 J	--	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	106	--	108	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	<0.46	--	<0.46	--	--	--
Total Organic Carbon	--	--	1.3	--	--	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	--	22.5	--	25.2	--	--	--
Nitrate	--	--	<0.25	--	<0.25	--	--	--
Nitrite	--	--	<0.4	--	<0.4	--	--	--
Sulfate	--	--	44	--	39.5	--	--	--
Arsenic	--	--	<0.0072	--	--	--	--	--
Iron	--	--	0.235	--	--	--	--	--
Manganese	--	--	0.0102	--	--	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-01	WP-01	WP-01	WP-01	WP-03	WP-03	WP-03	WP-03
Sample ID:	POM-G-WP-01(65.15)	POM-G-WP01-065.15	POM-G-WP01-073.15	POM-G-WP-01(73.3)	POM-G-WP-03(23.3)	POM-G-WP03-023.30	POM-G-WP-03(23.3)-D	POM-G-WP-03(30.1)
Analytical Laboratory:	Lancaster	Stone	Stone	Lancaster	Lancaster	Stone	Lancaster	Lancaster
Date Sampled:	02-Jun-10	02-Jun-10	02-Jun-10	02-Jun-10	02-Jun-10	03-Jun-10	02-Jun-10	03-Jun-10
QA/QC Sample Type:	--	--	--	--	--	--	Duplicate	--
Depth (ft bgs):	65.15	65.15	73.15	73.30	23.30	23.30	23.30	30.10
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<1	<2	<2	<1	--	<2	--	--
1,1-Dichloroethane	8	7.3	5.0	6	--	<2	--	--
1,1-Dichloroethene	22	16	5.4	8	--	<2	--	--
1,2-Dichloroethane	<1	<2	<2	<1	--	<2	--	--
cis-1,2-Dichloroethene	700	730	860	790	--	22	--	--
trans-1,2-Dichloroethene	240	190	160	190	--	8.3	--	--
Tetrachloroethene	7	4.4	<2	<0.8	--	28	--	--
1,1,1-Trichloroethane	<0.8	<2	<2	<0.8	--	<2	--	--
Trichloroethene	78	57	24	35	--	27	--	--
Vinyl Chloride	130	110	170	230	--	0.89 J	--	--
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	5.2	--	--	--	<1	--	<1	<1
Ethene	2.4 J	--	--	--	<1	--	<1	<1
Methane	390	--	--	--	<5	--	<5	<5
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	198	--	--	--	64.2	--	63.5	118
Alkalinity; Carbonate (CaCO ₃) at pH 8	11.8	--	--	--	<0.46	--	<0.46	1.2 J
Total Organic Carbon	5.4	--	--	--	0.92 J	--	0.88 J	3
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	45.9	--	--	--	11.0	--	11.9	19.1
Nitrate	<0.25	--	--	--	0.51	--	0.52	<0.25
Nitrite	<0.4	--	--	--	<0.4	--	<0.4	<0.4
Sulfate	35	--	--	--	16.6	--	16.6	20.2
Arsenic	0.0108 J	--	--	--	<0.0072	--	<0.0072	0.0249
Iron	3.89	--	--	--	<0.0522	--	<0.0522	0.261
Manganese	0.114	--	--	--	0.271	--	0.315	0.297

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-03	WP-03	WP-03	WP-03	WP-03	WP-03	WP-03	WP-03
Sample ID:	POM-G-WP03-030.10	POM-G-WP03-035.00	POM-G-WP03-040.00	POM-G-WP-03(45)	POM-G-WP03-045.00	POM-G-WP-03(50)	POM-G-WP03-050.00	POM-G-WP03-055.10
Analytical Laboratory:	Stone	Stone	Stone	Lancaster	Stone	Lancaster	Stone	Stone
Date Sampled:	02-Jun-10	02-Jun-10	03-Jun-10	03-Jun-10	03-Jun-10	03-Jun-10	02-Jun-10	04-Jun-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	30.10	35.00	40.00	45.00	45.00	50.00	50.00	55.10
<u>Volatil Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<2	<2	--	<2	--	<2	<2
1,1-Dichloroethane	<2	2.1	0.83 J	--	1.4 J	--	1.5 J	3.1
1,1-Dichloroethene	<2	3.0	2.6	--	1.8 J	--	2.0	4.2
1,2-Dichloroethane	<2	<2	<2	--	<2	--	<2	<2
cis-1,2-Dichloroethene	99	460	290	--	260	--	290	630
trans-1,2-Dichloroethene	35	85	98	--	97	--	120	280
Tetrachloroethene	41	1.6 J	<2	--	<2	--	<2	<2
1,1,1-Trichloroethane	<2	<2	<2	--	<2	--	<2	<2
Trichloroethene	54	26	6.6	--	0.47 J	--	0.56 J	<2
Vinyl Chloride	3.1	45	18	--	71	--	77	300
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	--	--	<1	--	1.9 J	--	--
Ethene	--	--	--	<1	--	1.5 J	--	--
Methane	--	--	--	25	--	360	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	194	--	332	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	12.2	--	14	--	--
Total Organic Carbon	--	--	--	--	--	9.7	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	--	--	25.1	--	40.3	--	--
Nitrate	--	--	--	<0.25	--	<0.25	--	--
Nitrite	--	--	--	<0.4	--	<0.4	--	--
Sulfate	--	--	--	18.4	--	27	--	--
Arsenic	--	--	--	--	--	<0.0072	--	--
Iron	--	--	--	--	--	0.486	--	--
Manganese	--	--	--	--	--	0.018	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-03	WP-03	WP-03	WP-03	WP-04	WP-04	WP-04	WP-04
Sample ID:	POM-G-WP03-060.00	POM-G-WP-03(70.5)	POM-G-WP03-070.50	POM-G-WP03-079.60	POM-G-WP04-012.00	POM-G-WP04-020.30	POM-G-WP-04(030.10)	POM-G-WP04-030.10
Analytical Laboratory:	Stone	Lancaster	Stone	Stone	Stone	Stone	Lancaster	Stone
Date Sampled:	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10	18-May-10	18-May-10	18-May-10	18-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	60.00	70.50	70.50	79.60	12.00	20.30	30.10	30.10
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	--	<2	<2	<2	<2	<1	<2
1,1-Dichloroethane	2.4	--	1.4 J	<2	<2	<2	<1	<2
1,1-Dichloroethene	6.4	--	4.1	<2	<2	<2	<0.8	<2
1,2-Dichloroethane	<2	--	<2	<2	<2	<2	<1	<2
cis-1,2-Dichloroethene	1,100	--	390	<2	0.54 J	9.6	9	6.2
trans-1,2-Dichloroethene	690	--	200	<2	<2	4.4	4 J	2.3
Tetrachloroethene	<2	--	7.9	<2	4.3	29	43	27
1,1,1-Trichloroethane	<2	--	<2	<2	<2	0.27 J	1 J	1.1 J
Trichloroethene	1.3 J	--	70	<2	1.8 J	17	18	12
Vinyl Chloride	590	--	110	<2	<2	<2	<1	<2
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	1.4 J	--	--	--	--	<1	--
Ethene	--	2.5 J	--	--	--	--	<1	--
Methane	--	740	--	--	--	--	<5	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	233	--	--	--	--	111	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	16.1	--	--	--	--	<0.46	--
Total Organic Carbon	--	5.4	--	--	--	--	0.86 J	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	<4	--
Chloride	--	47.7	--	--	--	--	35.9	--
Nitrate	--	<0.25	--	--	--	--	0.42 J	--
Nitrite	--	<0.4	--	--	--	--	<0.4	--
Sulfate	--	33.9	--	--	--	--	20.9	--
Arsenic	--	<0.0072	--	--	--	--	<0.0072	--
Iron	--	1.00	--	--	--	--	<0.0522	--
Manganese	--	0.0152	--	--	--	--	0.0214	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04
Sample ID:	POM-G-WP04-035.10	POM-G-WP-04(40.00)	POM-G-WP04-040.00	POM-G-WP04-042.60	POM-G-WP-04(45.1)	POM-G-WP04-045.10	POM-G-WP04-047.30	POM-G-WPFD-02
Analytical Laboratory:	Stone	Lancaster	Stone	Stone	Lancaster	Stone	Stone	Stone
Date Sampled:	18-May-10	18-May-10	18-May-10	18-May-10	19-May-10	19-May-10	19-May-10	19-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	Duplicate
Depth (ft bgs):	35.10	40.00	40.00	42.60	45.10	45.10	47.30	47.30
<u>Volatil Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<1	<2	<2	<1	<2	<2	<2
1,1-Dichloroethane	<2	<1	<2	<2	<1	<2	<2	<2
1,1-Dichloroethene	<2	<0.8	<2	<2	<0.8	<2	<2	<2
1,2-Dichloroethane	<2	<1	<2	<2	<1	<2	<2	<2
cis-1,2-Dichloroethene	12	15	10	17	28	25	27	26
trans-1,2-Dichloroethene	4.5	7	4.8	12	14	9.5	14	14
Tetrachloroethene	52	69	50	63	86	55	49	49
1,1,1-Trichloroethane	0.85 J	<0.8	0.49 J	0.45 J	<0.8	0.36 J	0.35 J	0.34 J
Trichloroethene	18	32	24	39	49	33	36	36
Vinyl Chloride	<2	<1	<2	0.52 J	<1	<2	0.36 J	0.46 J
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	<1	--	--	<1	--	--	--
Ethene	--	<1	--	--	<1	--	--	--
Methane	--	<5	--	--	<5	--	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	--	132	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	--	<0.46	--	--	--
Total Organic Carbon	--	--	--	--	0.99 J	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	5.1 J	--	--	<4	--	--	--
Chloride	--	--	--	--	13.7	--	--	--
Nitrate	--	--	--	--	<0.25	--	--	--
Nitrite	--	--	--	--	0.88	--	--	--
Sulfate	--	--	--	--	36.9	--	--	--
Arsenic	--	--	--	--	<0.0072	--	--	--
Iron	--	--	--	--	<0.0522	--	--	--
Manganese	--	--	--	--	0.227	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04
Sample ID:	POM-G-WP-04(47.5)	POM-G-WP-04(50.0)	POM-G-WP04-050.00	POM-G-WP-04(55.0)	POM-G-WP04-055.00	POM-G-WP-04(60.0)	POM-G-WP04-060.00	POM-G-WP-04(66.20)
Analytical Laboratory:	Lancaster	Lancaster	Stone	Lancaster	Stone	Lancaster	Stone	Lancaster
Date Sampled:	19-May-10	19-May-10	19-May-10	19-May-10	19-May-10	19-May-10	19-May-10	20-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	47.50	50.00	50.00	55.00	55.00	60.00	60.00	66.20
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<1	<1	<2	<1	<48	<1	<48	<1
1,1-Dichloroethane	<1	<1	<2	5	4.1	3 J	3.0 J	1 J
1,1-Dichloroethene	<0.8	1 J	<2	6	4.6	3 J	3.6 J	1 J
1,2-Dichloroethane	<1	<1	<2	<1	<48	<1	<48	<1
cis-1,2-Dichloroethene	34	70	53	680	800	580	520	250
trans-1,2-Dichloroethene	18	42	28	240	240	200	210	95
Tetrachloroethene	78	42	23	<0.8	<48	<0.8	<48	<0.8
1,1,1-Trichloroethane	<0.8	<0.8	<2	<0.8	<48	<0.8	<48	<0.8
Trichloroethene	54	71	41	66	46	28	29	7
Vinyl Chloride	1 J	4 J	2.1	110	86	51	71	61
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	<1	--	2.9 J	--	<1	--	6.6
Ethene	--	<1	--	<1	--	<1	--	6.3
Methane	--	5.5 J	--	79	--	20	--	1,700
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	169	--	--	--	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	7.5	--	--	--	--	--	--
Total Organic Carbon	--	3.8	--	--	--	5.5	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	16	--	<4	--	6.3 J	--	4.3 J
Chloride	--	59.1	--	--	--	36.4	--	--
Nitrate	--	<0.25	--	--	--	<0.25	--	--
Nitrite	--	<0.4	--	--	--	<0.4	--	--
Sulfate	--	40.6	--	--	--	16.1	--	--
Arsenic	--	0.0073 J	--	--	--	0.0174 J	--	--
Iron	--	0.646	--	--	--	0.829	--	--
Manganese	--	0.0723	--	--	--	0.0502	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-04	WP-04	WP-04	WP-04	WP-04	WP-04	WP-05	WP-05
Sample ID:	POM-G-WP04-066.62	POM-G-WP-04(72.00)	POM-G-WP04-072.00	POM-G-WP-04(75.60)	POM-G-WP04-075.60	POM-G-WP04-083.00	POM-G-WP-05(28.5)	POM-G-WP05-028.50
Analytical Laboratory:	Stone	Lancaster	Stone	Lancaster	Stone	Stone	Lancaster	Stone
Date Sampled:	20-May-10	20-May-10	20-May-10	20-May-10	20-May-10	21-May-10	21-May-10	21-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	66.62	72.00	72.00	75.60	75.60	83.00	28.50	28.50
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<12	<1	<24	<1	<8	<2	<1	<2
1,1-Dichloroethane	4.7 J	4 J	<24	<1	<8	<2	<1	<2
1,1-Dichloroethene	<12	6	<24	<0.8	<8	<2	<0.8	<2
1,2-Dichloroethane	<12	<1	<24	<1	<8	<2	<1	<2
cis-1,2-Dichloroethene	580	750	830	120	25	<2	<0.8	<2
trans-1,2-Dichloroethene	310	240	260	5 J	4.4 J	<2	<0.8	<2
Tetrachloroethene	<12	1 J	<24	<0.8	<8	<2	8	5.9
1,1,1-Trichloroethane	<12	<0.8	<24	<0.8	<8	<2	<0.8	<2
Trichloroethene	22	77	63	<1	<8	<2	1 J	1.0 J
Vinyl Chloride	230	130	120	84	11	<2	<1	<2
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	1.6 J	--	--	--	--	--	--
Ethene	--	1 J	--	--	--	--	--	--
Methane	--	320	--	--	--	--	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	273	--	--	--	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	33.6	--	--	--	--	--	--
Total Organic Carbon	--	--	--	--	--	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	<4	--	--	--	--	--	--
Chloride	--	43.3	--	--	--	--	--	--
Nitrate	--	<0.25	--	--	--	--	--	--
Nitrite	--	<0.4	--	--	--	--	--	--
Sulfate	--	38.5	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-05	WP-05	WP-05	WP-05	WP-05	WP-05	WP-05	WP-05
Sample ID:	POM-G-WP05-039.00	POM-G-WP-05(44.0)	POM-G-WP05-044.00	POM-G-WP05-050.00	POM-G-WP-05(53.0)	POM-G-WP05-053.00	POM-G-WP05-058.00	POM-G-WP-05(62.0)
Analytical Laboratory:	Stone	Lancaster	Stone	Stone	Lancaster	Stone	Stone	Lancaster
Date Sampled:	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	39.00	44.00	44.00	50.00	53.00	53.00	58.00	62.00
<u>Volatil Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<1	<2	<2	--	<2	0.45 J	<1
1,1-Dichloroethane	<2	<1	<2	<2	--	<2	12	6
1,1-Dichloroethene	<2	<0.8	<2	<2	--	2.2	57	39
1,2-Dichloroethane	<2	<1	<2	<2	--	<2	<2	<1
cis-1,2-Dichloroethene	2.6	4 J	3.1	5.1	--	14	180	130
trans-1,2-Dichloroethene	<2	<0.8	<2	<2	--	1.4 J	8.9	7
Tetrachloroethene	35	61	38	57	--	150	270	240
1,1,1-Trichloroethane	0.45 J	<0.8	0.39 J	0.62 J	--	1.4 J	47	18
Trichloroethene	6.0	11	8.2	12	--	26	68	72
Vinyl Chloride	<2	<1	<2	<2	--	<2	69	23
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	<1	--	--	<1	--	--	2.4 J
Ethene	--	<1	--	--	<1	--	--	<1
Methane	--	<5	--	--	<5	--	--	66
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	60.6	--	--	134	--	--	76.7
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	<0.46	--	--	<0.46	--	--	<0.46
Total Organic Carbon	--	0.64 J	--	--	0.72 J	--	--	0.91 J
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	22.5	--	--	28.4	--	--	26.9
Nitrate	--	0.83	--	--	0.86	--	--	0.31 J
Nitrite	--	<0.4	--	--	<0.4	--	--	<0.4
Sulfate	--	45.6	--	--	38.6	--	--	33.6
Arsenic	--	<0.0072	--	--	<0.0072	--	--	<0.0072
Iron	--	<0.0522	--	--	<0.0522	--	--	<0.0522
Manganese	--	0.0376	--	--	0.0898	--	--	2.74

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-05	WP-05	WP-05	WP-05	WP-05	WP-06	WP-06	WP-06
Sample ID:	POM-G-WP05-062.00	POM-G-WPFD-04	POM-G-WP-05(66.1)	POM-G-WP05-066.10	POM-G-WP05-071.40	POM-G-WP06-011.25	POM-G-WP-06(17.00)	POM-G-WP06-017.00
Analytical Laboratory:	Stone	Stone	Lancaster	Stone	Stone	Stone	Lancaster	Stone
Date Sampled:	01-Jun-10	01-Jun-10	01-Jun-10	01-Jun-10	02-Jun-10	17-May-10	17-May-10	17-May-10
QA/QC Sample Type:	--	Duplicate	--	--	--	--	--	--
Depth (ft bgs):	62.00	62.00	66.10	66.10	71.40	11.25	17.00	17.00
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<2	--	<2	<2	<2	--	<2
1,1-Dichloroethane	5.3	5.1	--	1.1 J	<2	<2	--	<2
1,1-Dichloroethene	24	22	--	4.4	<2	<2	--	<2
1,2-Dichloroethane	<2	<2	--	<2	<2	<2	--	<2
cis-1,2-Dichloroethene	96	100	--	310	<2	0.65 J	--	0.56 J
trans-1,2-Dichloroethene	5.1	4.8	--	38	<2	<2	--	<2
Tetrachloroethene	170	150	--	19	<2	2.3	--	5.8
1,1,1-Trichloroethane	16	15	--	0.40 J	<2	<2	--	<2
Trichloroethene	50	47	--	78	<2	0.98 J	--	2.0
Vinyl Chloride	17	17	--	31	<2	<2	--	<2
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	--	<1	--	--	--	<1	--
Ethene	--	--	<1	--	--	--	<1	--
Methane	--	--	160	--	--	--	<5	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	203	--	--	--	29.4	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	<0.46	--	--	--	<0.46	--
Total Organic Carbon	--	--	--	--	--	--	0.6 J	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	20	--
Chloride	--	--	50.4	--	--	--	22	--
Nitrate	--	--	<0.25	--	--	--	0.35 J	--
Nitrite	--	--	<0.4	--	--	--	<0.4	--
Sulfate	--	--	41.8	--	--	--	21.6	--
Arsenic	--	--	--	--	--	--	<0.0072	--
Iron	--	--	--	--	--	--	<0.0522	--
Manganese	--	--	--	--	--	--	0.0624	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06
Sample ID:	POM-G-WP06-023.00	POM-G-WP06-028.00	POM-G-WP06-033.00	POM-G-WP06-038.00	POM-G-WPFD-01	POM-G-WP-06(43.00)	POM-G-WP06-043.00	POM-G-WP06-047.40
Analytical Laboratory:	Stone	Stone	Stone	Stone	Stone	Lancaster	Stone	Stone
Date Sampled:	17-May-10	17-May-10	17-May-10	17-May-10	17-May-10	18-May-10	18-May-10	18-May-10
QA/QC Sample Type:	--	--	--	--	Duplicate	--	--	--
Depth (ft bgs):	23.00	28.00	33.00	38.00	38.00	43.00	43.00	47.40
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	<2	<2	<2	<2	--	<2	<2
1,1-Dichloroethane	<2	<2	<2	<2	<2	--	<2	<2
1,1-Dichloroethene	<2	<2	<2	<2	<2	--	<2	<2
1,2-Dichloroethane	<2	<2	<2	<2	<2	--	<2	<2
cis-1,2-Dichloroethene	0.68 J	0.99 J	2.4	4.0	3.6	--	11	39
trans-1,2-Dichloroethene	<2	<2	<2	1.0 J	1.1 J	--	7.3	24
Tetrachloroethene	6.1	8.4	24	41	37	--	52	35
1,1,1-Trichloroethane	0.25 J	0.31 J	0.46 J	0.57 J	0.56 J	--	0.29 J	<2
Trichloroethene	2.1	2.7	6.0	9.0	8.6	--	25	53
Vinyl Chloride	1.4 J	<2	<2	<2	<2	--	0.50 J	2.5
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	--	--	--	--	<1	--	--
Ethene	--	--	--	--	--	<1	--	--
Methane	--	--	--	--	--	<5	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	--	--	152	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	--	--	<0.46	--	--
Total Organic Carbon	--	--	--	--	--	0.92 J	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	4.2 J	--	--
Chloride	--	--	--	--	--	13.5	--	--
Nitrate	--	--	--	--	--	0.46 J	--	--
Nitrite	--	--	--	--	--	0.64	--	--
Sulfate	--	--	--	--	--	39.4	--	--
Arsenic	--	--	--	--	--	<0.0072	--	--
Iron	--	--	--	--	--	<0.0522	--	--
Manganese	--	--	--	--	--	0.382	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06
Sample ID:	POM-G-WP-06(50.00)	POM-G-WP06-050.10	POM-G-WP06-053.00	POM-G-WP-06(55.4)	POM-G-WP06-055.40	POM-G-WP06-058.00	POM-G-WP-06(60.0)	POM-G-WP06-060.02
Analytical Laboratory:	Lancaster	Stone	Stone	Lancaster	Stone	Stone	Lancaster	Stone
Date Sampled:	18-May-10	18-May-10	18-May-10	19-May-10	19-May-10	19-May-10	19-May-10	19-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	50.00	50.10	53.00	55.40	55.40	58.00	60.00	60.02
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	--	<2	<12	--	<12	<24	<1	<48
1,1-Dichloroethane	--	<2	4.7	--	8.1	9.1	12	10
1,1-Dichloroethene	--	2.0 J	4.4	--	6.8	11	14	11
1,2-Dichloroethane	--	<2	<12	--	<12	<24	<1	<48
cis-1,2-Dichloroethene	--	98	780	--	1,100	1,400	1,500	1,800
trans-1,2-Dichloroethene	--	41	260	--	350	520	490	600
Tetrachloroethene	--	34	<12	--	3.2	<24	<0.8	<48
1,1,1-Trichloroethane	--	0.50 J	<12	--	<12	<24	<0.8	<48
Trichloroethene	--	71	15	--	29	160	170	130
Vinyl Chloride	--	5.4	82	--	210	350	340	410
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	<1	--	--	7.8	--	--	13	--
Ethene	<1	--	--	1.3 J	--	--	2.9 J	--
Methane	<5	--	--	260	--	--	950	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	261	--	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	4.6	--	--	--	--
Total Organic Carbon	--	--	--	7.3	--	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	<4	--	--	<4	--	--	<4	--
Chloride	--	--	--	73.1	--	--	97.5	--
Nitrate	--	--	--	<0.25	--	--	<0.25	--
Nitrite	--	--	--	<0.4	--	--	<0.4	--
Sulfate	--	--	--	26.5	--	--	29.2	--
Arsenic	--	--	--	0.0087 J	--	--	--	--
Iron	--	--	--	0.157 J	--	--	--	--
Manganese	--	--	--	0.0775	--	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06	WP-06
Sample ID:	POM-G-WP06-062.51	POM-G-WP-06(65.50)	POM-G-WP06-065.50	POM-G-WP-06(69.70)	POM-G-WP06-069.70	POM-G-WP06-075.30	POM-G-WP06-086.50	POM-G-WP06-092.00
Analytical Laboratory:	Stone	Lancaster	Stone	Lancaster	Stone	Stone	Stone	Stone
Date Sampled:	19-May-10	20-May-10	20-May-10	20-May-10	20-May-10	20-May-10	21-May-10	21-May-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	62.51	65.50	65.50	69.70	69.70	75.30	86.50	92.00
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<48	--	<24	--	<24	<24	<2	<2
1,1-Dichloroethane	11 J	--	10 J	--	9.4 J	6.9	<2	<2
1,1-Dichloroethene	13	--	11 J	--	8.6 J	5.1	<2	<2
1,2-Dichloroethane	<48	--	<12	--	<24	<24	<2	<2
cis-1,2-Dichloroethene	1,200	--	1,500	--	1,500	1,100	0.45 J	<2
trans-1,2-Dichloroethene	520	--	480	--	480	280	<2	<2
Tetrachloroethene	<48	--	<24	--	<24	<24	<2	<2
1,1,1-Trichloroethane	<48	--	<24	--	<24	<24	<2	<2
Trichloroethene	180	--	91	--	66	84	<2	<2
Vinyl Chloride	550	--	510	--	530	560	<2	<2
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	21	--	25	--	--	--	--
Ethene	--	7.5	--	23	--	--	--	--
Methane	--	1,100	--	5,100	--	--	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--	--	--	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--	--	--	--	--	--
Total Organic Carbon	--	--	--	--	--	--	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	--	--	--	--	--	--	--
Nitrate	--	--	--	--	--	--	--	--
Nitrite	--	--	--	--	--	--	--	--
Sulfate	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08
Sample ID:	POM-G-WP08-030.35	POM-G-WP-08(35.60)	POM-G-WP08-035.60	POM-G-WP08-040.55	POM-G-WP08-043.30	POM-G-WP-08(46.15)	POM-G-WP08-046.15	POM-G-WP08-048.30
Analytical Laboratory:	Stone	Lancaster	Stone	Stone	Stone	Lancaster	Stone	Stone
Date Sampled:	03-Jun-10	03-Jun-10	03-Jun-10	02-Jun-10	02-Jun-10	03-Jun-10	03-Jun-10	04-Jun-10
QA/QC Sample Type:	--	--	--	--	--	--	--	--
Depth (ft bgs):	30.35	35.60	35.60	40.55	43.30	46.15	46.15	48.30
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	<2	--	<2	<2	<2	<1	<2	<2
1,1-Dichloroethane	<2	--	<2	<2	<2	<1	<2	<2
1,1-Dichloroethene	<2	--	<2	<2	<2	1 J	1.2 J	1.6 J
1,2-Dichloroethane	<2	--	<2	<2	<2	<1	<2	<2
cis-1,2-Dichloroethene	2.8	--	5.9	13	22	69	63	70
trans-1,2-Dichloroethene	<2	--	1.4 J	5.5	11	46	37	43
Tetrachloroethene	20	--	38	54	57	66	46	27
1,1,1-Trichloroethane	0.30 J	--	0.53 J	0.48 J	0.42 J	<0.8	0.54 J	0.45 J
Trichloroethene	4.9	--	10	20	32	94	71	85
Vinyl Chloride	<2	--	<2	<2	0.96 J	4 J	3.5	4.9
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	--	<1	--	--	--	<1	--	--
Ethene	--	<1	--	--	--	<1	--	--
Methane	--	<5	--	--	--	<5	--	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	130	--	--	--	141	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	<0.46	--	--	--	<0.46	--	--
Total Organic Carbon	--	<0.5	--	--	--	0.74 J	--	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	--	12.1	--	--	--	--	--	--
Nitrate	--	0.62	--	--	--	--	--	--
Nitrite	--	<0.4	--	--	--	--	--	--
Sulfate	--	37.9	--	--	--	--	--	--
Arsenic	--	<0.0072	--	--	--	<0.0072	--	--
Iron	--	<0.0522	--	--	--	<0.0522	--	--
Manganese	--	0.0095	--	--	--	0.255	--	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08	WP-08
Sample ID:	POM-G-WP-08(51.00)	POM-G-WP08-051.00	POM-G-WP08-051.00-FD	POM-G-WP-08(55.35)	POM-G-WP08-055.35	POM-G-WP08-060.30	POM-G-WP-08(65.30)	POM-G-WP08-065.30
Analytical Laboratory:	Lancaster	Stone	Stone	Lancaster	Stone	Stone	Lancaster	Stone
Date Sampled:	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10	04-Jun-10
QA/QC Sample Type:	--	--	Duplicate	--	--	--	--	--
Depth (ft bgs):	51.00	51.00	51.00	55.35	55.35	60.30	65.30	65.30
<u>Volatile Organic Compounds (µg/L)</u>								
Carbon Tetrachloride	--	<2	<2	--	<2	<2	--	<2
1,1-Dichloroethane	--	2.0 J	1.9 J	--	7.1	10	--	3.4
1,1-Dichloroethene	--	3.9	3.3	--	6.9	14	--	9.4
1,2-Dichloroethane	--	<2	<2	--	<2	<2	--	<2
cis-1,2-Dichloroethene	--	330	290	--	920	1,500	--	1,200
trans-1,2-Dichloroethene	--	140	110	--	380	680	--	510
Tetrachloroethene	--	2.6	2.3	--	<2	<2	--	<2
1,1,1-Trichloroethane	--	<2	<2	--	<2	<2	--	<2
Trichloroethene	--	150	120	--	92	110	--	47
Vinyl Chloride	--	29	24	--	270	810	--	590
<u>Dissolved Hydrocarbon Gases (µg/L)</u>								
Ethane	<1	--	--	9.2	--	--	21	--
Ethene	<1	--	--	1.7 J	--	--	13	--
Methane	29	--	--	320	--	--	2,100	--
<u>Organic Carbon Indicators (mg/L)</u>								
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	180	--	--	279	--	--	408	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	6.5	--	--	5.7	--	--	5.6	--
Total Organic Carbon	2	--	--	4.9	--	--	15.9	--
<u>Inorganics (mg/L)</u>								
Carbon Dioxide	--	--	--	--	--	--	--	--
Chloride	25.2	--	--	43.1	--	--	77.1	--
Nitrate	<0.25	--	--	<0.25	--	--	<0.25	--
Nitrite	<0.4	--	--	<0.4	--	--	<0.4	--
Sulfate	39.3	--	--	36.5	--	--	27	--
Arsenic	<0.0072	--	--	<0.0072	--	--	0.0088 J	--
Iron	0.0614 J	--	--	0.108 J	--	--	0.443	--
Manganese	0.0283	--	--	0.0311	--	--	0.0536	--

**TABLE A-1
SUMMARY OF GROUNDWATER VOC, DHG, ORGANIC AND INORGANIC RESULTS FROM WP INVESTIGATION
Pompton Lakes Works, Pompton Lakes, New Jersey**

Sample Location:	WP-08	WP-08	WP-08
Sample ID:	POM-G-WP08-070.30	POM-G-WP08-075.30	POM-G-WP-08(82.25)
Analytical Laboratory:	Stone	Stone	Lancaster
Date Sampled:	04-Jun-10	04-Jun-10	04-Jun-10
QA/QC Sample Type:	--	--	--
Depth (ft bgs):	70.30	75.30	82.25
<u>Volatile Organic Compounds (µg/L)</u>			
Carbon Tetrachloride	<2	<2	<1
1,1-Dichloroethane	9.1	5.0	<1
1,1-Dichloroethene	9.2	4.6	<0.8
1,2-Dichloroethane	<2	<2	<1
cis-1,2-Dichloroethene	1,500	1,000	1 J
trans-1,2-Dichloroethene	610	230	<0.8
Tetrachloroethene	<2	<2	<0.8
1,1,1-Trichloroethane	<2	<2	<0.8
Trichloroethene	58	4.0	<1
Vinyl Chloride	580	340	2 J
<u>Dissolved Hydrocarbon Gases (µg/L)</u>			
Ethane	--	--	--
Ethene	--	--	--
Methane	--	--	--
<u>Organic Carbon Indicators (mg/L)</u>			
Alkalinity; Bicarbonate (CaCO ₃) at pH 4	--	--	--
Alkalinity; Carbonate (CaCO ₃) at pH 8	--	--	--
Total Organic Carbon	--	--	--
<u>Inorganics (mg/L)</u>			
Carbon Dioxide	--	--	--
Chloride	--	--	--
Nitrate	--	--	--
Nitrite	--	--	--
Sulfate	--	--	--
Arsenic	--	--	--
Iron	--	--	--
Manganese	--	--	--

Notes:
 < - analyte not detected above associated MDL
 -- - not sampled
Bold - compound was detected above PQL
 DHG - dissolved hydrocarbon gases
 Duplicate - field duplicate
 ID - identifier
 ft bgs - feet below ground surface
 J - compound was detected above the MDL, but below the PQL
 Lancaster - Lancaster Laboratories, Lancaster, Pennsylvania
 MDL - method detection limit
 µg/L - micrograms per liter
 mg/L - milligrams per liter
 QA/QC - quality assurance / quality control
 R - rejected; data point failed laboratory QA/QC process
 Stone - Stone Environmental, Inc. On-Site Mobile Laboratory, Montpelier, Vermont
 VOC - volatile organic compound
 WP - Waterloo Profiler

 PQL - practical quantitation limit