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October 17, 2003.	
Mr. Jeffrey L. Dyber, P.E. NYSDEC	11 (n. 1907) (n. 1917)
Bureau of Eastern Remedial Action Division of Environmental Remediation	······································
625 Broadway Albany, New York 12233-7015	
Re: Pall Comporation 30 Sea Cliff Ave. Glen Cove	NY Site

Re: Pall Corporation, 30 Sea Cliff Ave, Glen Cove, NY Site IHWDS No. 1-30-053B Final In-Situ Chemical Oxidation, Phase I Pilot Test Report

Dear Mr. Dyber,

Enclosed are two (2) copies of the final In-Situ Chemical Oxidation, Phase I Pilot Test Report for the above referenced facility. The revised report incorporates all comments received from the NYSDEC. We are in the process of finalizing the work plan addendum for the Phase II Pilot Test work and we will be forwarding the addendum to you shortly.

If you have any questions or comments, please do not hesitate to contact me at (631) 207-9005 extension 102.

Sincerely, ENVIRO-SCIENCES, INC.

Daniel J. Smith, P.E. Vice President, Engineering & Remediation

DJS/djs document3

cc: M.A. Bartlett, Esq. / Pall W. Benzinger / Pall F. Fotouhi / Pall H. Katz / Pall K. Olson, Esq. / MT&E

IN-SITU CHEMICAL OXIDATION PHASE I PILOT TEST REPORT

PALL CORPORATION 30 SEA CLIFF AVENUE GLEN COVE, NEW YORK

NYSDEC Inactive Hazardous Waste Disposal Site No. 1-30-053B

Submitted to:

New York State Department of Environmental Conservation Bureau of Eastern Remedial Action Division of Environmental Remediation 625 Broadway Albany, New York 12233-7015

Prepared by:

Enviro-Sciences, Inc. 312 East Main Street Patchogue, New York 11772

October 17, 2003



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- 1. Enviro-Sciences, Inc., "*In-Situ* Chemical Oxidation Pilot Test Design, Pall Corporation, 30 Sea Cliff Avenue, Glen Cove, NY", July 31, 2002 (ESI, 7/2002)
- Enviro-Sciences, Inc., "In-Situ Chemical Oxidation Pilot Test Work Plan, Pall Corporation, 30 Sea Cliff Avenue, Glen Cove, NY", October 31, 2001 (ESI,10/2001a)

- 3. Enviro-Sciences, Inc., "Feasibility Study Report, Pall Corporation, 30 Sea Cliff Avenue, Glen Cove, NY", October 15, 2001 (ESI, 10/2001b)
- 4. Enviro-Sciences, Inc., "Phase II Remedial Investigation Report, Pall Corporation, 30 Sea Cliff Avenue, Glen Cove, NY", July 13, 2000 (ESI, 7/2000)

<u>IN-SITU CHEMICAL OXIDATION</u> <u>PHASE I PILOT TEST REPORT</u>

PALL CORPORATION 30 SEA CLIFF AVENUE GLEN COVE, NEW YORK

1.0 INTRODUCTION

Based upon the findings of the Feasibility Study (FS), Pall Corporation recommended *In-Situ* Chemical Oxidation (ISCO) to be tested as a potential remedy to address groundwater contamination underlying the Pall Corporation (Pall) facility located at 30 Sea Cliff Avenue in Glen Cove, New York. The analysis described in the FS showed that potassium permanganate would be an appropriate oxidant to meet remedial objectives in a safe and cost-effective manner. Based upon these findings and successful bench-scale treatability studies, a phased pilot test was developed and implemented to demonstrate applicability in the "real world" field conditions of the site. This ISCO Phase I Pilot Test Report details the work completed during the initial phase of the NYSDEC approved pilot test program.

<u>1.1</u> Scope and Objectives

This pilot test program was initiated to evaluate the effectiveness and feasibility of *ISCO* to address shallow and intermediate zone groundwater impacts. This report presents the results of the first phase of pilot testing. Specifically, the scope and objectives of the Phase I pilot test included the following:

- Design of the pilot test system including injection well locations, monitoring locations, and oxidant injection equipment setup;
- Installation of eighteen (18) new, shallow permanganate injection wells to evaluate the ability to inject the desired volume of permanganate and achieve adequate mixing in the shallow zone;
- Installation of eighteen (18) new, intermediate permanganate injection wells to evaluate the ability to inject the desired volume of permanganate and achieve adequate mixing in the intermediate zone;
- Installation of six (6) new monitoring well couplets (shallow and intermediate) to monitor permanganate injection events. In the future, the new monitoring wells will be used in conjunction with existing monitoring wells to provide a comprehensive injection monitoring network;



- Installation of a permanganate delivery / injection system including make-up tanks, mixers, pumps, and control systems;
- Completion of one (1) permanganate injection event at the Phase I, shallow and intermediate injection wells. During the injection event, parameters including optimum delivery rates, well fouling (if any), groundwater elevation changes, temperature changes, etc. were monitored at monitoring wells. The permanganate solution makeup procedures were evaluated to optimize the full-scale delivery system;
- Field monitoring during and following the permanganate injection event to determine the zone of influences, reaction rates, degree of reaction, contaminant reduction rates, estimates of the amount of unreacted reactants, etc. Monitoring included collection and analyses of groundwater samples, colorimetric analyses, etc.; and,
- Issuance of this Phase I Pilot Test Report documenting the findings of the study and identifying key design criteria and activities necessary for full-scale remediation to meet remedial objectives using this technology.

1.2 Overview of In-Situ Oxidation Using Permanganate

Permanganate ion (MnO_4) has been used as an oxidant to treat organic compounds in water and wastewater for many years. In recent years, it has been increasingly used *in-situ* to remediate groundwater contaminated with volatile organic compounds, primarily chlorinated organics. For this phase of the pilot test, potassium permanganate was used, although sodium permanganate can also be used effectively. Oxidation using permanganate has several major benefits over more traditional remediation methods such as pump and treat systems in that it removes significantly more contaminant mass via a destructive technology; it greatly reduces the time to complete remediation (often by a decade or more); and, it is more cost-effective than other remedies requiring complex air handling and/or water treatment systems.

Permanganate is a very effective oxidizer with high water solubility (approximately 60 to 65 grams per liter). The high solubility makes it highly mobile and relatively easy to inject into the subsurface. In addition, the high solubility allows the permanganate to achieve greater *insitu* mixing and better contact with contaminants of concern.

For the primary contaminants of concern at the site including Tetrachloroethene (PCE), Trichloroethene (TCE), *cis*-1,2-Dichloroethene (12DCE), and Vinyl Chloride (VC), the generalized chemical reactions that drive remediation are presented below:

PCE: $4KMnO_4 + 3C_2Cl_4 + 4H_2O \rightarrow 6CO_2 + 4MnO_2 + 4K^+ + 12Cl + 8H^+$ TCE: $2KMnO_4 + C_2HCl_3 \rightarrow 2CO_2 + 2MnO_2 + 2K^+ + 3Cl + H^+$ DCE: $8KMnO_4 + 3C_2H_2Cl_2 \rightarrow 6CO_2 + 8MnO_2 + 8K^+ + 6Cl + 2OH + 2H_2O$ VC: $10KMnO_4 + 3C_2H_3Cl \rightarrow 6CO_2 + 10MnO_2 + 10K^+ + 3Cl + 7OH + H_2O$

As indicated above, the volatile organic compounds and potassium permanganate are converted primarily to carbon dioxide (CO_2), manganese dioxide (MnO_2), water (H_2O), chloride ion (CI), and potassium ion (K^+) at completion. Since dissolved manganese and chloride have secondary maximum contaminant levels (MCLs), the formation of these ions during the pilot test was also carefully monitored.

In addition to the primary contaminants of concern, several other chemicals were present at concentrations exceeding NYSDEC Class GA Groundwater Quality Standards. 1,1,1,-Trichloroethane (TCA) and 1,1-Dichloroethane (11DCA) were present at concentrations typically an order of magnitude or two below the chlorinated alkenes, but above their respective groundwater quality standards (typical detections were less than 100 µg/l). Chlorofluorocarbons (i.e., "1,1,2-trichloro-1,2,2-trifluoroethane") were detected at concentrations typically between 100 and 1,700 µg/l in the shallow wells and at concentrations under 100 μ g/l in the intermediate groundwater zone. Although these compounds could potentially be degraded by permanganate injection, it was anticipated that degradation of the chlorinated alkanes and the chlorofluorocarbons would be less efficient because the reaction mechanism for these classes of chemicals would be through free radical formation, which is typically not the primary reaction mechanism associated with permanganate injection. Based upon the chemistry of permanganate reactions with VOCs and bench-scale treatability results, it was anticipated that degradation of chlorinated alkanes and chlorofluorocarbons could occur (through bioremediation and free radical reactions), although the remediation would take significantly longer than with the chlorinated alkenes.

Other oxidants such as Fenton's Reagent could more aggressively treat the chlorinated alkanes and potentially the chlorofluorocarbons; however, the use of Fenton's Reagent would likely result in more localized treatment (i.e., effective radius of influence would be smaller than with permanganate) and may require multiple injection events to address contaminants of concern. Fenton's Reagent should be considered for subsequent testing if localized treatment of the alkanes and/or chlorofluorocarbons that are not as effectively treated by permanganate is warranted.



2.0 PILOT TEST SYSTEM DESCRIPTION

The pilot test was designed to be completed in several phases that were selected to minimize site disruptions to occupants and to allow results from early phases to be interpreted to identify data gaps, optimize subsequent phases, and reduce total pilot test costs. This section of the report describes the overall pilot test system with a focus on the Phase I pilot test setup.

2.1 Overall Pilot Test System Layout

The test area was chosen based upon the results of the RI completed by Enviro-Sciences, Inc. on behalf of Pall Corporation. During the RI, it was concluded that the area of the highest concentrations of chlorinated VOCs in the shallow and intermediate groundwater zones is near the northern property line of the Pall site near well clusters at MW-5, MW-10, MW-2A, MW-11PS, and MW-12PS (see Figure 1). A complete description of the levels of contaminants, contaminant distribution, and geologic and hydrogeologic factors influencing this pilot test was provided in the RI and FS reports for the site. These documents are incorporated herein by reference.

The overall pilot test area is bounded on the north by the northern site property line; the south by MW-3P and the horizontal SVE well; the east by the eastern Pall property line; and, on the west by the MW-2A well clusters. This pilot test area was selected to address the areas of highest concentrations and because of the extensive monitoring well network available for collection of data to monitor the progress of the pilot test. The overall pilot test system layout and design is presented in Appendix A.

As indicated in the Appendix A, the pilot test was originally planned for completion in five phases. The first four phases were to focus on injection in horizontal lines of newly installed, dedicated, injection wells at varying distances from monitoring points and areas of elevated chlorinated VOC concentrations. The fifth phase was planned to test injection of KMnO₄ directly into existing monitoring wells to determine the effectiveness of using existing monitoring wells as future injection points. Based upon the data obtained during the Phase I Pilot Test, it is recommended the pilot test be modified by eliminating several phases, evaluating the use of a more aggressive oxidizer (e.g., Fenton's Reagent) to address chlorofluorocarbons, and changing the points of injection. These proposed modifications will be presented in an addendum to the Pilot Test Work Plan and Design documents and are offered to streamline the pilot test phase of this project and reduce costs, while allowing for the collection of data needed to complete the technology evaluation.

2.2 Phase I Pilot Test Layout

The Phase I pilot test layout is presented in Figure 2. The permanganate injection system consisted of four major components: (1) the KMnO4 Make-up Solution System, (2) The Injection Manifold System, (3) The Injection Well Network, and (4) the Monitoring Well Network.

All shallow permanganate injection wells were 4" diameter PVC wells screened from approximately 5 to 25 feet below grade surface. The intermediate injection wells were also 4" diameter PVC wells and were screened from approximately 35 to 55 feet below grade. The existing monitoring well clusters near the northern side of the Pall site were used for monitoring and data collection during the pilot test. In addition, six (6) new monitoring well couplets were installed as part of the pilot test (See Drawing Appendix A). As a minimum, there was at least one downgradient monitoring well couplet (shallow and intermediate) to monitor the oxidation reactions before (pre-injection baseline), during, and after each injection event. Monitoring well couplet locations were determined based upon modeling of the permanganate injection system to predict probable radii of influence and reaction rates. This information was provided in the Pilot Test Design submittal (ESI, 7/2002)

The permanganate makeup solution system was skid mounted and was set-up near the former metal shed storage area (see Figure 2). This location provided ready access to the water feed location and allowed the storage of KMnO4 bins within the secondary containment structure that was already present at the site. The injection manifold system was also skid mounted and was designed with quick-connect fittings so that it could be moved to any given area of injection. For the Phase I pilot test, it was located immediately to the south of pilot test injection well PT-16S. From this location, flex hoses were attached to the Phase I injection wells to allow simultaneous injections at up to five (5) injection wells. The following injection wells were used in the Phase I pilot test work:

Shallow Wells	Intermediate Wells
• PT-14S	• PT-14I
• PT-15S	• PT-15I
• PT-16S	• PT-16I
• PT-17S	• PT-17I
• PT-18S	• PT-18I

Shallow Wells	Intermediate Wells
• MW-11PS	• MW-11PI
• MW-12PS	• MW-12PI
• MW-10PS	• MW-5PI
• PTMW-1S	• MW-10PI
• PTMW-2S	• PTMW-11
• PTMW-3S	• PTMW-2I
• PTMW-4S	• PTMW-3I
	• PTMW-4I

The monitoring well network for Phase I pilot testing included the following wells:

It should be noted that existing monitoring well MW-5PS was originally included in the work plan to be sampled. However, the well could not be located during the pilot test because an area of the parking lot had been damaged near the well location, and there was a significant layer of sediments from stormwater runoff ponded in the area where the well was located.

The detailed design drawings in Appendix A provide the engineering details of the system and the injection-phasing plan (e.g., piping and instrumentation diagram, elevations, equipment specifications, etc.). Power and water were supplied from the Pall building. All potassium permanganate was staged prior to injection in the existing chemical storage area at the site north of the pilot test area. This area was ideal for chemical storage during the pilot test because it was previously used for chemical storage and was designed specifically to prevent accidental releases of chemicals to the environment (i.e., secondary containment is provided, the floor coating is impervious, etc.).

¹ Several additional wells were also sampled during the first phase of the pilot test. However, these wells were not required to be sampled as per the NYSDEC approved work plans and design documents. These wells included shallow wells PTMW-5S and PTMW-6S and intermediate wells PTMW-51 and PTMW-61. The results from these wells will be discussed in the text as appropriate. In addition, ESI completed sampling of several upgradient monitoring wells to establish background conditions at the site.



3.0 PILOT TEST PROCEDURES

After installation of the pilot test injection wells and new monitoring points, the wells were developed by pumping until development parameters such as turbidity, temperature, pH, and conductivity stabilized. Development waters were disposed via the municipal sewer system in accordance with City of Glen Cove approvals. Well development logs are provided in Appendix B.

The NYSDEC, as well as August Thomsen, the Glen Cove Day Care Center, the EMS Garage, and the Glen Cove Water Department, were given ten working days notice prior to the start of fieldwork. At the request of the NYSDEC, initial pilot test activities (i.e., permanganate makeup, equipment tests, etc.) began on a weekend when buildings near the pilot test were minimally occupied.

3.1 Pre-test (Baseline) Sampling

Prior to the start of permanganate injection events, baseline groundwater samples were collected from the following monitoring wells.

Shallow Wells	Intermediate Wells	<u>Deep Wells</u>
• MW-2A	• MW-2AI	• MW-2AD
• MW-4PS	• MW-5PI	• MW-5PD
• MW-7P	• MW-6P	• MW-6PD **
• MW-10PS	• MW-10PI	• MW-10PD
• MW-11PS	• MW-11PI	• MW-11PD
• MW-12PS	• MW-12PI	• MW-12PD
• MW-13PS	• MW-13PI	• MW-14PCD **
• PTMW-1S	• PTMW-1I	• MW-15PCD **
• PTMW-2S	• PTMW-2I	
• PTMW-3S	• PTMW-3I	
• PTMW-4S	• PTMW-4I	
• PTMW-5S	• PTMW-5I	
• PTMW-68	• PTMW-6I	

****** Note: Samples collected after KMnO4 Injection Events to update the site databaseunrelated to pilot test work.

All wells were sampled for VOCs, chlorofluorocarbons, total organic carbon (TOC), chlorides, and the following metals: iron (Fe), manganese (Mn), and chromium (Cr). Baseline sampling results are presented in Tables 1A, 1B, and 1C.

In addition to the analytical sampling, field monitoring was performed on wells related to pilot testing. The parameters evaluated were temperature, pH, conductivity, $KMnO_4$ (colorimetric method), Oxidation-Reduction Potential (ORP), wellhead VOCs (with a photoionization detector), dissolved oxygen and groundwater level measurements.

Data collected during the baseline sampling event was used as a basis of comparison for data generated during and following pilot testing. All analytical work was prepared and delivered in accordance with ASP Category B protocols.

A complete summary of the analytical work during the Phase I Pilot Test is provided in Table 2 for Shallow Wells and Table 3 for Intermediate Wells. Data collected from the deep wells is provided in Table $1C^2$.

3.2 Treatability Study Results and Pilot Test Dosing Estimates

In order to evaluate the proper concentrations and dosing requirements for the permanganate injection pilot test, ESI completed a bench-scale treatability study in coordination with the Environmental Research Institute (ERI) at the University of Connecticut (UCONN). The complete text of the Treatability Study Report is provided in Appendix C. The significant findings of the bench-scale treatability study are summarized in Table 4.

As indicated in Table 4, the treatability study concluded that permanganate could effectively degrade PCE, TCE, cis-12DCE, VC, and 1,1,2-trichloro-1,2,2-trifluoroethane in the site soil and/or groundwater. The degradation of 1,1,2-trichloro-1,2,2-trifluoroethane in the control experiment was observed as well as in the permanganate injection test setup. 1,1,2-trichloro-1,2,2-trifluoroethane degradation is expected to occur, only at a slower rate than the other compounds of concern. One of the primary objectives of the pilot test was the evaluation of the effectiveness of $KMnO_4$ for 1,1,2-trichloro-1,2,2-trifluoroethane removal.

The soil oxidant demand was determined to be approximately 1 to 4 g/kg soil and increased with an increase in $KMnO_4$ concentration. This is representative of a relatively low soil demand factor thus making permanganate injection a very attractive remedy. A low *in-situ* $KMnO_4$ dosage concentration of 1 to 2 g/L (approximately 0.1% to 0.2% by weight) was evaluated in the first phase of the pilot test.

² Deep well data were only collected as part of the baseline sampling program and is therefore included in the baseline sampling summary table (Table 1).



Based upon the size of the site and the $KMnO_4$ demand determined during the bench-scale treatability study, as much as 480,600 pounds of oxidant may be required for full-scale remediation of the area of concern. This first phase of the pilot test included injection of 39,600 pounds of potassium permanganate to achieve an *in-situ* dosage concentration of approximately 1 g/L (after accounting for a soil oxidant demand factor of 1g / kg within the anticipated area of influence of the Phase I injection events). Approximately 22,700 pounds were injected into five (5) intermediate injection wells during this phase of testing. The remaining 16,900 pounds were injected into the five, Phase I, shallow injection wells. A complete summary of the KMnO4 injection parameters for the Phase I pilot test is provided in Table 5.

As indicated in Table 5, the average concentration of KMnO₄ injected in the shallow wells was 2.3% and the average concentration in the intermediate wells was 2.2%. Approximately 80,000 gallons of make-up water were required for the shallow injections and 118,400 gallons for the intermediate injections during Phase I. Average flow rate into the five well, shallow network was 35.8 gallons/minute (approximately 7.1 gpm per well average). Intermediate well injection flow rates for the five well network of Phase I averaged approximately 82.2 gpm (average of about 16.4 gpm per well).

3.3 Permanganate Solution Make-up and Injection Sequence

The permanganate make-up and injection system consisted of a dry chemical feed system, a make-up tank with a mixer, a potassium permanganate injection system with feed rates that could be varied in the field, safety systems (e.g., relief valves, etc.), and monitoring instrumentation (e.g., pressure gauges, temperature gauges, flow meters, etc.).

An injection manifold was developed to allow injection in several wells simultaneously. The injection of permanganate was completed in phases so that monitoring data could be properly collected and catalogued. Injection began at Phase I near the MW-11P and MW-12P clusters. Injections were first performed in the intermediate wells (perpendicular to the groundwater flow direction) until the desired volume of the permanganate solution was introduced. The injection events then proceeded in the shallow wells. Monitoring was performed until essentially all permanganate had been reacted to completion (as determined by visual observations and colorimetric data).

3.4 Performance Monitoring and Sampling

The existing monitoring well network, as supplemented with the six (6) new monitoring well clusters, was utilized for pilot test performance monitoring. The parameters monitored and the frequency of monitoring performed is summarized in Table 6.

All analytical samples collected were collected in accordance with the procedures outlined in the existing Quality Assurance Project Plan (QuAPP) for the site. Laboratory data was presented following ASP Category B deliverables.

All field data was documented in a field logbook or on field data sheets developed for the project.

3.5 Termination of Field Pilot Tests

Field tests were terminated after the desired mass of permanganate had been added to the subsurface and sufficient data had been collected to meet pilot test objectives. Upon termination of pilot testing, the pilot test well network remained in place to the support additional phases of the pilot test.



4.0 DATA EVALUATION AND MONITORING

Data collected from the pilot test were entered into a database for preparation of the Phase I Pilot Test Report. Specifically, data pertaining to the following were catalogued:

- A summary of the work sequence and daily field activity;
- Permanganate injection dosing rates, injected concentrations, the mass of permanganate injected, etc.;
- Injection well monitoring to determine maximum possible injection rates and well performance;
- Field monitoring data (i.e., field screening parameter collection) obtained during and following permanganate injection events to measure degree of *in-situ* mixing and reaction effectiveness;
- Contaminant reduction data collected to evaluate the potential for the remedy to meet remedial objectives for the primary chlorinated VOCs of concern and chlorofluorocarbons; and,
- Groundwater table monitoring to evaluate potential mounding and to ensure that contamination was not spread during injection events.

The ability to remediate many chlorinated compounds using potassium permanganate is readily accepted in a perfect environment. However, the ability to remediate these same compounds under "real world" conditions with imperfect mixing, soil heterogeneity, and variable groundwater conditions was the focus of the first phase of the pilot test. The ability to achieve adequate *in-situ* mixing and measurement of the effectiveness of the desired reactions was determined during the pilot test by a combination of physical measurements (e.g., depth to water, flow rates, etc.), chemical measurements (oxidation-reduction potential, VOC analyses, etc.), visual observations (colorimetric indicators, ability of the wells to accept flow, etc.) and data interpretation (e.g., effective radius of influence of injection wells, contaminant reductions and rebound effects, etc.). Due to the comprehensive well network at the site, these parameters were monitored and evaluated at multiple locations to develop a comprehensive understanding of the *in-situ* performance of the permanganate injections.

The following parameters were monitored in the field and evaluated to determine the effectiveness of the pilot test and to gather data required for full-scale implementation.

• **Depth to Water:** Depth to water was monitored to evaluate potential mounding and as a relative indicator for the radius of influence for the injection wells.

- *Groundwater Temperature:* Monitoring was conducted to evaluate the heat of reaction and to protect the health and safety of workers and the neighboring community.
- *Groundwater Conductivity:* Monitoring was performed as a relative indicator of the metals in solution before, during and after injection events.
- **Groundwater pH:** pH data was recorded to assist in the evaluation of other parameters and to document site conditions as part of the Phase I Pilot Test.
- **Dissolved Oxygen (DO) in Groundwater:** DO data were collected to evaluate the effective radius of influence of the injection well network and as an indicator of oxidant mixing and consumption.
- **ORP in Groundwater:** ORP data were collected to determine the effectiveness of permanganate injection events and the impact of the events on the oxidizing / reducing environment *in-situ*.
- **Permanganate in Groundwater (color):** Data collected provided an indirect measurement of $KMnO_4$ in groundwater and served as an indicator of mixing of reactant in the water table and the radius of influence from the injection wells.

In addition, analytical data were collected before and after injection events to directly measure the potential to reduce contaminant concentrations by permanganate injection. Specifically, the following analytical data were collected and analyzed:

- **VOCs and Chlorofluorocarbons in Groundwater:** These parameters indicate effectiveness of the proposed remedy and the degree of completion of reaction, residual contaminant levels, etc. Essentially, these data provide the best indicator of the ability of the proposed remedy to meet remedial objectives.
- *Metals in Groundwater:* These parameters indicate potential bi-products of reaction, ion formation, etc.
- **TOC in Groundwater:** TOC is an indicator of soil and groundwater oxidant demand and as such is an input parameter for model verifications, extent of reaction indicators, etc.
- *Chloride in Groundwater:* This parameter indicates potential bi-products of reaction, degree of reaction completed, etc.

The data obtained during the pilot test and the implications are discussed in the following sections of the report.

Although it is acknowledged that it is not entirely possible to analyze intermediate groundwater performance without consideration of the adjacent shallow groundwater zone, these two zones

behave very differently with regard to the injection of fluids and the ability to remediate the contaminants of concern in a cost-effective manner. For this reason, the shallow (from grade to approximately 30 feet below grade) and intermediate (from 30 to about 65 feet below grade) groundwater zones will be addressed separately in this report. Where it is appropriate to discuss the interrelations between the two zones, this report will present the appropriate data and discussion.

4.1 Intermediate Groundwater Injection Performance

Intermediate zone injections for the first phase of the pilot test were initiated on November 19, 2002, and were completed on November 25, 2002. The following sections present the intermediate groundwater zone data and conclusions.

4.1.1 Intermediate Injection Well Performance

The performance of the intermediate injection well network was primarily determined by the ability to deliver the desired quantity of KMnO₄ to the subsurface in a reasonable amount of time without causing contaminant migration or unacceptable mounding of groundwater. This aspect of the test focused on mechanical injection data such as flow rates and pressures and the groundwater parameters related to injection (e.g., depth to water, etc.). The ability of the injected reactants to reduce contaminant concentrations effectively is discussed elsewhere in this report.

Average flow rate into the five well, intermediate network was 82.2 gpm (average of about 16.4 gpm per well). In general, injection events at the intermediate wells proceeded as planned with generally uniform injection rates at all wells. The maximum anticipated design injection rate at the intermediate zone was approximately 15 gpm without causing potential and temporary "spread" of contaminants due to the local injection wave front. The field data verified the design models for injection in the intermediate zone and data collected indicate no evidence of any potential spreading of contaminants (see Section 4.1.3 for additional information on contaminant reduction effectiveness).

Mounding in the intermediate injection wells was not a significant concern, nor were there any other significant problems with the mechanical injection of the permanganate solution into the intermediate groundwater zone. However, problems with the individual well manifold flow meters were experienced because of fouling of the meters caused by solids from the makeup solution. The solids were present primarily from silica in the permanganate that is normal when "free flowing" permanganate is purchased. When individual wellhead flow meters were not operational, manual flow measurements were used (i.e., timed volume discharges to the

groundwater) and total flow readings for the whole intermediate injection well network were not impacted. For full-scale operation, individual wellhead metering will have to be more thoroughly addressed.

The radius of influence from intermediate injection points was relatively uniform in the general direction of groundwater flow (toward the north), but was greater toward the middle of the injection line due to interwell effects as would be expected. In addition, it is also likely that there was a temporary influence against the natural groundwater flow direction immediately following injection events, but this could not be confirmed during the Phase I Pilot Test.

Based upon changes in field monitoring data and evaluation of pre-injection and post-injection analytical data, the radius of influence in the intermediate zone ranged from approximately 20 to 25 feet near the periphery of the injection line to over 50 feet near the center of the Phase I injection zone. This estimate is based upon visual observations (colorimetric changes) and review of field screening data indicating changes from baseline conditions (e.g., increases in water table elevation, dissolved oxygen changes, REDOX changes, etc.).

Additional information regarding the effective radius of influence is presented in the following sections.

4.1.2 Intermediate Permanganate Mixing & Reaction Effectiveness Monitoring

The effectiveness of *in-situ* mixing and reactions was measured by collecting and analyzing the data outlined in Section 4.0. The data obtained during the pilot test for these parameters are provided in Tables 7 and 8. In addition, analytical testing was also performed to measure the ability of the permanganate to reduce contaminant concentrations. The analytical data are presented and discussed in Section 4.1.3.

Intermediate well $KMnO_4$ injections were initiated on November 19, 2003, after two initial days of preparing the initial injection solution batch. Prior to injection of permanganate, a water injection test was performed on November 7, 2002, to check the system piping and components for leakage. A few minor leaks were evident during the water test and the equipment was repaired and re-tested successfully on November 7, 2002. During the water test, the injection wells were observed for mounding and other indications that the wells could not accept the design flow rates of 10 to 15 gallons per minute. All wells performed satisfactorily during the water injection test.

Prior to the start of permanganate injections, baseline data was collected from representative wells in the Phase I area to document baseline conditions in the intermediate wells prior to

injection events. Baseline data was collected on November 18, 2003 and early on November 19, 2003, before injection system start-up. Baseline field monitoring included collection of the following data:

- Depth to Water
- Groundwater Temperature
- Groundwater Conductivity
- Groundwater pH
- Dissolved Oxygen (DO) in Groundwater
- ORP in Groundwater
- Permanganate (colorimetric)
- Groundwater Wellhead VOCs (using a PID)

The data collected during the field screening for the intermediate injection events are provided in Tables 7 and 8.

It should be noted that field monitoring for all parameters at all wells as originally outlined in the work plan was not possible because of the time required to collect data at certain wells. Therefore, informal screening at select wells was performed to determine if full sets of data needed to be collected from every well, every day. As is evident from the large data set summarized in the tables, an extensive amount of high quality data was collected and analyzed even after elimination of some of the data points originally identified for data collection. Whenever it was determined that data may be required to evaluate system performance, the data were collected and analyzed regardless of the time required to collect the data.

As indicated in Table 89 the background values for all intermediate wells in the Phase I area were typically in the ranges indicated below:

• **pH:** Average³ pH of 7.86 (7.80 without PT-9I). Values ranged from 7.23 to 9.92 Standard pH Units with the exception of PT-9I, which had a localized pH of 11.27 at the start of testing. In general, intermediate wells near the east and north had slightly higher background pH readings.

Logarithmic adjustment made for pH

- **Conductivity:** Average conductivity of 0.49 mhos (0.32 without PT-9I). Values ranged from 0.05 to 0.58 mhos with the exception of PT-9I, which had a localized conductivity of 1.71 at the start of testing. In general, higher conductivity values were correlated with higher pH values.
- **ORP:** Average ORP of 39.88 (47.71 without PT-9I). Values ranged from -19 to 73 at the start of testing, with all locations except PTMW-6I and PT-9I exhibiting an ORP indicative of an oxidizing environment (i.e., positive) ORP value.
- **Temperature:** Average temperature of 17.74 degrees Celsius. Values ranged from 15.8 to 19.6 deg. C.
- **DTW:** Average depth to water of 3.67 feet. Values ranged from 3.24 to 4.43 feet.
- **Dissolved Oxygen:** Average DO of 0.65 mg/l. Values ranged from 0.39 to 1.68 mg/l. There was a general correlation between DO and ORP, with higher ORP present at the same locations of higher DO.
- Wellhead VOCs: The average wellhead VOC readings were 13.9 ppmv equivalence units (isobutylene calibration gas). However, there was wide variation from well to well. Values ranged from zero ppmv at several wellheads to 85.4 at well PT-13I. Breathing zone VOCs above the wellhead were generally non-detectable, so the localized wellhead VOC readings were not a health and safety concern.

At the onset of permanganate injections, the pH was relatively stable at most well locations. As indicated in Figure 3, there was no significant change in pH during permanganate injection events at the intermediate wells. The pH within the Phase I Pilot Test area remained relatively constant between 6.0 and 9.0 throughout testing with the notable exception of PT-9I where elevated pH levels (compared to other wells on-site). Permanganate degradation reactions typically occur independently of pH values in this range. Since a significant drop in pH was not evident during testing, it is probable that acidic byproducts or intermediates of the degradation reactions were either not present or short-lived. In general, pH monitoring indicated that pH should not be impacted significantly in the subsurface during intermediate zone permanganate injections, nor should it inhibit the desired degradation reactions.

Since metals may be added to the aquifer during permanganate injections because of their trace presence as impurities in the make-up solution, monitoring of conductivity in the groundwater was performed. Conductivity also is a good screening tool to assist in the analysis of metals behavior in the subsurface during and following permanganate injections. Conductivity readings increased slightly immediately following the start of permanganate injections on most days of testing (see Figure 4), but returned to (or close to) the previous baseline levels overnight when injections were suspended. This minor change in localized conductivities is not considered significant. The minimal changes in conductivity, coupled with the fact that the pH did not significantly drop during injection events, are good indications that metal mobilization was not significant during the intermediate injection events. This topic is discussed in more detail in Sections 4.1.3 and 4.2.3 of the report.

The oxidation-reduction potential (ORP) data for the groundwater system is probably the most difficult to interpret during permanganate injection because of the complex nature of the multiple chemical processes that are constantly occurring in the subsurface. In general, there is typically an increase in ORP immediately after permanganate injection as the oxidant enters the subsurface. However, the presence of free oxidant may be very short-lived in an effective permanganate injection design because the oxidant delivered should be readily consumed by the reactants as the degradation reactions progress. Further, the stimulation of biodegradation may compound the shift to a reducing environment because of the depletion of available oxygen as bioremediation occurs. As indicated in Figure 5, there were often significant changes in the ORP from the time immediately following injection to the completion of the daily injection events. For example, PTMW-2I, located approximately 20 feet away from the injection line, had a baseline ORP near zero mV indicating a neutral environment. Immediately following the start of the intermediate injection events, the ORP was increased to over 200 mV indicating the effective addition of the oxidant to the subsurface. Following the typical spike in ORP after the injection was initiated, the ORP usually dropped rapidly (within 24 hours) as the oxidant became consumed. This same general trend of increases in ORP followed by rapid decreases was evident in most, though not all, monitoring locations during the intermediate injection events.

Another interesting conclusion that is evident from Figure 5 is that the data implies that shallow injections may positively influence the intermediate groundwater zone. This is best demonstrated by MW-12PI and PTMW-11. These intermediate monitoring locations had returned to their approximate baseline ORP levels following the completion of intermediate injection events on November 25, 2002. At the initiation of shallow injections on November 26, 2002, there was no immediate increase in the intermediate monitoring locations. However, by December 12, 2002, there was a significant spike in ORP in these intermediate monitoring location intoring locations. It is probable that the shallow injection of permanganate ultimately reached the intermediate groundwater zone, although it was not nearly as rapid as the direct injection into the intermediate injection wells.

Temperature monitoring was performed primarily for health and safety reasons to ensure that the reaction would not release an unacceptable level of thermal energy. Although this was not expected to be a problem with permanganate, the monitoring was performed as part of a rigorous health and safety program at the site. The temperature response data are presented graphically in Figure 6. As indicated by the figure, the temperatures in each of the monitoring locations remained relatively constant throughout testing. There was a slight decrease in temperature, but it is likely that this is independent of the Phase I Pilot Test and occurred naturally due to the very cold temperatures in the early weeks of December 2002.

One of the most important parameters evaluated during intermediate well injection events was the depth to water, DTW (i.e., groundwater elevation). DTW readings were collected to evaluate the potential for mounding during injections and to help assess the radius of influence of the injection wells. DTW data for intermediate injection well monitoring are presented in Figure 7. During injection events, there was evidence of localized mounding in the wells closest to the injection line. The mounding generally diminished as the distance from the injection wells increased; however, the proximity to the center point of the injection line was also a significant factor due to the cumulative affects of injections at adjacent wells (i.e., overlapping of the effective ROI). Although some mounding was evident as would be expected, the mounding did not result in the groundwater table rising to the surface in any wells during the intermediate injection events. As will be discussed later in the report, mounding was a much more significant concern during shallow injection events.

Mounding at wells within 20 feet of the center of the injection line typically resulted in a water table rise of 1.5 to 2 feet during intermediate injections. For wells located along the periphery of the injection line (i.e., PT-9I and MW-12PI), the water table rose approximately 1 to 1.5 feet during injection rates of about 15 gpm per well. For monitoring locations along the north property line, the water table increase was typically less than 0.5 feet.

The DO data was used to indicate the level of oxygen available in the subsurface to stimulate bioremediation and to enhance degradation reactions. In general, excellent DO response was noted during injection event monitoring. DO increases were evident in the majority of monitoring locations within 50 feet of the injection line. Just as importantly, DO increases were not significant at distances greater than 50 feet from the injection wells, which helps to define the effective radius of influence of the injection wells in the intermediate zone (see Figure 8). DO increases of greater than 100% were common in wells within 20 feet of the injection line. As would be expected, the DO increases were more pronounced near the center point of the injection line because of the overlapping of the injected oxidant from individual

wells. There was no significant increase in DO levels at wells along the north property line over 100 feet away from the injection area.

Wellhead PID screening was provided primarily for health and safety monitoring and the data are presented in Table 10. Additional ambient air screening in breathing zones and at property boundaries was also conducted to ensure the health and safety of site personnel and off-site receptors. There were no health and safety concerns noted during the intermediate injection event, or at any other time during testing.

Colorimetric monitoring for KMnO₄ was performed during the pilot test to assist in the evaluation of dosing effectiveness and *in-situ* mixing. In most instances, visual gauging was possible because a deep purple color indicating KMnO₄ concentrations in the range of 5 to greater than 25 mg KMnO4 per Liter of groundwater was evident in, and immediately around, the injection wells. Where visual indications were less reliable (i.e., at concentrations under 5 mg/l KMnO₄), a colorimetric meter was used. The data collected is presented in Table 8. Since the colorimetric meter can be influenced by other substances within the same color spectrum as permanganate, an upgradient sample from MW-6I was also collected to "blank out" background levels. Upgradient (i.e., background) colorimetric levels were typically at or near 0.3 to mg/l.

As indicated in the table, the concentration of KMnO₄ in the aquifer within 17 feet of the injection wells at PTMW-11 in the week following the initial injection event was near 3 mg/l. Concentrations gradually dropped off to around 1 mg/l in the month following injections. During the first few days of injections, much higher levels were present as indicated by visual evidence of a deep, purple color in the groundwater samples. Similar, though slightly lower, levels were present in PTMS-2I, which was located 42 feet from the injection line. As would be expected, there was a lag of several days before the maximum concentrations at PTMW-2I were detected. These data are indicative of good in-situ mixing to a distance of at least 40 feet from the injection line.

Based upon review of all the field screening parameters, it was concluded that the Phase I intermediate injection well network performed effectively with regard to delivery of oxidant to the subsurface. The effective radius of influence, based upon review of screening data and visual observations (i.e., colorimetric changes), is at least 25 feet and is very likely greater than 50 feet in the general direction of natural groundwater flow (toward the north). There was also some likely, short-term influence against the natural groundwater flow direction immediately following the injection events, but that could not be confirmed during the Phase I Pilot Tests.

In-situ mixing of oxidant with the contaminants of concern in the dissolved phase also appeared to be achieved based upon field analyses and visual observations.

4.1.3 Intermediate Contaminant Reduction & Potential Remedial Effectiveness

Although the field screening data presented in the previous section is useful in understanding the radius of influence that is needed for full-scale implementation, the most direct measure of a proposed remedy's ability to meet remedial goals is the reduction in the mass of contamination at the site. This section of the report presents the analytical data obtained to determine if the permanganate injection events at the intermediate wells effectively reduced the concentration of the contaminants of concern in the study area.

As mentioned previously in the report, all analytical data for the intermediate groundwater zone is presented in Table 3. Although the VOC parameter list is extensive as required by the NYSDEC, the primary contaminants of concern at the site are chlorinated VOCs in groundwater: specifically, Tetrachloroethene (PCE), Trichloroethene (TCE), 1,2-Dichloroethene (12DCE), 1,1,1-Trichloroethane (TCA), and Vinyl Chloride (VC). Secondary contaminants of concern include 1,1,2-trichloro-1,2,2-trifluoroethane. The Phase I Pilot Test also included an analysis of several parameters required to evaluate the use of permanganate injection at the site. These parameters included chromium, iron, chlorides, manganese, and total organic carbon (TOC).

Pre-injection (i.e., baseline) sampling was performed between October 30, 2002, and November 7, 2002, to establish pre-test conditions. In order to allow comparison of data to historic site monitoring, analytical samples were collected from pre-existing monitoring wells in the pilot test area as well as from the new monitoring wells installed for the pilot test. The following intermediate monitoring wells were sampled during the Phase I Pilot Test:

• MW-2AI*	• PTMW-11
• MW-5PI	• PTMW-2I
• MW-6P*	• PTMW-3I
• MW-10PI	• PTMW-4I
• MW-11PI	• PTMW-5I
• MW-12PI	• PTMW-6I
• MW-13PI*	

* Wells indicated by an asterisk were sampled for background information and are not discussed in this report.

In general, the baseline levels of VOCs were either non-detectable or relatively low (less than 10 ug/l) except for the following compounds:

- **1,2DCE:** (maximum concentration of 180 µg/l at PTMW-5I, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 48 µg/l at PTMW-1I within the Phase I pilot test study area);
- Acetone: (maximum concentration of 10,000 µg/l at PTMW-3I but it may have been related to a lab contaminant because acetone has never been an issue at the site in years of testing and there is no new source of acetone possible since the site is inactive);
- **Chlorofluorocarbons:** (e.g., 1,1,2-trichloro-1,2,2,-trifluoroethane) (maximum concentration of 1,100 μ g/l at MW-2AI, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 12 μ g/l at PTMW-1I within the Phase I Pilot Test study area)⁴;
- Methylene Chloride: (maximum concentration of $600 \mu g/l$ in PTMW-41, however this sample was flagged with a "B" so it may have been the result of blank contamination).
- **PCE:** (maximum concentration of 1,700 µg/l in MW-2AI and concentrations between 14 and 700 µg/l in other intermediate wells sampled);
- **TCE:** (maximum concentration of 320 μ g/l in MW-2AI and concentrations between 4 and 88 μ g/l in other intermediate wells sampled);
- VC: (maximum concentration of 61 μ g/l in PTMW-5I, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 6 μ g/l in PTMW-4I within the pilot test area).

In addition to the VOCs, background data was also collected for TOC, chlorides, iron, manganese, and chromium. TOC background levels ranged from 1 to 4 mg/l. Chloride background levels ranged from 12 to 146 mg/l with the highest baseline levels present in PTMW-1I, PTMW-2I, and PTMW-3I. The lowest levels were present at MW-5PI and MW-12PI. Chromium baseline levels were all less than 3 μ g/l. For iron, the baseline levels in groundwater varied greatly with the lowest level of 345 μ g/l present at MW-11PI and the highest level of 5,860 μ g/l present at PTMW-3I. Most iron concentrations were between 600 and 2,500 μ g/l. Manganese baseline levels prior to testing also varied widely with the highest concentrations present at PTMW-5I (3,230 μ g/l) and the lowest at PTMW-2I (72 μ g/l).

⁴ It should be noted that chlorofluorocarbons were not anticipated to undergo rapid reaction with permanganate based upon the available literature. Slower biodegradation was expected. However, insufficient data are available with regard to this specific compound's response to permanganate injection. Alternative oxidizers such as hydrogen peroxide (i.e., Fenton's Reagent) may be more appropriate if rapid degradation of chlorofluorocarbons (as well as alkanes present at lower levels) is required. Testing of oxidizers that are more aggressive is recommended if the NYSDEC requires more rapid chlorofluorocarbon degradation.

After the completion of baseline documentation, the intermediate well injections were initiated for Phase I at wells PT-14I through PT-18I. Injection events were conducted from November 19, 2002, through November 25, 2002. Two post-injection sampling events were conducted to assess the short-term and long-term reductions after consideration of rebound effects. The first post-injection sampling event for the intermediate zone was completed on December 18-19, 2002, approximately 3 to 4 weeks after the completion of injections. The final post-injection sampling event was completed on April 2-4, 2003 approximately 3 months after the completion of injections to ensure that any rebound effects would have already occurred (i.e., the sampling event would represent permanent reduction in contaminant concentrations). The results of the post injection sampling events and removal efficiency estimates are provided in Table 11.

As indicated in Table 10, the concentrations of contaminants in the intermediate groundwater zone were reduced in almost all wells, for all parameters with a few exceptions. In general, contaminant reductions were the greatest in the monitoring points closest to the injection line and nearest to the center of the pilot test area. Contaminant reductions for all VOCs within 50 feet of the injection line were reduced to non-detectable levels within 41 days of injection with the exception of 1,2-DCE which was reduced 62.5% (from $12 \mu g/l$ to $5 \mu g/l$). All contaminants of concern within 50 feet of the injection wells were reduced to levels at or below Class GA Groundwater Quality Standards. Although reductions beyond 50 feet were evident for most VOCs, the reductions were not as uniform and a direct correlation to distance from the injection wells was present for some compounds, but not for others. 1,1DCA was reduced to non-detectable levels in all samples (except for one which was only at 5 $\mu g/l$), even those as far away as 150 feet from the injection line. However, this data must be interpreted cautiously because starting concentrations before testing were relatively low and it is possible that this reduction is just due to the normal variability of groundwater data from one sampling event to the next.

MW-12PI did not achieve the same high levels of contaminant reductions for most chemicals. Based upon discussions with those overseeing drilling in this area, it was determined that drilling near the westernmost injection wells in Phase I was extremely difficult and injection of oxidant in this area was more difficult than most other areas. In fact, the shallow wells in this area mounded frequently even at very low injection flow rates. Therefore, it is likely that the localized geology at and near MW-12PI adversely effects the ability to inject oxidant when compared to the other wells in the Phase I pilot test area.

A reduction in 1,1,2-trichloro-1,2,2-trifluoroethane was observed in 6 of the 10 intermediate monitoring wells for this phase of testing, although this rate of a reduction was not anticipated based upon the permanganate reaction mechanism (i.e., reaction with carbon-carbon double

bonds which are not present in 1,1,2-trichloro-1,2,2-trifluoroethane). Review of the available literature indicates that under certain conditions the permanganate reaction with the VOCs of concern may generate some free hydroxyl radicals. The reductions of chlorofluorocarbons noted might have been caused by free radical formation in a manner similar to that, which occurs with some other oxidants (most notably, Fenton's Reagent).

Since one of the adverse affects of permanganate injection is the possible mobilization of metals and chlorides in the aquifer, these parameters were also evaluated. Chloride increases in the subsurface were not realized in 9 out of 10 monitoring locations and an increase from 95 mg/l to only 112 mg/l was evident in the one well that did exhibit an increase (MW-11PI). Chromium concentration increases were evident in all but the two wells that were over 160 feet from the injection line. Although the percent increases were often high (as high as 1825% in MW-11PI), the actual concentration increases were very minor with only one well exhibiting chromium concentrations exceeding 20 μ g/l (38.5 μ g/l at MW-11PI). These levels of chromium are not considered a concern. Manganese levels did increase substantially during the first post-injection sampling event 41 days after injections. However, in all wells except for three the concentrations dropped off to below pre-injection levels within the 146 days before the final post-injection sampling event. This temporary increase is considered normal and it is likely that the remaining elevated concentrations of manganese will drop off in the three wells that remained with high Manganese concentrations after the final sampling event.

After completion of post-injection monitoring, it was evident that injection of oxidant into the intermediate zone can result in excellent chlorinated VOC contaminant reduction within 50 feet of the injection wells. In fact, final concentrations after the Phase I intermediate zone injections were at or below 50 μ g/l for all VOCs in all wells within the pilot test area. Most parameter concentrations were below their respective Class GA Groundwater Quality Standards. Chlorofluorocarbons appeared to be degraded during the injection events; however, additional testing is required to determine if the 1,1,2-trichloro-1,2,2-trifluoroethane concentrations noted were temporary effects caused by the high initial injection volumes of permanganate solution or whether the effects are longer lasting due to *in-situ* oxidation. Use of a more aggressive oxidizer (e.g., Fenton's Reagent) should be considered to more aggressively address chlorofluorocarbons

4.2 Shallow Groundwater Injection Performance

The following sections discuss the results of the shallow groundwater injection events during Phase I of the pilot test.

4.2.1 Shallow Injection Well Performance

As with the intermediate zone evaluation, the performance of the shallow injection well network was primarily evaluated on the ability to deliver the desired quantity of KMnO₄ to the subsurface in a reasonable amount of time without causing contaminant migration or unacceptable mounding of groundwater. This aspect of the test focused on mechanical injection data such as flow rates and pressures and the groundwater parameters related to injection (e.g., depth to water, turbidity, etc.).

The average flow rate into the five well, shallow network was 35.8 gallons/minute (approximately 7.1 gpm per well average). However, injection rates varied significantly well by well during the Phase I test because of problems with localized mounding. Some shallow injection wells readily accepted the permanganate solution, and flow rates much higher than the 7.1 gpm were achievable without a significant rise in the localized water table. Conversely, shallow injection wells PT-14S, PT-15S, and PT-18S mounded at flow rates above five gpm and sometimes even mounded at lower flow rates. When mounding neared the surface, injection events at that well location exhibiting the water table rise were suspended until the water table receded locally.

Additional discussion regarding the ability to effectively inject permanganate into the shallow groundwater zone is provided in the following section.

4.2.2 Shallow Permanganate Mixing & Reaction Effectiveness Monitoring

Shallow well injections were initiated on November 26, 2003, immediately following the completion of the intermediate well injections. Throughout shallow well injections, weather conditions including heavy rains with localized flooding hampered the shallow well pilot tests. Due to the shallow water table, the rain events caused the water table to rise to almost immediately beneath the ground surface on several days and testing was suspended to let the water table subside. In addition, the uneven parking lot caused localized ponding of water in some monitoring locations, which may have influenced data collection (i.e., when the wells were opened to collect monitoring parameters, surface water sometimes ran into the monitoring wells). Whenever possible, berms were made around monitoring points and water was kept away from the test area to the greatest practical extent.

Prior to the start of shallow well injections, baseline data were collected from representative wells in the Phase I area to document baseline conditions in the shallow wells (see Table 12).

Baseline data was collected on November 25, 2003, before injection system start-up⁵. Baseline field monitoring in the shallow zone included collection of the same parameters as the intermediate well sampling events. The data collected during the field screening for the shallow injection events are provided in Tables 7 and 8.

As indicated in Table 11, the baseline values for all shallow wells in the Phase I area were typically in the ranges indicated below:

- **pH:** Average[°] pH of 6.37. Values ranged from 5.87 to 6.70 Standard pH Units.
- **Conductivity:** Average conductivity of 0.61 mhos. Values ranged from 0.39 to 1.01 mhos. Unlike the intermediate zone, there was no direct correlation between conductivity and pH in the shallow zone. This may have been due to the impact of the prior intermediate injection events before the start of shallow well testing.
- **ORP:** Average ORP of -66.00. Values ranged from -153 to +26 at the start of shallow testing, with all locations except MW-12PS and PT-12S exhibiting an ORP indicative of reducing environment (i.e., negative) ORP value.
- **Temperature:** Average temperature of 19.12 degrees Celsius. Values ranged from 18.30 to 20.00 deg. C.
- **DTW:** Average depth to water of 3.84 feet. Values ranged from 3.37 to 4.13 feet.
- **Dissolved Oxygen:** Average DO of 0.27 mg/l. Values ranged from 0.11 to 0.65 mg/l. There was a no direct correlation between DO and ORP in the shallow groundwater at the onset of testing.
- Wellhead VOCs: The average wellhead VOC readings were 21.9 ppmv equivalence units (isobutylene calibration gas). However, there was wide variation from well to well. Values ranged from zero ppmv at several wellheads to 85.7 at well MW-12PS. Breathing zone VOCs above the wellhead were generally non-detectable, so the localized wellhead VOC readings were not a health and safety concern.

At the onset of shallow permanganate injections, the pH was relatively stable at most well locations. As indicated in Figure 9, there were minor changes in pH evident during shallow well injections (typically changed +/- one pH SU). The pH within the Phase I test area



³ Several background samples were collected on 11/26/03 in the morning before the start of shallow well injections.

⁶ Logarithmic adjustment made for pH

remained relatively constant between 5.8 and 7.0 throughout shallow well testing. Permanganate degradation reactions typically occur independently of pH values in this range. Since a significant drop in pH was not evident during shallow testing, it is probable that acidic byproducts or intermediates of the degradation reactions were either not present or short-lived. In general, pH monitoring indicated that pH should not be impacted significantly in the subsurface during shallow zone permanganate injections, nor should it inhibit the desired degradation reactions.

Conductivity readings oscillated up and down following the start of shallow permanganate injections on most days of testing (see Figure 10), but returned to (or close to) the previous baseline levels when injections were suspended. This minor change in localized conductivities is not considered significant.

As indicated in Figure 11, there were only relatively minor changes in the ORP during the shallow injection events in most monitoring locations. Increases of only about 35 to 50 mV were typical in most monitoring locations. There was no correlation between changes in the ORP and the distance from the injection line in the shallow wells as there was with the intermediate wells. ORP data did not serve as a good indicator of shallow injection system performance because of the relatively small changes in readings that were observed.

The temperature response data are presented graphically in Figure 12. As indicated by the figure, the temperatures in each of the monitoring locations remained relatively constant throughout testing. There was a slight decreasing temperature trend, but it is likely that this is independent of the Phase I Pilot Testing and occurred naturally due to the very cold temperatures in December 2002.

One of the most important parameters evaluated during shallow well injection events was the depth to water. DTW readings were collected to evaluate the potential for mounding during injections and to help assess the radius of influence of the injection wells. DTW data for shallow injection well monitoring are presented in Figure 13. During injection events, there was severe mounding in several of the injection wells. In fact, the groundwater table reached the surface at each of the injection perspective were PT-14S, PT-15S, and PT-18S, which were frequently shut down to allow the water table to lower before continuing with the injections. Flow rates for the shallow wells were maintained below 10 gpm to minimize mounding, and many times were run under 5 gpm at the more problematic wells. The shallow well injection problems were compounded by a severe cold streak in the area wherein freezing

temperatures were common overnight. Several wellhead assemblies froze and had to be repaired / replaced during testing.

Unlike the intermediate zone, the degree of mounding was relatively uniform in the shallow zone regardless of distance from the center of the injection line. All monitoring locations within 60 feet of the injection line, whether near the center of the line or the periphery, exhibited a water table rise of approximately 1.5 feet during each day of testing. This mounding would have been more significant if the same, higher, flow rates used during intermediate testing were continued. The fact that the mounding at the monitoring locations 20 to 60 feet away from the injection wells was only about 1 to 1.5 feet, while the mounding at the shallow injection points was often greater than 3 feet (i.e., almost to the surface) indicates that the severe mounding is localized at the point of injection. The mounding evident during testing at the shallow wells was more significant than anticipated by pre-injection modeling and the injection flow rate was reduced accordingly to prevent unwanted migration of contaminants. Subsequent phases of pilot testing well help determine if the problems with shallow injections are limited to this one area of the site or are more widespread.

In general, there was not a significant DO increase evident in the majority of monitoring locations within 50 feet of the injection line (See Figure 13). Although some of the percent increases neared 100%, the actual value of the DO remained low (i.e., all readings were below 0.8 mg/l). It is possible that the DO may increase with time in the subsurface but insufficient data were available to make this determination⁷. This issue will be more carefully monitored during subsequent phases of the pilot test.

Wellhead PID screening was provided primarily for health and safety reasons and the data are presented in Table 7. Additional ambient air screening in breathing zones and at property boundaries was also conducted to ensure the health and safety of site personnel and off-site receptors. This monitoring data are presented in Table 10. There were no health and safety concerns noted during the intermediate injection event, or at any other time during testing.

Colorimetric monitoring for KMnO₄ was performed during the shallow groundwater pilot test to assist in the evaluation of dosing effectiveness and *in-situ* mixing in the shallow zone. In most instances, visual gauging was possible because a deep purple color indicating KMnO₄ concentrations in the range of 5 to greater than 25 mg KMnO4 per Liter of groundwater was evident in, and immediately around, the injection wells. However, the permanganate levels

Post-injection monitoring was originally planned to continue after the completion of shallow injection events. However, severe winter storms prevented access to the site and continual snow cover made it impossible to locate wells for sampling.

dropped off significantly beyond 20 feet from the injection line. Shallow zone colorimetric data are presented in Table 8.

Based upon review of all the field-screening parameters and visual observations, it was concluded that the Phase I shallow injection well network did not perform as anticipated. However, it was still effective in delivering permanganate to the subsurface. The major conclusions drawn from the field screening data are that the injection rate for permanganate delivery must be decreased for the shallow zone to prevent mounding at the surface, and that additional time may be required from the onset of injections to see a more pronounced response in field screening parameters at greater distances from the injection line. The effective radius of influence based upon review of screening data (changes in parameter values) and visual observations (i.e., colorimetric changes) is probably only about 20 to 25 feet in the shallow zone initially (in the general direction of natural groundwater flow toward the north). Future monitoring during the following phases of pilot testing will determine if the long-term ROI in the shallow zone is actually greater. *In-situ* mixing of oxidant with the contaminants of concern in the dissolved phase also appeared to be achieved based upon visual observations (color changes) and review of DTW and ORP data. However, the mixing appears to have been better in the intermediate zone injection events.

Additional discussion on the reasons for the difference in performance between the shallow and intermediate zones is presented in Section 4.2.3 which presents the analytical data results.

4.2.3 Shallow Contaminant Reduction & Potential Remedial Effectiveness

Although the field screening data presented in the previous section indicated some potential short-term problems with shallow zone permanganate injection, the problems identified can most likely be corrected by slowing the injection flow rate. The best indicator of long-term effectiveness of a proposed remedy is the reduction in the mass of contamination at the site. This section of the report presents the analytical data obtained to determine if the permanganate injection events at the shallow wells effectively reduced the concentration of the contaminants of concern in the study area.

All analytical data for the shallow groundwater zone monitoring are presented in Table 2. The primary contaminants of concern at the shallow zone are the same as in the intermediate zone: specifically, Tetrachloroethene (PCE), Trichloroethene (TCE), 1,2-Dichloroethene (12DCE), 1,1,1-Trichloroethane (TCA), and Vinyl Chloride (VC). Secondary contaminants include 1,1,2-trichloro-1,2,2-trifluoroethane. The Phase I Pilot Test also included analysis of several parameters required to evaluate the use of permanganate injection at the site. These parameters included chromium, iron, chlorides, manganese, and total organic carbon (TOC).

Pre-injection (i.e., baseline) sampling was performed between October 30, 2002, and November 7, 2002, to establish pre-test conditions. In order to allow comparison of data to historic site monitoring, analytical samples were collected from pre-existing monitoring wells in the pilot test area as well as from the new monitoring wells installed for the pilot test. The following shallow monitoring wells were sampled during the Phase I pilot test:

• MW-2A*	• PTMW-1S
• MW-4PS*	• PTMW-2S
• MW-7P*	• PTMW-3S
• MW-10PS	• PTMW-4S
• MW-11PS	• PTMW-5S
• MW-12PS	• PTMW-6S
• MW-13PS*	

* Wells indicated by an asterisk were sampled for background information and are not discussed in this report.

In general, the baseline levels of VOCs in the shallow wells were either non-detectable or relatively low (less than $10 \mu g/l$) except for the following compounds:

- **1,2DCE:** (maximum concentration of 7,600 µg/l at PTMW-5S which is outside the anticipated ROI of the Phase I Pilot Test area. Maximum concentration of 400 µg/l at PTMW-1S within the Phase I pilot test study area);
- **1,1,1TCA**: (maximum concentration of 29 µg/l in MW-12PS within the Phase I Pilot Test area);
- **1,1DCA:** (maximum concentration of 26 µg/l in PTMW-5S, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 4 µg/l at PTMW-1S and PTMW-2S within the Phase I pilot test study area);
- **Chlorofluorocarbons:** (1,1,2-trichloro-1,2,2-trifluoroethane): (maximum concentration of 1,700 µg/l at PTMW-5S, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 1,600 µg/l in MW-12PS within the Phase I Pilot Test area);
- **PCE:** (maximum concentration of 2,200 µg/l in PTMW-5S, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 1,200 µg/l in MW-12PS within the Phase I Pilot Test area);
- **TCE:** (maximum concentration of 2,000 µg/l in PTMW-5S, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 1,400 µg/l in MW-12PS within the Phase I Pilot Test area);

• VC: (maximum concentration of 850 µg/l in PTMW-5S, which is outside the anticipated ROI for the Phase I Pilot Test. Maximum concentration of 70 µg/l in MW-11PS within the Phase I Pilot Test area).

In addition to the VOCs, background data were also collected for TOC, chlorides, iron, manganese, and chromium. TOC background levels ranged from 4 to 15 mg/l. Chloride background levels ranged from 19 to 172 mg/l with the highest baseline levels present in MW-10PS and PTMW-5S. The lowest levels were present at MW-11PS and PTMW-3S. Chromium baseline levels were between 1 μ g/l and 19 μ g/l. For iron, the baseline levels in groundwater varied greatly with the lowest level of 1,510 μ g/l present at PTMW-4S and the highest level of 49,000 μ g/l present at MW-11PS. Manganese baseline levels prior to testing were relatively consistent throughout the test area with the highest concentrations present at PTMW-2S (925 μ g/l) and the lowest at PTMW-6S (81 μ g/l). Most manganese concentrations were between 400 and 800 μ g/l in the baseline-sampling event.

After the completion of baseline documentation and the intermediate well injections, the shallow well injections were initiated for Phase I at wells PT-14S through PT-18S. Injection events were conducted from November 26, 2002, through December 19, 2002. Two post-injection sampling events were conducted to assess the immediate reductions in contaminants of concern and the projected long-term reductions after consideration of rebound effects. The first post-injection sampling event for the shallow zone was completed on January 29-30, 2003, approximately 31 days after the completion of injections. The final post-injection sampling event was completed on April 2-4, 2003, approximately 103 days after the completion of injections to ensure that any rebound effects would have already occurred (i.e., the sampling event would represent permanent reduction in contaminant concentrations). The results of all post-injection sampling events for the shallow zone are provided in Table 2. Removal efficiency estimates for the shallow zone for all contaminants initially present above 10 µg/l are provided in Table 13.

Despite some of the slower injection rates and less prominent responses in field screening, the analytical data summarized in Tables 2 and 13 indicated that the shallow injection events were eventually effective within 50 feet of the injection line and somewhat effective beyond 50 feet. The concentrations of all contaminants in the shallow groundwater zone at all monitoring locations within 50 feet of the injection line were reduced to non-detectable levels or levels below Class GA Groundwater Quality Standards. However, unlike the intermediate zone injections, the shallow zone contaminant decreases did not all occur within the first 20 to 40 days following the injections. It was not until the second post-injection events more than 100 days after the initial shallow injections that the significant reductions were observed. This

observation is consistent with the field screening data in that most field screening parameters did not show rapid changes within the first few weeks following the shallow injection events.

Although reductions beyond 50 feet were evident for most VOCs, the reductions were not as uniform or as significant for most compounds. Reductions for 111TCA and 11DCA were essentially greater than 80% even as far away as 180 feet from the injection line. However, as discussed in the intermediate results section of the report, the reaction mechanism for permanganate is typically not as rapid or efficient for the alkanes. Therefore, these reductions may have been at least partially caused by wave effects and dilution related to the injection events.

Reductions for 12DCE, 1,1,2-trichloro-1,2,2-trifluoroethane, PCE, TCE, and VC were not nearly as pronounced once the distance from the injection line exceeded 50 feet. VC concentrations were only reduced approximately 20% to 30% at distances of only 50 to 60 feet from the injection line while the concentrations of some other compounds *rose* immediately after shallow injections at distances greater than 50 feet from the injection line. Although a second round of post-injection data was not collected at PTMW-5S and PTMW-6S, concentrations of contaminants of concern in these wells *rose* in the first post-injection sampling event⁸. This is likely a temporary phenomena cause by a wave pulse during the shallow injection events and concentrations will likely decrease as seen in almost all other wells during subsequent testing. It is theorized that had a second round of testing occurred in these wells, the reductions would have been similar to those demonstrated by MW-10PS (typical reductions of approximately 15% to 63%) which is located a similar distance away from the injection line. This assumption will be tested in the field during the second phase of pilot testing when additional PTMW-5S and PTMW-6S samples will be collected.

It is interesting to note that better contaminant reductions were noticed at distances approximately 60 to 80 feet from the injection line than from wells 50 to 60 feet from the shallow injection line for almost all parameters. This may be due to geologic variations in the pilot test area because similar results were noticed in the intermediate well sampling events also.

⁸ The evaluation of shallow injection response at wells PTMW-5S and PTMW-6S at distances greater than 150 feet from the injection line is complicated by the fact that only one post-injection sampling round (i.e., the first round, 40 days after injections) was collected for these wells. The second round of post-injection sampling at wells PTMW-5S and PTMW-6S was not conducted after it was realized that these wells should <u>not</u> have been sampled for the Phase I Pilot test because they were well outside the anticipated radius of influence for the Phase I test. Given that the shallow well contaminant reductions occurred more significantly after the first post-injection sampling event in almost all other wells sampled, it is probable that the relatively high increases in contaminant levels evident in PTMW-5S and PTMW-6S after the first post-injection sampling and the start of the Phase II pilot test work by collecting an additional set of samples from PTMW-5S.



Chlorofluorocarbon reductions of 100% were also achieved within 50 feet of the injection line and in general, the 1,1,2-trichloro-1,2,2-trifluoroethane contaminant reduction efficiencies paralleled those of the other contaminants of concern. Based upon the treatability test results, it is possible for degradation of 1,1,2-trichlor-1,2,2-trifluorethane reductions with permanganate injection. However, the mechanism for such reductions via permanganate oxidation is not readily apparent.

In addition to the contaminant reduction efficiencies for the chlorinated VOCs of concern, the possible mobilization of metals and chlorides in the aquifer was also evaluated during the shallow injections. Chloride increases in the subsurface were relatively insignificant with the highest levels of chloride after testing actually lower than at the onset of testing (36.7 μ g/l as compared to 69 μ g/l at the start of testing). Chromium concentration increases were evident in all but the three wells. Although the percent increases were often high, the actual concentration increases were minor with only one well exhibiting chromium concentrations exceeding 10 μ g/l (35.2 μ g/l at MW-10PS). These levels of chromium are not considered a concern. Manganese levels also did not increase substantially during the first shallow injection tests except for three wells (PTMW-1S, MW-11PS, and PTMW-6S). This temporary increase is considered normal for permanganate injection and it is likely that the elevated concentrations of manganese will drop off in time.

After evaluation of all data, it was determined that the shallow injection of KMnO₄ may be able to reduce contaminant concentrations. However, the cost-effective delivery of oxidant may be problematic using the design flow rates of the Phase I Pilot Test. The physical delivery of permanganate into the shallow zone required much lower flow rates and additional field time as compared to the intermediate injection events. Additionally, the impact of the permanganate at distances greater than 50 feet from the shallow injection line was highly variable with some parameters showing the potential for reductions of close to 100%, while others only indicating potential reductions of 20% to 30%. Additional data will be required from wells further than 100 feet away from the shallow injection line to determine if a "pulsing" wave effect may temporarily push contaminants away from the injection area in the shallow zone. However, it is unlikely that this is a long-term effect because monitoring from wells 180 feet away (MW-10PS) did ultimately indicate the potential for contaminant reductions given a sufficient amount of time after the initial injection events.

It is likely that the permanganate injection events in the shallow zone did not achieve the same results as the intermediate zone injections initially because the first injections in the shallow zone served primarily to flush any contaminants that may have been "trapped" in the smear (i.e., shallow) zone at the site. In addition, the natural soil oxidant demand in the shallow /

vadose zone was significantly higher than in the intermediate, groundwater-only zone such that the bulk of the injected permanganate may have been "used up" in the reaction with the naturally occurring organics in the vadose zone (i.e., leaving less unreacted permanganate to address the contaminants of concern). It is probable that after "trapped" contaminants in the shallow zone were "freed" by the initial flushing (as simulated during the Phase I injections) and the soil oxidant demand was reduced during the initial injections, residual contaminant concentrations may be more readily reduced by permanganate or a different oxidant (e.g., Fenton's Reagent) during additional injection events. A modified Phase II Pilot Test would be able to evaluate this theory through secondary injections in the shallow groundwater zone to determine if a more pronounced reduction of contaminants after a secondary injection is achievable.

In the intermediate zone, where all of the energy of the permanganate delivery system was focused solely on dissolved phase contamination during Phase I injections, the initial response of the injection was much more pronounced.

4.3 Health and Safety Monitoring

The existing Health and Safety Plan (HASP) was modified to specifically address the permanganate injection pilot test and to address the scope of work covered under the pilot test. Tailgate safety meetings were held and documented for each day of field activities. In addition, all ESI employees working on the site attended an internal training program to ensure that the field program was completed safely and effectively. Parties other than ESI or persons who have contracted directly with ESI were responsible for developing and implementing their own site-safety procedures. Access to the construction areas reflected in the Phase I, II, III, IV and V injection drawings was restricted during pilot testing.

Although negative ambient air impacts were not expected or likely, an ambient air monitoring program was included during the pilot test as a precautionary measure. Wellhead monitoring for VOCs was completed periodically during injection events. In addition, breathing zone monitoring was performed on the Pall site and immediately downgradient at the Glen Cove Day Care center property line. The design of the pilot test system minimized particulate emissions through use of covered mixing and transfer vessels and a vacuum eductor system.

The results of the air-monitoring program indicating that there were no concerns are summarized in Table 10.

5.0 CONCLUSIONS & RECOMMENDATIONS

Based upon site observations and review of field and analytical data, the following conclusions can be made regarding the use of potassium permanganate injection to remediate the contaminants of concern at Pall's 30 Sea Cliff Avenue, Glen Cove, New York facility:

- Potassium permanganate solutions can be effectively and safely made up on-site and introduced to the subsurface in a controlled manner.
- There was no significant mobilization of metals and inorganics noted during pilot testing except for manganese. Manganese concentration increases were evident during shallow and intermediate injections in several wells. However, these concentration increases are expected to be short-term and a return to pretesting levels is anticipated.
- Intermediate injection wells performed in accordance with design projections, with flow rates greater than 15 gpm per well sustainable without unacceptable mounding near the surface.
- Intermediate groundwater zone injections of potassium permanganate can effectively reduce contaminant concentrations of chlorinated VOCs at the site when injected at wells designed for oxidant delivery. The effective radius of influence in the intermediate zone is likely greater than 50 feet in the general direction of groundwater flow (toward the north), with significant reductions of contaminants also noted as far away as 150 feet from the injection wells.
- Contaminants of concern (i.e., chlorinated VOCs) can effectively be reduced by as much as 100% within 50 feet of the intermediate zone injection wells. Chlorinated VOC concentrations within the Phase I pilot test area were reduced to within Class GA Groundwater Quality Standards within 150 days of permanganate injections as far away as 50 feet of the intermediate injection wells. Most reductions occurred in under 41days.
- Chlorofluorocarbons were apparently reduced through potassium permanganate injections in the intermediate groundwater, with reductions of 100% evident in six out of 10 monitoring wells. However, due to the fact that the reaction mechanism of permanganate is not typically effective for 1,1,2-trichloro-1,2,2-trifluoroethane or chlorinated alkanes, it cannot be definitively stated whether the chlorofluorocarbon reductions noted were the result of oxidation / bioremediation due to some limited free radical formation, or were caused by dilution / wave effects.
- Shallow injection wells did not perform in accordance with design predictions because flow rates greater than five gpm per well resulted in surface mounding at several injection locations. It is believed that the five gpm per well injection rate can still effectively treat the shallow groundwater zone, if the field time



required to complete injections is increased. Additional data are required to optimize the delivery system. Also, additional study is necessary to evaluate potential "wave effects" (i.e., a pushing of contaminants because of the localized mounding at the point of injection) during and following shallow injection events because of the results for chlorofluorocarbons and alkanes that were not wholly consistent with what was anticipated based upon the reaction mechanisms typically associated with permanganate.

- The effective radius of influence in the shallow zone is likely up to 50 feet in the general direction of groundwater flow (toward the north), with some evidence of reductions of contaminants also noted as far away as 150 feet from the injection wells. The contaminant reductions noted in the shallow zone were less uniform than those noted in the intermediate groundwater.
- Contaminants of concern (i.e., chlorinated VOCs) can effectively be reduced by as much as 100% within 50 feet of the shallow zone injection wells. However, there was a temporary increase in shallow groundwater contaminant concentrations prior to the long-term reductions noted.
- Chlorinated VOC concentrations within the Phase I Pilot Test area were reduced to within Class GA Groundwater Quality Standards within 150 days of permanganate injections as far away as 50 feet of the shallow injection wells. 1,1,2-trichloro-1,2,2-trifluoroethane was only reduced through potassium permanganate injections in the shallow groundwater at distances less than 50 feet from the shallow injection wells. At distances greater than 50 feet, there was limited evidence of significant 1,1,2-trichloro-1,2,2-trifluoroethane degradation.

Based upon the foregoing conclusions, the following actions are recommended:

- The shallow groundwater portions of the Phase II Pilot Test should proceed as originally designed with the exception that the shallow injection flow rates should be reduced to less than 5 gpm per well. This additional shallow groundwater study is necessary to evaluate the destructive capabilities of oxidizers at lower injection flow rates and the impact of localized mounding, and "wave effects" during and following shallow well injections.
- Additional pilot testing should be performed with a more aggressive oxidant such as Fenton's Reagent to determine if full-scale remediation is potentially possible at lower costs. In addition, the use of Fenton's Reagent will address several secondary contaminants of concern (e.g., chlorofluorocarbons and chlorinated alkanes) that are not as readily reduced by permanganate. Fenton's Reagent injection will require less water addition than permanganate and will help better determine whether dilution and wave effects may have caused some of the contaminant reductions that were noted during Phase I testing.
- Since intermediate zone contaminant reductions were so pronounced, it is recommended that the originally planned Phase II through V pilot tests be



eliminated and further evaluations be limited to a small-scale, modified Phase II Pilot Test for the intermediate zone. The details of the modified Phase II Pilot Test for the intermediate zone (as well as the shallow zone) will be addressed in an addendum to the Pilot Test Work Plan and Design as a separate submittal.

- Injection of Fenton's Reagent directly into existing monitoring wells should be evaluated as a localized treatment option. The wells recommended for inclusion in the direct monitoring well injection aspects of the pilot test will be discussed in the addendum to the Pilot Test Work Plan and Design as a separate submittal.
- The mass of oxidant introduced to the shallow zone should be reassessed for the Phase II Pilot Test because of the mixed results obtained at distances greater than 50 feet away from the injection wells and because of the lack of a pronounced response immediately after injection events. If Fenton's Reagent is used in the next phase, the mass of oxidant introduced in the modified Phase II Pilot Test for the intermediate zone should be re-calculated to take the stronger nature of Fenton's Reagent into consideration. If successful, this modified dosing with Fenton's Reagent could reduce full-scale remediation costs and could result in a more rapid degradation of the secondary contaminants of concern such as chlorofluorocarbons (e.g., 1,1,2-trichloro-1,2,2-trifluoroethane).
- The frequency of monitoring at shallow and intermediate monitoring locations should be reduced significantly because of problems identified in the field with the time required for many readings to stabilize. However, the parameters analyzed should not be changed. In addition, several additional rounds of field monitoring after the final injection events should be added to better understand the long-term impacts to ORP, DO, pH, etc. after injection events. The revised monitoring program will be outlined in the addendum to the Pilot Test Work Plan and Design to be submitted separately.
- Fieldwork on the Phase II Pilot Test should be initiated only during the warmer months (after NYSDEC approval of this report) to eliminate many of the problems identified in the field during previous testing during colder months. Performing fieldwork in the warmer months only (typically late March through early November) will protect the health and safety of workers; ensure better data collection; minimize the probability of releases related to frozen piping, fittings, and equipment; and, lower overall pilot test costs.
- Better quality flow meters and a possible particulate filter should be used at the injection manifold to ensure better data acquisition at each wellhead.



All results in ugd except ex noted.

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1.2-Dichloropropane	<10	<10	<10	¢10	<10	410 4	<10	<10	<10	<10	¢10	<10 <	¢10	<10	01>	01>	<10	\$10	å15	410	\$10
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Toluene	£	0 10	40 4	¢10	¢;	2]	0 1	¢10	-	<10	1	<10	<10	<10	2	<10	<\$0	<10	0 1 0	\$10	<10
Chlorobenzene	¢10	410	₽ ₽	<10	615	¢ 10	2 1	<10	ç. V	0 ¹ 2	¢10	<10	<10	<10	r 7	<10	<10	<10	¢10	<10	012
Ethylbenzene	¢10	₽,	5 5	40 4	95	¢10	0 ¹ 0	40	40	<10	6 <u>5</u>	<10	<10	< 10	4	<10	<10	<10	0F2	¢10	0]v
Slyrene	ę	6	40	<10 <	¢10	<10	<10	\$	410	0 ¹ 2	610	<10	<10	<10	¢10	\$10	¢10	¢10	< 10 <	<10	012
Xylene (total)	5	5		410	2 2	<10	<10	V	012 10	¢10	5	<10	c10	<10	17	<10		<10	<10	¢10	¢10
I olai Frech TICs	•	-	2	38 NJ	•	•	2 2		80 NJ	0	20 2	LN 01	0	53 NJ	350 NJ	22 NJ	240 NJ	45 N1			L 21
Tolal VOCs	46	4,480	369	205	-		1.408	134	4,754	8	623	408	135	883	14,437	108	2.075	5.013	631	2,028	645

Nates:

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Alf results in up? except as noted.

Table, 18 Greundwater Samola Resulta, Jadar mediara Greundwater Monitoring Yells Phase J Pitol Taati, Predinission Baselina Monitoring

	Illumentione				I Incodes I	Increased in ref.				The second second	1.11										
Partmeter (1999)	MM-1P1 10/30/02	11/3/02	MW-4P1 10/30/02	MW-5P1 10/01/02		NEW-8P1	11/1/02	10/31/02	MW-12P1 11/4/02	IDV-13PI	MW-10PCI 10/20/03	PTIMM-11 10/31/02	PTWW-ZI	PTNM-31	PTNM-4	PTMM-51	PTIMP C	PT-44	PT-01	PT-11	Pt-TS
Chloromethane	<10	510 1	<10	<10	¢10	¢10	<10			<10	01×		ê	012	97	410	9÷	\$10	<10	210 AL	11(0/17
Bromomethane	<10 <	<10	< +0	×10	412	Q1>	¢10	01>	410	0 ¹	012	410	01>	\$10	¢10	¢10	¢10	\$10	10	1019	
Vinyl Chloride	-	ר ח	<10 10	г 2 Г	<10	-	o1>	6 1	¢10	21	¢10	-	2	-	9	10	410	1012	5	, P	9
Chloroethane	<10 210	<10	<10	01×	<10	<10 <	đ	<10 <	40	410	012	410	410	¢10	95	015	410	\$10	410	Ę	2
Methylene Chioride	<10	47	<10	<10	¢10	Ş	<10	410	410	\$10	610	40	\$10	2	25 B		410	25 B	24 8	Ş	2
Acetone	<10	38	<10	<10	<10	<10	<10	410	<10	0L>	012	0	011	0 000'04	ì –	170	13	28	6	Ş	
1,1-Dichloroethene	<10	÷	<10	≤10	~	=	612	г в	\$15		912	01v	410	¢10	2	-	410	1	ļ		
Carbon Disulfida	₽	<10		¢10	410	50	2 7	012	410	410	•••	\$10	0,V	410	10	1	012			2	2
1, 1-Dichlorethane	6	13	<10	012	5	8	410	1	2	51	2	14	2	4	1	1	-	-		- 	
1.2-Dichloroethene (total)	99 79	110	12	23	24	"	2	68	9	170 D	01>	4	7	5	110	1 08	1		•		-
Chloroform	<10	610	<10	<10	₽ţ¥	¢10	40	¢10	40	410	\$10	410	6 <u>1</u> 0	01>	012	017	61s	\$10 \$	- 11	2	
Freon-113	<10	1,100 D	91	n e	01.>	¢10	36	0;	410	¢10	01×	14	•10	2	4	1	1	610 610	9	101	10
1,2-Dichloroethane	¢10	<10	410	¢10	F -	2 1	¢10	01>	<10		01×	<10	6	¢10	22	012	615	210 210	1		
2-Butanone	<10	<10	\$10	0(>	0(>	01>	012	012	<10	<10 <	015	<10	\$10	ŝ	919	10	012	015			
1,1,1-TricNotoethane	<10	<10	c10	10	-	4	10	8	012	2 J	410	40	0	0,4	-	\$15	410 4	2	2		
Carbon Tetrachionde	<10	\$10	410	¢10	0 v	¢10	¢10	012	¢10	¢10	6	¢10	9	\$10	610	10	113			2	2
Bromodichi Gromelhane	¢10	<1D	<10	¢10	012	¢10	0i>	¢10	410	\$10	¢10	10	915	410	610	9	015				
1,2-Dichioropropane	01¥	012	¢10	01v	\$10	6 <u>5</u>	410	40	c10	¢10	014	615	10	10	01				,	- 9	
cts-1,3-Dichloropropene	0 1	10	410	6 ¹⁰	65	10	1014	012	95	410	1012	<10			2	;		2	2	₽	P
Trichloroethene		320 D	9	4	8	3	55	2	æ	130	610	12	;	2			;	,		ļ	2
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			2			2		2	₽	8	410	¢10	ŝ	0î,	¢10	<10	410	ŝ	¢10	¢10	¢10
auadoxdoxnicxri.c'; -1uan			2	0	P.	₽	₽	9	ŝ	¢10	¢10	<u>6</u> 10	6 <u>5</u>	¢10	¢10	<10	¢10	¢10	0;>	410	<10
Diomandim	212	2		Ş	0	7	ŝ	2	0 1	<10	¢10	1	410	¢10	<10	<10	2 1	-	2	-	<10
euousius		012		Ŷ	ç,	ŝ	ŝ	¢ ₽	ę	<10	410	¢10	ê	¢10	410	<10 <	619	¢10	₽,	¢10	<10 <10
Runitever. 7	PL2		*	4	0,2	8	₽	ê	ŝ	¢10	\$	<10	10	¢10	410	<10	015	<10	015	012	¢10
l et la chioroethene		01	5	ŝ	4	15	130	260 D	43	28	<10	800 D	200 D	120	72	0.026	8	15	2	1	130
1.1.2.2-1 etrachioroethane	\$10	0 1	¢10	ŝ	ŝ	đ	<10	¢10	<10	¢10	6 2	Q.V	015	010	¢10	<10	¢10	012	012	<10	410
loluene		-	0 V	ŝ	ę	¢10	4	¢10	2 J	<10	e,	r 2	<10 <	~	¢10	-	<10	012	ŧ,	÷.	\$10
ChicrobenZene	<10	ę	\$10	0 V	ê	99	410	¢10	¢10	<10	0 i v	ţ	410	012	410	410	¢10	410	¢t0	40	<10
Ethylbenzene	¢10	95	ę	ê	9 9	610	\$10	210	¢10	¢10	\$10	ę	610	\$10	¢10	410	3	¢10	410	10	1012
Styrene	<10	¢10	ŝ	6	0	5 <u>5</u>	<10	910	610 012	410	0;>	<10	61A	9 1 2	10	012	0 1	410 1	014	2	0,0
Xyterne (tocal)	~10 ~	2	¢†>	0I>	C\$0	<10	15 2	\$10	<10	<10	512	01×	01>	¢10	¢10	0	4	\$10	5	19	2
Total "Freen" TICs	2 E		0	0	•	0		0	•	0	∩Z 82	0	0	TN A	8	28 N	0	e	2		
Total VOCs	44	3.344	55	3	44	187	355	469	01	405	\$	156	342	10.276	2.758		223	85	1	, 9	210
Total VDCs (lass Acetone)	44	3,306	8	52	44	187	355	469	61	405	5	750	232	278	350	189	150	5	364	er.	212
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Notes:

intermedual georolowan is defined as wels screened in the interval from approximately 45 b 65 feb; mb the water table. Mile 16 Trimway femined of the Compound, 1,5-OCE lease of the myoritance at the sta. Mile 16 Trimway femined compound, 1,5-OCE lease and the myoritance at the sta. J 5 Environment environment for an environment of the GCMS for that specific analyse. The sample was divided and re-environment environment and are not an environment and are analyzed. J 5 Environment environment environment and are not a myoritance at the standard of the environment environment environment environment environment and are not and and the second on symposities to the area of the area of the formation environment envictore environment environment environment e

Groundwater Sample Results - Deep Groundwater Monitoring Wells Phase I Pilot Test.: Pre-Injection Baseline Monitoring **Table 1C**

All results in ug/l except as noted.

Parameter	Upgradient MW-1PD 10/30/02	MW-2AD 11/1/02	MW-4PD 10/30/02	MW-5PD 10/31/02	Upgradient MW-6PD 10/30/02	MW-10PD 11/1/02	MW-11PD 10/31/02	MW-12PD 11/4/02	Upgradient MW-13PD 10/29/03	Upgradient MW-14PCD 11/3/02	Upgradient MW-15PCD 10/29/03	Upgradient MW-16PCD 10/29/02
Chloromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Bromomethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Vinyl Chloride	2 J	300 D	<10	16	57	13	10	<10	г £	110	r 2	<10
Chloroethane	<10	4 J	<10	<10	<10	<10	<10	<10	<10	<10	Г Е	<10
Methylene Chloride	<10	r 2 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acetone	<10	<10	<10	<10	12	<10	<10	<10	<10	<10	<10	<10
1,1-Dichloroethene	3 J	10	-	11	45	14	12	<10	5 1	11	51	4
Carbon Disuffide	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	r 7
1,1-Dichlorethane	12	5	2	10	67	10	Г 6	2.	49	53	150	г 6
1,2-Dichloroethene (total)	110	3,500 D	35	220 D	920 D	t80	130	36	160 D	1,200 D	680 D	91
Chloroform	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Freon-113	<10	190	<10	14	<10	30	8	<10	<10	<10	<10	<10
1,2-Dichloroethane	<10	<10	<10	<10	16	<10	<10	<10	<10	<10	г е	<10
2-Butanone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1,1-Trichloroethane	<10	2 J	<10	10	<10	11	13	<10	г 9 Г	<10	5 J	<10
Carbon Tetrachloride	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	01>
Bromodich!oromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-Dichloropropane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-1,3-Dichloropropene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Trichtoroethene	72	200 DJ	76	370 D	140	250 [D 110	45	140	180 D	220 D	55
Dibromochloromethane	<10	4 0	<10	-	<10	<10	<10 <10	<10	<10	<10	2 J	<10
1,1,2-Trichloroethane	40	40	<10	<10	<10	<10	<10 510	<10	<10	<10	<10	<10
Benzene	<10	2 J	<10	<10	с Г	<10	<10	<10	<10	-	<10	2 J
trans-1,3-Dichloropropene	<10	40	<10	<10	<10	<10	₹10	<10	<10	<10	<10	<10
Bromoform	<10	¢10	40	- -	<10	<10	1	<10	L 1	<10	2 J	<10
4-Methyl-2-Pentanone	<10	40	<10	<10	<10	<10	<10	12	<10	<10	<10	<10
2-Hexanone	<10	√10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tetrachloroethene	- С	280 D	с Г	140	46	33	24	2 ,	27	47	32	5 J
1,1,2,2-Tetrachloroethane	<10	¢10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	2	<10 <10	<10	<10	<10	<10	<10	<10	<10	2	<10	<10
Chlorobenzene	<10	<10	<10 <	<10 <	<10	<10	¥10	<10	<10	<10	<10	<10
Ethylbenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Styrene	<10	<10	¢10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylene (total)	40	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total "Freon" TICs	15 NJ		0	0	0	11 NJ	0		0	12 NJ	LN 01	LN 72
Total VOCs	206	4,500	112	793	1,336	541	317	97	391	1,604	1,155	173

Notes:

55 to 105 feet into the water table.
TICs = Tentatively identified Compounds, 1,2-DCE listed individually as a VOC because of its importance at the site.
NA = Not Avaiable
Na = Not Avaiable
Set and a volve
J estimated volve
B = Analyte is found in associated blank as well as in the sample
B = Analyte is found in associated blank as well as in the sample
D = Compound whose concentrations exceeded the calibration range of the GC/MS for that specific analysis. The sample was diluted and re-analyzed.
D = Compound whose concentrations exceeded the CICs.
A = Compound was analyzed for but not detected. The ## represents the sample quantitation limit (This is similar to the U flag).
Indicates a guidance value, not a standard.
MD = Tentatively identified compound that was not detected, Actual MDL not available but likely <10 vg/l based upon similar sample matrices.

	a de la companya de La companya de la comp				l en de l				SHALL	OW WELLS			1977 - 1978 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 - 1979 -		· : :	
Analyte	Collection Date	Collection Date	MW-2A	MW- 4PS	MW-7P	MW-10PS	MW-11PS	MW-12PS	MW-13PS	PTMW-1S*	PT-MW2S	PT-MW3S	PTMW-3S	PTMW- 4S	PTMW-5S	PTMW-65
	Pre-Injection (10/30 - 11/7/0)2)										······				
1,1,1-Trichloroetharie	[10/30/02		100			· · · · ·	· · · · · · · · · · · · · · · · · · ·								
		10/31/02				12DJ	10U	- water of the tableau and the			201	10U				
		11/01/02	250U				· · · · · · · · · · · · · · · · · · ·							· · · ·		20U
		11/04/02		l				29				· · · · · · · · · · · · · · · · · · ·			100	
		11/05/02		j						2J				·		
		11/07/02	L	1	1	12DJ	4010	J	L	2.	1 201	100		23	1	
	Intermediate Post-Injection		2500	100	· · · · · · · · · · · · · · · · · · ·	12W	100	29	r		200	100	T	2J	100	200
		12/18/02														
	Desite and the second second	12/19/02	1	1	1	l			1	1	1	1	1	1		-l
	Shallow Post-Injection (1/2)	01/29/03	1	·	r	<u>' ' </u>	1	1000		10U	100	r	1011	200		100U
		01/29/03		· ·		100U	100	1000	100		100	ł · · · · · ·	100	200	500U	1000
	Second Post - Injection (4/		L	·	1,	1 1000	1 100			. <u> </u>			· · · · · · · · · · · · · · · · · · ·	.1		
	Second Fost - Injection (4/	04/02/03	1	· · · · · · · · · · · · · · · · · · ·	1	T	100	T	100	100			r	· · · · · · · · · · · · · · · · · · ·	1 — · ····	- <u>-</u>
	1	04/03/03		<u> </u>	1	·				1	100		100	100	— ·	
1) i	04/04/03		ł	1	200		50U	· · · · · · · · · · · · · · · · · · ·		· [· · · · · · · · · · · · · · · · · ·					
	Upgradient Background (4/		· · · · ·	1	!	1	· · · · · · · · · · · · · · · · · · ·	1	<u>. </u>		· · · · · · · · · · · · · · · · · · ·	· · · ·	<u> </u>	*		
	opgradient classigradina (4)	04/10/03	1	1	100	1		1	1	1	7		T	F	- F	
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	Pre-Injection (10/30 - 11/7/				4 (1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1											
1,1,2,2-Tetrachloroethane	Tie-steeden Traise	10/30/02	T	100	I	1		T	F	T	1	1	1	I	·] · · · · · · · · · · · · ·	E
1, 1, 2, 2-1 20 101000000000		10/31/02				50U	100	· · · · ·	· · · · · · · · · · · · · · · · · · ·		20U	100				
		11/01/02	2500				· ···· · ····					· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	200
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		11/07/02			1								-	10U ⁻		
	Intermediate Post-Injection	(12/18 - 12/19/02)											<u> </u>			
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	1	12/19/02					·] · ····						· — ·-			
	Shallow Post-Injection (1/2													•		
		01/29/03			I			100U		100	100	1	10U	20U	5000	100U
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<u>Table ک</u> KMnOA Injection Analytical Results Summary for Shallow Wells (AnDA Injection Results in Ugu in Italicated)

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<u>ZəbleZ</u> Remmary for Sheile X (bəlsəini szeinu l\gu ni siluzən liA)

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Z abbe Z KMnO4 Injection Analytical Results Summary for Shallow Wells (bajacibni zzelnu I/gu ni ziluzer IIA)

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<u></u>	Pre-Injection (10/30 - 11/7/	(02)	· · ·													
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		10/31/02				110D	2J				24D	ີມ				
	1	11/01/02	280D								1			1	T	83D
		11/04/02						1200D							2200D	
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		11/07/02			1	I		.t	1		1	L		36D		
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		04/02/03					14	·	10U	10U	i					
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.,,		10/31/02	1			500	100				200	10U				
		11/01/02	250U				-	1		· · · · · · · · · · · · · · · · · · ·		130				200
		11/04/02	-					100	1				1		17	
		11/05/02	I							100						
		11/07/02	L	L	I	L	1	L		<u> </u>	1			100		
	Intermediate Post-Injection			- 	· · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·					
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	Shallow Post-Injection (1/25				L	L	_I		L	L.,,	I	L	<u> </u>	<u> </u>	1	1
	Griander Gateringeshoft (1)23	01/29/03	r	· · · · · · · · · · · · · · · · · · ·	r—	r	-r	100U		100	100	1	[L 60011	Т
		01/30/03	[1	1000	10U		100				100	200	5000	1000
	Second Post - Injection (4/2			-	1						1	L	<u>.</u>	L	· L	
		04/02/03	r]	I	T	10U	<u></u>	10U	100	I	I	1	T	т	1
		04/03/03	1		[1	· · · · · · · · · · · · · · · · · · ·	1	·		100		100	100		1
		04/04/03	1			20U		50U					· · · · · · · · · · · · ·			
													**	<u> </u>		
	Upgradient Background (4/	04/10/03		· · · · · · · · · · · · · · · · · · ·	100			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·				

(betecibni zzelnu l\pu ni ztluzer llA)
KMnO4 injection Analytical Results Summary for Shallow Wells
<u>2 əlde</u> T

29-WMT9	PTMW-55	S4	SE-WW19	SEWM-14	SZMIN-1d	SI-MALA	SAEL-WM	SdZ1-MM	SULL-WW	SHOL-MIN	d1-WW	Sdt •MW	WM-SV	Collection Date	Collection Date	aryisnA
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I		· · · · · · · · · · · · · · · · · · ·	· ···· ·····		I	·	L		· · · · · · · · · · · · · · · · · · ·		·	. <u> </u>			Pre-Injection (10/30 - 11/1	
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30			··				· · · ·			7,				11/01/05		
	69							31						11/04/05		
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58	18 -	52	52		13	91	<u> </u>	96	· · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·			E0/6Z/L0		
r			T	T	· · · · · · · · · · · · · · · · · · ·		83	· · · · · · · · · · · · · · · · · · ·	61	54	r			E0/0E/10	Second Post - Injection (4)	
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		48	1.71		5.41									£0/C0/Þ0		
			T	1				341	r	30.5	<u> </u>			E0/p0/p0		
				L	۱	المصدية بسبب بعرب با	l	·	I		I,			∀/N (£0/01/	Upgradient Background (4	

Table 2
KMnO4 Injection Analytical Results Summary for Shallow Wells
(All results in ug/l unless indicated)

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i san ing s				t have b					SHALL	OW WELLS				1		
Analyte	Collection Date	Collection Date	MW-2A	MW- 4PS	MW-7P	MW-10PS	MW-11PS	MW-12PS	MW-13PS	PTMW-15*	PT-MW2S	PT-MW3S	PTMW-3S	PTMW-	PTMW-5S	PTMW-6S
	Pre-Injection (10/30 - 11/7/										•			1		
hromium		10/30/02		108										1		1
		10/31/02				19	5B				15	10				
		11/01/02	1B												1	2B
		11/04/02	·			- · · · ·		18							48	
		11/05/02				I				108	.					
		11/07/02	L	i	1			1			L	L		10B		
	Intermediate Post-Injection		· · · · · · · · · · · ·		γ··			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						
		12/18/02														_
		12/19/02	.	L	L	1			Ļ	<u> </u>	I			I		
	Shallow Post-Injection (1/2		••••		r	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	······································		-					
		01/29/03				\$1.	13*	4B*		88*	5B*		4B•	18*	3B*	4B
		01/30/03	I	I		1 11	13*	1	4B*	1	l		I			
	Second Post - Injection (4/	04/02/03		7	1	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·				r=•••	التعدا عجابتك عموا			
		04/03/03	· · · · · · · · · · · · · · · · · · ·			- }	38		4.3B	1.48						
		04/03/03	1 · · · ·					2.1B			5.4B		4.6B	3.2B		
	Upgradient Background (4/		J	L	I	35.2		2.18		i	[J		_l	
	Opgradient background (4)	NA	1	ŋ	1	···· 1	1	r	1 ***			·	1			
		INA			1			1	1	1	1,,,		1	L	1	
	Pre-Injection (10/30 - 11/7/	021		30 ⁹⁴ (5)			<u>, 1997) (1997) (1997) (1</u>						a de la caractería de la			
n	19-infection (10:30 - 11/1)	10/30/02		11700	1	· · · · · · · · · · · ·	·	(.	I	1			· · · · · · · · · · · · · · · · · · ·		
<i>μ</i> ι		10/31/02	•		· · · · · · ·	20000	49000		.		40100	18200	· ·			k
		11/01/02	602		+ ·····	20000	45000	• · · · · · · ·	· ·		40100	18200				· • • • • •
		11/04/02		• · - · · · · • • · ·	· · · · · ·	· · · · · · · · ·	· · ·	2690			· · · · · · · · · · · · · · · · · · ·	a a a			1	6410
		11/05/02		}	· ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	2090	· · · · · · ·	26000			· · ·		43400	
		11/07/02		<u> </u>					· · · · · ·	20000		· · · · · · · · · · · · · · · · · · ·				
	Intermediate Post-Injection		<u>ا</u>	L	1				I		L		1	1510	. I	- J
		12/18/02	T	T	1	· I		· · · · · · · · · · · · · · · · · · ·	1	T	I		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
		12/19/02			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			· ·	· · · · · · ·	· · · · · · · · · ·					
	Shallow Post-Injection (1/2)		1	.				1	I	۸	L	L	1	l		
		01/29/03	r	1	1	-1	·····	5780	I	18700	20800	······	16800	,	1	
		01/30/03	t		· · · · · · · · · · · · · · · · · · ·	20500	67000		5220	*0100	20000		16800	8100	59600	20800
	Second Post - Injection (4/2		• • • • • • • • • • • • • • • • • • • •	.	*		1 01000		5220	L		L	L	L		
		04/02/03	1	r	r	1	68800	1	2730	19700	· · · · · · · · · · · · · · · · · · ·			1	I ·· ·· ·	1
		04/03/03	1		· · · · · · ·		1				17100		9360	7120		4
		04/04/03		l · · · · · · · · · · · · · · · · · · ·		35600		2380	· · ····				000			1
	Upgradient Background (4/	10/03)		•		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	.1	L	L	L	<u>الــــــــــــــــــــــــــــــــــــ</u>		i
		NA	1	1]	1		1	l	T	l	· · · · · · · · · · · · · · · · · · ·	r · · · · · · · · · · · · · · · · · · ·	· · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	1
The second s					ित्याः अन्तरम्	108990 - 54-5							Lan Rig Alexand	L		

									SHALL	OW WELLS						
Analyte	Collection Date	Collection Date	MW-2A	MW- 4PS	MW-7P	MW-10PS	MW-11PS	MW-12PS	MW-13PS	PTMW-15*	PT-MW2S	PT-MW3S	PTMW-3S	PTMW- 4S	PTMW-5S	PTMW-68
	Pre-Injection (10/30 - 11/7)	02)														
anganese		10/30/02		323	· [· · · · · · · · · · · · · · · · · ·			1]	1	Ι		[1	1 1
		10/31/02				479	730				925	635				
		11/01/02	1940	1						I					1 -	1 8
	1	11/04/02	·	·				82					1	1	570	
		11/05/02				[[469						
		11/07/02							i					892		
	Intermediate Post-Injection															
		12/18/02							[L					T	
		12/19/02	1	<u>ì </u>			1					[
	Shallow Post-Injection (1/2															
		01/29/03		i				146*		_20800*	892		652*	305*	762*	29
		01/30/03	L	L		617*	1100*	<u> </u>	1810*		L	L				
	Second Post - Injection (4/		· · · · · · · · · · · · · · · · · · ·		·							r=				
		04/02/03					1510		1670	1490						
	1	04/03/03			I						697		432	468		
		04/04/03	I	1	1	713	1	64.9	L	l	L	L		[
	Upgradient Background (4		T			· · · · · · · · · · · · · · · · · · ·	······································		······································	· · · · · · · · · · · · · · · · · · ·	·····		· · · · · · · · · · · · · · · · · · ·			
		NA	L				l l	1		1	1	1	1	1	1	1

Notes:

1. All data is draft and is currently undergoing QA/QC review.

2. "U" = Compound was analyzed for but not detected.

3. "J" = Estimated value.

4. "B" = For organics - Parameter was present in the associated blank as well as in the sample. Indicates probable blank contamination - interpret cautiously.

5. "B" = For inorganics - Reported value is less than Contract Required Detection Limit, but greater than Instrument Detection Limit.

6. "D" = Compounds identified at a secondary dilution factor. If re-analyzed at a higher dilution factor as in an "E" flag, the suffix "DL" is used.

7. All results in ug/l except chlorides (mg/l) and TOC (mg/l)

8. PTMW-1S was incorrectly labelied on one data report, and was standardized with the correct terminology as "PTMW-1S" on this summary table.

						espers phi	an that a star		INTERMED	ATE WELL	S .	1.1				
Analyte	Collection Date	Collection Date	MW-2AI	MW-SPI	MW-6P	MW-10PI	MW-11PI	MW-P11I	MW-P121	MW-P13I	PTMW-11	PTMW-2	PTMW-3	PTMW-4I	PT-MW5I	PTMW-6
	Pre-Injection (10/30 - 11/7/02)															
1,1-Trichloroethane		10/30/02	1				I		I	L						1
	1	10/31/02		100			LOT				50U	200	1000U			1
		11/01/02	250U			100				1	1	.				[
		11/04/02	1				[100		(100	10
	1	11/05/02								· · _ · ·]					1
		11/07/02								[1J		1
	Intermediate Post-injection (12	2/18 - 12/19/02)														
		12/18/02		100		·	100		100		1		1000		10U	10
	1	12/19/02						4J		2j	10U	100		2500	[
	Shallow Post-Injection (1/29 -	1/30/03)														
		01/29/03	1	[1]						1
		01/30/03													I	1
	Second Post - Injection (4/2 -		· · · · · · · · · · · · · · · · · · ·													
		04/02/03	1	1		1] 30	1	[40,	1]	1	1	1
	1 1	04/03/03				1		1			100	100	10U T	[·		
		04/04/03		100		10U			10U				I	100		-
	Upgradient Background (4/10)	03)	•	·												
		04/10/03	1		100				1				1]	1
		2.11.11.11.11.11.11.11	11100			100 C. 100 P.	요즘 같은 것이 같이 같이 많이 많이 많이 많이 많이 했다.	in data di Sara								
	Pre-Injection (10/30 - 11/7/02)						كالكامية ومتنفقات الالان ومتخفيها									
1,2,2-Tetrachioroethane	The injection (Torog_ Thirds,	10/30/02	1	1		I	1	1]	1	· · · · · · · · · · · · · · · · · · ·	1	1	1		1
1,2,2.1 E(180110/06010110		10/31/02		100			200	(50Ū	20U	1000U	1 .		
	1)-	11/01/02	250U	in conditions		100										i
		11/04/02							100						100	1 10
		11/05/02	· · · · · · · · · · · ·	• ·· · · •			1							1		1
))	11/07/02						· · · · · · · · · · · · · · · · · · ·						100		
	Intermediate Post-Injection (1)		· · · · · · · · · · · · · · · · · · ·		<u> </u>	· · · · · · · · · · · · · · · · · · ·		• • • • • • • • • • • • • • • • • • • •							·*····	
		12/18/02	1	100			100	1	100	T	1	r	1000	1	100	10 10
		12/19/02		·				100		100	100	100		2500	1 - TR	
	Shallow Post-Injection (1/29 -		L	·	····-			A			,		·		A	_
	Citation Cost Theorem Tures	01/29/03	T			I			1		T	1	1	1	1	1
	!	01/30/03				· · · · · · · · · · · · · · · · · · ·	· · · · ·		· · · · · · · · · · · · · · · · · · ·						1	· · -
	Second Post - Injection (4/2 -		A			4								+		-l
	Boosting : Con Infoordant (Site	04/02/03	1	r1		· · · · · · · · · · · · · · · · · · ·	100	T		200		Γ	1	1	1	F
	1 -	04/03/03	· · · · ·	· · · · ·		f	· • · · · · · · · · · · · · · · · · · ·			· · · ·	100	- 10Ú	100		• ···	· ·
	1	04/04/03		10U		100	t ·· · · · · · · ·	1	100 -		1			100		1
											·	4		1	A	
	Upgradient Background (4/10)	03)														

<u>Table 3</u> KMnO4 injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

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and the second			ta tu		na k	t na hAdi		Xee	INTERMEDI	ATE WELL	S					
Analyte	Collection Date	Collection Date	NW-2AI	MW-SPI	MW-6P	MW-10PI	MW-11PI	MW-P11	MW-P12	MW-P13I	PTMW-1	PTMW-2I	PTMW-3I	PTMW-4	PT-MW5I	PTMW-6
	Pre-Injection (10/30 - 11/7)	02)														
1,1,2-Trichloroethane		10/30/02														1
	1	10/31/02		100			20U				500	200	1000U			
		11/01/02	250U	· · ·		10U									1	- 1011
		11/04/02				· · · · · · · · · · ·			100	t		·····	l		100	100
		11/05/02		· · · · · · · · · · · · · · · · · · ·						·	··· ·· ·			100	· · · ·	
		11/07/02	L	L		L	I	L		L	1		L	100		I
	Intermediate Post-Injection	12/18/02	1	100	· · · · · · · · · · · · · · · · · · ·	T	100	T	100	T	······	- <u> </u>	1000	1		100
		12/19/02	· · · ·	i				100		100	100	100	1000 .	2500		
	Shallow Post-Injection (1/2		I					<u> </u>	L.,				•	1	d	
	Shanow Posengechida (172	01/29/03]	I		1	T	T	T		1	T	F	T	1	1
		01/30/03		···· · · ·						· · · · · · · · · · · · · · · · · · ·					-	
	Second Post - Injection (4)		6	L	<u> </u>		·	· · · · · · · · · · · · · · · · · · ·		·				-	······	·
]		04/02/03	I]	100	1		200		1			[
		04/03/03						1			100	100	100			
		04/04/03		100		100			100		l			100		
	Upgradient Background (4				L		· ····	·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·			
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<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

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KMn04 Injection Analytical Results Summary for Intermediate Wells
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KMnO4 Injection Analytical Results Summary for Intermediate Wells
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Mond# Injection Activitical Results Summary for Intermediate Wells (AnnO# Injection is a logul up in estimated)
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<u>Table 3</u>
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

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		12/19/02						100			100	100	1000	250U	1	1
	Shallow Post-Injection (1/2			·	·	L				1		· · · · · · · · ·	•	*		
	Shallow Post-Injection (1/2	01/29/03	1	T	T	1	T	1	1	1	.	I	1	1	1	1
		01/30/03	· · · · · · · · · · · · · · · · · · ·				1				1					
	Second Post - Injection (4/		-		· · ·	· · ·				· · · · · · · · · · · · · · · · · · ·						
	Contra - Contra - Anna - An	04/02/03		1	[T T	100			20U						
		04/03/03									100	100	10U			1.
		04/04/03		10U		100			100	1		1	<u> </u>	10U	1	
	Upgradient Background (4)	/10/03)						· · · ······						· ···		1
	-	04/10/03			100		<u> </u>	<u> </u>		1	<u> </u>		1	1		
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	Pre-Injection (10/30 - 11/7)	(02)						·	1		.,		n	r:	1.1.1.1	1
omodichioromethane		10/30/02			1				1		50U	200	10000		4 ···	
	1	10/31/02		100			20U			·	500	1 200	10000			
		11/01/02	250U			100			100	· · ·=		1			100	10
	1	11/04/02		· · ····	·				· · · · · · · · · · · · · · · · · · ·			· · ·			1.00	
		11/05/02				····				· · · · · · · · · · · · · · · · · · ·	1.1.1	·		100		+ ·
	Intermediate Post-Injection		<u> </u>			مر مر ا م				·L	· · · · · · · · · · · · · · · · · · ·		·····	· · · · · · · · · · · · · · · · · · ·		
	Internediate Post-injection	12/18/02	1	100	1	T	100	1	100	1	·····		1000	1	100	10
	1	12/19/02						100		100	100	100		250U		
	Shallow Post-Injection (1/2								· · · · · · · · · · · · · · · · · · ·			-	· · · · · · · · · · · · · · · · · · ·	4		
	Griding in Cost information 3 in	01/29/03	Т	1	T	1	1	1		I	1	T	I	1	1	1
		01/30/03					1				1	·		1		-
	Second Post - Injection (4/	2 - 4/4/03)													-	
		04/02/03	1				10U			20U						
		04/03/03	I						1		100	100	100	1	1	1
		04/04/03		100	L	10U	1	I	100	1	L	<u> </u>	l	100	J	
	Upgradient Background (4	/10/03}					100 C									
	the second second second second second second second second second second second second second second second se	04/10/03			100											

<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

Analyte	Collection Date	Collection Date	1911	INTERMEDIATE WELLS													
			MW-2AI	MW-5PI	MW-6P	MW-10PI	MW-11PI	MW-P111	MW-P121	MW-P13t	PTMW-1	PTMW-2I	PTMW-3	PTMW-41	PT-MW5I	PTMW-6I	
	Pre-Injection (10/30 - 11/7)						•			· · · · · · · · · · · · · · · · · · ·	,			,	,		
Bromoform		10/30/02															
		10/31/02		100			200				50U	200	10000				
		11/01/02	250U			10U											
		11/04/02					J		10U							² J	
		11/05/02							· · · · · · · · · · · ·		ļ	· · · · · · · · · · · · · · · · · · ·	· · ·	- 10U ·	-		
		11/07/02	I	المرجعي الم		1	- <u> </u>	L		L	L	.	_	1 100		L	
	Intermediate Post-Injection	n (12/18 - 12/19/02) 12/18/02	· · ·	100		1	1 1011	F	100	т	1	1	1000	1	10U	10U	
		12/18/02		· '''' - ·			100	100		100	10U	100		250U	- 100	1 100	
	Shallow Post-Injection (1/2		L			L	· · · · ·			1	1 100	1		1 2.00	· · · · · · · · · · · · · · · · · · ·	1	
	Shakaw Post-injection 1 1/2	01/29/03	r	1	· · ·	T		1	· · · · · · · · · · · · · · · · · · ·	I	· · · · · · · · · · · · · · · · · · ·	l	1	1	1	· · · · · · · · · · ·	
		01/30/03						· · · · · ·			·		·			· · · · · ·	
	Second Post - Injection (4)				·····			• • • • • • • • • • • • • • • • • • • •	• • • •			•		•		*	
		04/02/03		1		1	10U		1	20U				1			
		04/03/03					1				100	10U	10U				
		04/04/03		10U		10U			10U					100			
	Upgradient Background (4	1/10/03)			· · ·				• • • • • • • • • • • • • • • • • • • •		• · · · · · · · · · · ·						
1		04/10/03			10U							L		I			
	a na mang ang sa sa sa sa sa sa sa sa sa sa sa sa sa				양 전 감독 감독		461 (f - 16) (c					under an an	a canagara a	이 그 것 동안한 것			
	Pre-Injection (10/30 - 11/7	/02)				· · · · · · · · · · · · · · · · · · ·									• · · · · · ·		
Bromomethane		10/30/02						····									
		10/31/02		100			20U				50U	200	1000U			÷ .	
		11/01/02	250U			100			100	· · … ·					1	1 4011	
	1	11/04/02	·					· · · · · · · · ·	100	· · · · · · · ·					100	10,0	
		11/05/02 11/07/02												100			
	Intermediate Post-Injection		ŀ.,	I				<u>.</u>	1	1.,	1			100	.L	L	
	Inter regiate Post-injection	12/18/02	r	100		1	100		10U		T	1	1000	J	10U	100	
	1	12/19/02	• • - • - • • • • • •	· · · · · · · · · · · · · · · · · · ·				100	-	100	100	100		2500			
	Shallow Post-Injection (1/					· ·	. .				1	1				-L	
	1	01/29/03	T T	1		1	· · · · · · · · · · · · · · · · · · ·		1	1			1	1	Ι	1	
	1	01/30/03														· ·	
	Second Post - Injection (4	/2 - 4/4/03)		and the second second												*	
	1	04/02/03					10U			20U		1				1	
	1	04/03/03						{			100	100	100	i i			
	ļ	04/04/03	I,	100		10U	1	{	100	<u> </u>	L	I		10U		1	
ł	Upgradient Background (4		·								· · · · · · · · · · · · · · · · · · ·						
<u> </u>	1	04/10/03	L	L	100	L		t	1	1	L	l	1		1		
		방법 소설은 신문 사람이 있는 것이다.		and a first state		 Provide a subscription 					and a second of	i i i sur cate da	10.151.000.001				

<u>Table 3</u>
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

		and the second second							INTERMED	ATE WELL	S alle.					
Analyte	Collection Date	Collection Date	MW-2AI	MW-5PI	MW-6P	MW-10PI	MW-11PI	MW-Pttl	MW-P12	MW-P13I	PTMW-1	PTMW-2I	PTMW-3I	PTMW-4	PT-MW51	PTMW-6
	Pre-Injection (10/30 - 11/7/	02)									·	,			1	
Carbon disulfide		10/30/02														
		10/31/02		100			20U	I			500	200	10000			1
		11/01/02	250U			100			· · · · · · · · · · · · · · · · · · ·	1						
		11/04/02							10U						100	10U
	}	11/05/02				1							l		1	
		11/07/02				<u> </u>	1	<u> </u>	l	L	L	1	ļ	100	<u> </u>	.I
	Intermediate Post-Injection			· · · · · · · · · · · · · · · · · · ·			1				T			·····		·
		12/18/02		100			100		100		I		1000		100	100
		12/19/02	<u> </u>	L		L	1	10U	I	100	10U	10U	1	250U	l	L
	Shallow Post-Injection (1/2	9 - 1/30/03)		· · · · · · · · · ·					· · · · · · · · · · · · · · · · · · ·		r			T		
		01/29/03							· · · · · · · · · · · · · · · · · · ·	1	· · ·					
		01/30/03	L	i	L	<u>i</u>	L			1	L	I	<u>I</u>		L	L
	Second Post - Injection (4/	2 - 4/4/03}					7	· · · · · · · · · · · · · · · · · · ·	·	1		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	1 ······
	(04/02/03					100		· · · · · · · · · · · · · · · · · · ·	20U	· ···· · · · · ·		100			
	1	04/03/03									100	100	<u></u>			
		04/04/03		10U		100	<u> </u>	<u> </u>	100	L	L	!	I	100	<u> </u>	.I
	Upgradient Background (4)	/10/03)		<u>,</u>		r	- e	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				1 · · · · · · ·	
	l	04/10/03	L		10U	L	1	1	1			1	1,		1	<u> </u>
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	Pre-Injection (10/30 - 11/7/	/02)		,		•	· · · · · · · · · · · · · · · · · · ·		1		ŋ <u> </u>	- · · · · · · · · · · · · · · · · · · ·	. · · · · · · · · · · · · · · · · · · ·		1	1
Carbon tetrachloride		10/30/02										200				
		10/31/02		10U		1	20U	·			500	200	1000Ц		· · · ·	
		11/01/02	250U	• •		_10U			6011		l					
		11/04/02				·			10U	·			1			10U
		11/05/02								· • · · · · · · · · · · · · · · · · · ·		· · - · · -				
			L		I, .			L			I	1	J	1 100	.L	<u>i</u>
	Intermediate Post-Injection		· · · · · · · · · · · · · · · · · · ·	1011		r	100	T	100	T	r	· · · · · · · · · · · · · · · · · · ·	1		1 400	1
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	Shallow Post-Injection (1/2	01/29/03	1	1	· · · · · · · · · · · · · · · · · · ·	T	η	· · · · · · · · · · · · · · · · · · ·	T	· · · · · · · · · · · · · · · · · · ·	T	r	· · · · · · · · · · · · · · · · · · ·	·	1	·
	1	01/30/03			· · · · · · · · · · · · · · · · · · ·			·				· - ··		· · · ·		
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	Second Post - Injection (4/	2 ~ 4/4/03)		r			100	1		200	1 ··	I	P** **	· · · · · ·	1	1
)	04/03/03	· [· · · · ·		100	100	100	· · · · · · ·		
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	opgravient background (4)	04/10/03	5	1	100	1	· · · · · · · · · · · · · · · · · · ·	·	7	· · · · · · · · · · · · · · · · · · ·	1	1 ·	·····	-1	1	1
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<u>Table 3</u>
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

							e di ing		INTERMED	ATE WELL	S		· · ·			
Analyte	Collection Date	Collection Date	MW-2AI	MW-5PI	MW-6P	MW-10PI	MW-11PI	MW-P11	MW-P121	MW-P13I	PTMW-11	PTMW-2	PTMW-31	PTMW-4I	PT-MW51	PTMW-6
	Pre-Injection (10/30 - 11/7/0						·	,								
Chloroform		10/30/02														
		10/31/02		100			20U		I		50U	20U	10000			
		11/01/02 _	250U			10U								- · · · · · · · · · · · · · · · · · · ·		
		11/04/02					· · · ·		100	·					100	100
		11/05/02														
		11/07/02	1	L	L	L	1	I	1	L	L		I	100		1
	Intermediate Post-Injection	(12/18 - 12/19/02) 12/16/02	1	100	r	· · · · · · · · · · · · · · · · · · ·	100	1	100	· · · · ·		Г	1000	r	1	
		12/16/02						100	· · ·····	100	· ····· · · · · · · · · · · · · · · ·	tou	1000	2500	100	100
	Shallow Post-Injection (1/29		L	L	L	L	· · · · · · · · · · · ·	1 100	L	1	<u> </u>	1 100	<u>هــــــــــــــــــــــــــــــــــــ</u>	2300	<u> </u>	I
	analiow Post-Injection (1/28	01/29/03	1		<u>,</u>	1		1	1	1	1	I	P	J	1	1
	i i	01/30/03	·					· · ·		····						
	Second Post - Injection (4/2		•			L	<u>.</u>	·	•	L			<u> </u>	1	L	
	Contract out interest in	04/02/03	1	1	[[100	T	I	200	1	T	[1 ···· · · · · · ·	
		04/03/03									100	10U	100			
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	Pre-Injection (10/30 - 11/7/0)2}														
Chloromethane	1	10/30/02	[[1							[1
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	Shallow Post-Injection (1/29		1	L	!	1	1	100	J	<u> </u>	100	100	L	2500	J	J
	Snallow Post-Injection [1/25	01/29/03	1	·	r	r	1	T	1	1	1		r	Y	· · · · · · · · · · · · · · · · · · ·	•
		01/30/03			· ·		f		· · — · · — ·	· · · · · · · · · · · · · ·						1
	Second Post - Injection (4/2		L	L.,	L	L	4	ـــــــــــــــــــــــــــــــــــــ	I	L	L	L	L		l,	L
		04/02/03	1	Γ	<u>га</u>		100	I	1	20U	1	1	1	I	1	1 · · · · ·
		04/03/03			· · · · · · · · · · · · · · · · · · ·		1	· · · · · · · · · · · · · · · · · · ·		1	100	100	100			-
		04/04/03		10U	1	100			100	· - · ····				100		
1	Upgradient Background (4/1	10/03}	•		• • • • • • • • • • • • • • • • • • • •	· · · · · · · · · · · · · · · · · · ·		<u> </u>	· · · · · · · · · · · · · · · · · · ·	•	A	*	•	L	-h	L
		04/10/03]	10U]	T	1	T		1	1	1]	1	1
						1028033			1. Sec. 1. Sec.		Real and the second second	s - 19 - 19 - 19 - 19 - 19 - 19 - 19 - 1				

<u>Table 3</u>
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

			an ja ang	e a l'alate					NTERMED	ATE WELL	S					
Analyte	Collection Date	Collection Date	MW-2AI	MW-5PI	MW-6P	MW-10PI	MW-11PI	MW-P11	MW-P12I	MW-P13I	PTMW-1I	PTMW-21	PTMW-3I	PTMW-4	PT-MWSI	PTMW-6i
	Pre-Injection (10/30 - 11/7/	02)														
cis-1,3-Dichloropropene	1	10/30/02														1
		10/31/02		100			200				50Ú	200	10000		· · · · ·	1
		11/01/02	250U]	100		· · ·								I " .
		11/04/02			- ·		· · · · · · · · · · · · · · · · · · ·		100						100	100
		11/05/02		- · · · · · · · · · · · · · · · · · · ·	· · ·											
		11/07/02		l	<u> </u>	L	ļ	<u>}</u>	l	L	1	<u></u>	L	100		1
	Intermediate Post-Injection	(12/18 - 12/19/02)	- r	1		,	1			·	r		r			· · · · · · · · · · · · · · · · · · ·
		12/18/02		100		· · ·	100	100	10U	100			1000		100	100
					<u> </u>	I.,	L.,		L	1 100	100	10U	· · · · · · · · · · · · · · · · · · ·	250U	L	1
	Shallow Post-injection (1/2	01/29/03	F	η	i	····	r	r	r	······	<u></u>	······	· · · · · · ·	e		
	1	01/29/03				•	···									
	Second Post - Injection (4/					l	L	<u> </u>	L		L	1	L	t	L	J
	Second Fost - Injection (4/	04/02/03	Т	1	T	1	100	7 <u> </u>	····	200	· ·	r	I		r	n (
	1	04/03/03			<u>+</u> -				· – · · · – – · ·	200	100	100	100		· ···-	
		04/04/03		10U		10U	• • • • • • • • • • • • • • • • • • • •		100			}— ₩ .		100		
	Upgradient Background (4/				L.,	1	L	ļ	,	· · · · · · · · · · · · · · · · · · ·	L	L		100	L	I
	Conditional and a second 7	04/10/03	-1	1	100	J		п <u>— — — — — — — — — — — — — — — — — —</u>		1	1	1		I	p	1
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· · · · · · · · · · · · · · · · · · ·	Pre-Injection (10/30 - 11/7/	02)														
Dibromochloromethane		10/30/02	ן <u>ו</u>	1	T	_ · · · · · · · · · · · · · · · · · · ·	1	T		1			I		I	1
		10/31/02	1	100			20U				500	20U	10000			
	l	11/01/02	250U]		100	1									
		11/04/02			I				104						100	1 · · · 1J
		11/05/02]					·							1
		11/07/02	i	<u> </u>	L		<u>}</u>					1		100		1
	Intermediate Post-Injection			· · · · · ·		· · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·								
		12/18/02		100			10U		10U				t00U		100	100
		12/19/02		L	I	l	<u> </u>	100	l	100	100	100	<u> </u>	2500		
	Shallow Post-Injection (1/2		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	I	r	·····			T		· · · · · · · · · · · · · · · · · · ·			
		01/29/03				· · ·										
		01/30/03		.l		<u> </u>	I	L	L.,	L	L	L	L			
	Second Post - Injection (4/		i januaria a samu		· · · · · · · · · · · · · · · · · · ·	<u></u>	100		,	· · · · · · · · · · · · · · · · ·						
		04/02/03		·			100			20U	10U					
	1	04/03/03	· · · · · · · · · · · · · · · · · · ·	10U		100			100			100	100	100		-
				3 100	1	1 100	1	1	1 100	1	1	1	1	i 1003	1	1
	I Ingradient Background (4)		· · · · · ·			4,,	·····				A		I	1		· · · · · · · · · · · · · · · · · · ·
	Upgradient Background (4/			1	100	······	1	1	·	1	·	· ···· · ····	L	· · · · · · · · · · · ·	· ····································	

									INTERMEDI	ATE WELL	S					
Analyte	Collection Date	Collection Date	MW-2AI	MW-5PI	MW-6P	MW-10PL	MW-11PI	MW-P11	MW-P12I	MW-P13I	PTMW-1I	PTMW-2	PTMW-3I	PTMW-4I	PT-MW5	PTMW-6I
	Pre-Injection (10/30 - 11/7/0	12)											,			
Ethylbenzene		10/30/02											·	l		
		10/31/02		100	· · · · - · - · ·		200				500	200	10000			
		11/01/02	250U	· · · ·		10U			100						100	4J
		11/04/02					/		100	j			+ · · · · ·		. 100	4J
	1	11/05/02 11/07/02		· · ·]	· · · -							· · · · · · · · · · · · · · · · · · ·		100		
	Intermediate Post-Injection		L		L 		l	L	1	L		.	J	L 100	J	I
	memediate Post-mection	12/18/02	1	100			100	[100	1	Т — — — — — — — — — — — — — — — — — — —	1	1000	· • • • • • • • • • • • • • • • • • • •	100	100
		12/10/02						100		- 10U	100	10U		2500		
1	Shallow Post-Injection (1/2		L	· · · · · · · · · · · · · · · · · · ·	•	1		· · ·	· · · · ·	*****				····-	A	1
	Changer 1 correlation (inc	01/29/03	T	[I	1	1	ſ	1			1	T	1	1	
	-	01/30/03								1						
	Second Post - Injection (4/2	2 - 4/4/03)	· · · · · · · · · · · · · · · · · · ·													
		04/02/03					100		1	20U					1	1.
		04/03/03									100	100	100	100	1	
		04/04/03	L	100	I	100	1	<u> </u>	100	L		1	1	100	L	L
1	Upgradient Background (4/	10/03)	1	<u>, </u>	100	r	- <u>i</u>	····			r	1	1	• • • • •	1	
	1	04/10/03		L	100	1 				1			L	1		1
		<u> </u>		1878 St. 1977 St. 1977	<u></u>	tas intra la glavia incontra la										
Freon-113	Pre-Injection (10/30 - 11/7/	10/30/02	· · · · · · · · · · · · · · · · · · ·	· · · · · ·	l	ц	1	T	10 × 1000	I the second		1	1	1	1	1
Freor-113		10/31/02	· ·	_9.							12DJ	9DJ	10000			1
1		11/01/02	1100D	==		66]		1	1	1	j –	1 · · · = · · ·
	1	11/04/02							100	1					340	33
	1	11/05/02	· · · · · · · · · · · · · · · · · · ·]			1	I	1
		11/07/02												48JD		
	Intermediate Post-Injection										-r					
!		12/18/02		27		1	56		40				8000		100	12
		12/19/02	L		<u> </u>	1		BJ	1	10U	100	10U		250U	L	1
	Shallow Post-Injection (1/2		T	T		· · · · · · · · · · · · · · · · · · ·	1	· · · · · · · · · · · · · · · · · · ·	1	· · ·	1		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		.
1		01/29/03						· 								
	Second Post - Injection (4/)		.I	L	1	1	1	1	1	1		1	1			
	Becurio Post - Injection (4/	04/02/03	· · · · · · · · · · · · · · · · · · ·	r	J	p	1	1		200	1	· . · · · · · · ·	1	· · · · · · ·	1	i
l		04/03/03					1 · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		200	100	100	10U			
ł		04/04/03		10U		16			15					39		1
	Upgradient Background (4/		•	·	•						•	4			•	
1	Inter de latter trouble build.	04/10/03	T	1	100	1	[1	1	1	1	1	1		· · · · · · · · · · · · · · · · · · ·	1
				J			A	A	J	- Internet and the second second second second second second second second second second second second second s		1			- <u>1</u>	

<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

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					el a sur a La sur de pr	en de plas			INTERMED	IATE WELL	S					
Analyte	Collection Date	Collection Date	MW-2A!	MW-SPI	MW-6P	MW-10PI	MW-11PI	MW-P11I	MW-P12I	MW-P13I	PTMW-1I	PTMW-2I	PTMW-3	PTMW-4	PT-MW5	PTMW-6i
	Pre-Injection (10/30 - 11/7.						·								diserte en en en en en en en en en en en en en	
Methylene chloride		10/30/02	Ι]	1]		
		10/31/02		100			20U				50U	20U	130DJ	I		
		11/01/02	2500			10U									1	1
		11/04/02			· · • • • • • • • • • • • • • • • • • •			· · ·	10U						10U	100
		11/05/02														
		11/07/02	L	.l.,		L	<u> </u>	L	1	J	1	L		600BD	<u> </u>	
	Intermediate Post-Injection		r				1	1				T	1		· I ······	
		12/18/02 12/19/02		100			100	10U	100			100	1000		100	10U
	Challes: Deat Inighting Id P		I	- I		I	1	1. 100	1	100	100	100	L	250U	J	
1	Shallow Post-Injection (1/2	01/29/03	T	· · · · · · · · · · · · · · · · · · ·	· · · · ·		ſ	i			T	T	·		L	
		01/30/03			···· ——— ·-											
1	Second Post - Injection (4				L	<u></u>	1		- <u> </u>		.L			L		
1	Second 1 cat - Injection (4	04/02/03	r	T	· · · · · · · · · · · · · · · · · · ·	1	100	r		200	1		1	I	-1	1
		04/03/03							· · · · · ·		100	100	100 ×			
		04/04/03		100		100			100					100	· ·	
	Upgradient Background (4		• • • • • • • •	1	···		••••••••••••••••		1	-k	· · · · · · · · · · · · · · · · · · ·					
		04/10/03	1	1	100	1		1	T	}	1	т	· · · · · · · · · · · · · · · · · · ·	T		
				n a state a state a state a state a state a state a state a state a state a state a state a state a state a st			100000000		n san pinang ana	ित्रां सम्बद्धाः व	C. Constant		a ta ang sa	ha og kopera	a the second second second second second second second second second second second second second second second	
	Pre-Injection (10/30 - 11/7	/02)									· · · · · · · · · · · · · · · · · · ·					
Styrene		10/30/02	1				1	1	·		1	Τ	η · · · · · · · · · ·	Γ	1	1
	l	10/31/02	1	10U			20U			1	50U	20U	1000U	1		1 · ·
		11/01/02	250U			100						1			1	
		11/04/02							100	1			1 I	1	100	100
		11/05/02	I												1.1.1	
		11/07/02												100		
	Intermediate Post-Injection	n (12/18 - 12/19/02)	·				- .	·								
	1	12/18/02		100			10U		10U				100U	I	100	100
		12/19/02	L		L	I	L	100		10U	10U	100		250U		
	Shallow Post-Injection (1/2	29 - 1/30/03)	·	· · ·	r	· · · · · · · · · · · · · · · · · · ·	·····	T		·,	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
	1	01/30/03	· · · · · · ·			· · · · · ·	· · · · ·									
	Second Post - Injection (4)					L		L			J			ļ	_L	
	Second Post - Injection (4)	04/02/03	1- · · · · ·	ı ———————		1	100	· · · · · · · · · · · · · · · · · · ·	- i	1						
		04/03/03		· · ·-			1			200	100		100			
		04/04/03		100		100			100		. 100	100	100	100	•	
	Upgradient Background (4		A	1	1	1	4	1	1 100		J	1	1	1		
	and a state of the		1	1*************************************		· · · · · · · · · · · · · · · · · · ·	~~~~·		-, · · · · · · · · · · · · · · · · · · ·							
1		04/10/03			10U	1			1			1				

<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

e a serie de la case a a serie da case		a sa sa sa sa sa sa	S. G. Star				al de partes	a An an Arg	INTERMED	IATE WELL	S	$\tau = 1$				
Analyte	Collection Date	Collection Date	MW-2AI	MW-SPI	MW-6P	MW-10PI	MW-11PI	MW-P11	MW-P12	MW-P13I	PTMW-11	PTMW-2I	PTNW-3I	PTMW-4	PT-MW5I	PTMW-6
	Pre-Injection (10/30 - 11/7/															(International State
etrachioroethene		10/30/02									· · · ·	·				1
		10/31/02		14			260D			1	700D	200D	1000U	L		1
		11/01/02	17000			130										1
		11/04/02	l	ļ		[.			43						320D] (
		11/05/02		1		!										1
	Intermediate Post-Injection	11/07/02	1	<u>.</u>	Ļ	t		<u>ا</u>	L		L	L	<u> </u>	60JD		1
	Intermediate Post-injection	12/18/02	1	21	1	t	130	1	52	1	I	· · · · · · · · · · · · · · · · · · ·	1	r	1	1
	•	12/19/02	· ·		··· ·	· · · · · · · · · · · · · · · · · · ·		37		19	100	100	1000	2500	17	
	Shallow Post-Injection (1/2		1		I	£	-	1. 3/	L	1 19	100	1	J	2500		
	Silaiow i use i jecucis (i iz	01/29/03	1	1	1)		r	1 ···	1		r		· · · · · ·	· · · · · · · · · · · · · · · · · · ·	1
		01/30/03		1		Į		·				· · · · · ·				4
	Second Post - Injection (4/		L	•	.	I			L		L				L	
	Contract of the contract of the second	04/02/03	1	1	1]	100	1	1	25D	1	I			F	1
		04/03/03	1	1	- · - · ·				·· · · · · ·	+ ··· · · · ·	10U	10U	10U	•···		
		04/04/03		2J		130			27		and a state	· · · · ·		14	• •	
	Upgradient Background (4)	/10/03)						·				*		-de	d	- i
		04/10/03	1		10U					1	1		1	I	1	1
		그는 시 것을 같은 바람을 물었다.		6	방송 문화 영상								- S. S	i Desgenne i		
	Pre-Injection (10/30 - 11/7/			· · · · · · · · · · · · · · · · · · ·												
luene		10/30/02											l	1	T i i i	1
		10/31/02		10U			200		· · · · · · · · · · · · · · · · · · ·		500	200	1000U			
		11/01/02	250U			41										
		11/04/02	· · · · ·						2J						L U	1 10
		11/05/02 11/07/02	I	· · · · · · · · · · · · · · ·		· · ·			· ·							
	Intermediate Post-Injection		l	L		L	<u> </u>	I		1	L		I	100		
	Interneolate Post-njection	12/18/02	r	100			1	r	1	T		· · · · · · · · · · · · · · · · · · ·		,	• • • • • • • • • • • • • • • • • • •	
		12/19/02					100	100	10U	100	100	100	1000		10U	10
	Shallow Post-Injection (1/2		1		L		1	100	I		100	100	J	250U	I	
		01/29/03	I	יייייין אין אין אין אין אין אין אין אין	I	T	i	1	r	T	1 ····································	r <u> </u>	1	· · · · · · · · · · · · · · · · · · ·	· · · · · · · ·	· · · · · - · ·
		01/30/03					- i	· · ·					· · ·			
	Second Post - Injection (4/					<u> </u>		·	H	4	1	4	·I	L	I.,	
		04/02/03	1	1		f	10U	t	I	200	r	· · · · · · · · · · · · · · · · · · ·	1 · · · · ·	1		1
		04/03/03	1		J			· · · · · · · · · · · · · · · · · · ·			100	10U	10U	1 · ·		
		04/04/03		100		100		· · · · · · · -	10U					100	· · · · ·	-
	Upgradient Background (4)									•	••••••			1 100		- L
		04/10/03	F		10U				1	· · · · · · · · · · · · · · · · · · ·			a submer sur unanter a			

<u>SeldeT</u> 2119W 916ibernson for Internation Rolled (betscibni zzelnu I/gu ni ztluzen IIA)

					Ş	ATE WELLS	NTERMEDI									
I9-MWId	ISMW-1d	IN-WWT9	FTMW-31	PTMW-21	PTWW-II	ICL4-MM	NW-P12	ILLEMM	Idi i-MM	Id01-AAM	MW-6P	MW-SPI	IAS-WM	Collection Date	Collection Date	atylsnA
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				500	105				500			noi		10/31/05		enegorgooldoiO-£,1-sr
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	-	noi		· · · · — ·				• • • • • • • • • • • • • • • • • • • •						Z0/20/LL Z0/90/LL		
·····			r"		T			r	,			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		Intermediate Post-Injection	
noi	100		1001	l			101		ាច់រ			101	1	12/18/02	1	
		nosz	[nei		กอเ		001	· · · · · · · · · · · · · · · · · · ·			1	<u>, <u>i</u>n</u>	20/61/21		
•	I		L	L			··· ; · ·	·			L	1	I		Shallow Post-Injection (1/29	
									·			l		01/30/03	-	
		······		r											Second Post - Injection (4/2	
			[SOU			រាចរ			1	1	E0/20/#0	1	
			101	101	nou							1-1.00		E0/E0/#0	1	
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Table 3
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

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					lan parte				NTERMED	ATE WELL	S					
Analyte	Collection Date	Collection Date	MW-2AI	MW-6P1	MW-6P	MW-10P1	MW-11PI	MW-P11L	MW-P121	MW-P13I	PTMW-11	PTMW-2	PTMW-3t	PTMW-4	PT-MW5I	PTMW-6I
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	· [-	10/31/02		2.j			5DJ]		50U	20U	1000U			
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	Intermediate Post-Injection (· · · · · · · · · · · · · · · · · · ·	·····		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
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	Second Post - Injection (4/2	- 4/4/03)		· · · · · · · · · · · · · · · · · · ·				·			·					
		04/02/03					100			220						
		04/03/03			·						100	100	100			
		04/04/03	I	100	L	2j	L	L	100	I	L	1		<u>4</u> J	<u> </u>	. <u> </u>
	Upgradient Background (4/10	0/03)		· · · · · · · · · · · · · · · · · · ·					r	· · · · · · · · · · · · · · · · · · ·	·····	·	· · · · · · · · · · · · · · · · · · ·	s		
		04/10/03	1	1	100		1	L	<u>}</u>			1	L	<u>i</u>	L	
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	Pre-Injection (10/30 - 11/7/02	2)		·	· · · · · · · · · · · · · · · · · · ·		· ····		· · · · · · · · · · · · · · · · · · ·	1		•	r	· · · · · · · ·		
Xylene (lotal)		10/30/02										200	1.000			
		10/31/02		100	· · · · · · · · · · · · · · ·	7.5	20U				500	200	10000			
		11/01/02	250U			/	· · · · <u> </u>	· · · · · · · · · · · · · · · · · · ·						· ·		
		11/04/02							100	· · · · · · · · · · · · · · · · · · ·		·	· · · ·		100	BJ
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		11/07/02	<u> </u>		L	L	1	I	L	<u>ا</u>	<u> </u>	1	1	100	1	<u> </u>
	Intermediate Post-Injection (1	r	· · · · · · · · · · · · · · · · · · ·	1	,	1 4011	1			1	T		
		12/18/02		100			100		100	100		100	100U		100	10U
		12/19/02	L	L	<u> </u>	l		10U	L	100	100	100	L	2500		
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(bənəsibni zzəlnu l\pu ni zıluzər l\A)
sliew exection Analytical Results Summary for Intermediate Wells
<u>CəldbT</u>

PTMW-61	ISWM-19	IF-MMLd	FIMM 31	PTMW-21	ELWM-II	ATE WELLS		II III III III III III III III III III	JULI-WW	IG01-WM	MM-6P	Ids-MM	IAS-WM	Collection Date	Collection Date	etvisnA
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	Pre-Injection (10/30 - 11/7/															
Chromium		10/30/02														
		10/31/02		3В			28				2B	38	3B			
		11/01/02	2B			28		l								
		11/04/02							1B						2B	6B
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		01/30/03				•				· · · · · · · ·	····			· · ·	1 · ·	
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	[04/03/03							(4.1B	9.78	19.6	• • • • • • • • •		
	\$	04/04/03		4.7B		1.4B			2.68					12.3		
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	ł	11/04/02					1		1290	1.					2130	517
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		01/30/03	• • • • • • • • • • • • • • • • • • • •			j		·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · ·		1	· · ·		
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	1	04/03/03				·	· · · · · ·				B35	236	2100		4 ·	
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<u>Table 3</u> KMnO4 Injection Analytical Results Summary for Intermediate Wells (All results in ug/l unless indicated)

<u>Table 3</u>
KMnO4 Injection Analytical Results Summary for Intermediate Wells
(All results in ug/l unless indicated)

		la serente			ana ang Manana atau at				INTERMEDI	ATE WELL	S · · ·					
Analyte	Collection Date	Collection Date	MW-2AI	MW-5PI	MW-6P	MW-10PI	MW-11Pi	MW-P11	MW-P12I	MW-P13I	PTMW-1	PTMW-2I	PTMW-3	PTMW-4	PT-MW5I	PTMW-6
	Pre-Injection (10/30 - 11/7/	02)			·											
anganese	• • • • • • • • • • • • • • • • • • • •	10/30/02]	Γ	l			
		10/31/02		73			242				914	72	1350			1
		11/01/02	247			1560					1					
		11/04/02			·				132						3230	160
		11/05/02						1								
		11/07/02				1	1	1		1				909		
[Intermediate Post-Injection		· · · · ·			·										
		12/16/02		106			532		107		L		156000E		1950	120
		12/19/02					1	52600E		3750	76300E	97700E		110		
	Shallow Post-Injection (1/2											· · · · · · · · · · · · · · · · · · ·				
1		01/29/03														
		01/30/03			L	1	J	L	L	1	l	L		1		1.
-	Second Post - Injection (4/							· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
1		04/02/03					32600			2830					1	
		04/03/03					//				335	511	2430			
		04/04/03		212	L	658			112	l		L		299	1	
	Upgradient Background (4)		· · · · · ·	_ · · · · · · · · · · · · · · · · · · ·					·····		· · · · · · · · · · · ·					
	·	<u>NA</u>				L		L	1					1		

Notes:

1. All data is draft and is currently undergoing QA/QC review.

2. "U" = Compound was analyzed for but not detected.

3. "J" = Estimated value.

4. "8" = For organics - Parameter was present in the associated blank as well as in the sample. Indicates probable blank contamination - interpret cautiously.

5 "B" = For inorganics - Reported value is less than Contract Required Detection Limit, but greater than Instrument Detection Limit.

6. "D" = Compounds identified at a secondary dilution factor. If re-analyzed at a higher dilution factor as in an "E" flag, the suffix "DL" is used.

7. All results in ug/l except chlorides (mg/l) and TOC (mg/l)

8. PTMW-5I was incorrectly labelled on one data report, and was standardized with the correct terminology as "PTMW-5I" on this summary table.

<u>TABLE 4</u> <u>TREATABILITY STUDY RESULTS SUMMARY</u>

The Site-Specific, Treatability Study concluded the following:

- $KMnO_4$ rapidly degraded PCE, TCE, *cis*-12DCE, VC, chlorotrifluoroethene, and the low level xylene that was present in the site groundwater under the experimental conditions.
- The degradation of 1,1,2-trichloro-1,2,2-trifluoroethane in the control experiment implied that active biological activities might have occurred in the control experiment during the treatability test. 1,1,2-trichloro-1,2,2-trifluoroethane degradation in the site groundwater was also observed, although the degradation rate was slower than the other chlorinated VOCs. Due to the inconclusive nature of treatability testing for 1,1,2-trichloro-1,2,2-trifluoroethane, additional or alternative remedial measures may be necessary to address chlorofluorocarbon contamination in the groundwater at this site.
- Remediation using $KMnO_4$ oxidation is a feasible and effective alternative.
- The Pall site has a low $KMnO_4$ demand estimated at 1 to 4 g/kg soil. The oxidant demand increased with increasing $KMnO_4$ concentrations.
- The decomposition of $KMnO_4$ in the subsurface materials is slow. Therefore, a low $KMnO_4$ dose of 1 to 2 g/L is recommended for pilot testing.
- The impact of $KMnO_4$ injection on metal leaching was determined not to be significant.
- A site investigation and characterization (i.e., a Pilot Test) was suggested to design and implement an effective oxidant delivery system



<u>Table 5</u> <u>Phase I Permanganate Injection Pilot Test</u> <u>KMnO4 Injection Summary</u>

Date of Injection	Daily Water Feed for KMnO4 (gal)	Daily Water Flush (gal)	Daily Mass of Water Injected (Ib)	No. of KMnO4 Bins	Daily Mass of KMnO4 Added (Ib)	Concentration KMnO4 Injected (%)	Production Time (hrs)	Injection Time (hrs)
Intermediate Inj	ections							
11/12/2002	22,634	0	188,768	1&2	2,732	1.4%	5.40	
11/13/2002	3,126		26,071	1&2	377	1.4%	0.75	
11/18/2002	675	404	8,999	1&2	81	0.9%	0.16	
11/19/2002	28,239	270	237,765	1&2	3,409	1.4%	6.70	6.00
11/20/2002	20,974	402	178,276	3&4	6,600	3.7%	5.00	7.50
11/21/2002	24,625	708	211,277	5&6	5,775	2.7%	6.25	6.25
11/25/2002	18,103	1,267	161,546	7&8(6.25)	3,752	2.3%	4.25	4.25
Totals:	118,376	3,051	1,012,701	NA	22,727	2.2%	28.51	24.00
Shallow Injection	ons		· · · · · · · · · · · · · · · · · · ·					
11/26/2002	17,719	883	155,141	7&8	3,673	2.4%	6.50	6.50
12/02/2002	0	623	5,196	7&8	0	0.0%	4.00	4.00
12/10/2002	14,048	1,253	127,610	9&10	2,855	2.2%	2.00	4.00
12/11/2002	13,849	1,078	124,491	9&10	2,814	2.3%	3.00	5.00
12/16/2002	4,583	2,270	57,154	9&10	931	1.6%	1.00	5.00
12/17/2002	18,171	791	158,143	11&12	4,072	2.6%	4.50	6.50
12/18/2002	11,278	680	99,730	11&12	2,528	2.5%	4.00	6.00
Totals:	79648	7578	727,465	NA	16,873	2.3%	25	37

<u>Table 5 (Continued)</u> Phase I Permanganate Injection Pilot Test Field Work Summary

Date	Job	Weather	Temperature (F)
09/16/2002	Well Installation	Raining	78
09/17/2002	Well Installation	Cloudy / Humid	80
09/18/2002	Well Installation	Cloudy / Humid	80
09/19/2002	Well Installation	Partly Cloudy	78
09/20/2002	Well Installation	N/A	78
09/23/2002	Well Installation	Sunny	78
09/24/2002	Well Installation	Sunny	75
09/25/2002	Well Installation	Sunny	75
09/26/2002	Well Installation	Raining	63
09/30/2002	Well Installation	Sunny	60
10/01/2002	Well Installation	Sunny	80
10/02/2002	Well Installation	Sunny	78
10/03/2002	Well Installation	Sunny	78
10/04/2002	Well Installation	Raining	60
10/07/2002	Well Installation	Raining	65
10/08/2002	Well Installation	Sunny	65
10/09/2002	Well Installation	Sunny	65
10/10/2002	Well Installation	Cloudy	60
10/11/2002	Well Installation	Raining	60
10/12/2002	Well Installation	Raining	60
10/14/2002	Well Installation	Mild	60
11/04/2002	Sample Wells for Baseline	Sunny	40
11/05/2002	Sample Wells for Baseline	Sunny	40
11/07/2002	Sample Wells for Baseline	Sunny	40
11/08/2002	Sample Wells for Baseline	Sunny	40
11/07/2002	Water Injection Test	Sunny	40
11/11/2002	KMnO4 Injections (Intermediate Wells)	N/A	
11/13/2002	KMnO4 Injections (Intermediate Wells)	N/A	
11/18/2002	KMnO4 Injections (Intermediate Wells)	Cloudy	40
11/19/2002	KMnO4 Injections (Intermediate Wells)	Sunny	40
11/20/2002	KMnO4 Injections (Intermediate Wells)	Overcast	40
11/21/2002	KMnO4 Injections (Intermediate Wells)	Cloudy	40
11/25/2002	KMnO4 Injections (Intermediate Wells)	Cloudy	35
11/26/2002	KMnO4 Injections (Shallow Wells)	Sunny	40
12/02/2002	KMnO4 Injections (Shallow Wells)	Breezy	30
12/10/2002	KMnO4 Injections (Shallow Wells)	Sunny	20
12/11/2002	KMnO4 Injections (Shallow Wells)	Raining	35
12/16/2002	KMnO4 Injections (Shallow Wells)	Raining	40
12/17/2002	KMnO4 Injections (Shallow Wells)	Sunny	20
12/18/2002	KMnO4 Injections (Shallow Wells)	Sunny	25
12/19/2002	KMnO4 Injections (Shallow Wells)	Cloudy	25

<u>TABLE 6</u> <u>PILOT TEST MONITORING PARAMETERS & FREQUENCY</u>

Field Screening & Monitoring Program:

Field Monitoring Parameter	Field Monitoring Frequency	Purpose of Monitoring
Depth to Water	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Evaluate potential mounding. Evaluate ROI of injection events.
Groundwater Temperature	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Monitor for heat of reaction, health and safety.
Groundwater Conductivity	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Assist in evaluation of possible metals in solution
Groundwater pH	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Data required to evaluate extent of reaction, reaction kinetics, and general system performance
Dissolved Oxygen in Groundwater	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Data required to evaluate extent of reaction, reaction kinetics, and general system performance
Groundwater Turbidity	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Indicator of possible presence / absence of KMnO4 when used in conjunction with other data.
Permanganate in Groundwater (color)	Baseline Before Injection, Daily During Injection, Weekly Following Injection until Reaction is Complete	Direct KMnO4 measurement, extent of reaction, ROI of injection wells, etc.

Continued on next page . . .

TABLE 6 (CONTINUED)

Sample Analyses Parameter	When Sampled	Purpose of Monitoring
VOCs and Chlorofluorocarbons in Groundwater	Baseline prior to injection, Twice after start of injection based upon field screening data reviews.	Indicates effectiveness and degree of completion of reaction, residual contaminant levels, etc.
Metals in Groundwater	Baseline prior to injection, Twice after start of injection based upon field screening data reviews.	Indicates potential bi-products of reaction, ion formation, etc.
ORP in Groundwater	Baseline prior to injection, Twice after start of injection based upon field screening data reviews.	Assist in evaluating reaction effectiveness
TOC in Groundwater	Baseline prior to injection, Twice after start of injection based upon field screening data reviews.	Indicator of soil and groundwater oxidant demand, input parameter for model verifications, extent of reaction indicator, etc.
Chloride in Groundwater	Baseline prior to injection, Twice after start of injection based upon field screening data reviews.	Indicates potential bi-products of reaction, degree of reaction completed, etc.

Note: The level of post-injection field monitoring was less than originally planned following the shallow injection events because of severe weather conditions that limited site access. In the months immediately following shallow injections, there were several blizzards that prevented well locating and access for post-injection sampling.

Welf	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
Shallow We	lis Monitored Dur	ing Phase I F	Pilot Test			al de la composición de la composición de la composición de la composición de la composición de la composición El composición de la composición de la composición de la composición de la composición de la composición de la c		• •
PT-9S	12/11/02 8:50	. i				3.83		4.9
PT-9S	12/11/02 11:30	6.57	0.612	-210	18.8		0.27	
PT-9S	12/11/02 13:00	6.39	0.718	-165	18.7		0.19	
PT-9\$	12/11/02 13:45					3		
PT-9S	12/12/02 10:20				1	0	0	
PT-9S	12/16/02 9:15					3.35		2.9
PT-9S	12/16/02 15:00				·	2.34		
PT-9S	12/17/02 8:10		i		·····	3.41		0
PT-9S	12/17/02 9:30	6.48	0.52	-124	17.9		0.27	
PT-9S	12/17/02 14:00	6.46	0.841	-126	18.1		0.77	
PT-9S	12/17/02 15:00	· · · · · · · · · · · · · · · · · · ·	i.			2.82		
PT-9S	12/18/02 7:30			• • • • • •		3.45		
PT-9S	12/18/02 15:30					3.19		
PT-9S	12/19/02 15:00	ļ				2.76		
PT-9S	12/19/02 8:00	1		·		3.43		. 0
PT-10S	12/11/02 8:50					4.17		55.6
PT-10S	12/11/02 11:30	6.35	0.69	-162	19.4		0.11	
PT-10S	12/11/02 13:00	6.75	0.708	-210	19.4		0.15	
PT-10S	12/11/02 13:45			+		3.15		
PT-10S	12/12/02 10:20					3.65	0	
PT-10S	12/16/02 9:15	0.70				3.43		2.8
PT-10S	12/16/02 10:30	6.56	0.499	-141	19.1		0.28	
PT-10S	12/16/02 13:45	6.63	0.445	-149	19.2		0.27	
PT-10S	12/16/02 15:00					2.46		
PT-10S	12/17/02 8:10			i		3.57		3.8
PT-10S	12/17/02 9:30	6.51	0.964		18.7		0.32	
PT-10S	12/17/02 14:00	6.51	0.9	-141	18.8		0.98	
PT-10S PT-10S	12/17/02 15:00					3.02		
	12/18/02 7:30 12/18/02 15:30		•••••			3.61		
PT-10S PT-10S	12/19/02 8:00					3.30		A A
PT-105 PT-105	12/19/02 15:00					2.9		4.4
PT-11S	11/26/02 8:15					3.23		28.3
PT-115 PT-11S	11/26/02 10:00	5.98	0.546	-37	20	3.23	0.11	
PT-11S	11/26/02 14:00	5.86	0.533	-37	19.9		0.77	
PT-115	11/26/02 14:00	5.60	0.000	-22	15.5	2.11	0.32	
PT-115	12/2/02 8:30					4.13		
PT-115	12/2/02 10:30	6.14	0.531	-65	19.9	4.13	0.25	
PT-11S	12/2/02 13:30	0.14				2.57		
PT-11S	12/2/02 13:30	6.02	0.503	-48	19.9		0.34	
PT-115	12/4/02 9:00					3.63		[
PT-11S	12/10/02 9:00					3.81		
PT-11S	12/10/02 12:15	6.46	0.736	-199	19.4		0.26	
PT-11S	12/10/02 14:20	6.16	0.586	-90	19.5		0.28	
PT-11S	12/10/02 15:30					2.71		·····
PT-11S	12/11/02 8:50					3.78		0
PT-11S	12/11/02 9:30	5.9	0.499	-33	19.7		0.3	
PT-11S	12/11/02 13:00	5.95	0.495	-33	19.7	1	0.27	
PT-11S	12/11/02 13:45					2.76		
PT-11\$	12/12/02 10:20					3.33	0	
PT-11S	12/16/02 9:15		<u> </u>	Ì		3,14		0
PT-11S	12/16/02 10:30	6.34	0.647	-128	19.3		0.18	
PT-11S	12/16/02 13:45	6.38	0.627	-110	19.3		0.28	
PT-11S	12/16/02 15:00	1	· · ·			2.11		
PT-11S	12/17/02 8:10		<u> </u>			3.28	i 	0
PT-11S	12/17/02 9:30	6.16	0.627	-64	19.3		0.2	
PT-11S	12/17/02 14:00	6.47	0.601	-110	19.4		0.46	

<u>Table 7</u>
Permanganate Injection Pilot Test
Field Monitoring Data Summary

PT-15 12/19/02 15:00 2.75 PT-12S 11/28/02 16:30 5.87 0.496 15 19.6 0.21 PT-12S 11/28/02 14:00 5.86 0.503 -10 19.8 0.25 PT-12S 11/28/02 14:00 5.86 0.503 -10 19.8 0.25 PT-12S 12/2/02 8:30 2.49 7 <th>PT-11S 12/1802 (27:30) 3.29 PT-11S 12/1902 8:00 3.31 PT-11S 12/1902 8:00 2.57 PT-12S 11/2802 8:15 2.75 PT-12S 11/2802 1:000 5.87 0.496 15 19.6 0.21 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 12/202 8:30 2.86 79 -12.8 12/102 0:30 3.41 PT-12S 12/102 0:30 5.85 0.489 23 18.8 0.23 PT-12S 12/102 0:345 3.41 -17.5 17.5 17.5 17.5 PT-12S 12/102 0:30 5.85 0.489 23 18.8 0.23 PT-12S 12/102 0:30 5.85 0.489 2.18 3.41 17.5 PT-12S 12/102 0:30 6.21 0.631 -33 18.7 0</th> <th>Well</th> <th>Date/Time</th> <th>Ph (st. units)</th> <th>Conductivity (mhos)</th> <th>ORP (eV)</th> <th>Temperature (deg. C)</th> <th>DTW (feet)</th> <th>Dissolved Oxygen (mg/l)</th> <th>PID (ppb e.u.)</th>	PT-11S 12/1802 (27:30) 3.29 PT-11S 12/1902 8:00 3.31 PT-11S 12/1902 8:00 2.57 PT-12S 11/2802 8:15 2.75 PT-12S 11/2802 1:000 5.87 0.496 15 19.6 0.21 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 11/2802 1:400 5.86 0.503 -10 19.8 0.25 PT-12S 12/202 8:30 2.86 79 -12.8 12/102 0:30 3.41 PT-12S 12/102 0:30 5.85 0.489 23 18.8 0.23 PT-12S 12/102 0:345 3.41 -17.5 17.5 17.5 17.5 PT-12S 12/102 0:30 5.85 0.489 23 18.8 0.23 PT-12S 12/102 0:30 5.85 0.489 2.18 3.41 17.5 PT-12S 12/102 0:30 6.21 0.631 -33 18.7 0	Well	Date/Time	Ph (st. unit s)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
Pr-145 2/140/2 8/00 3.04 Pr-145 12/190/2 8/00 2.57 Pr-125 11/26/02 16/00 2.57 Pr-125 11/26/02 16/00 2.57 Pr-125 11/26/02 16/00 2.57 Pr-125 11/26/02 14/00 5.87 0.496 15 19.6 0.21 Pr-125 11/26/02 14/00 5.86 0.503 -10 19.8 0.25 Pr-125 12/2/02 3/30 2.19 3.7 17125 12/10/02 9/00 3.41 Pr-125 12/10/02 15/30 2.33 2.33 1.0 3.34 1.0 Pr-125 12/10/02 15/30 2.75 1.0 3.34 1.0 1.0 Pr-125 12/10/02 13/45 2.16 3.34 1.0 2.3 Pr-125 12/10/02 13/45 2.75 1.0 1.75 1.75 Pr-125 12/10/02 13/45 2.10 1.1 2.26 1.4 1.75 Pr-125 12/10/02 13/45 2.10 2.17 1.75	PT-115 12/1802 15:30 3.04 PT-115 12/1902 15:00 2.57 PT-125 11/2602 16:00 2.57 PT-125 11/2602 16:00 5.87 0.496 15 19.5 0.21 PT-125 11/2602 16:00 5.87 0.496 15 19.5 0.21 PT-125 11/2602 14:00 5.86 0.503 -10 19.6 0.25 PT-125 11/2602 14:00 3.7 2.88 7 1.91 1.12	PT-11S	12/17/02 15:00							
PT-115 12/1902 (2) 3.31 PT-125 11/26/02 8:15 2.57 PT-125 11/26/02 8:15 2.75 PT-125 11/26/02 10:00 6.87 0.496 15 19.6 0.21 PT-125 11/26/02 14:00 5.86 0.503 -10 9.6 0.25 PT-125 11/26/02 14:00 5.86 0.503 -10 9.6 0.25 PT-125 12/2/02 13:30 2.88 - 2.88 - 2.83 PT-125 12/10/02 15:30 2.33 - 2.33 - 3.34 - PT-125 12/10/02 13:30 5.85 0.489 23 18.8 0.23 PT-125 12/11/02 14:45 - 2.75 1 - PT-125 <td>PT-11S 12/19/02 15:00 2.57 PT-12S 11/26/02 8:15 2.75 PT-12S 11/26/02 10:00 5.87 0.496 1.5 19.6 0.21 PT-12S 11/26/02 10:00 5.87 0.496 1.5 19.6 0.21 PT-12S 11/26/02 14:00 5.86 0.503 -10 9.8 0.25 PT-12S 12/2002 8:30 2.88 2.88 2.88 2.88 PT-12S 12/2002 8:30 2.35 2.85 2.35 2.7 PT-12S 12/2002 8:30 2.35 2.35 2.7 2.7 PT-12S 12/10/2 15:30 2.35 2.35 2.7 2.7 PT-12S 12/10/2 15:30 2.35 2.34 3.41 2.35 PT-12S 12/11/02 13:00 5.85 0.489 2.3 18.8 0.23 PT-12S 12/11/02 13:00 5.27 0.608 5.2 18.6 0.23 PT-12S 12/11/02 13:00 6.27 0.608 5.2 18.6 0.44 PT-12S 12/11/02 14:00 6.27</td> <td>PT-11S</td> <td>12/18/02 7:30</td> <td> </td> <td></td> <td>· · · · · · · · · · · · · · · · · · ·</td> <td></td> <td>3.29</td> <td></td> <td></td>	PT-11S 12/19/02 15:00 2.57 PT-12S 11/26/02 8:15 2.75 PT-12S 11/26/02 10:00 5.87 0.496 1.5 19.6 0.21 PT-12S 11/26/02 10:00 5.87 0.496 1.5 19.6 0.21 PT-12S 11/26/02 14:00 5.86 0.503 -10 9.8 0.25 PT-12S 12/2002 8:30 2.88 2.88 2.88 2.88 PT-12S 12/2002 8:30 2.35 2.85 2.35 2.7 PT-12S 12/2002 8:30 2.35 2.35 2.7 2.7 PT-12S 12/10/2 15:30 2.35 2.35 2.7 2.7 PT-12S 12/10/2 15:30 2.35 2.34 3.41 2.35 PT-12S 12/11/02 13:00 5.85 0.489 2.3 18.8 0.23 PT-12S 12/11/02 13:00 5.27 0.608 5.2 18.6 0.23 PT-12S 12/11/02 13:00 6.27 0.608 5.2 18.6 0.44 PT-12S 12/11/02 14:00 6.27	PT-11S	12/18/02 7:30			· · · · · · · · · · · · · · · · · · ·		3.29		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	PT-11S 12/1802 12.57 2.57 PT-12S 11/2802 11/2802 10 5.67 0.496 15 19.6 0.21 PT-12S 11/2802 14.00	PT-11\$	12/18/02 15:30					3.04		:
Pr-11 12/19/02 15:00 2.75 P7-12S 11/28/02 16:00 5.87 0.406 15 19.6 0.21 P7-12S 11/28/02 16:00 5.86 0.503 -10 19.8 0.25 P7-12S 11/28/02 14:00 5.86 0.503 -10 19.8 0.25 P7-12S 12/200 13:30 2.49 3.41 - - - P7-12S 12/10/02 9:00 3.41 - - 3.34 - P7-12S 12/10/02 9:00 3.34 - - 3.34 - P7-12S 12/10/02 9:30 6.05 0.484 23 19.1 0.32 P7-12S 12/11/02 13:45 341 - - 2.75 - P7-12S 12/11/02 13:45 341 - - 2.75 - P7-12S 12/17/02 9:30 6.21 0.631 33 18.7 0.25 P7-12S 12/17/02 15:00 - 2.17 - - <t< td=""><td>Pr1-18 12/1902 15:00 2.57 P7-125 11/2602 21:00 5.87 0.496 15 19.6 0.21 P7-125 11/2602 14:00 5.86 0.503 -10 19.8 0.21 P7-125 11/2602 14:00 5.86 0.503 -10 19.8 0.21 P7-125 12/202 13:30 2.49 7 7 7 7 P7-125 12/202 15:30 2.33 7</td><td>PT-11S</td><td>12/19/02 8:00</td><td></td><td>· · ·</td><td></td><td></td><td>3.31</td><td></td><td>2.8</td></t<>	Pr1-18 12/1902 15:00 2.57 P7-125 11/2602 21:00 5.87 0.496 15 19.6 0.21 P7-125 11/2602 14:00 5.86 0.503 -10 19.8 0.21 P7-125 11/2602 14:00 5.86 0.503 -10 19.8 0.21 P7-125 12/202 13:30 2.49 7 7 7 7 P7-125 12/202 15:30 2.33 7	PT-11S	12/19/02 8:00		· · ·			3.31		2.8
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	PT-11S	12/19/02 15:00		·		:	2.57		
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PT-14S 11/21/02 15:24 6.41 0.544 -95 18.7 2.34 0.07 PT-14S 11/25/02 9:15 6.34 0.879 -138 18.3 4.13 0.21 PT-14S 11/25/02 13:00 2.79 2.69 2.69 2.69 2.69 PT-15S 11/19/02 8:50 5.99 0.989 -21 19.9 3.93 0.49 PT-15S 11/19/02 10:50 2.67 2.67 2.67 2.67 2.67 PT-15S 11/19/02 15:20 6.06 1.35 -23 20 3.31 0.32 PT-15S 11/20/02 8:00 3.96 3.96 3.96 3.96 3.96 PT-15S 11/20/02 12:15 2.84 2.84 2.84 2.84 2.84 PT-15S 11/20/02 14:15 2.84 2.84 2.84 3.96 3.96 PT-15S 11/20/02 14:15 6.01 1.48 2.29 19.6 0.27 PT-15S 11/20/02 14:15 0.01 1.48 2.91 19.6 0.27 PT-15S 11/20/02 15:00 6.11 <td>PT-14S 11/21/02 15:24 6.41 0.544 -95 18.7 2.34 0.07 PT-14S 11/25/02 9:15 6.34 0.879 -138 18.3 4.13 0.21 PT-14S 11/25/02 13:00 2.79 2.69 2.69 2.69 2.69 PT-15S 11/19/02 8:50 5.99 0.989 -21 19.9 3.93 0.49 PT-15S 11/19/02 10:50 2.67 2.67 2.67 2.67 2.67 PT-15S 11/19/02 15:20 6.06 1.35 -23 20 3.31 0.32 PT-15S 11/20/02 8:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84</td> <td></td> <td>11/21/02 11:00</td> <td></td> <td></td> <td></td> <td></td> <td>2.44</td> <td></td> <td></td>	PT-14S 11/21/02 15:24 6.41 0.544 -95 18.7 2.34 0.07 PT-14S 11/25/02 9:15 6.34 0.879 -138 18.3 4.13 0.21 PT-14S 11/25/02 13:00 2.79 2.69 2.69 2.69 2.69 PT-15S 11/19/02 8:50 5.99 0.989 -21 19.9 3.93 0.49 PT-15S 11/19/02 10:50 2.67 2.67 2.67 2.67 2.67 PT-15S 11/19/02 15:20 6.06 1.35 -23 20 3.31 0.32 PT-15S 11/20/02 8:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84		11/21/02 11:00					2.44		
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PT-15S 11/19/02 8:50 5.99 0.989 -21 19.9 3.93 0.49 PT-15S 11/19/02 10:50 2.67 2.64 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.64 2.68 2.68 2.67 2.68 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67	PT-15S 11/19/02 8:50 5.99 0.989 -21 19.9 3.93 0.49 PT-15S 11/19/02 10:50 2.67 2.68 2.68 2.68 2.68 2.68 2.68 2.67 2.68 2.67 2.68 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.67 2.68 2.67 2.67 2.67 2.67 2	PT-15S	#VALUE!							
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PT-15S 11/19/02 15:20 6.06 1.35 -23 20 3.31 0.32 PT-15S 11/20/02 8:00 3.96 3.96 3.96 3.96 PT-15S 11/20/02 9:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84 2.84 2.8 2.8 PT-15S 11/20/02 14:15 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09 PT-15S 11/21/02 8:00 3.94 3.94 3.94 3.94	PT-15S 11/19/02 15:20 6.06 1.35 -23 20 3.31 0.32 PT-15S 11/20/02 8:00 3.96									
PT-15S 11/20/02 8:00 3.96 PT-15S 11/20/02 9:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84 2.84 2.84 2.84 PT-15S 11/20/02 14:15 2.8 2.8 0.27 PT-15S 11/20/02 15:00 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09 PT-15S 11/21/02 8:00 3.94 3.94 3.94	PT-15S 11/20/02 8:00 3.96 PT-15S 11/20/02 9:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84 2.85			6.06	1.35	-23	20		0.32	
PT-15S 11/20/02 9:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84 2.85 2.95 0.09 2.85 2.95 0.09 2.85 2.95 0.09 2.95 0.09 2.95 0.09 2.95 0.	PT-15S 11/20/02 9:20 5.93 1.04 -26 18.1 2.93 0.86 PT-15S 11/20/02 12:15 2.84 2.								<u>U.UL</u>	
PT-15S 11/20/02 12:15 2.84 PT-15S 11/20/02 14:15 2.8 PT-15S 11/20/02 14:15 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09 PT-15S 11/21/02 8:00 3.94 3.94 3.94 3.94	PT-15S 11/20/02 12:15 2.84 PT-15S 11/20/02 14:15 2.8 PT-15S 11/20/02 14:15 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09			5.93	1.04	-26	18.1		0.86	
PT-15S 11/20/02 14:15 2.8 PT-15S 11/20/02 14:15 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09 PT-15S 11/21/02 8:00 3.94 3.94 3.94 3.94	PT-15S 11/20/02 14:15 2.8 PT-15S 11/20/02 14:15 6.01 1.48 -29 19.6 0.27 PT-15S 11/20/02 15:00 6.11 1.39 -17 18.1 2.25 0.09							in the second second second second second second second second second second second second second second second		
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				0.11	1.39	-17	10.1		0.09	
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<u>Table 7</u>
Permanganate Injection Pilot Test
Field Monitoring Data Summary

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PT-15S	11/21/02 11:00		······			2.33		
PT-15S	11/21/02 13:00			1		2.24		
PT-15S	11/21/02 15:24	6.24	1.69	-40	19.7	2.24	0.15	
PT-15S	11/25/02 9:15	6.03	1.01	-56	19.6	3.92	0.65	23.4
PT-15S	11/25/02 13:00					2.68	~	
PT-15S	11/25/02 14:45	·	Ţ			2.6		L
PT-16S	#VALUE!		i					
PT-16S	11/18/02 9:00	6.13	0.622	-60	19.2	3.71	0.75	55.1
PT-16S	11/19/02 8:50	6.2	0.785	-103	19.4	3.75	0.23	
PT-16S	11/19/02 10:50					2.46		
PT-16S	11/19/02 15:20	6.35	0.788	-140	19.3	3,41	0.2	
PT-16S	11/20/02 8:00	1		:		3.77		
PT-16S	11/20/02 9:20	6.1	0.587	-79	19.3	2.71	0.54	
PT-16S	11/20/02 12:15		1			2.64		
PT-16S	11/20/02 14:15					2.59		
PT-16S	11/20/02 14:15	6.19	0.736	-133	19		0.1	,
PT-16S	11/20/02 15:00	6.26	0.538	-69	19.5	3.08	0.07	
PT-16S	11/21/02 8:00					3.37		
PT-16S	11/21/02 9:30	6.38	0.529	-97	19.5	2.13	0.15	
PT-16S	11/21/02 11:00					2.13		
PT-16S	11/21/02 13:00					2.06		
PT-16S	11/21/02 15:24	6.39	0.566	-116	19.3	2.06	0.12	
PT-16S	11/25/02 9:15	6.56	0.556	-153	18.9	3.93	0.14	0.3
PT-16S	11/25/02 13:00					2.48		
PT-16S	11/25/02 14:45					2.4		
PT-17S	#VALUE!		· · · · · · · · · · · · · · · · · · ·					
PT-17S	11/18/02 9:00	6.03	0.54	-6	19.2	3.69	0.72	129
PT-17S	11/19/02 8:50	6.21	0.597	-64	19.7	3.7	0.71	
PT-17S	11/19/02 10:50					2.4		
PT-17S	11/19/02 15:20	6.23	0.625	-72	19.8	3.39	0.28	
PT-17S	11/20/02 8:00					3.74		
PT-17S	11/20/02 9:20	6.04	0.502	-37	19.7	2.64	0.5	
PT-17S	11/20/02 12:15					2.59		
PT-17S	11/20/02 14:15		· · · · · · · · · · · · · · · · · · ·			2.54		
PT-17S	11/20/02 14:15	6.05	0.578	-45	19.7		0.49	
PT-17S	11/20/02 15:00	6.1	0.529	-34	19.7		0.09	
PT-17S	11/21/02 8:00					3.47		
PT-17S	11/21/02 9:30	6.18	0.523	-36	19.8	2.07	0.06	
PT-17S	11/21/02 11:00					2.07		
PT-17S	11/21/02 13:00					1.99		
PT-17S	11/21/02 15:24	6.21	0.534	-43	19.2	1.99	0.09	
PT-17S	11/25/02 9:15	6.18	0.657	-80	19.5	3.88	0.36	43.9
PT-17S	11/25/02 13:00	i				2.41		
PT-17S	11/25/02 14:45					2.33		
PT-18S	#VALUE!					ĺ		
PT-18S	11/19/02 8:50	6.11	0.621	-54	19.6	3.81	0.43	
PT-18S	11/19/02 10:50					2.52		
PT-18\$	11/19/02 15:20	6.11	0.555	-59	19	3.51	0.19	
PT-18S	11/20/02 8:00			1		3.83		
PT-18S	11/20/02 9:20	6.02	0.592	-31	19	2.73	0.45	
PT-18S	11/20/02 12:15							
PT-18S	11/20/02 14:15							
PT-18S	11/20/02 14:15							
PT-18S	11/20/02 15:00		1.76		18.7	3.08		
PT-18S	11/21/02 8:00					3.5		
PT-18S	11/21/02 9:30			1				
PT-18S	11/21/02 11:00							
PT-18S	11/21/02 13:00							

<u>Table 7</u>
Permanganate Injection Pilot Test
Field Monitoring Data Summary

Weil	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PT-18S	11/21/02 15:24							
PT-18S	11/25/02 9:15			-				3.1
PT-18S	11/25/02 13:00					2.56		
PT-18S	11/25/02 14:45			_				
PTMW-1S	11/18/02 9:00	6.17	0.488	-53	18.4	3.73		
PTMW-1S	11/19/02 8:50	6.23	0.583	-84	19	3,78	0.18	
PTMW-1S	11/19/02 10:50					2.55		
PTMW-1S	11/19/02 15:20	6.33	0.12	-440	19.1	3.47	0.74	h
PTMW-1S	11/20/02 8:00	<u>+</u>		i		3.81		
PTMW-1S	11/20/02 9:20	6.26	0.75	-123	19.1	2.76	0.48	
PTMW-1S	11/20/02 12:15			·		2.72		
PTMW-1S	11/20/02 14:15					2.67		
PTMW-1S	11/20/02 14:15	6.22	0.549	-95	18.4		0.15	
PTMW-1S	11/20/02 15:00	6.33	0.81	-133	19	2.56	0.25	
PTMW-1S	11/21/02 8:00					3.48		
PTMW-1S	11/21/02 9:30	6.43	0.765	-138	19.2	2.14	0.31	·······
PTMW-1S	11/21/02 11:00			· · · · · · · · · · · · · · · · · · ·		2.19		
PTMW-1S	11/21/02 13:00					2.14		
PTMW-1S	11/21/02 15:24	6.43	0.812	-127	19	2.14	0.12	
PTMW-1S	11/25/02 9:15	6.28	0.415	-96		3.96	0.3	0
PTMW-1S	11/25/02 13:00				,	2.54		
PTMW-1S	11/25/02 14:45					2.46		
PTMW-1S	11/26/02 8:15					3.97		0.7
PTMW-1S	11/26/02 10:00						0.38	
PTMW-1S	11/26/02 14:00	5.99	0.567	-99	18.2		0.47	
PTMW-1S	11/26/02 14:00				· · · · · · · · · · · · · · · · · · ·	2.69		
PTMW-1S	12/2/02 8:30			400		4.23		
PTMW-1S	12/2/02 10:30	6.15	0.58	-108	17.4	0.00	0.36	
PTMW-1S	12/2/02 13:30		0.000	4.40	47.0	3.82	0.04	
PTMW-1S	12/2/02 13:30	6.33	0.606	-146	17.3	4.20	0.34	
PTMW-1S	12/4/02 9:00					4.38 4.54		
PTMW-1S PTMW-1S	12/10/02 9:00 12/10/02 12:15	6.29	0.649	-133	16.9	4.54	0.23	
PTMW-15	12/10/02 12:13	6.54	0.639	-153	17		0.23	•
PTMW-13	12/10/02 14:20	0.04	0.005	-100		3.29	0.22	
PTMW-1S	12/11/02 8:50					4.52		0
PTMW-1S	12/11/02 9:30	6.94	0.579	-160	16.1		0.32	
PTMW-1S	12/11/02 13:00	6.31	0.646	-156	16.5	<u></u> ,	0.65	<u> </u>
PTMW-1S	12/11/02 13:45	0.01	0.010			3.29	0.00	·
PTMW-1S	12/12/02 10:20					4.08		
PTMW-1S	12/16/02 9:15					3.86		2.69
PTMW-1S	12/16/02 10:30	6.5	0.386	-136	16		0.57	
PTMW-1S	12/16/02 13:45	6.84	0.32	-193	15.8		0.25	
PTMW-1S	12/16/02 15:00					2.69		
PTMW-1S	12/17/02 8:10					4.01		1
PTMW-1S	12/17/02 9:30	6.93	0.317	-128	14.7		0.49	
PTMW-1S	12/17/02 14:00	6.32	0.332	-72	14.6		0.42	
PTMW-1S	12/17/02 15:00			;		3.27		
PTMW-1S	12/18/02 7:30				· · · · · · · · · · · · · · · · · · ·	4.03		
PTMW-1S	12/18/02 15:30					2.84		
PTMW-1S	12/19/02 8:00			· · · · · ·		4.04		0
PTMW-1S	12/19/02 15:00					3.24		
PTMW-2S	11/18/02 9:00	6.42	0.247	-12	18	3.51		0
PTMW-2S	11/19/02 8:50	6.42	0.418	-41	19	3.52	2.5	
PTMW-2S	11/19/02 10:50					2.35		
PTMW-2S	11/19/02 15:20	6.43	0.442	-69	19.3	3.19		
PTMW-2S	11/20/02 8:00					3.78		
PTMW-2S	11/20/02 9:20	6.81	0.482	-71	19.2		0.58	

Wel!	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PTMW-2S	11/20/02 12:15	:				2.5		
PTMW-2S	11/20/02 14:15		:			2.45		
PTMW-2S	11/20/02 14:15	6.43	0.558	-102	18.5		0.45	
PTMW-2S	11/20/02 15:00	6.78	0.512	-115	18.5	2.73	0.37	
PTMW-2S	11/21/02 8:00					3.58		
PTMW-2S	11/21/02 9:30	6.51	0.497	-101	19.3	2.02	0.07	
PTMW-2S	11/21/02 11:00					2.02	~	
PTMW-2S	11/21/02 13:00			-		1.96		-
PTMW-2S	11/21/02 15:24	6.56	0.561	-117	19.3	1.96	0.13	
PTMW-2S	11/25/02 9:15	6.7	0.546	-75	18.6	3.7	0.29	0
PTMW-2S	11/25/02 13:00					2.36		
PTMW-2S	11/25/02 14:45					2.29		
PTMW-2S	11/26/02 8:15		i			4.72		0.1
PTMW-2S	11/26/02 10:00	6.18	0.571	-14	18.4		0.4	
PTMW-2S	11/26/02 14:00	6.21	0.582	-102	18.8		0.55	
PTMW-2S	11/26/02 14:00					2.55		
PTMW-2S	12/2/02 8:30		1			3.99		
PTMW-2S	12/2/02 10:30	6.28	0.563	-112	18		0.35	
PTMW-2S	12/2/02 13:30					3.25		• ••
PTMW-2S	12/2/02 13:30	6.38	0.56	-120	17.9		0.29	
PTMW-2S	12/4/02 9:00					4.12		
PTMW-2S	12/10/02 9:00					4.29		
PTMW-2S	12/10/02 12:15	6.22	0.435	-50	16.7		0.55	
PTMW-2S	12/10/02 14:20	6.41	0.465	-88	17.2		0.62	
PTMW-2S	12/10/02 15:30					3.18	0.02	
PTMW-2S	12/11/02 8:50					4.26		0
PTMW-2S	12/11/02 9:30	6.16	0.439	-48	16.5	1.2.0	0.3	
PTMW-2S	12/11/02 13:00	6.38	0.483	-150	17.3		0.41	
PTMW-2S	12/11/02 13:45	0.00				3.22		
PTMW-2S	12/12/02 10:20					3.69	0	
PTMW-2S	12/16/02 9:15					3.61		2.71
PTMW-2S	12/16/02 15:00	;				2.71		2.7 1
PTMW-2S	12/17/02 8:10	,				3.74		0.7
PTMW-2S	12/17/02 9:30	6.48	0.538	-66	15.5	0.1.4.	0.74	
PTMW-2S	12/17/02 14:00	6.41	0.597	-27	14.9		0.28	
PTMW-2S	12/17/02 15:00	0.11	0.001			3.11		
PTMW-2S	12/18/02 7:30					3.78		
PTMW-2S	12/18/02 15:30					3.52		
PTMW-2S	12/19/02 8:00					3.79		0
PTMW-2S	12/19/02 15:00					3.04		·Y
PTMW-5S	12/18/02 7:30		·····			2.91		
PTMW-5S	12/18/02 15:30			İ		2.68		
MW-12S	#VALUE!	An and an article in			. Thursday in start			
MW-12S	11/18/02 9:00	6.16	0.418	86	16.9	3.25	0.43	85.4
MW-125	11/19/02 8:50	5.94	0.422	19	19.5	3.14	0.43	
MW-12S	11/19/02 10:50		U.TLL			2.85	0.54	
MW-125	11/19/02 15:20	6.23	0.426	13	19.6	2.92	4.01	
MW-125	11/20/02 8:00	0.25	0.420			3.22	4.01	
MW-125	11/20/02 9:20	6.06	0.453	51	17.1	2.9	0.6	
MW-125 MW-125	11/20/02 12:15	0.00	0.700			2.3	0.0	
MW-123	11/20/02 12:15					2.68		
MW-125	11/20/02 14:15	5.82	0.388	42	19.2	2.00	0.19	
MW-125 MW-125	11/20/02 14:15	5.82	0.388	50	19.2	2.69	0.19	
MW-125 MW-125	11/21/02 8:00	J.94	0.437		10.4	4.05	0.37	
MW-125 MW-125	11/21/02 9:30	6.09	0.422	-13	19.7	2.62	0.24	
MW-125 MW-125	11/21/02 9:30	0.09	0.422	-13	19.(0.24	
MW-125 MW-125	11/21/02 13:00					2.62		
DVIVV= LZCS	11/21/02 13.00		i			2.53	í.	

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Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
MW-12S	11/25/02 9:15	5.9	0.388	26	19.1	3.37	0.15	85.7
MW-12S	11/25/02 13:00					2.89		:
MW-12S	11/25/02 14:45					2.75		
MW-12\$	11/26/02 8:15					4.38		22.7
MW-12S	11/26/02 10:00	5.81	0.4	13	19.2		0.18	
MW-12S	11/26/02 14:00	6.24	0.413	5	18.2		0.23	·
MW-12S	11/26/02 14:00					2.86		
MW-12S	12/2/02 8:30					3.42		
MW-125	12/2/02 13:30				·····	3.21		
MW-12S	12/4/02 9:00			•		3.76	·······	
MW-12S	12/10/02 9:00			· · ·		3.72		
MW-12S	12/10/02 15:30					3.68		
MW-12S	12/11/02 8:50					3.89		264
MW-12S	12/11/02 13:45					3.57		
MW-12S	12/12/02 10:20				· · ·	0	0	
MW-12S	12/16/02 9:15					2.93	v	44.4
MW-12S	12/16/02 15:00					2.91		
MW-12S	12/17/02 8:10					3.2		30.1
MW-125	12/17/02 15:00	.+		· · ·		3	_	50.1
MW-12S	12/18/02 7:30		·····	;		3.43		
MW-12S	12/18/02 15:30				· · · ·	3.12		
MW-12S	12/19/02 8:00					3.42		13.3
MW-125	12/19/02 15:00			i		3.05		13.3
				· · · · · · · ·		3.00		
Intermediate		44.07	- Columbia da 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 -	4 F		0.00	• • •	
PT-9/	11/18/02 9:00	11.27	1.71	-15	17.9	3.52	0.5	0
PT-91	11/19/02 8:50	11.19	1.5	-25	18	3.55	0.4	
PT-9I	11/19/02 10:50					2.61		
PT-9I	11/19/02 15:20	11.25	1.49	-396	17.8	2.61	0.24	
PT-9I	11/20/02 8:00					3.52		
PT-91	11/20/02 9:20	11.21	1.74	-248	18.4	2.72	0.32	
PT-91	11/20/02 12:15					2.6		
PT-91	11/20/02 14:15					2.55		
PT-9I	11/20/02 14:15	11.08	1.38	-318	17.6		0.22	
PT-9I	11/20/02 15:00	11.23	1.78	-168	18	2.49	0.24	
PT-9I	11/21/02 8:00					3.32		
PT-9I	11/21/02 9:30	11.21	1.43	34	17.3	2.25	0.21	
PT-91	11/21/02 11:00					2.25		
PT-9I	11/21/02 13:00			· · · · · · · · · · · · · · · · · · ·		2,14		
PT-91	11/21/02 15:24	11.28	1.39	-266	17.6	2.14	0.31	
PT-91	11/25/02 9:15	11.17	1.38	-342	17.8	3.63	0.16	10.9
PT-91	11/25/02 13:00					2.52		
PT-9I	11/25/02 14:45					2.43		_
PT-9/	11/26/02 8:15					3.65		4.4
PT-91	11/26/02 10:00	10.99	1.37	-170	17.5	······	0.22	
PT-9I	11/26/02 14:00	10.96	1.31	-264	17		0.55	
PT-9I	11/26/02 14:00					2.74		
PT-9I	12/2/02 8:30	<u></u>		· · · · · ·		3.2	·····	
PT-9I	12/2/02 10:30	11.15	1.42	-347	17.8		0.58	
PT-9I	12/2/02 13:30					3.09		
PT-9I	12/2/02 13:30	11.07	1.38	-282	17.3		0.3	
PT-91	12/4/02 9:00	ļ				4.02		
PT-91	12/10/02 9:00		l.			4.16		10.4
PT-9I	12/10/02 12:15	11.2	1.75	-337	17.6		0.51	
PT-91	12/10/02 15:30					3.4		
PT-91	10/30/06 0:00	11.19	1.72	-274	17.4		0.49	
PT-9I	12/11/02 8:50					4.13		5.7
PT-91	12/11/02 9:30	11.13	1.64	-409	17.8		0.17	
PT-9I	12/11/02 13:00	11.11	1.05	-482	17.3		0.31	

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.
PT-9I	12/11/02 13:45					3.34		
PT-9I	12/12/02 10:20					3.69	4.1	
PT-91	12/16/02 9:15					3.49		2.6
PT-91	12/16/02 10:30	11.32	1.57	-236	17.3		0.32	
PT-91	12/16/02 13:45	11.35	1.55	-265	17.1		0.28	
PT-91	12/16/02 15:00					2.67		
PT-91	12/17/02 8:10					3.62		4.6
PT-9I	12/17/02 9:30	11.37	1.57	-236	17.2		0.95	
PT-91	12/17/02 14:00	11.36	1.55	-219	16.9		0.91	
PT-91	12/17/02 15:00					3.04		
PT-9I	12/18/02 7:30					3.66	······	
PT-9I	12/18/02 15:30					3.31		
PT-91	12/19/02 8:00	· · · · ·	· · · · · · · · · · · · · · · · · · ·			3.66		6.5
PT-91	12/19/02 15:00					3.06	·	
PT-101	11/18/02 9:00	8.06	0.578	71	19.6	3.31	0.57	0
PT-101	11/19/02 8:50	6.47	0.912	-95	19.9	3.55	0.29	V
PT-101	11/19/02 10:50	0.47		-00	10.0	2.25	0.23	<u> </u>
PT-10	11/19/02 15:20	6.43	1.01	-92	19.6	2.91	0.19	
PT-10	11/20/02 8:00	0.45		-52	13.0	3.4	0.19	
	11/20/02 9:20	0.75	0.622		20.4		0.04	
PT-10		6.75	Ų.022	-26	20.1	2.45	0.34	
PT-10	11/20/02 12:15			· · · ·		2.38		
PT-101	11/20/02 14:15		0.070			2.32		
PT-10I	11/20/02 14:15	6.11	0.973	-11	18.9		0.24	
PT-101	11/20/02 15:00	. 7.97	0.642	-32	19.2	2.21	0.32	
PT-10I	11/21/02 8:00			<u> </u>		3.3		
PT-101	11/21/02 9:30	6.42	0.99	-78	19.3	1.43	0.34	
PT-10I	11/21/02 11:00					1.93		
PT-10I	11/21/02 13:00					1.87		
PT-10I	11/21/02 15:24	6.53	1.02	-80	19.3	1.87	0.18	
PT-10I	11/25/02 9:15	6.14	0.97	-16	19.1	3.52	0.21	2.6
PT-101	11/25/02 13:00		1			2.25	1	
PT-10I	11/25/02 14:45					2.17		
PT-10I	11/26/02 8:15					3.54		3.9
PT-10I	11/26/02 10:00	6.42	1	-55	19.2		0.7	
PT-10I	11/26/02 14:00	6.06	1.01	-35	18.6		0.33	
PT-101	11/26/02 14:00	1	-			2.44		
PT-10	12/2/02 8:30					3.79		•••
PT-10I	12/2/02 13:30		1			2.92		
PT-10I	12/4/02 9:00	;				3.94		
PT-10I	12/10/02 9:00	i i				4.11		1.3
PT-10	12/10/02 15:30					3.06		
PT-101	12/11/02 8:50					4.08		0
PT-101	12/11/02 13:45	1				3.11		
PT-101	12/12/02 10:20			1		3.62	0	
PT-101	12/16/02 9:15			1		3.44		2.45
PT-10I	12/16/02 15:00					2.45	Ť	
PT-101	12/17/02 8:10					3.56		0.8
PT-10	12/17/02 15:00		······································			2.99		
PT-10I	12/18/02 7:30	i			l l	3.59		
PT-10	12/18/02 15:30					3.34		
PT-111	11/18/02 9:00	7.88	0.314	71	19.4	3,24		0
PT-11	11/19/02 8:41	,						
PT-11	11/19/02 8:50	6.43	0.414	-62	20	3.3	0.87	
PT-11	11/19/02 10:50	0.40		-04	20	2.17	0.07	
PT-111	11/19/02 15:20	6.62	0.445	-111	19.4	2.83	0.22	
PT-11	11/20/02 8:00	0.02	0.440		13.4	3.33	<u></u>	
PT-111 PT-111		6.74	0.336	-34	19.8			
	11/20/02 9:20	0.74	0.336	-34	19.8	2.35	0.4	

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Oxygen (mg/l)	PID (ppb e.u.)
PT-11	11/20/02 14:15					2.24		
PT-111	11/20/02 14:15	6.67	0.074	-18	18.5		0.28	
PT-11	11/20/02 15:00	7.7	0.339	-46	18	2.2	0.26	
PT-11	11/21/02 8:00					3.85		
PT-11	11/21/02 9:30	6.64	0.428	-106	19.2	1.83	0.38	
PT-11	11/21/02 11:20				i	1.83		
PT-11	11/21/02 13:20					1.77		
PT-11	11/21/02 15:24	6.59	0.452	-89	18.9	1.77	0.23	
PT-11	11/25/02 9:15	6.47	0.075	-13	18.7	3.44	0.22	0
PT-111	11/25/02 13:00					2.15		
PT-111	11/25/02 14:45					2.08		
PT-111	11/26/02 8:15					3.46		0.4
PT-111	11/26/02 10:00	6.78	0.072	-33	18.9		0.35	
PT-11	11/26/02 14:00	6.11	0.372	-10	18.2		0.33	
PT-11	11/26/02 14:00					2.35		
PT-11	12/2/02 8:30					3.71		
PT-11	12/2/02 10:30	7.76	0.086	-75	18.9		0.46	
PT-11	12/2/02 13:30					2.82		
PT-11	12/2/02 13:30	6.36	0.118	-18	18.7		0.39	
PT-11	12/4/02 9:00		0.110			3.85	0.00	
PT-11	12/10/02 9:00				· · · · · ·	4.04		2.1
PT-11	12/10/02 12:15	6.89	0.072	-70	18.7		3.82	
PT-11	12/10/02 12:19	7.31	0.072	-57	19		3.64	
PT-11	12/10/02 15:30	7.31	0.07	-57		2.98	5.04	
						4,01		
PT-111	12/11/02 8:50 12/11/02 9:30	7.06	0.066	-27	19.1	4,01	3.35	
PT-11			0.066					
PT-11	12/11/02 13:00	6.66	0.000	-65	19.1	3.04	7.9	
PT-11	12/11/02 13:45					3.04		
PT-11I	12/12/02 10:20					3.38	0	0.07
PT-11	12/16/02 9:15	10.2	0 171	406	10 5	3.35	4 3 2	2.37
PT-111	12/16/02 10:30	10.2	0.171	-126	18.5		1.32	
PT-11	12/16/02 13:45	9.16	1.178	-142	18.3		3.47	
PT-111	12/16/02 15:00					2.37		
PT-111	12/17/02 8:10		0.047			3.5		
PT-11	12/17/02 9:30	6.7	0.347	-34	18.1		3.65	
PT-11I	12/17/02 14:00	8.61	0.231	-141	18.2		3.65	
PT-11I	12/17/02 15:00					2.98		
PT-11	12/18/02 7:30					3.55		
PT-11	12/18/02 15:30	i				3.29		
PT-11	12/19/02 8:00					3.52		
PT-11I	12/19/02 15:00		1			2.82		
PT-121	11/18/02 9:00	7.9	0.348	73	17.5	3.77	0.45	18.6
PT-121	11/19/02 8:50	6.4	0.457	-67	20	3.84	0.27	
PT-121	11/19/02 10:50					2.65		
PT-12I	11/19/02 15:20	6.53	0.472	-92	19.7	3.5	0.2	
PT-12I	11/20/02 8:00					3.88		
PT-12I	11/20/02 9:20	6.59	0.39	-44	18.8	2.73	0.35	
PT-121	11/20/02 12:15				_	2.89		
PT-12	11/20/02 14:15					2.95	· · · · · · · · · · · · · · · · · · ·	
PT-12i	11/20/02 14:15	6.41	0.403	-33	14.3		0.29	
PT-12	11/20/02 15:00	7.78	0.396	-16	19.3	3.1	0.31	
PT-12I	11/21/02 8:00					4.31		
PT-121	11/21/02 9:30	6.58	0.448	-84	19.5	2.79	0.34	
PT-12I	11/21/02 11:00	ļ				2.79		
PT-12I	11/21/02 13:00					2.78		
PT-121	11/21/02 15:24	6.5	0.451	-61	19.5	2.78	0.22	
PT-121	11/25/02 9:15	6.65	0.372	-81	19.4	3.95	0.24	3.3
PT-12l	11/25/02 13:00					3.04		

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PT-12I	11/25/02 14:45					2.9	·	
PT-12I	11/26/02 8:15					3.98		4.6
PT-12I	11/26/02 10:00	6.39	0.394	-51	19.4		0.2	
PT-121	11/26/02 14:00	6.27	0.393	-35	19.4		1.85	
PT-121	11/26/02 14:00					3.6		
PT-12	12/2/02 8:30				_	3.43	·	
PT-121	12/2/02 13:30	<u> </u>	· · · · · · · · · · · · · · · · · · ·			3.82		
PT-121	12/4/02 9:00					4.25		5.7
PT-12I PT-12I	12/10/02 9:00 12/10/02 15:30				· · · · · · · · · · · · · · · · · · ·	<u>4.31</u> 3.95		5.7
PT-121 PT-121	12/11/02 8:50					4.31	·	6.3
PT-121 PT-121	12/11/02 8:50					3.95		0.3
PT-12	12/12/02 10:20	<u>+</u>	:			3.95	5	
PT-121	12/12/02 10:20					3.85		3.55
PT-121	12/16/02 3:13					3.55		3.55
PT-121	12/17/02 8:10				<u>+</u> .	3.95		0
PT-121	12/17/02 15:00					3.72		
PT-121	12/18/02 7:30					3.96		
PT-12I	12/18/02 15:30					3.88		
PT-131	11/18/02 9:00	7.98	0.413	73	17.3	4.21	0.39	85.4
PT-13I	11/19/02 8:50	6.37	0.797	-79	19.6	4.27	0.31	00.1
PT-13I	11/19/02 10:50					3.15		
PT-13I	11/19/02 15:20	6.79	0.827	-147	19.2	3.96	0.26	
PT-13I	11/20/02 8:00					4.31		
PT-13I	11/20/02 9:20	6.78	0.489	-72	19.3		0.42	
PT-13I	11/20/02 12:15					3.41		
PT-13I	11/20/02 14:15			[3.47		
PT-13I	11/20/02 14:15	6.18	0.695	-51	18.5		0.25	
PT-13I	11/20/02 15:00	7.75	0.496	-66	18.7	3.57	0.39	
PT-13I	11/21/02 8:00					5.18		
PT-13I	11/21/02 9:30	6.9	0.75	-132	18.9	3.32	0.38	
PT-13	11/21/02 11:00					3.32		
PT-13I	11/21/02 13:00					3.32		
PT-13I	11/21/02 15:24	6.53	0.767	-93	18.8	3.32	0.21	
PT-13I	11/25/02 9:15	6.32	0.656	-76	18.9	4.39	0.25	2.3
<u>PT-13I</u>	11/25/02 13:00					3.61		
PT-13I	11/25/02 14:45		· · · · · · · · · · · · · · · · · · ·	······		3.66	· • • • • • • • • • • • • • • • • • • •	
PT-131	11/26/02 8:15				10.0	4.45		7.2
PT-131	11/26/02 10:00	6.18	<u>0.71</u> 0.705	-79 -61	<i>18.6</i> 18.2		0.24 0.28	
PT-13I PT-13I	11/26/02 14:00 11/26/02 14:00	6.15	0.705	-01	10.2	4.15	0.20	
PT-131	12/2/02 8:30	+				4.15		
PT-131	12/2/02 10:30	6.43	0.649	-82	18.9	4.30	0.44	
PT-131	12/2/02 10:30	0.45	0.040	-02		4.34		<u> </u>
PT-13	12/2/02 13:30	6.26	0.646	-64	18.6		0.43	
PT-13I	12/4/02 9:00					4.72		
PT-13I	12/10/02 9:00		······			4.76		
PT-13I	12/10/02 12:15	8.5	0.517	50	18.7		0.37	
PT-13I	12/10/02 14:20	8.23	0.51	-227	18.8		0.37	
PT-13I	12/10/02 15:30					4.5		
PT-13I	12/11/02 8:50					4.78		0
PT-13I	12/11/02 9:30	7.72	0.471	95	18.7		0.54	
PT-13I	12/11/02 13:00	7.7	0.449	-112	17.6		0.23	
PT-13I	12/11/02 13:45					4.5		
PT-13I	12/12/02 10:20					4.38	0	
PT-13I	12/16/02 9:15					4.3		4.09
PT-13I	12/16/02 10:30	7.63	0.594	-158	18.5		1.02	
PT-13I	12/16/02 13:45	7.62	0.635	-154	18.3		1.73	

Table 7 Permanganate Injection Pilot Test Field Monitoring Data Summary

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PT-13I	12/16/02 15:00				· · · · · · · · · · · · · · · · · · ·	4.09		
PT-13I	12/17/02 8:10					4.41		0
PT-131	12/17/02 9:30	7.46	0.624	-105	<u>18.1</u>		1.33	
PT-13I	12/17/02 14:00	6.47	0.683	-117	18.3		0.41	
PT-13I	12/17/02 15:00					4.24		
PT-13I	12/18/02 7:30					4.44		1
PT-13I	12/18/02 15:30					4.34		
PT-13I	12/19/02 8:00		İ	:	!	4.42		0
PT-13I	12/19/02 15:00					4.25		
PTMW-11	11/18/02 9:00					3.55		0.02
PTMW-1I	11/19/02 8:30			i		3.99		
PTMW-1I	11/19/02 10:50				16.9	2.48	1.28	
PTMW-11	11/19/02 15:20	1				3.85	4.8	
PTMW-1I	11/20/02 8:00					3.59		
PTMW-1I	11/20/02 9:20	6.97	0.348	-108	18.9	2.76	0.58	
PTMW-1I	11/20/02 12:15					2.73		
PTMW-1I	11/20/02 14:15					2.71		
PTMW-1I	11/20/02 14:15						6.81	
PTMW-1I	11/20/02 15:00					3.05		
PTMW-1I	11/21/02 8:00					3.82		
PTMW-1I	11/21/02 9:30	7.02	0.311	-140	19.2	2.34	6.88	
PTMW-11	11/21/02 11:26					2.34		
PTMW-1I	11/21/02 13:30					2.27		
PTMW-1I	11/21/02 15:24	6.97	0.319	-139	19.7	2.27		
PTMW-1I	11/25/02 9:15					4.13	0.59	0
PTMW-1I	11/25/02 13:00					2.63		
PTMW-1I	11/25/02 14:45					2.57		
PTMW-11	11/26/02 8:15					4.19		0
PTMW-11	11/26/02 10:00	6.38	0.156	13	17.9		7,17	
PTMW-11	11/26/02 14:00	6.28	0.157	64	18,2		6.18	
PTMW-1I	11/26/02 14:00					3.36		
PTMW-1	12/2/02 8:30					4.37		
PTMW-1I	12/2/02 13:30	· · · · · · · · · · · · · · · · · · ·				3.77		
PTMW-1I	12/4/02 9:00	·····				4,54	* L D' - · · <u> </u>	
PTMW-1I	12/10/02 9:00					4.56		
PTMW-1I	12/10/02 12:15	7.15	0.11	-39	18.5		4.36	
PTMW-1	12/10/02 14:20	8.52	0.116	-45	18		5.4	
PTMW-1I	12/10/02 15:30					3.73		
PTMW-1I	12/11/02 8:50					4.62		0
PTMW-1I	12/11/02 9:30	6.75	0.111	-96	18.3		1.59	
PTMW-11	12/11/02 13:45	1				0		
PTMW-1I	12/12/02 10:20			l		4.14	0	
PTMW-1I	12/16/02 9:15					4		3.19
PTMW-1	12/16/02 10:30	6.27	0.523	-99	16		1.45	
PTMW-1I	12/16/02 13:45	6.71	0.572	160	16.4		0.86	
PTMW-1I	12/16/02 15:00	;				3.19		
PTMW-1I	12/17/02 8:10					4.09		
PTMW-1I	12/17/02 15:00					3.51		
PTMW-1I	12/18/02 7:30					4.14		
PTMW-11	12/18/02 15:30					4.17		
PTMW-11	12/19/02 8:00					4.28		
PTMW-1I	12/19/02 15:00					3.96		
PTMW-21	11/18/02 9:00	7.23	0.126	3	15.8	3.41	1.68	Ō
PTMW-2I	11/19/02 8:41	6.31	0.12	178	19.7	3.54	0.59	
PTMW-2I	11/19/02 8:50	6.31	0.12	178	19.7	3.54	0.59	
PTMW-2I	11/19/02 10:50					2.2		
PTMW-2I	11/19/02 15:20	7.56	0.12	-79	20.1	3.15	1.2	
PTMW-2I	11/20/02 8:00		1			3.49		

Table 7
Permanganate Injection Pilot Test
Field Monitoring Data Summary

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PTMW-2I	11/20/02 9:20					2.45	4.63	
PTMW-2I	11/20/02 12:15					2.37	<u> </u>	
PTMW-2I	11/20/02 14:15				1	2.34		
PTMW-2I	11/20/02 14:15	6.88	0.081	-94	18.6		6.36	
PTMW-21	11/20/02 15:00	6.62	0.137	220	18.7	2.58	0.76	-
PTMW-21	11/21/02 8:00					3.55		
PTMW-21	11/21/02 9:30	7.14	0.109	-86	19.3	1.97	1.63	
PTMW-21	11/21/02 11:28					1.97		
PTMW-2I	11/21/02 13:29					1.83		
PTMW-21	11/21/02 15:24	7.11	0.115	-90	19.6	1.83	1.51	
PTMW-21	11/25/02 9:15	8.13	0.086	-53	19	3.62	1.34	0
PTMW-21	11/25/02 13:00					2.34		
PTMW-21	11/25/02 14:45					2.18		
PTMW-21	11/26/02 8:15					3.62		0
PTMW-21	11/26/02 10:00	6.62	0.092	-82	18.7		7.41	
PTMW-21	11/26/02 14:00	6.48	0.094	-95	18.6		7.36	• • · · · · ·
PTMW-2I	11/26/02 14:00		0.001			2.49		
PTMW-21	12/2/02 8:30					3.86		
PTMW-2I	12/2/02 10:30	6.63	0.082	-66	19.3	0.00	3.03	
PTMW-21	12/2/02 13:30	0.00	0.002		10.0	3.22	0.00	
PTMW-21	12/2/02 13:30	6.73	0.079	-70	19	<u>J.ZZ</u>	4.34	
PTMW-21	12/4/02 9:00	0.75	0.013	-70		4.01	4.04	
PTMW-21	12/10/02 9:00					4.18	———	
PTMW-21 PTMW-21		7 10	0.073	65	18.8	4.10	0.520	
	12/10/02 12:15	7.18		<u>-65</u> -71	18.9	ا م	0.539	
PTMW-2I	12/10/02 14:20	7.33	0.073		10.9		6.71	
PTMW-2	12/10/02 15:30			·		3.11		
PTMW-2I	12/11/02 8:50	7.00	0.074		40.4	4.15		
PTMW-2I	12/11/02 9:30	7.22	0.074	-75	18.4		5.74	
PTMW-2I	12/11/02 13:45					0	<u>_</u>	
PTMW-21	12/12/02 10:20					3.82	0	
PTMW-2I	12/16/02 9:15		0.000			3.55		2.54
PTMW-2I	12/16/02 10:30	6.77	0.063	-31	18.2		5.39	
PTMW-21	12/16/02 13:45	7.29	0.065	-56	18.6	0.54	4.34	
PTMW-21	12/16/02 15:00					2.54		
PTMW-2I	12/17/02 8:10					3.65		
PTMW-21	12/17/02 9:30	7.3	0.062	-88	18.3		4.07	
PTMW-21	12/17/02 14:00	7.1,	0.07	-68	18.4		3.43	
PTMW-2I	12/17/02 15:00					2.94		
PTMW-21	12/18/02 7:30					3.69		
PTMW-2I	12/18/02 15:30					3.27	•	
PTMW-2I	12/19/02 8:00					3.67		
PTMW-2I	12/19/02 15:00			i		3.1	1	
PTMW-51	11/19/02 8:50	8.83	0.142	32	17.3	3.05	0.34	
PTMW-5I	11/19/02 10:50					2.35		
PTMW-51	11/19/02 15:20	6.78	0.131	-63	17.4	2.47	0.23	
PTMW-51	11/20/02 8:00					3.09	İ	
PTMW-5I	11/20/02 9:20	6.84	0.882	-60	18.2	2.49	0.33	
PTMW-5I	11/20/02 12:15				ł	2.43		
PTMW-5I	11/20/02 14:15					2.4		
PTMW-5I	11/20/02 14:15	8.22	0.114	-76	17.2		0.24	
PTMW-5I	11/20/02 15:00	6.85	0.139	68	17.8	2.34	0.46	
PTMW-51	11/21/02 8:00					3.1		
PTMW-5I	11/21/02 9:30	8.29	0.139	84	17.3	2.22	0.37	
PTMW-5I	11/21/02 11:00					2.22		
PTMW-5I	11/21/02 13:00					2.18		
PTMW-5I	11/21/02 15:24	6.36	0.127	-17	17.3	2.18	0.23	
PTMW-5I	11/25/02 9:15	8.16	0.117	-69	17.2	3.35	0.17	0
PTMW-51	11/25/02 13:00					2.62		······

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen	PID (ppb e.u.)
			(minoa)	(01)	(089.0)	. ,	(mg/l)	(ppp e.u.)
PTMW-5I	11/25/02 14:45					2.56	••• ••••	
PTMW-51	11/26/02 8:15				. <u> </u>	3.38		18.8
PTMW-5I	11/26/02 10:00	6.63	0.116	-42	17.1		0.56	
PTMW-5I	11/26/02 14:00	7.58	0.117	-90			0.19	
PTMW-5I	11/26/02 14:00					2.85		
PTMW-5I	12/2/02 8:30					3.17		<u> </u>
PTMW-5I	12/2/02 13:30					2.88	<u> </u>	
PTMW-5	12/4/02 9:00				·····	3.64		
PTMW-5I	12/10/02 9:00					3.75		<u> </u>
PTMW-5I	12/10/02 15:30					3.25	·····	
PTMW-5I	12/11/02 8:50			i		3.75	_	0
PTMW-5I	12/11/02 13:45		·	;		0		
PTMW-5I	12/12/02 10:20		· · · · · · · · · · · · · · · · · · ·			3.3	0	
PTMW-5I	12/16/02 9:15					3.19		0
PTMW-5I	12/16/02 10:30	9.31	0.182	-81	17.5		0.54	
PTMW-5I	12/16/02 13:45	9.35	0.182	-101	17		0.51	
PTMW-5I	12/16/02 15:00					2.76		
PTMW-5I	12/17/02 8:10			<u> </u>		3.33		0
PTMW-5i	12/17/02 9:30	8.83	0.191	-37	17.2		0.29	
PTMW-5I	12/17/02 14:00	8.66	0.185	-52	17.2		0.38	
PTMW-5I	12/17/02 15:00			1		3.08		
PTMW-5I	12/18/02 7:30					3.38		
PTMW-5I	12/18/02 7:30					3.18		
PTMW-5I	12/18/02 15:30			i		3.28		
PTMW-5I	12/18/02 15:30					2.88		
PTMW-5I	12/19/02 8:00			1		3.44		0.1
PTMW-5I	12/19/02 15:00					3.12		
PTMW-6I	11/18/02 9:00	9.92	0.415	-19	17.3	3.5	0.54	0.6
PTMW-6I	11/19/02 8:50	7.42	0.814	-33	18.2	3.55	0.29	
PTMW-6I	11/19/02 10:50	6.56	0.847	-47	18.3	3.02		
PTMW-6I	11/19/02 15:20	6.87	0.82	-64	18.2	3.18	0.28	
PTMW-6I	11/20/02 8:00		ł			3.59		
PTMW-6I	11/20/02 9:20	7.88	0.139	-68	17.7	3.1	0.51	
PTMW-6I	11/20/02 12:15					3.11		
PTMW-6I	11/20/02 14:15				i	3.11		
PTMW-6i	11/20/02 14:15	7.08	0.783	-34	17.7		0.25	
PTMW-6I	11/20/02 15:00	9.69	0.448	-27	18.1	3.08	0.68	
PTMW-6I	11/21/02 8:00							
PTMW-6I	11/21/02 9:30	6.49	0.811	58	17.7	3.03	0.58	
PTMW-6I	11/21/02 11:00					3.03		
PTMW-6I	11/21/02 13:00					3.04		
PTMW-6I	11/21/02 15:24	6.85	0.788	-45	18.1	3.04	0.47	
PTMW-6I	11/25/02 9:15	7.1	0.782	-43	17.7	3.67	0.31	0
PTMW-6I	11/25/02 13:00					3.18		
PTMW-6I	11/25/02 14:45					3.15	ļ	
PTMW-6I	11/26/02 8:15		\$			3.68		1.3
PTMW-6I	11/26/02 10:00	6.44	0.804	-31	17.5	1	0.54	
PTMW-6I	11/26/02 14:00	6.99	0.806	-35	17.2		0.27	
PTMW-6I	11/26/02 14:00					3.42		
PTMW-6I	12/2/02 8:30					3.8		
PTMW-6I	12/2/02 10:30	6.31	0.762	-9	17.5		0.39	
PTMW-6I	12/2/02 13:30					3.63		
PTMW-6I	12/2/02 13:30	7.53	0.739	-71	17.8		0.36	
PTMW-6I	12/4/02 9:00					3.93		
PTMW-6I	12/10/02 9:00					3.96		
PTMW-6I	12/10/02 12:15	6.92	0.71	-138	17.9		1.36	
PTMW-6I	12/10/02 14:20	6.88	0.8	-47	17.6		0.24	
PTMW-6I						3.7		

	Date/Time	(st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Oxygen (mg/l)	PID (ppb e.u.)
PTMW-6I	12/11/02 8:50					3.95		0
PTMW-6I	12/11/02 9:30	8.46	0.493	-144	18		0.36	·
PTMW-6I	12/11/02 13:00	9.45	0.465	-178	18.6		0.43	
PTMW-6I	12/11/02 13:45					3.64		
PTMW-6I	12/12/02 10:20					3.6	0	
PTMW-6I	12/16/02 9:15					3.54		0
PTMW-6I	12/16/02 10:30	10.21	0.238	-141	17.5		2.94	
PTMW-6I	12/16/02 13:45	10.16	0.235	-160	17.2	·	3	
PTMW-6I	12/16/02 15:00				i	3.34		//
PTMW-6I	12/17/02 8:10					3.64	·	0
PTMW-6I	12/17/02 9:30	10.27	0.228	-117	17.2		0.31	
PTMW-6I	12/17/02 14:00	10.24	0.244	-114	17.1	———	0.31	
PTMW-6I	12/17/02 15:00					3.5		· · · · · · · · · · · · · · · · · · ·
PTMW-6	12/18/02 7:30					3.67		
PTMW-6I	12/18/02 15:30	· · · · · · · · · · · · · · · · · · ·				3.56		
PTMW-61	12/19/02 8:00					3.65		0
PTMW-6	12/19/02 8:00					3.41		0
		8.27	0.051	60	17.1	4.43	0.45	
MW-121	11/18/02 9:00			62			0.45	6.8
MW-12I	11/19/02 8:50	6.45	0.049	18	20	4.5	0.41	
MW-12I	11/19/02 10:50					3.05		
MW-12I	11/19/02 15:20	6.76	0.048	-3	19.7	4.32		
MW-12I	11/20/02 8:00					4.52		
MW-12I	11/20/02 9:20	6.51	0.053	39	20.1	3.06	4.3	
MW-12I	11/20/02 12:15						· · · · · · · · · · · · · · · · · · ·	
MW-121	11/20/02 14:15					3.45		
MW-121	11/20/02 14:15	6.56	0.055	-26;	19.1		0.37	
MW-121	11/20/02 15:00	6.27	0.054	32	19.2	3.95	0.33	
MW-12	11/21/02 8:00					3.2		
MW-12I	11/21/02 9:30	6.64	0.052	-20	19.5	3.28	0.27	
MW-121	11/21/02 11:00				j	3.28		
MW-121	11/21/02 13:00					3.32		
MW-12!	11/21/02 15:24	6.92	0.044	-22	19.2	3.37	0.2	
MW-121	11/25/02 9:15	6.54	0.059	-30	19.5	4.62	0.27	0
MW-121	11/25/02 13:00				•••••	3.58		
MW-121	11/25/02 14:45				-	3.58	• i	
MW-121	11/26/02 8:15					4.66		0
MW-121	11/26/02 10:00	6.31	0.061	3	19		0.38	
MW-121	11/26/02 14:00	6.81	0.058	-10	18.5		0.25	
MW-121	11/26/02 14:00					4.29		••••
MW-121	12/2/02 8:30					4.78		
MW-121	12/2/02 10:30	6.78	0.076	-26	19		0.24	
MW-121	12/2/02 13:30	1				4.53		
MW-121	12/2/02 13:30	6.83	0.077	-35	19.1		0.3	•••••
MW-121	12/4/02 9:00					4.92		
MW-121	12/10/02 9:00		ŀ			4.97		
MW-121	12/10/02 12:15	6.12	0.097	134	18.7		0.67	
MW-121	12/10/02 14:20	7.31	0.101	-85	19	ł	3.12	
MW-12I	12/10/02 15:30	<u> </u>				4.65		
MW-121	12/11/02 8:50	<u> -</u>				4.99		0
MW-121	12/11/02 9:30	5.97	0.096	148	19.4		0.69	······································
MW-12I	12/11/02 3:30	6.22	0.096	3	19.3	+	2.8	
MW-121	12/11/02 13:45	0.22		J	10.0	4.65	2.0	····· •••
MW-121	12/11/02 13:45					2.95	3.2	
MW-121	12/12/02 10:20					4.53	J.Z	0
		7 16	0.092	-96	18.6	4.00	0.20	
MW-121	12/16/02 10:30 12/16/02 13:45	7.45			18.6		0.28	
MW-121		7.13	0.094	-61	10.0	4.05	0.27	
MW-12I MW-12I	12/16/02 15:00 12/17/02 8:10		······································			4.25		12.7

Well	Date/Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
MW-12I	12/17/02 9:30	8.13	0.123	-51	18.6		2.08	
MW-121	12/17/02 14:00	7.08	0.093	-45	18.5		0.43	
MW-12I	12/17/02 15:00			1		4.39		
MW-12I	12/18/02 7:30					4.63		
MW-121	12/18/02 15:30			1		4.53	·····	
MW-12I	12/19/02 8:00					4.64		0
MW-121	12/19/02 15:00					4.41		
MW-12D	11/18/02 9:00	6.85	0.089	59	18	5.3		13.2
MW-12D	11/19/02 8:50					5.28		
MW-12D	11/19/02 10:50					5.22	· · · · · · · · · · · · · · · · · · ·	
MW-12D	11/20/02 8:00					5.24	· ····································	• • • • • • • • • • • • • • • • • • •
MW-12D	11/20/02 9:20	6.45	0.096	-35	19.1	5.21	2.69	*
MW-12D	11/20/02 12:15							
MW-12D	11/20/02 14:15					5.18		·
MW-12D	11/20/02 14:15	6.56	0.078	-52	19.2		0.75	L
MW-12D	11/20/02 15:00	6.15	0.097	-35	18.5	5.16	1.28	••
MW-12D	11/21/02 8:00	0.10	0.007			4.53		1
MW-12D	11/21/02 9:30	6.53	0.106	-6	19.6	5.15	1.08	ļ
MW-12D	11/21/02 11:00	0.00	0.100		10.0	5.15	1.00	
MW-12D	11/21/02 13:00		· · · · · · · · · · · · · · · · · · ·		····	5.13	·	
MW-12D	11/21/02 15:24	6.68	0.095		19.5	5.13	0.89	
			0.095	-52	19.9			
MW-12D MW-12D	11/25/02 9:15	6.65	0.076	•52	19.9	<u>5.18</u> 5.13		<u> </u>
	11/25/02 13:00							
MW-12D	11/25/02 14:45					5.13	•	
MW-12D	11/26/02 8:15	0.05			40.0	5.19		0
MW-12D	11/26/02 10:00	6.35	0.082	10	18.9		0.8	
MW-12D	11/26/02 14:00	6.72	0.085	_4	18.6	<u> </u>	0.54	
MW-12D	11/26/02 14:00					5.12	• • • • • • • • • • • • • • • • • • • •	
MW-12D	12/2/02 8:30					5.16		
MW-12D	12/2/02 10:30	6.51	0.082	-5	19.4		0.24	
MW-12D	12/2/02 13:30		0.004	45	40.0	5.11		
MW-12D	12/2/02 13:30	6.57	0.081	-15	19.3		0.18	
MW-12D	12/4/02 9:00					5.17	·	
MW-12D	12/10/02 9:00					5.1		
MW-12D	12/10/02 12:15	6.03	0.091	138	18.5		0.63	
MW-12D	12/10/02 14:20	7.04	0.091	-49	19.3		1.32	
MW-12D	12/10/02 15:30		··			5.08		
MW-12D	12/11/02 8:50			-		5,1		0
MW-12D	12/11/02 9:30	5.99	0.085	158	18.8		0.39	
MW-12D	12/11/02 13:00	6.31	0.087	-17	19.3		0.25	
MW-12D	12/11/02 13:45					5.14		
MW-12D	12/12/02 10:20					5.02	0.2	
MW-12D	12/16/02 9:15					4.98		0
MW-12D	12/16/02 10:30	7.08	0.115	-62	18.7		1.68	
MW-12D	12/16/02 13:45	7.03	0.114	-66	19		0.96	
MW-12D	12/16/02 15:00					5		
MW-12D	12/17/02 8:10					5.08		1.7
MW-12D	12/17/02 9:30	7.37	0.117	-86	18.3		0.72	
MW-12D	12/17/02 14:00	7.49	0.118	-104	18.3		0.72	
MW-12D	12/17/02 15:00					5.04		
MW-12D	12/18/02 7:30					5.05		
MW-12D	12/18/02 15:30					5		
MW-12D	12/19/02 8:00					5.04		0
MW-12D	12/19/02 15:00					4.9		

Notes:

Baseline data for shallow injection events (i.e., - pre-shallow injection) presented in *blue, italic*. Shallow Injections initiated on 11/26/02.
 Baseline for intermediate injection events presented in *green, italic*. Intermediate injections initiated on 11/19/02.

Table 8
Permanganate Injection Pilot Test
Colormetric Sampling Data Summary

Location	Date	Time	KMnO4 Concentration Equivalent (mg/l)		
PT-9S	11/21/2002	13:05	0.50		
PT-10S	4/24/2003	NA	19.30		
PT-11S	11/26/2002	11:25	9.00		
PT-11S	12/17/2002	11:30	10.80		
PT-11S	4/24/2003	NA	1.00		
PT-12S	11/26/2002	11:25	14.60		
PT-12S	4/11/2003	11:25	0.20		
PT-12S	4/24/2003	NA	0.20		
PT-13S	4/11/2003	11:25	0.30		
PT-13S	4/24/2003	NA	0.30		
PTMW-1S	12/17/2002	11:30	10.40		
PTMW-1S	4/24/2003	NA	3.70		
PTMW-2S	12/17/2002	11:30	10.30		
PTMW-2S	4/24/2003	NA	2.10		
PTMW-3S	4/24/2003	NA	2.30		
PTMW-6S	12/17/2002	11:30	32.50		
PTMW-6S	4/11/2003	11:25	0.30		
PT-91	11/26/2002	11:25	0.00		
PT-111	11/20/2002	13:15	0.80		
PT-111	11/20/2002	14:21	0.50		
PT-111	11/21/2002	11:08	1.00		
PT-111	11/21/2002	13:05			
PT-111	11/26/2002	11:25	1.60		
PT-111	12/2/2002	12:30	1.90		
PT-11I	12/10/2002	12:30	0.30		
PT-11I	12/11/2002	8:30	1.30		
PT-11I	12/16/2002	12:35	1.30		
PT-11I	12/17/2002	11:30	1.60		
PT-12I	11/26/2002	11:25	2.00		
PTMW-1I	11/20/2002	13:15	3.30		
PTMW-11	11/20/2002	14:21	2.80		
PTMW-1I	11/21/2002	11:08	3.10		
PTMW-1I	11/21/2002	13:05	3.10		
PTMW-1I	11/26/2002	11:25	1.40		
PTMW-1I PTMW-1I	12/2/2002	12:30 12:30	0.70		
PTMW-11 PTMW-11	12/10/2002 12/11/2002	8:30	0.80		
PTMV-11 PTMV-11	12/16/2002	12:35	1.10		
PTMW-11 PTMW-11	12/17/2002	11:30	1.30		
PTMW-21	11/20/2002	13:15	2.10		
PTMW-21 PTMW-21	11/20/2002	14:21	1.70		
PTMW-21 PTMW-21	11/21/2002	11:08	2.20		
PTMW-21	11/21/2002	13:05	1.50		
PTMW-21	11/26/2002	11:25	2.10		

Location	Date	Time	KMnO4 Concentration Equivalent (mg/l)
PTMW-2I	12/2/2002	12:30	1.10
PTMW-2I	12/10/2002	12:30	2.50
PTMW-21	12/11/2002	8:30	2.00
PTMW-2I	12/16/2002	12:35	0.70
PTMW-21	12/17/2002	11:30	0.80
MW-61	11/20/2002	13:15	0.30
MW-6I	11/20/2002	14:21	0.30
MW-61	11/21/2002	11:08	0.60
MW-6I	11/21/2002	13:05	0.40
MW-61	11/26/2002	11:25	0.70
MW-6I	12/2/2002	12:30	0.30
MW-6I	12/10/2002	12:30	2.20
MW-61	12/11/2002	8:30	1.90
MW-61	12/16/2002	12:35	1.50
MW-61	12/17/2002	11:30	2.10
MW-12I	11/20/2002	13:15	1.10
MW-12I	11/20/2002	14:21	1.30
MW-121	11/21/2002	11:08	1.60
MW-121	11/21/2002	13:05	1.30

<u>Table 8</u> <u>Permanganate Injection Pilot Test</u> <u>Colormetric Sampling Data Summary</u>

Method 101 and Method 102 Absorbance at 520 nm used for KMnO4 equivalence.

<u>Table 9</u> <u>Permanganate Injection Pilot Test</u> Intermediate Injection Event - Baseline Data for Intermediate Monitoring Locations

Well	Date	Time	Ph (st. units)	Conductivity (mhos)	ORP (eV)	Temperature (deg. C)	DTW (feet)	Dissolved Oxygen (mg/l)	PID (ppb e.u.)
PT-14S	11/18/2002	9:00	6.23	0.534	128	17.5	3.9	1.78	7.6
PT-15S	11/18/2002	9:00	5.96	0.939	-23	19	3.91	0.72	86.6
PT-16S	11/18/2002	9:00	6.13	0.622	-60	19.2	3.71	0.75	55.1
PT-17S	11/18/2002	9:00	6.03	0.54	-6	19.2	3.69	0.72	129
PT-18S	11/18/2002	9:00	6.06	0.572	-13	19.2	3.78	0.71	0
PTMW-1S	11/18/2002	9:00	6.17	0.488	-53	18.4	3.73	Mini-Troll	0
PTMW-2S	11/18/2002	9:00	6.42	0.247	-12	18	3.51	Mini-Troll	0
MW-12S	11/18/2002	9:00	6.16	0.418	86	16.9	3.25	0.43	85.4
PT-9i	11/18/2002	9:00	11.27	1.71	-15	17.9	3.52	0.5	0
PT-101	11/18/2002	9:00	8.06	0.578	71	19.6	3.31	0.57	0
PT-111	11/18/2002	9:00	7.88	0.314	71	19.4	3.24		0
PT-12I	11/18/2002	9:00	7.9	0.348	73	17.5	3.77	0.45	18.6
PT-13I	11/18/2002	9:00	7.98	0.413	73	17.3	4.21	0.39	85.4
PTMW-1I	11/18/2002	9:00	See Troll Dat	а			3.55		0.02
PTMW-2I	11/18/2002	9:00	7.23	0.126	3	15.8	3.41	1.68	0
PTMW-6I	11/18/2002	9:00	9.92	0.415	-19	17.3	3.5	0.54	0.6
MW-12I	11/18/2002	9:00	8.27	0.051	62	17.1	4.43	0.45	6.8
MW-12D	11/18/2002	9:00	6.85	0.089	59	18	5.3		13.2

<u>Table 10</u> Permanganate Injection Pilot Test Ambient Air Monitoring Results

		Work Zone PID Results	Perimeter PID Results (ppb	Lower Explosive Limit Monitoring	Oxygen Monitoring	Carbon Monoxide Monitoring	Hydrogen Sulfide Monitoring
Date	Time	(ppb equiv.)	equiv.)	(%LEL)	(% 02)	(CO)	(H2S)
9/16/02	9:30	0.0	0.0				
9/16/02	9:45	0.0					
9/16/02	10:00	0.0					
9/16/02	10:15	0.0					
9/16/02	10:30	0.0	0.0			_	
9/16/02	10:45	0.0					
9/16/02	11:00	0.0					
9/16/02	11:15	0.0					
9/16/02	11:30	0.0	0.0				
9/16/02	13:00	0.0	0.0				
9/16/02	13:15	0.0					
9/16/02	13:30	0.0					
9/16/02	13:45	0.0					
9/16/02	14:00	0.0	0.0				
9/16/02	14:15	0.0					
9/16/02	14:30	0.0					
9/16/02	14:45	0.0					
9/17/02	8:30	0.0	0.0				
9/17/02	8:45	1.4	0.2	1			
9/17/02	9:00	2.5	0.0				
9/17/02	9:15	0.0	0.0				
9/17/02	9:30	0.0					
9/17/02	9:45	0.0					
9/17/02	10:00	0.0					
9/17/02	10:45	0.0	0.0				
9/17/02	11:00	0.0					
9/17/02	11:15	0.0					
9/17/02	11:30	0.0	0.0				
9/17/02	11:45	0.0					
9/17/02	12:00	0.0					
9/17/02	13:30	0.0	0.0				
9/17/02	13:45	0.0					
9/17/02	14:00	0.0					
9/17/02	14:15	0.0					
9/17/02	15:15	0.0	0.0	0	20.9	0	0
9/17/02	15:30	0.0	0.0 0.0	0			
9/17/02 9/17/02	15:45 16:00	0.0	0.0	0			
9/17/02	16:00	0.0	0.0		20.8	0	0
9/17/02	16:30	0.0	0.0	0	20.0	0	0
9/18/02	8:45	0.0	0.0	0	20.9	0	0
9/18/02	9:00	0.0	0.0	0	20.5		0
9/18/02	9:15	0.0		0			
9/18/02	9:30	0.0		0			
9/18/02	9:45	0.0	0.0	0	20.8	0	0
9/18/02	10:00	0.0		0			
9/18/02	10:15	0.0		0			
9/18/02	11:15	0.0	0.0				

<u>Table 10</u> Permanganate Injection Pilot Test Ambient Air Monitoring Results

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
9/18/02	11:30	0.0					
9/18/02	13:15	0.0	0.0	0	20.9	0	0
9/18/02	13:30	0.0		0			
9/18/02	13:45	0.0		0			
9/18/02	14:00	0.0		0			
9/18/02	14:15	0.0	0.0	0	20.8	0	0
9/19/02	7:45	0.0	0.0		21.2	0	0
9/19/02	8:00	0.0					
9/19/02	8:15	0.0					
9/19/02	8:30	2.9	0.0		20.9	0	0
9/19/02	8:45	2.1	0.0		20.9	0	0
9/19/02	9:00	0.8	0.0		20.8	0	0
9/19/02	9:15	0.0	0.0		20.8	0	0
9/19/02	10:00	0.0	0.0			0	0
9/19/02	10:15	0.0					
9/19/02	10:30	0.0					
9/19/02	10:45	0.0					
9/19/02	11:00	0.0	0.0		20.8	0	0
9/19/02	11:15	0.0		•			
9/19/02	11:30	0.0	0.0		21.0	0	0
9/19/02	11:45	0.0					
9/19/02	12:00	0.0					
9/19/02	13:45	0.0	0.0		21.0	0	0
9/19/02	14:00	0.0					
9/19/02	14:15	0.0					
9/19/02	14:30	0.0					
9/19/02	14:45	0.0	0.0		21.1	0	0
9/20/02	8:30	0.0	0.0	0	20.7	0	0
9/20/02	8:45	0.0		0			
9/20/02	9:00	0.0		0			
9/20/02	9:15	0.0		0			
9/20/02	9:30	0.0	0.0	0	20.7	0	0
9/20/02	10:45	0.0	0.0	0	20.8	0	0
9/20/02	11:00	0.0		0			
9/20/02	11:15	0.0		0			
9/20/02	11:30	0.0	0.0	0	21.0	0	0
9/20/02	11:45	0.0		0			
9/20/02	13:30	0.0	0.0	0	21.0	0	0
9/20/02	13:45	0.0		0			
9/20/02	14:00	0.0		0			
9/20/02	14:15	0.0		0			
9/20/02	14:30						
9/23/02	9:00	0.0	0.0	0	20.9	0	0
9/23/02	9:15	2.8	0.0	0			
9/23/02	9:30	0.0		0			
9/23/02	9:45	0.0		0			
9/23/02	10:00	0.0	0.0	0	20.9	0	0
9/23/02	10:15	0.0		0			

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
9/23/02	10:30	0.0		0			1 · · · · · · · · · · · · · · · · · · ·
9/23/02	10:45	0.0		0		·····	
9/23/02	11:00	0.0	0.0	0	20.7	0	0
9/23/02	11:15	0.0		0			
9/23/02	11:30	0.0		0			
9/23/02	11:45	0.0		0			
9/23/02	12:00	0.0	0.0	0	20.8	0	0
9/23/02	12:15	0.0	0.0	0	20.0	<u> </u>	
9/23/02	12:30	0.0		0			
9/23/02	12:45	0.0		0			
9/23/02	13:00	0.0	0.0	0	20.8	0	0
9/23/02	13:15	0.0	0.0	0	20.0	U	0
9/23/02	8:15	0.0	0.0	0	20.8		
9/24/02		0.0	0.0	0	20.8	0	0
	8:30		······································				
9/24/02	8:45	0.0	· · · · · · · · · · · · · · · · · · ·	0			
9/24/02	9:00	0.0		0			
9/24/02	9:15	0.0	0.0	0	20.7	0	0
9/24/02	9:30	0.0		0			
9/24/02	9:45	0.0		· 0			
9/24/02	10:00	0.0	0.0	0	20.7	0	0
9/24/02	11:45	0.0	0.0	0	21.0	0	0
9/24/02	12:00	0.0		0		· · · · ·	
9/24/02	12:15	0.4	0.0	0	21.0	0	0
9/24/02	12:30	3.4	0.0	0	20.9	0	0
9/24/02	12:45	0.0		0			
9/24/02	13:15	0.0		0			
9/24/02	13:30	0.0		0			
9/24/02	13:45	0.0	0.0	0	20.8	0	0
9/24/02	14:00	0.0		0			
9/24/02	14:15	0.0		0			
9/24/02	14:30	0.0	0.0	0	20.8	0	0
9/24/02	14:45	0.0		0			
9/24/02	15:00	0.0		0			
9/25/02	9:00	0.0	0.0	0	20.6	0	0
9/25/02	9:15	0.0		0			
9/25/02	9:30	0.0		0			
9/25/02	9:45	0.0		0			
9/25/02	10:00	0.0	0.0	0	20.8	0	0
9/25/02	10:15	0.0		0			
9/25/02	10:30	0.0		0			
9/25/02	10:45	0.0		0			
9/25/02	11:00	0.0	0.0	0	20.7	0	0
9/25/02	11:15	0.0		0			
9/25/02	12:00	0.0	0.0	0	21.1	0	0
9/25/02	12:15	0.0		Ō			
9/25/02	13:00	0.0	0.0	0	21.1	0	0
9/25/02	13:15	0.0		0			
9/25/02	13:30	0.0		0			

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)		Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
9/25/02	13:45	0.0		0			
9/25/02	14:30	0.0	0.0	0	21.0	0	0
9/25/02	14:45	0.3	0.0	0			
9/25/02	15:00	0.3		0			
9/25/02	15:15	1.1		0	·····		
9/25/02	15:30	0.0	0.0	0	21.0	0	0
9/25/02	15:45	0.0	0.0	0	21.0	0	0
9/25/02	16:00	0.0	0.0	0	21.0		
9/25/02	16:15	0.0		0			
9/25/02	16:30	0.0	0.0	0	21.1	0	0
9/25/02	16:45	0.0	0.0	0	<u> </u>		
9/25/02	17:00	0.0	······································	0			
9/25/02	17:15	0.0		0		···	
9/25/02	17:30	0.0	0.0	0	21.0	0	0
9/25/02	17:45	0.0	0.0	0		0	U
9/26/02	9:00	0.0	0.0	0	21.1		
9/26/02	9:15	0.0	0.0	0	<u> </u>	0	0
9/26/02	9:30	0.0		0			
9/26/02	9:45	0.0	• •	0			
9/26/02		0.0	0.0	0	21.0		
9/26/02	<u>10:00</u> 10:15	0.0	0.0		21.0	0	0
9/26/02	10:15	0.0		0			
				0			····
9/26/02	10:45	0.0		0	01.0		
9/26/02	11:00	0.0	0.0	0	21.0	0	0
9/26/02	11:15	0.0		0			
9/26/02	11:30	0.0		0			
9/26/02	12:45	0.0	0.0	0		0	0
9/26/02	13:00	0.0		0			
9/26/02	13:30	0.0		0			
9/30/02	8:00	0.0	0.0	0	21.0	0	0
9/30/02	8:15	0.0	<u> </u>	0			
9/30/02 9/30/02	8:30 8:45	0.0	0.0	0			
9/30/02		0.0	0.0	0	21.0	0	0
9/30/02	9:00 9:15	0.0		0			
		0.0		0		·	
9/30/02 9/30/02	9:30 9:45	0.0	0.0	0	21.1	0	
9/30/02	10:00	0.0	0.0	0		<u>U</u>	0
9/30/02	10:00	0.0		0			
9/30/02	10:30	0.0	·····	0			
9/30/02	10:45	0.0	0.0	- 0	21.4	0	0
9/30/02	11:00	0.0	0.0		<u> </u>		
9/30/02	11:15	0.0		0			
9/30/02	11:30	0.0	0.0	0	21.6		
9/30/02	11:45	0.0	0.0			0	0
9/30/02	12:00	0.0					
9/30/02	12:15	0.0					
9/30/02	12:30	0.0	0.0		21.9	0	0

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
	1		equiv.)		(/0 02)	(00)	(123)
9/30/02	12:45	0.0		· · · · · · · · · · · · · · · · · · ·		· • • • • • • • • • • • • • • • • • • •	
9/30/02	13:00	0.0	·····				
9/30/02	13:15	0.0		0			
9/30/02	13:30	0.0	0.0	0	21.9	0	0
9/30/02	13:45	0.0		0			·
9/30/02	14:00	0.0		0			
9/30/02	14:15	0.0		0			
9/30/02	14:30	0.0	0.0	0	21.9	00	0
9/30/02	14:45	0.0		00			
9/30/02	15:00	0,0		0			
9/30/02	15:15	0.0		0			
9/30/02	15:30	0.0	0.0	0	21.8	0	0
10/1/02	8:30	0.0	0.0	0	21.1	0	0
10/1/02	8:45	0.0		0			
10/1/02	9:00	0.0		0			
10/1/02	9:15	0.0		0			
10/1/02	9:30	0.0	0.0	0	21.0	0	0
10/1/02	9:45	0.0		0			
10/1/02	10:00	· 0.0		0			
10/1/02	10:15	0.0		0			
10/1/02	10:30	0.0	0.0	0	21.3	1	0
10/1/02	10:45	0.0		0			
10/1/02	11:45	0.0	0.0	0	21.4	0	0
10/1/02	12:00	0.0		0			
10/1/02	12:45	0.0	0.0	0	21.3	0	0
10/1/02	13:00	0.0		0			
10/1/02	13:15	0.0		0			
10/1/02	13:30	0.0	0.0	0	21.3	0	0
10/1/02	13:45	0.0		0			
10/1/02	14:00	0.0		0			
10/1/02	14:15	0.0		0			
10/1/02	14:30	0.0	0.0	0	21.4	1	0
10/1/02	14:45	0.0		0			
10/2/02	8:15	0.4	0.0	0	21.0	0	0
10/2/02	8:30	0.0		0			
10/2/02	8:45	0.0		0			
10/2/02	9:00	0.0	0.0	0	21.3	0	0
10/2/02	9:15	0.0	0.0	0			
10/2/02	9:30	0.0		0			
10/2/02	9:45	0.0		0			
10/2/02	10:00	0.0	0.0	0	21.6	0	0
10/2/02	10:15	0.0		0			
10/2/02	10:30	0.0		0			
10/2/02	10:45	0.0		0			
10/2/02	11:00	0.0	0.0	0	21.4	0	0
10/2/02	11:15	0.0		0			
10/2/02	11:30	0.0		0			
10/2/02	11:45	0.0		0			

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
10/2/02	12:00	0.0	0.0	0	21.5	0	0
10/2/02	12:45	0.0	0.0	0	21.8	0	0
10/2/02	13:00	0.0		0			
10/2/02	13:15	0.0		0			
10/2/02	13:30	0.0	0.0	0	21.7	0	0
10/2/02	13:45	0.0		0			
10/2/02	14:00	0.0	0.0	0	21.6	0	0
10/2/02	14:15	0.0		0			
10/2/02	14:30	0.0		0			
10/2/02	14:45	0.0		0			
10/2/02	15:00	0.0	0.0	0	21.3	0	0
10/3/02	8:45	0.0	0.0	0	21.1	0	0
10/3/02	9:00	0.0		0			
10/3/02	9:15	0.2		0			· •··
10/3/02	9:30	0.0		0			
10/3/02	9:45	0.0	• • • • • • • • • • • • • • • • • • •	0			
10/3/02	10:00	0.0	0.0	0	21.2	0	0
10/3/02	10:15	0.0		0			
10/3/02	10:30	0.0	. 0.0	0	21.3	0	0
10/3/02	10:45	0.0		0			
10/3/02	11:00	0.0		0			
10/3/02	11:15	0.0		0			
10/3/02	11:30	0.0	0.0	0	21.3	0	0
10/3/02	11:45	0.0		0			v
10/4/02	8:45	0.0	0.0	0	21.0	0	0
10/4/02	9:00	0.0	0.0	0			
10/4/02	9:15	0.0		0			
10/4/02	9:30	0.0		0			
10/4/02	9:45	0.0	0.0	0	21.0	0	0
10/4/02	10:00	0.0		0			
10/4/02	10:15	0.0		0			
10/4/02	10:30	0.0		0			
10/4/02	10:45	0.0	0.0	0	21.1	0	0
10/4/02	11:00	0.0	······	0			
10/4/02_	11:15	0.0		0			
10/4/02	11:30	0.0		0			· · ·
10/4/02	11:45	0.0	0.0	0	21.0	0	0
10/4/02	12:00	0.0		0			
10/4/02	12:15	0.0		0			
10/4/02	12:30	0.0		0			
10/4/02	12:45	0.0	0.0	0	21.0	0	0
10/4/02	13:00	0.0	·····	0			
10/4/02	13:15	0.0		0			
10/4/02	13:30	0.0		0			
10/4/02	13:45	0.0	0.0	0	21.0	0	0
10/4/02	14:00	0.0	······································	0			
10/4/02	14:15	0.0		0			
10/4/02	14:30	0.0		0			

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
10/7/02	8:30	0.0	0.0	0	21.0		
10/7/02	8:30	0.0	0.0	0	21.0	0	0
10/7/02	9:00	0.0	<u> </u>	0			
10/7/02	9:00	0.0		0		·	
10/7/02	9:30	0.0	0.0	0	21.2	0	
10/7/02	9:30	0.0	0.0	0	21.2	U	0
10/7/02	10:00	0.0		0			
10/7/02	10:15	0.0	0.0	0	04.0		
10/7/02	10:30	0.0	0.0	0	21.2	0	0
10/7/02	10:45	0.0		0			
10/7/02	11:00	0.0					
10/7/02	11:15	0.0		0		<u> </u>	
10/7/02	11:30	0.0	0.0	0	21.3	1	0
10/7/02	11:45	0.0		0			
10/7/02	12:00	0.0		0			
10/7/02	13:00	0.0	0.0	0	21.3	0	0
10/7/02	13:15	0.0		0			
10/7/02	13:30	0.0		0			
10/7/02	13:45	0.0	·	0			
10/7/02	14:00	0.0	0.0	0	21.4	0	0
10/7/02	14:15	0.0		0			
10/7/02	14:30	0.0	0.0	0	21.3	0	0
10/8/02	8:15	0.0	0.0	0	21.0	0	0
10/8/02	8:30	0.0	• • •	0			
10/8/02	8:45	0.0		0			
10/8/02	9:00	0.0	0.0	0	21.1	0	0
10/8/02	9:15	0.0	····	0			
10/8/02	9:30	0.0		0			
10/8/02	9:45	0.0		0			
10/8/02	10:00	0.0	0.0	0	21.3	0	0
10/8/02	10:15	0.0		0			
10/8/02	10:30	0.0		0			
10/8/02	11:15	0.0	0.0	0	21.4	0	0
10/8/02	11:30	0.0	· · · · · · · · · · · · · · · · · · ·	0			
10/8/02	11:45	0.0		0			
10/8/02	12:00	0.0		0			
10/8/02	12:30	0.0	0.0	0	21.0	0	0
10/8/02	12:45	0.0		0			
10/8/02	13:00	0.0		0			
10/8/02	13:15	0.0		0			
10/8/02	13:30	0.0	0.0	0	21.3	0	0
10/8/02	13:45	0.0		0			··· , ,
10/8/02	14:00	0.0	0.0	0	21.0	0	0
10/8/02	14:15	0.0	0.0	0			
10/8/02	14:30	0.0		0			
10/8/02	14:45	0.0		0			
10/8/02	15:00	0.0	0.0	0	21.3	0	0
10/8/02	15:15	0.0		0			

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/8/02	15:30	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		15:45	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			0.0	0.0	0	21.4	0	0
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	10/9/02	8:30	0.0	0.0	0	21.0		0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	8:45	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	9:00	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	9:15	0.0	······································	0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	10:00	0.0	0.0	0	21.1	0	0
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	10/9/02	10:15	0.0		0			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	10/9/02		0.0	0.0	0	21.2	0	0
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		11:15	0,0		0			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	10/9/02	11:30	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	11:45	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			0.0	0.0	0	21.2	0	0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	13:15	0.0	0.0	0	21.1	0	0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	13:30	0.2		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	13:45	1.6	0.0	0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	14:00	0.0	0.0	0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		14:15	0.0	0.0	0	21.2	0	0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10/9/02	14:30	0.0		0			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		14:45	0.0		0			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		8:30	0.0	0.0	0	21.0	0	0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10/10/02	8:45	0.0		0			
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10/10/02	9:45	0.6	0.0	0			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10/10/02	10:00		0.0	0			
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10/14/02 13:30 0.0 0.0 0.0 0 21.1 0 0								
	10/14/02	13:30	0.0	0.0	0	21.1	0	0

Date	Time	Work Zone PID Results (ppb equiv.)	Perimeter PID Results (ppb equiv.)	Lower Explosive Limit Monitoring (%LEL)	Oxygen Monitoring (% O2)	Carbon Monoxide Monitoring (CO)	Hydrogen Sulfide Monitoring (H2S)
10/14/02	15:00	0.0	0.0	0	21.3	0	0
10/14/02	16:00	0.0	0.0	0	21.3	0	0

. .

Table 11 Intermediate Injection Events Contaminant Reduction Data Summary

		1. S	-Dichloroe	thane (11DC	A)	·	2-Dichloroe	thene (11DC	E}		Freo	n•113			Methylen	e Chloride	ar e s		Tetrachloro	ethene (PC	E)
Well No.	Distance to Nearest Injection Well (ft)	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction	Pre- injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction
PTMW-1I	17	14	0	0	100.0%	48	<10	0	100.0%	12	<10	0	100.0%		<10	<10	NA	700	<10	Ó	100 0%
PTMW-21	42	<20	<10	<10	NA	13	<10	5	61.5%	9	<10	0	100.0%	<10	<10	<10	NA.	200	<10	0	100.0%
MW-12PI	50	2	2	0	100.0%	6	15	19	-216.7%	<10	40	15	NA	<10	<10	<10	NA	43	52	27	37.2%
MW-11PI	68	10	1	5	50.0%	85	66	Ó	100.0%	9	56	11	-22.2%	<10	<10	<10	NA	260	130	0	100.0%
PTMW-3I	86	<1000	<100	<10	NA	<1000	<100	<10	NA (<1000	80	<10	NA	130	<100	0	100.0%	<1000	<100	<10	NA
PTMW-41	89	13	<250	0	100.0%	100	90	45	55.0%	48	<250	39	18.8%	600	<250	0	100.0%	60	<250	14	76.7%
MW-5PI	138	<10	< 10	< 10	NA I	23	32	4	82.6%	9	27	0	100.0%	<10	<10	<10	NA	14	21	2	85.7%
PTMW-5I	155	12	0	NS	100.0%	180	0	NS	100.0%	34	0	NS	100.0%	<10	<10	NS	NA	320	17	NS	94.7%
PTMW-6	169	2	0	NS	100.0%	32	7	NS	78.1%	33	12	NS	48.5%	<10	<10	NS	NA	56	18	NS	67.9%
MW-10PI	177	2	NS	0	100.0%	91	NS	49	46.2%	66	NS	16	75.8%	<10	NS	<10	NA	130	NS	130	

										e di star		Parmete	ers Monitor	ed for Pos	sible increa	se Resulti	ng from KN	nO4 Inject	on Event		
		e se se gi	Trichloroe	thene (TCE)		at te dreg	Vinyl C	hloride			Chi	oride			Chro	mium			Mang	janese	
Well No.	Distance from Nearest Injection Well (ft)	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- injection (41 Days)	Post- injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction	Pre- Injection	Post- Injection (41 Days)	Post- Injection (146 Days)	Final Percent Reduction
PTMW-1	17	71	<10	0	100.0%	<50	<10	<10	NA	146	<20	5.1	96.5%	2	1	4.1	-105.0%	914	76300	335	63 3%
PTMW-2I	42	15	<10	0	100.0%	<20	<10			113	<10	15	86.7%	3	40	9.7	-223.3%	72	97700	511	609.7%
MW-12P1	50	8	17		_125.0%	<10	<10	<10		12	9	10.7	10.8%	1	2	2.6	-160.0%	132	107	112	15.2%
MW-11PI	68		37	0	100.0%	5	<10	0	100.0%	95	55	112	-17.9%	2	1	38.5	-1825.0%	242	532	32600	-13371.1%
PTMW-3I	86	<1000	<100	<10	NA	<1000	80	<10	NA	137	72	15.6		3	463	19.6	-553.3%	1350	156000	2430	-80.0%
PTMW-4L	89	70	<250	33			<250	4	33.3%	49	31	12.8	73.9%	3	1	12.3	-310.0%		110	299	
MW-5PI	138	4	4	2	50.0%	2	3	0	100.0%	12	27	4.1	65.8%	3	3	4.7	-56.7%	73	106	212	-190.4%
PTMW-5I	155	38	0	NS	· · · · · · · · · · · · · · · · · · ·		0	NS		NS	10	NS	NA	2	3	NS	-50.0%	3230	1950	NS	
PTMW-6I	169	12	3	NS	a second a second a second a second a second a second a second a second a second a second a second a second a s	<10	<10	NS	NA 🔿	42	10	NS	76.2%	6	0	NS	100.0%	- 160	120	NS	25.0%
MW-10PI	177	55	NS	45	18.2%	<10	NS	2	NA	31	NS	18.5	40.3%	2	NS	1.4	30.0%	1560	NS	658	57.8%

<u>Notes:</u> 1. NA = Not applicable because parameter was non-detectable in pre- and post-injection sampling.

2. NS = Not Sampled or Data Not Available due to problem with laboratory deliverables.

3. Non-detectable values in final post-injection sampling event considered 0 ug/l for percent reduction calculations

4. Table only includes values where at least one parameter was detected above 10 ug/l. All other parameters were non-detectable.

5. Acetone data not included in percent reduction calculations due to probable lab contamination and no known sources based on historic sampling.

 Table 12

 Permanganate Injection Pilot Test

 Shallow Injection Event - Baseline Data for Shallow Monitoring Locations

			Ph	Conductivity	ORP	Temperature	MLD	Dissolved	DId
Well	Date	Time	(st. units)	(mhos)	(eV)	(deg. C)	(feet)	Oxygen (mg/l)	(ppb e.u.)
PT-11S	11/26/2002	10:00		0.546	-37	20		0.11	
PT-12S	11/26/2002	10:00	5.87	0.496		19.6		0.21	
PT-14S	11/25/2002	9:15		0.879	T	18.3	4.13	0.21	0
PT-15S	11/25/2002	9:15	6.03	1.01		19.6		0.65	23.4
PT-16S	11/25/2002	9:15		0.556	-153	18.9		0.14	0.3
PT-17S	11/25/2002	9:15		0.657		19.5		0.36	43.9
PTMW-1S	11/25/2002	9:15		0.415				0.3	0
PTMW-2S	-	9:15			-75			0.29	0
MW-12S	11/25/2002	9:15	5.9	0.388		19.1	3.37	0.15	85.7
PT-91	11/25/2002	9:15						0.16	10.9
PT-10	11/25/2002	9:15		26.0			1	0.21	2.6
PT-10	11/26/2002	10:00	6.42	F			I - -	0.7	
PT-11	11/25/2002	9:15		0.075	-13		3.44	0.22	0
PT-111	11/26/2002	10:00	6.78	0.072				0.35	
PT-12I	11/25/2002	9:15		0.372		19.4		0.24	3.3
PT-131	11/25/2002	9:15	6.32	0.656			4.39	0.25	2.3
PT-13	11/26/2002	10:00		0.71			•	0.24	-
PTMW-11	11/26/2002	10:00	6.38	0.156		17.9		7.17	
PTMW-2I	11/25/2002	9:15		0.086	-53	19	3.62	1.34	0
PTMW-5I	11/25/2002	9:15		0.117		17.2		0.17	0
PTMW-6I	11/25/2002	9:15		0.782		17.7	1	0.31	0
MW-12I	11/25/2002	9:15		0.059	-30	19.5	4.62	0.27	0
MW-12D	11/25/2002	9:15	6.65	0.076		19.9	5.18	0.86	0

1 of 1

Table 13 Shallow Injection Events Contaminent Reduction Data Summary

(Freen-113							айан (э	DOST) enert	2-Dichloroet	51	(A	DOLL) enset	1-Dichloroet	4	(V)	TTTI) ənerti	eonold2hT-f	V1 , ⁴⁵⁶ - 1		
Final Percent Reduction	-1sog injection Post-	-tso9 Injection (at Days)	Pre- pre-	Final Percent Reduction	Post- Injection (146 Days)	Post- Injection (41 Days)	Pre- Pre-	Final Percent Reduction	Post- Injection (146 Days)	Post- Injection (41 Days)	-erd Pre-	Final Percent Reduction	Post- Injection (146 Days)	Post- Injection (4) Days)	-er Pre-	Final Percent Reduction	-teof Injection (\$46 Days)	-leof Injecton (41 Days)	Injection Pre-	Distance to Mearest Injection Well It)	Well No.
%0 001	0	68	41	%0'00L	0	OLL	0 # 9	%£'66	3	160	400	%0.001	0	2	\$	%0'001	0	01>	5	72	SI-WM19
%0'001	0	01>	54	%0'00L	0	1	01	%2'86	7	21	300	%0'001	0	01>	4	AN	01>	01>	<50	64	SS-WM19
%8 <u>7 </u> 8%	56	27	96	80.44	051				130	051	500	%0 09-	3	<50	Z	%0'00L	0	<20	5	79	St-WMT9
%9'ZL	330	029	1500	%8.69	082	026			300	017	390	%0'00L	0	001>	3	%0'00L	0	001>	57	85	SH21-WW
%0 001	0	30	5	AN	01>	15	01>	80.26	7	82	09	%0'0	2	01>	5	VN	01>		01>	<u>9</u>	SHII-WW
%0 00L	0	01>	£	%5'79	5	54	8	85 2%	21	081	26	%0'00L	0	£	2	٧N	01>	01>	SN	68	PTMW-35
-500 0%	SN	0099	5500	%9'ZI	SN	1400			SN	0002	0092	%0'00l	SN	0	97	VN	SN	0	<10	123	PTMW-55
\$1.1%	130	09	68	%0 ^{.00E-}	SN	1000	520	%8 LÞ1-	SN	049	530	%0.001	SN	0	3	٧N	SN	0	<20	291	S8-WM19
%2 29	14	09C	011	%6 #9-	530	008	140	%8°E1	520	0/8 .	084	%0.08	3	001>	5 L	%0.001	0	001>	15	081	SHOT-WM

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	Chromeum							əbho	она			abhold	Vinyi Ci	^a la fa		(30T) enert	Trichloroet				
Final Percent Reduction	Post- Injection Post-	-teof Injection (41 Days)	Pre- notice(nt	lsnif Percent Reduction	-teof Post- (stsD 34t)	-teo9 notce(n) (ays() fb)	Pre- Pre-	Final Percent Reduction	Post- Injection (146 Days)	-teo9 notceini (avsi fa)	-an9 nottoe{nt	leraf Percent Peduction	-Jaoq Injection (146 Days)	-Jeog noiseint (sys)	Pre-	leniन Percent Reduction	Post- Injection (sys) (sys)	Post- Injection (41 Days)		Distance Distance Disction Well Disction Well	,on liaw
511 1%	0671	20800	69⊅	%0.98	Þ.1	8	01	%0.94	9.61	91	52	%0'00I	0	91	67	%7 86	4	09	520	45	SI-MW10
54 9%	269	269		%0 79	P' 9		91		9.41	£1	30	%0'00L	0	01>	07	%7 I L	2	9	1	43	S2-WM15
%9'ZÞ	891	302		%0.89	3.2	81	0L	%0'26-	87	57	52	%E'9Z	82	EZ	38	%1.79	76	510	280	₽ ⊊	ST-MWL
50.9%	1	971	28	%0'011-	51	b		%8'2	34 1	90	20	%2'72	₽£	07	77	%0'59	067	0011	1400	62	SHIZE-WW
%8 901-		1100		%0 07	6	£1	G		2.96	61	61	%0.08	4L	GL	07	%0 GZ	Z	29	8	<u>99</u>	SHI-WW
35 0%		259		%0 ¢S	9.4	b	οι	%8'82	1.21	67	54	%7'78	6	17	61	%5.58	L	7	9	83	SE-MWLC
%2 68-		792	4 · · · · · · · · · · · · · · · · · · ·	%0.02	SN	р	č	% 21-	SN	18	εε 69		SN	09	058	%0'9£-	SN		5000		SS-WHIC
%£ 697-	SN	162	18	%0'001-	SN	11	7	%2.12	SN	107	62	%E*11-	80 SN	0012	58	%8'081-		000	210 500		S9-WMTG
%6 87-	113	119	627	%8 98-	32'5		C 1	%9'29	302	127	71	%9°SL	00	<100	, CF	%6'95	077	10001	inic	081	SH01-WW

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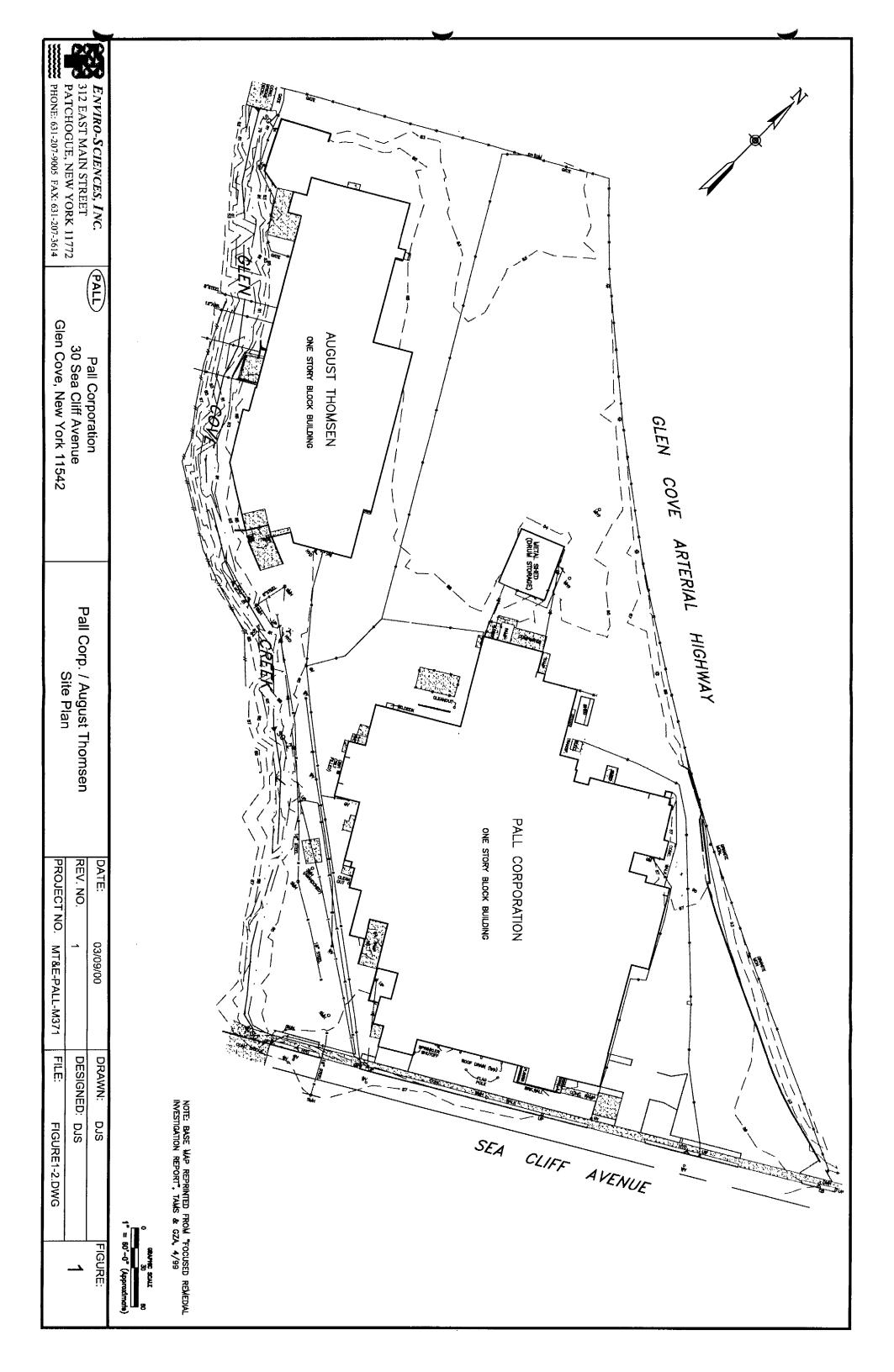
t. NA = Not applicable because parameter was non-detectable in pre- and post-injection sampling.

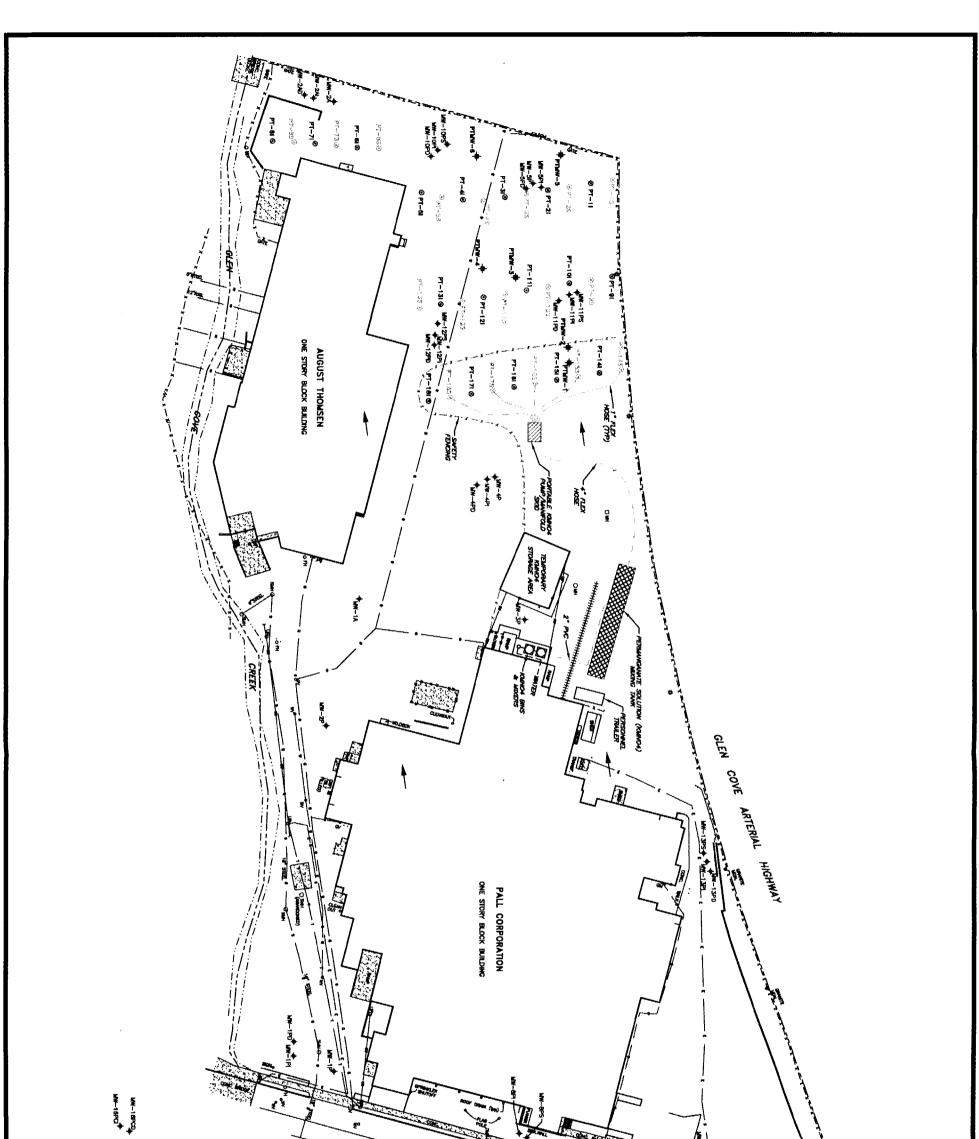
2. NS = Not Sampled or Data Not Available due to problem with laboratory deliverables.

3. Non-delectable values in final post-injection sampling event considered 0 ug/i for percent reduction calculations

4. Table only includes values where at least one parameter was detected above 10 ug/i. All other parameters were non-detectable.

5. Acetone data not included in percent reduction calculations due to probable lab contantivation and no known sources based on historics. 5.

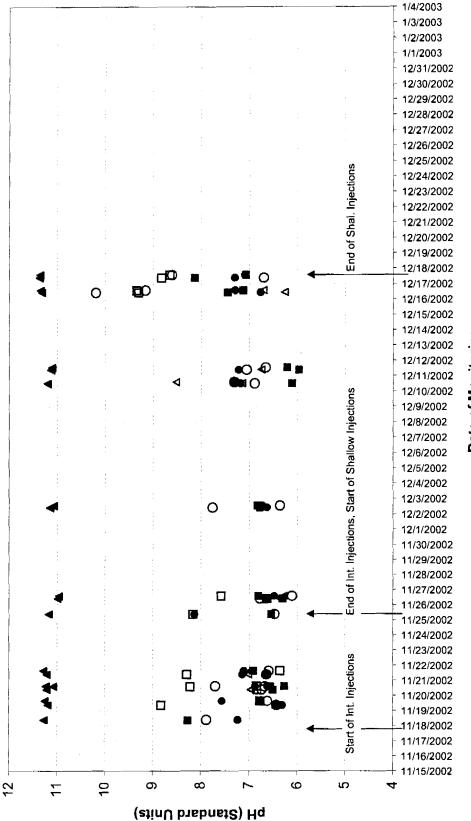




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PALL CORPORATION PILOT TEST 30 SEA CLIF AVENUE 30 SEA CLIF AVENUE BUN COVE, NEW YORK AS-BUILT PHASE I PHASE I	CLEMT: CLEMT: ENTIRO-SCIENCES, INC. S12 E. MAIN STREET PATCHOCUE, N.Y. 11772 PHENNE: (651) 207-8005	PROJECT MOR:	 CATCH BASN WATER VALVE Gas VALVE SEVER MAHOLE SEVER MAHOLE HUDERGROUND ELECTRIC LIVE I UNDERGROUND GAS LIVE Gan UNDERGROUND GAS LIVE Gan UNDERGROUND GAS LIVE MAETTON WELL SANCING APPRICAL 3D FEET (TOTAL OF 38 WELLS). ALECTION WELL SANCING APPRICAL 3D FEET (TOTAL OF 38 WELLS). ALECTION WELL SANCING APPRICAL 3D FEET (TOTAL OF 38 WELLS). ALECTION WELL SANCING APPRICAL 3D FEET (TOTAL OF 38 WELLS). ALECTION MONTONING WELLS AMALARE FOR 3J ACCESS TO ALGUST THOUSEN PROPERTY IS COMPOSIDE TO ALGUEST THOUSEN PROPERTY IS 	

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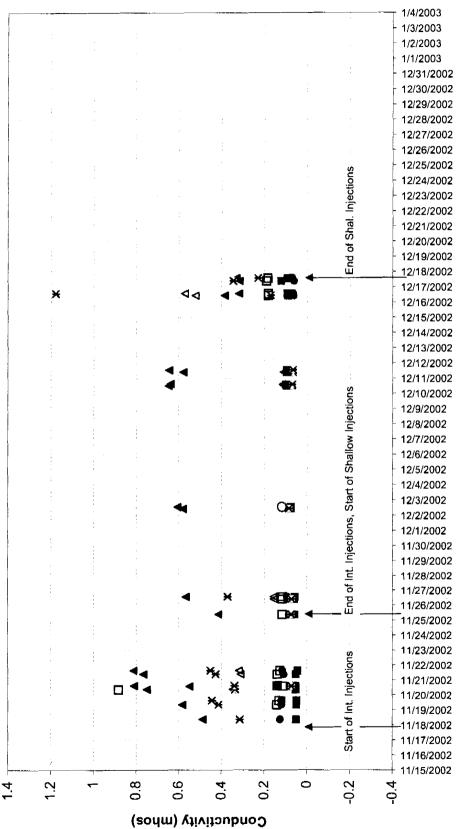




Date of Monitoring

DTMW-5I (155' from Injections, Center) MW-12PI (50' from Injections, Periphery) APTMW-1I (17' from Injections, Center) OPT-111 (60' from Injections, Center) PTMW-2I (42' from Injections, Center) ▲ PT-9! (60' from Injections, Periphery)





Date of Monitoring

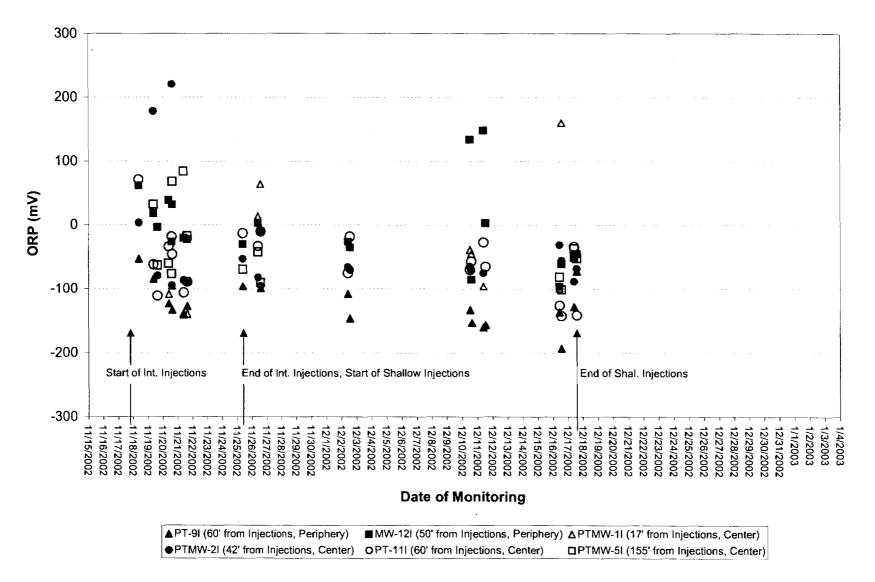
■ MW-12PI (50' from Injections, Periphery) ▲ PTMW-1I (17' from Injections, Center) ▲ PT-9I (60' from Injections, Periphery)

□ PTMW-5I (155' from Injections, Center)

PTMW-2I (42' from Injections, Center)

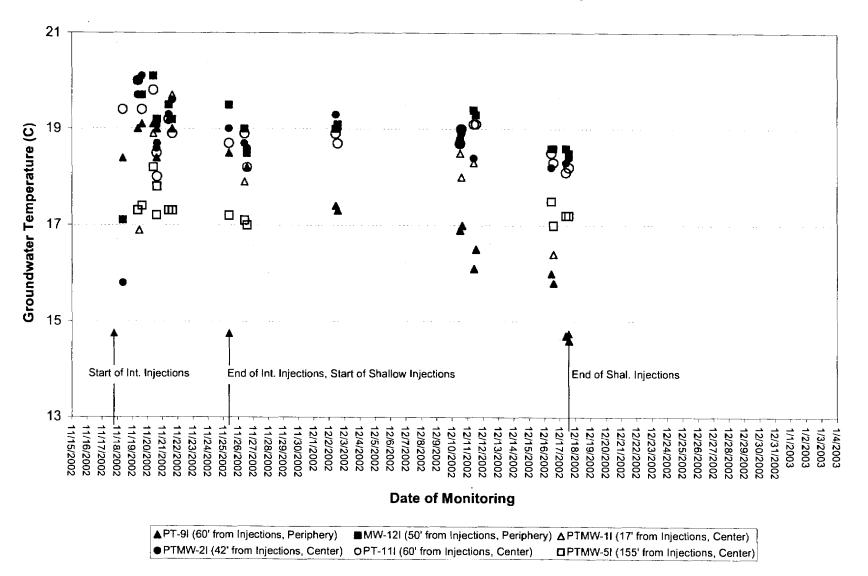
X PT-111 (60' from Injections, Center)

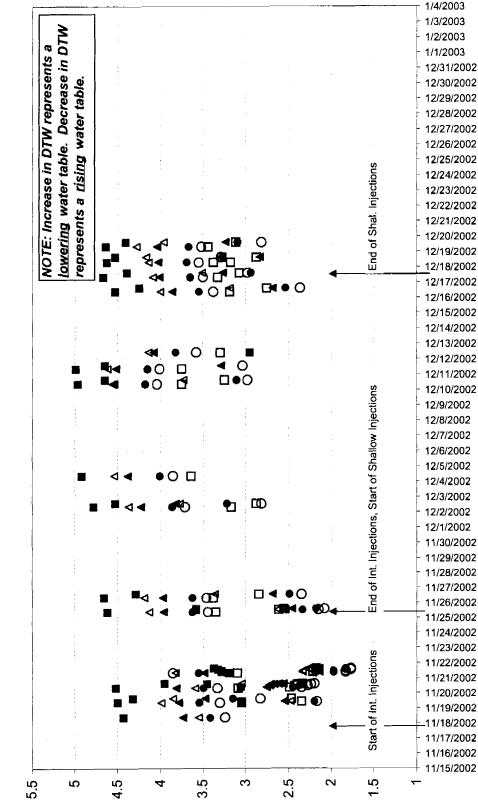
Figure 5 ORP Trend During Intermediate Injections



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Figure 6 Temperature Trend During Intermediate Injections





(feeth to Water (feet)



Date of Monitoring

DTMW-5I (155' from Injections, Center) ■MW-12I (50' from Injections, Periphery) ▲PTMW-1I (17' from Injections, Center) OPT-11I (60' from Injections, Center) PTMW-2I (42' from Injections, Center) ▲ PT-94 (60' from Injections, Periphery)

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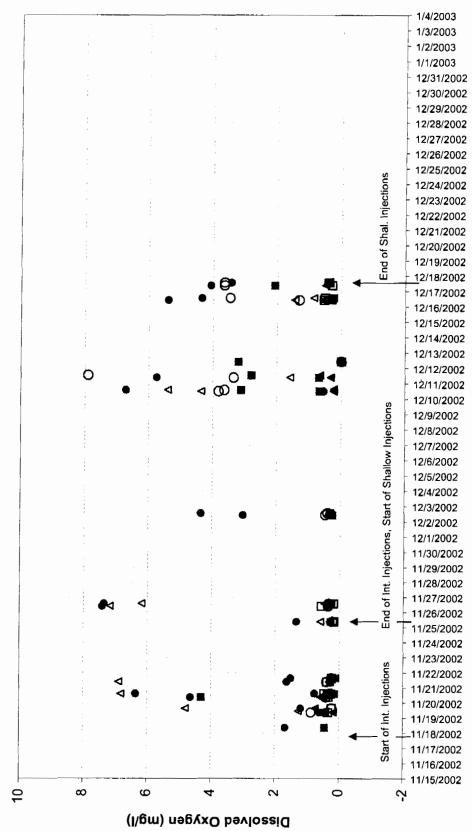
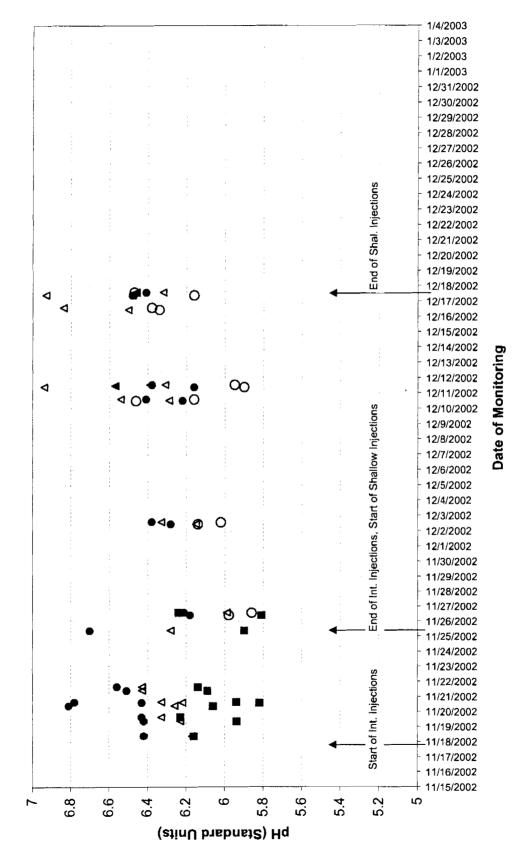


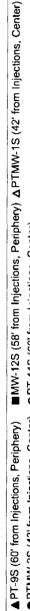
Figure 8 Dissolved Oxygen Trend During Intermediate Injections

Date of Monitoring

DPTMW-5I (155' from Injections, Center) ■MW-12I (50' from Injections, Periphery) ΔPTMW-1I (17' from Injections, Center) OPT-111 (60' from Injections, Center) PTMW-2l (42' from Injections, Center) ▲ PT-9I (60' from Injections, Periphery)

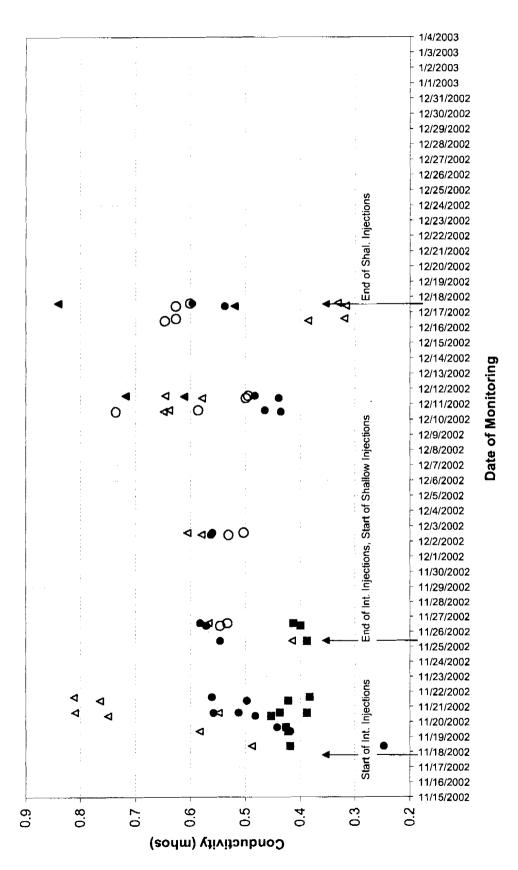


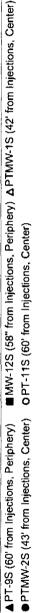




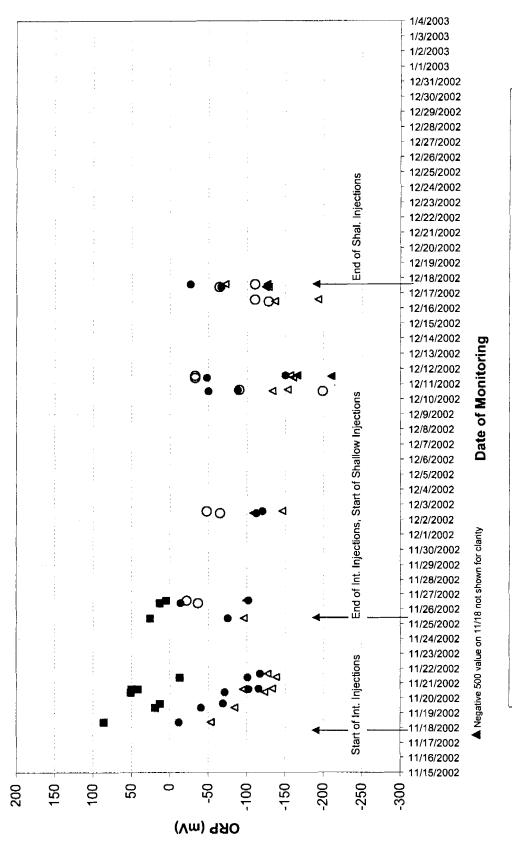
PTMW-2S (43' from Injections, Center)
 OPT-11S (60' from Injections, Center)



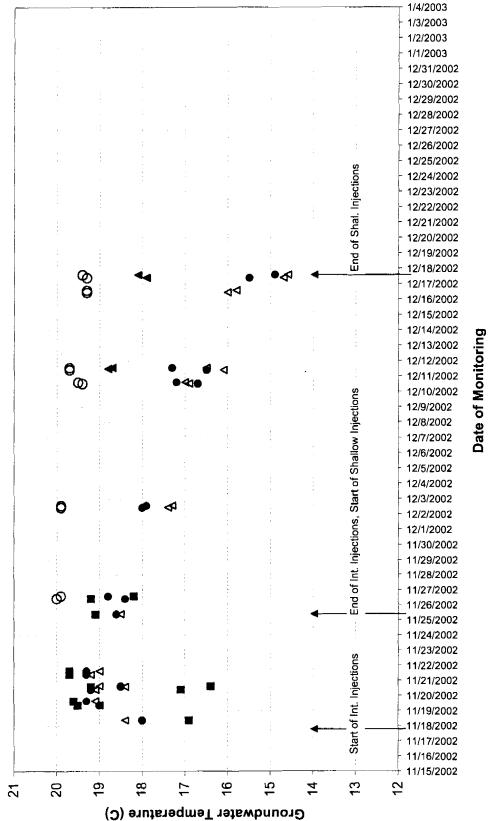






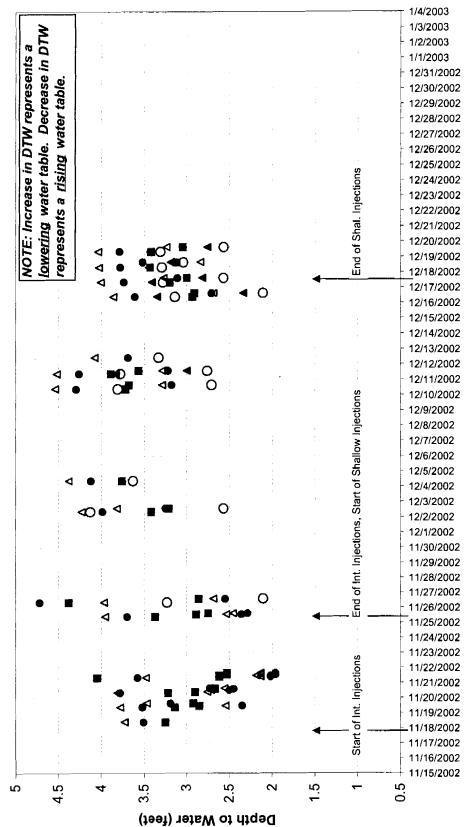


MW-12S (58' from Injections, Periphery) APTMW-1S (42' from Injections, Center) OPT-11S (60' from Injections, Center) ▲ PT-9S (60' from Injections, Periphery)● PTMW-2S (43' from Injections, Center)





MW-12S (58' from Injections, Periphery) & PTMW-1S (42' from Injections, Center) OPT-11S (60' from Injections, Center) PTMW-2S (43' from Injections, Center) ▲ PT-9S (60' from Injections, Periphery)

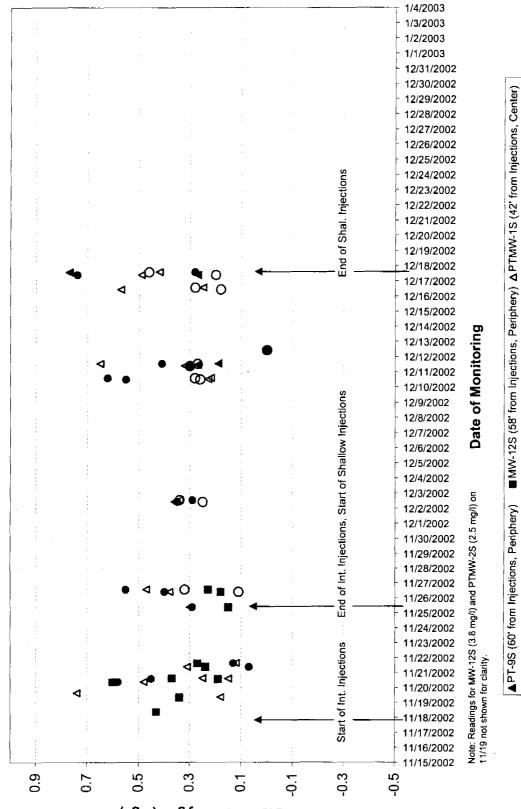


Eigure 13 Groundwater Elevation Changes During Shallow Injections

Date of Monitoring

MWV-12S (58' from Injections, Periphery) A PTMWI-1S (42' from Injections, Center) OPT-11S (60' from Injections, Center) PTMW-2S (43' from Injections, Center) ▲PT-9S (60' from Injections, Periphery)

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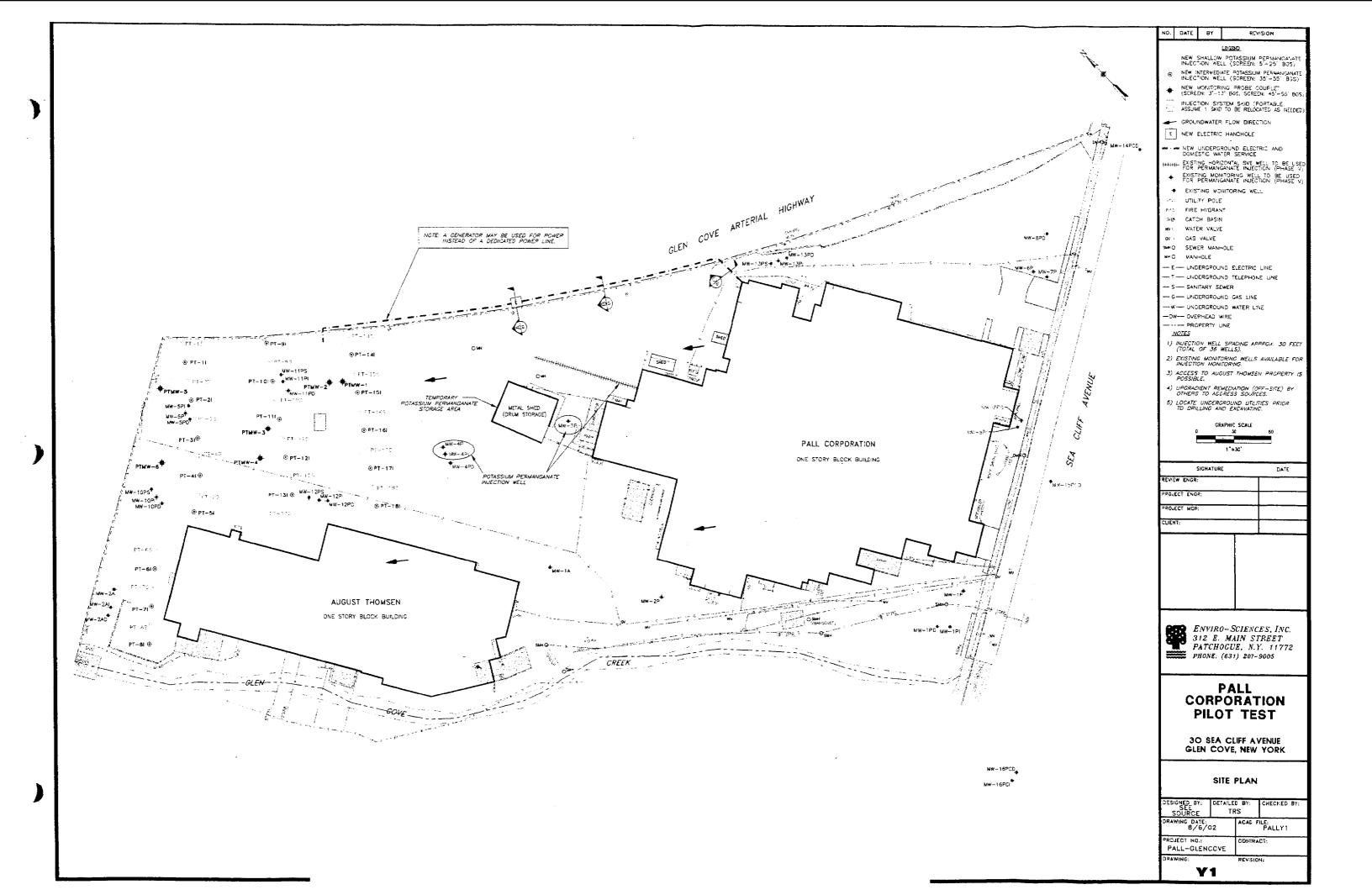


O PT-11S (60' from Injections, Center)

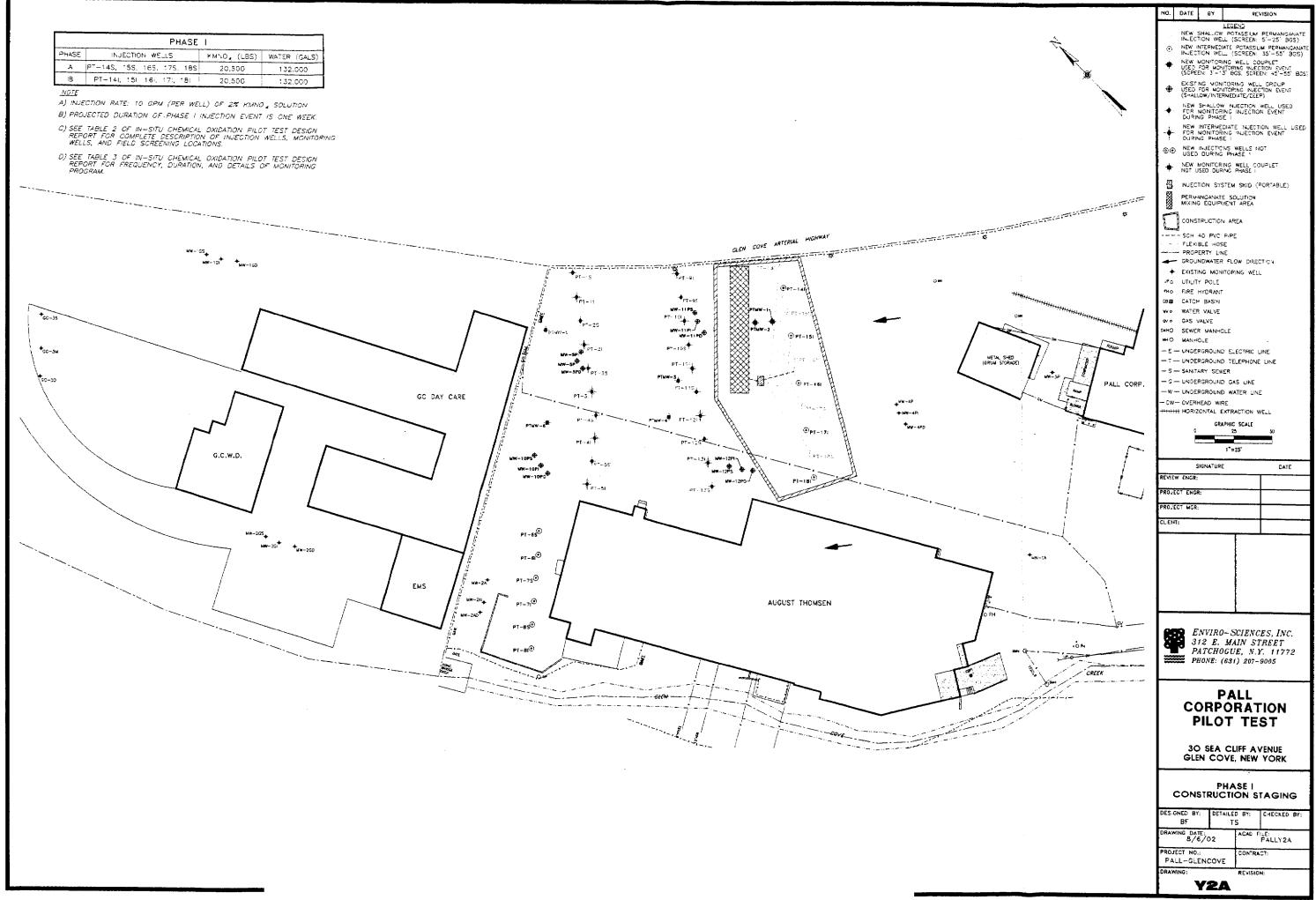
PTMW-2S (43' from Injections, Center)

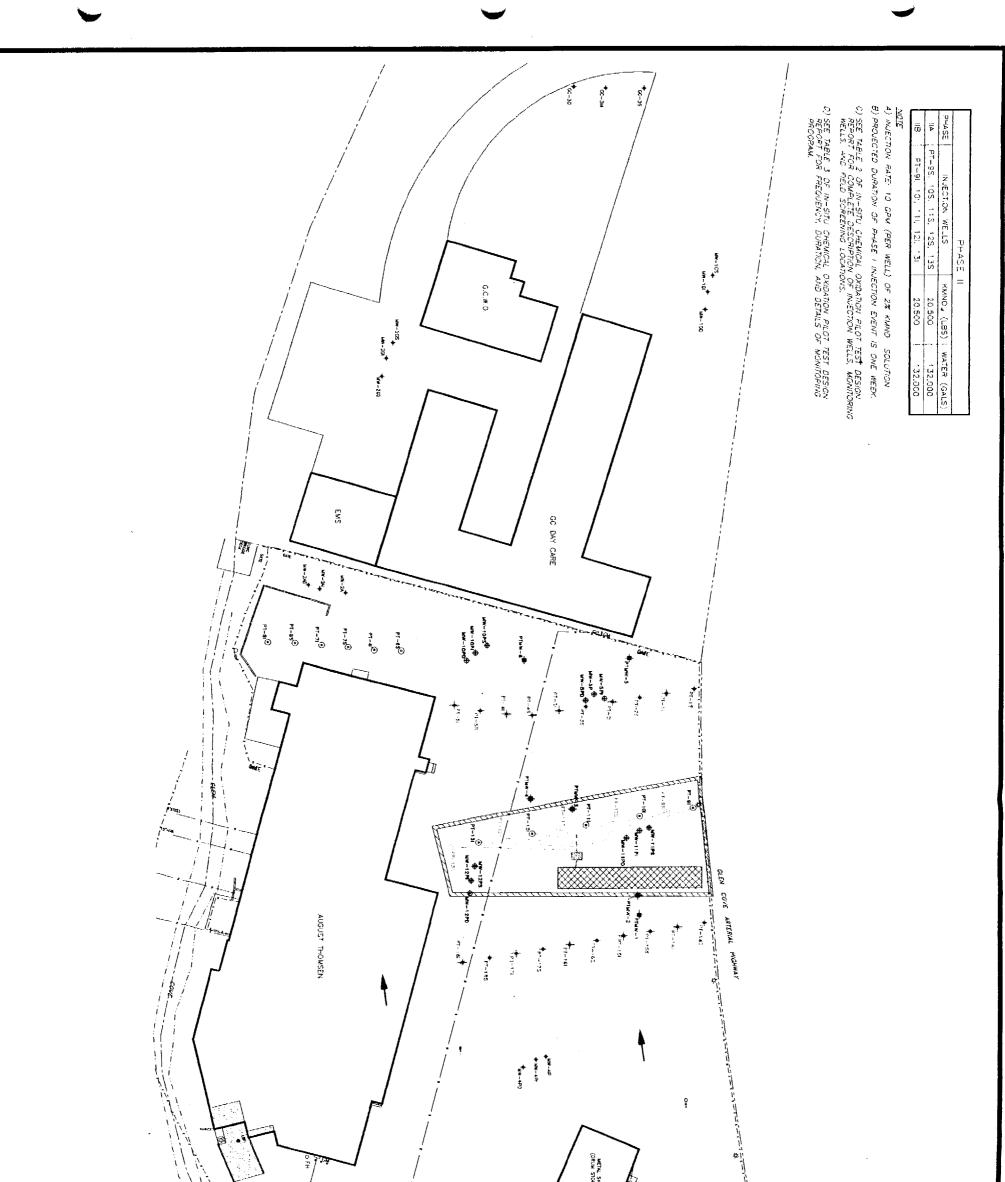


(l\gm) nsgyxO bsvlozeiQ



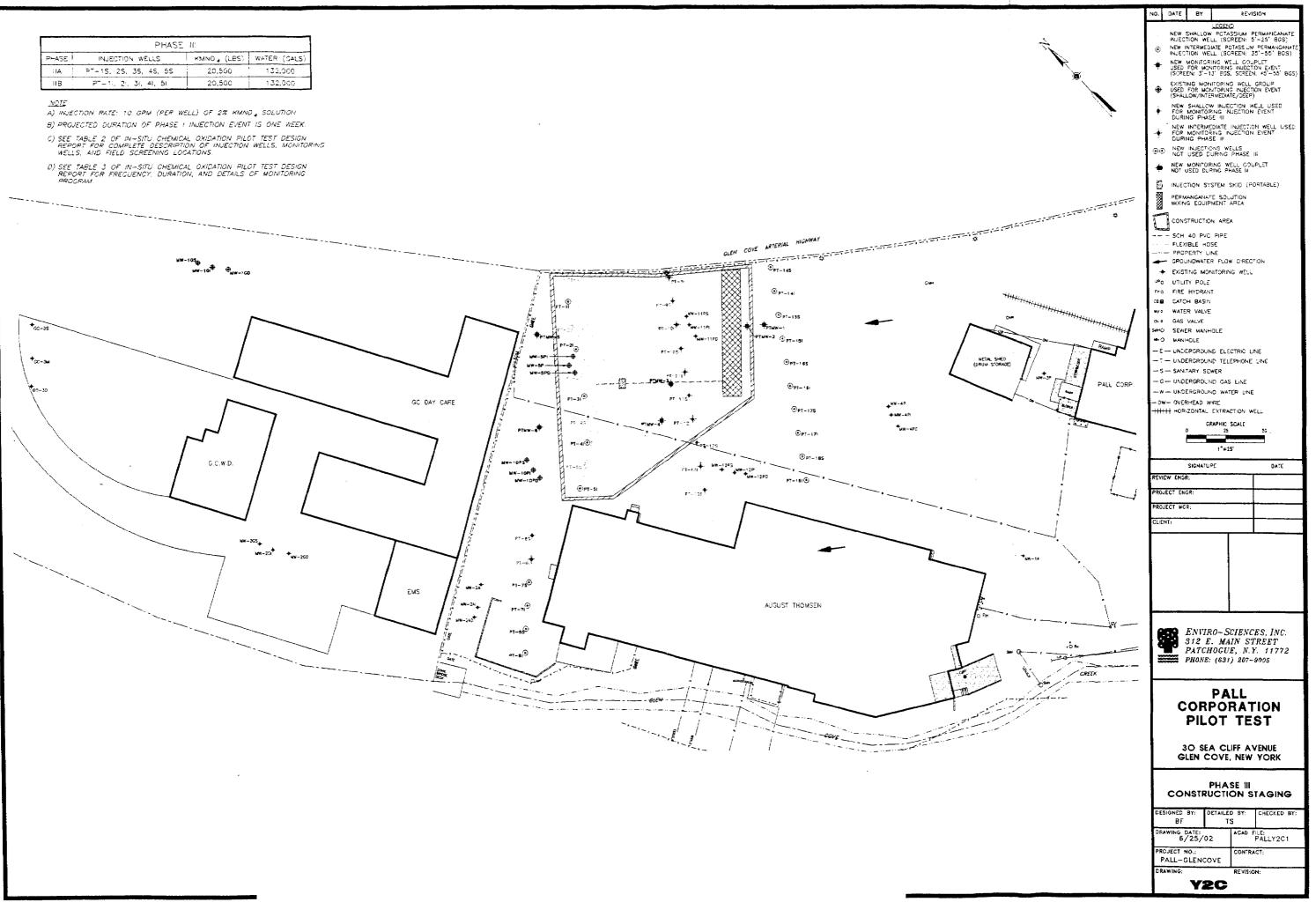
PHASE I					
INJECTION WELLS	KMNO, (LBS)	WATER (GALS)			
PT-145, 155, 165, 175, 185	20,500	132.000			
PT-14I, 15I, 16I, 17I, 18I	20,500	132.000			
	INJECTION WELLS PT-145, 155, 165, 175, 185	INJECTION WELLS KMNO, (LBS) 27-145, 155, 165, 175, 185, 20,500			



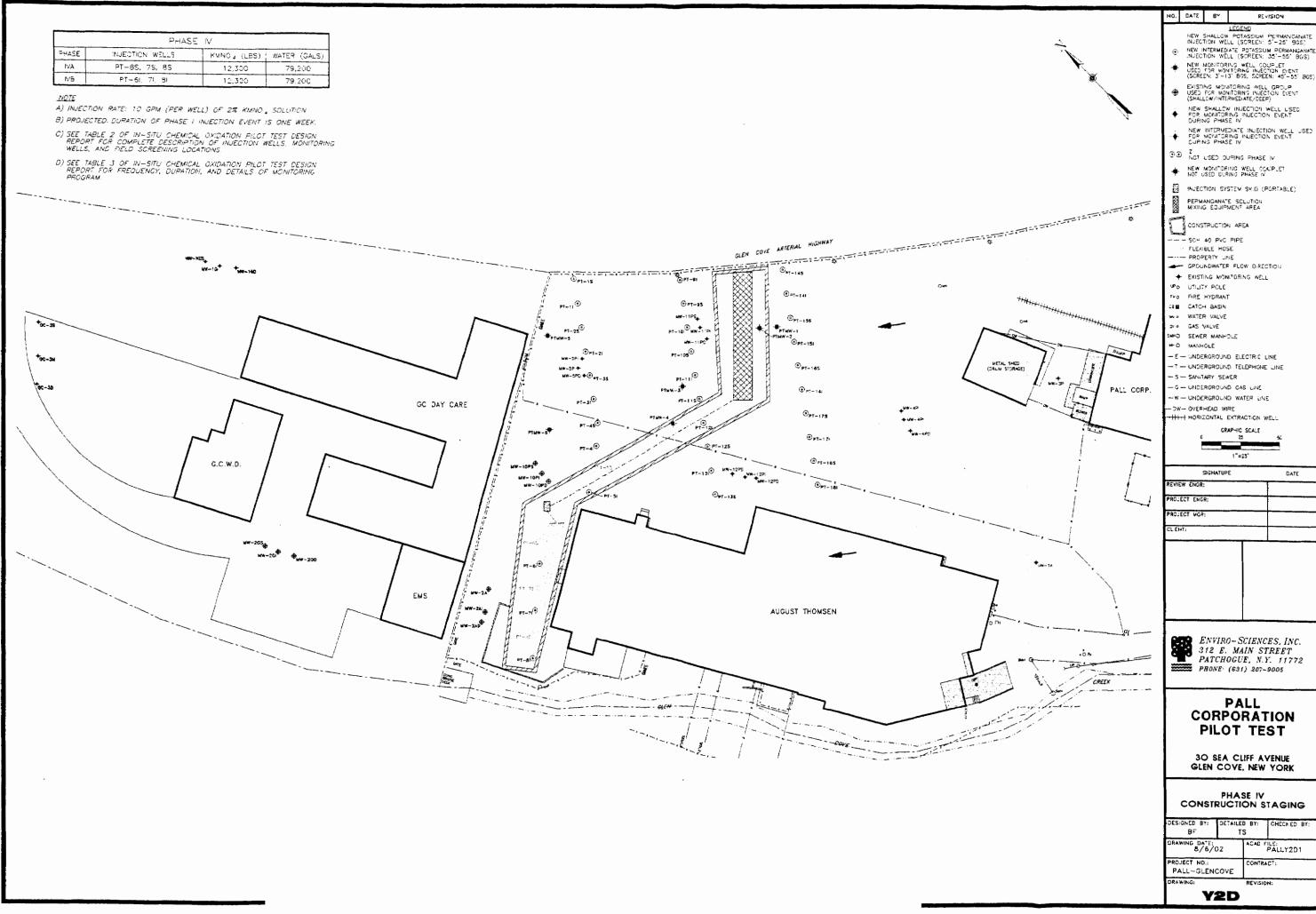


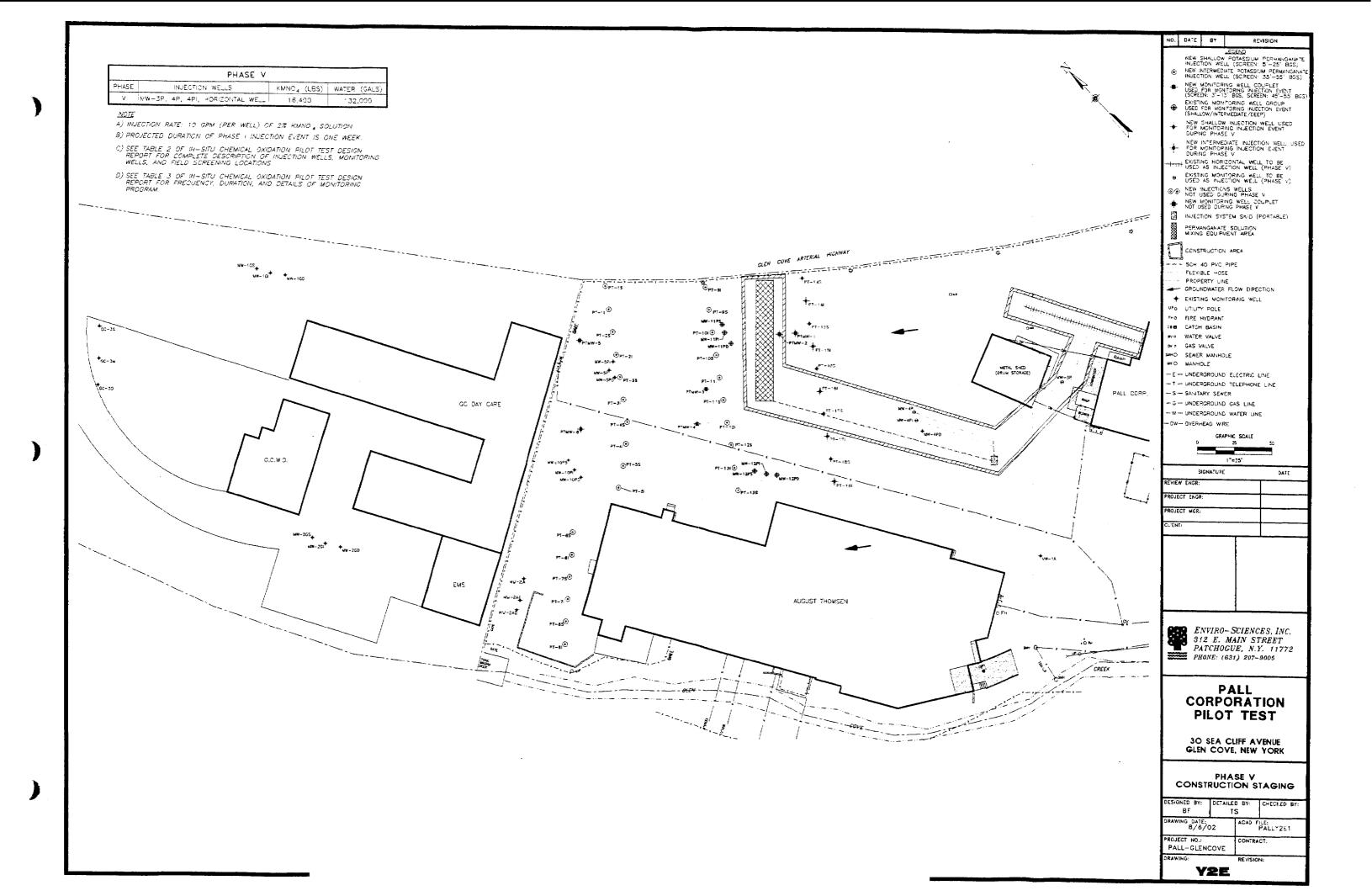
	A CONTRACT OF CONTRACT.	Strend Corp.	
30 SEA CLIFF AVENUE GLEN COVE, NEW VORK PHASE II CONSTRUCTION STAGING BF DETAILED BY: CHECKED BY: BF. CHECKED BY: BRAWING DATE: PROJECT NO.: CONTRACT: PALL-CLENCOVE CONTRACT: PALL-CLENCOVE REVISION:	ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 PHONE: (631) 207-9005 PALL CORPORATION PILOT TEST		NO. DATE BY REVISION IEGERUM POTASSIUM PERMANJANTE NETTINA WELL GOVERN: 4-24, POCY

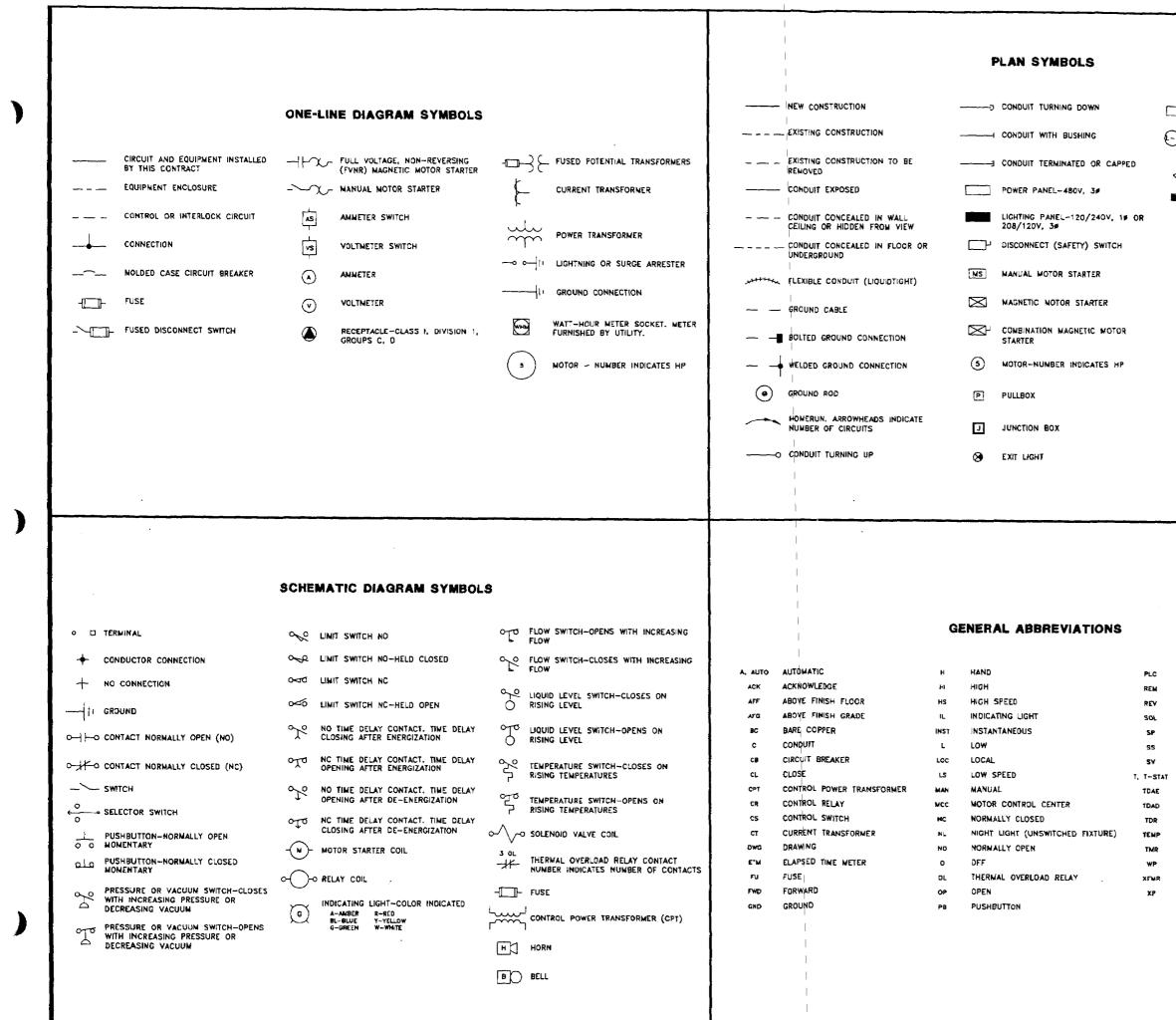
	PHASE	, 11:	
PHASE I	INJECTION WELLS	KMNO (LES)	WATER (GALS)
HA	PT-15, 25, 35, 45, 55	20,500	132,000
ШВ	P ⁺ =11, 21, 31, 41, 51	20,500	132,000



	PHAS	EIV	
PHASE	INJECTION WELLS	KMNO + (LBS)	WATER (GALS)
IVA	PT-65, 75, 85	12,300	79,200
M9	PT-51, 71, 81	12,300	79.200

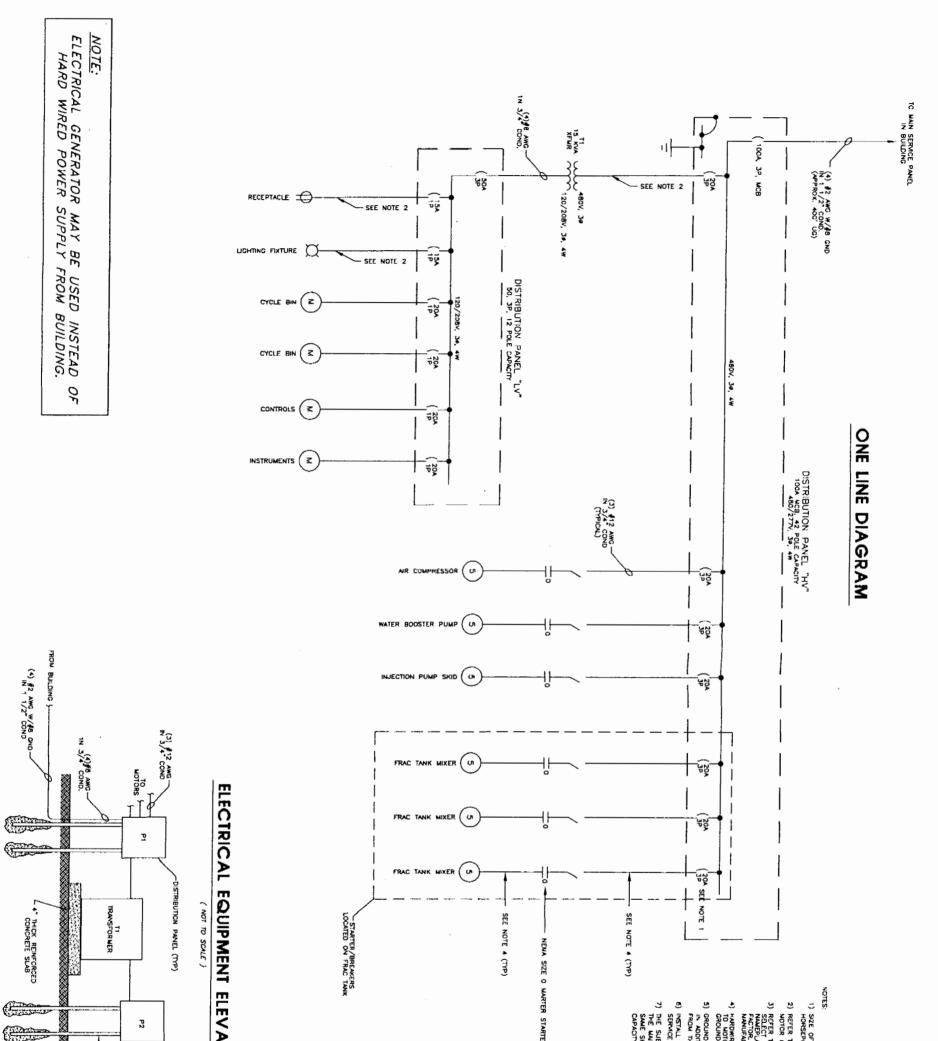






		NO.	DATE	BY		DC.	ISION
					L		
		NOT 1)	DEFER 1	IO THE	PIPING D, DR XLS AM	a a ins Awing ND Desi	STRUMENTATION P1, FOR GNATIONS.
<u>[-1</u>]	FLUORESCENT LUNINAIRE TYPE L-1						
) []	INCANDESCENT OR H.I.D. LUMINAIRE TYPE L-1						
₽	ENERGENCY LIGHTING UNIT						
	ENERGENCY FLUORESCENT UGHTING						
¢	DUPLEX RECEPTACLE WP-WEATHERPROOF GFCI-GROUND FAULT CIRCUIT INTERRUPTER						
۲	RECEPTACLE-CLASS 1, DIVISION 1, GROUPS C, D						
1	THERNOSTAT						
S	SINGLE POLE SWITCH						
53	THREE-WAY SWITCH						
54	FOUR-WAY SWITCH						
	• • •						
				IGNATUR	Æ		DATE
		_	EW ENG				
		L	JECT MG				L
		CLIE	NT:				
		┝─					
PROGR	AMMABLE LOGIC CONTROLLER						
REMOT		L					
REVERSE SOLENOID (OTHER THAN VALVE) SPARE SELECTOR SWITCH SOLENOID VALVE THERMOSTAT TIME DELAY AFTER ENERGIZATION TIME DELAY AFTER DE-ENERGIZATION TIME DELAY RELAY TEMPERATURE			P	112 E Patci	C. M. Togi	AIN : UE, N	VCES, INC. STREET V.Y. 11772 7-9005
		PALL CORPORATION PILOT TEST					
WEATH	TIMER WEATHERPROOF TRANSFORMER EXPLOSIONPROOF-CLASS I, DIVISION I, GROUPS C, D						YORK
EXPLO GROUF			EL	ECTR	RICA	L LE	gend
		DES	IGNED B	: DE	TAILED		CHECKED BY:
		DAT	E: 3/1	3/02		FILE:	PALL-ED
			JECT NO			CONTRA	CT:
			WING:			REVISIO	

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HI JA CONO	ATION	F CIRCUIT BREAKER CHANGES WITH MOTOR POWER, AND SERVICE FACTOR. TO ARTICLE 430 OF THE NEC FOR COMPUTINE SIZING. THE NEC FOR TONERLOAD EVICES FROM THE NOTOR ATTIRENT TO THE MOTOR THE INFO ATTIRENT SOLALLO. UTTER INFO ATTIRENT SOLALLO. THE NOTOR THE INFO THE MATTOR TERNING EXAMINE INFO TO THE GROUNDING COMOUCTOR THE MAIN SERVICE PAREL LIVI 120V GFCI RECEPTACLE NEAR THE				
PALL CORPORATION PILOT TEST 30 SEA CLIFF AVENUE CIEN COVE, NEW YORX ONE LINE DIAGRAM BF 75 CHECKED BY: DRAWING DATE: DRAWING DAT	SIGMATURE DATE REVIEW ENGE: PROJECT ENGR: PROJECT ENGR: CLIENT: CLIENT: CLIENT: CLIENT: DENVIRO-SCIENCES, INC. 312 E. MAIN STREET PHONE: (631) 207-8005	NO. DATE BY REVISION LEIRDE Imansformer		VALVE AND P	IPING	SYMBOLS
-----------------	--	------------------	---------------------------------			
⊲	GLOBE VALVE	Ō	BASKET TYPE STRAINER			
\triangleleft	GATE VALVE	\mathbf{k}	Y-TYPE STRAINER			
ł	BUTTERFLY VALVE	1 8 1	DUPLEX STRAINER			
Zı	CHECK VALVE		SLEEVE COUPLING (SC)			
X	PLUG VALVE	Y	FLOOR DRAIN			
4	3-WAY VALVE	Y	EQUIPMENT DRAIN			
2	ANGLE VALVE	⊅	CLEANOUT (CO)			
7	RELIEF OR SAFETY VALVE	Þ	REMOVABLE PLUG			
ฮ	DIAPHRAGN VALVE	-3	RENOVABLE CAP			
ж	BALL VALVE	BF	BLIND FLANGE			
0	GLOBE VALVE	ł	EXHAUST TO ATMOSPHERE (INSIDE)			
Z	SELF-CONTAINED PRESSURE REGULATING VALVE W/RELIEF	ŧ	EXHAUST TO ATMOSPHERE (OUTSIDE)			
-	KNIFE GATE VALVE	Δ	REDUCER			
PH	BACKFLOW PREVENTER	t	UNION			
0	NORMALLY OPEN	c	QUICK DISCONNECT COUPLING			
IC	NORMALLY CLOSED	8	GAUGE SEAL			
•	SAMPLE PORT	- / -	- DAMPER			
ન	FLEXIBLE HOSE					
	VALVE OPER	ATOR	SYMBOLS			
S	SOLENOID	ፑ	DIAPHRAGM WITH POSITIONER			
M	MOTOR, ELECTRIC	т	HANDWHEEL OR LEVER			
Ŷ	DIAPHRAGM	A	CHAINWHEEL			
	PRIMARY ELEMEN	T SYM	BOLS - FLOW			
	ORIFICE PLATE		FLUME			
		[WEIR			
	AVERAGING PITOT	[TURBINE OR PROPELLOR			
-0	VENTURI OR	—4	MAGNETIC FLOW METER			
		(
	EQUIPMENT	SYM	BOLS			
		2				
	PUMP	-	BLOWER			
		Ć	AIR COMPRESSOR			

GENE	RAL INSTRUM	ENT SYMBOLS	PROCESS	B LINE ABBRE
ONE VARIABLE	TWO VARIABLES		AIR	AIR, ATMOSPHER
\bigcirc	\bigcirc	LOCALLY MOUNTED	8₩	BACKWASH
	\sim		CA CGW	COMPRESSED AL CONTAMINATED
Θ		PANEL MOUNTED	۵	DRAIN
\ominus	\overleftrightarrow	REAR-OF-PANEL MOUNTED	EFF EXH	EFFLUENT EXHAUST
			GW	GROUNDWATER
$\langle v \rangle$		INTERLOCK	NPW	NON-POTABLE
P		PURGE	P PW	FRODUCT POTABLE WATER
Ŷ	LINE SYM	BOLS	S SL SP SS TF	SANITARY SLUDGE SAMPLE PORT STORM SEWER TOTAL FLUIDS
·	- PROCESS	PIPES OR CHANNELS	V Vap	VENT VAPOR
	_ CONNECT	ION TO PROCESS, MECHANICAL INSTRUMENT SUPPLY	PIPING MA	TERIAL IDEN
_##	- PNEUMAT	IC SIGNAL		
	- ELECTRIC	SIGNAL	CPVC CSP COP CWP CIP	CHLORINATED P CARBON STEEL COPPER CORRUGATED M CAST IRON PIPE
-x - x x	- CAPILLAR	Y TUBING (FILLED SYSTEM)	DIP GAL PE	DUCTILE IRON I GALVANIZED ST POLVETHYLENE
~ LL Ŀ	- HYDRAUL	IC SIGNAL	PP PVC RCP RUB	POLYPROPYLENE FOLYVINYL CHL REINFORCED CO RUBBER HOSE
<u>-~-~</u> ~		MAGNETIC OR SONIC SIGNAL AG OR TUBING	SS VCP	STAINLESS STEI VITRIFIED CLAY

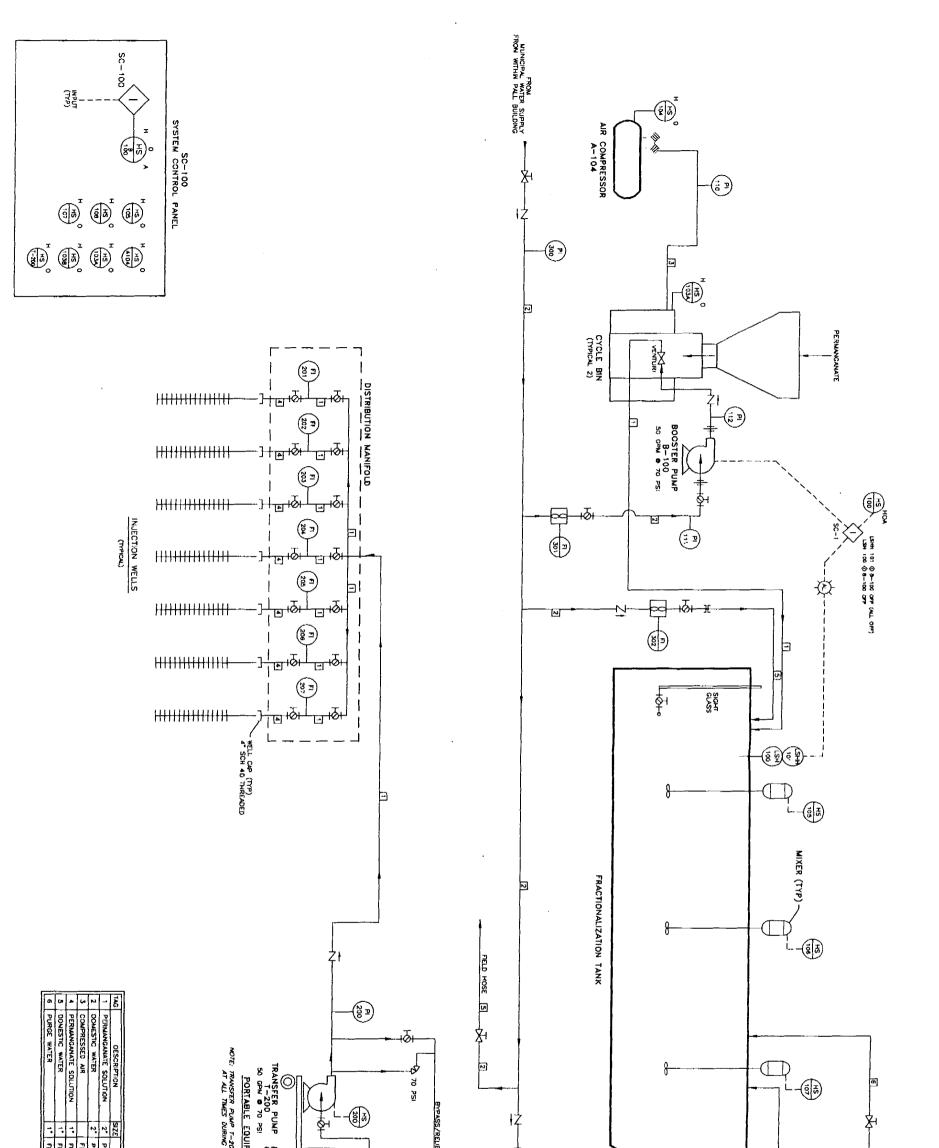
INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS			
	MEASURED OR	NODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER	
A	ANALYSIS		ALARM			
8	BURNER FLANE					
С	CONDUCTIVITY			CONTROL		
D	DENSITY (SP. GR.)	DIFFERENTIAL				
Е	VOLTAGE		PRIMARY ELEMENT			
F	FLOW RATE	RATIO				
G	GAUGING (DIMENSIONAL)		GLASS		·	
н	HAND (MANUAL)				HIGH	
1	CURRENT		INDICATE			
J	POWER	SCAN				
ĸ	TINE OR SCHEDULE			CONTROL STATION		
L	LEVEL		LIGHT (PILOT)		LOW	
M	NOISTURE OR HUMIDITY				MIDDLE	
N						
0			ORIFICE	·		
P	PRESSURE OR VACUUM		POINT (TEST)			
۵	QUANT. OR EVENT	INTEGRATE				
R	RADIOACTIVITY		RECORD OR PRINT			
s	SPEED OR FRED.	SAFETY		SWITCH		
Т	TEMPERATURE	[TRANSNIT		
Ũ	NULTIVARIABLE		NULTIFUNCTION			
۷	VISCOSITY	1		VALVE OR DAMPER		
W	WEIGHT OR FORCE		WELL		1	
X	UNCLASSIFIED	1	UNCLASSIFIED		1	
Y	1		<u> </u>	RELAY OR COMPUTE	<u> </u>	
Z	POSITION			DRIVE, ACTUATE		
		1		[1	
			1		1	

PROCESS PIPING IDEN

		ICESS PIPE PIPE DIAMETER (XXX-YY-Z	(INCHES)
			ULATION DESIGN INE ABBR
			IFFIX (NO NUMBER
IC IL IOA /I FEL R	DISSOLVED OXYI FAIL CLOSED FAIL INDETERMIN FAIL LOCKED FAIL OPEN HAND-OFF-AUTI CURRENT-TO-CI CURRENT-TO-CI LOWER EXPLOSI LOCAL-REMOTE	NATE OMATIC URRENT NEUMATIC	ABBREVIA OC ORP OSC SS > < V T E

			NO. DATE BY RE	VISION
LINE	ABBRI	EVIATIONS		
AIR, A	TMOSPHE	RIC PRESSURE		
BACKV				
	RESSED A	GROUNDWATER		
ORAIN				
EFFLU EXHAL				
GROUN	NDWATER			
NON-	POTABLE	WATER		
FRODU POTAB	UCT ILE WATE	Ř		
TOTAL	FLUIDS			
VENT VAPOR	र			
TERIA	L IDEN	TIFICATION		
	RINATED I	POLYVINYL CHLORIDE		
COPPE	ER	NETAL PIPE		
DUCTI	IRON PIE	PIPE		
POLYS	ANIZED S THYLENE PROPYLEN			
POLYN	/INYL CH	LORIDE PIPE ONCRETE PIPE		
RUBBI STAIN	ER HOSE LESS STE	EL PIPE		
VITRIF	TED CLAY	r PIPE		
			APPROVALS	
		·	SIGNATURE REVIEW ENGR:	DATE
			PROJECT ENGR:	
			PROJECT MGR:	
5 PIPIN	G IDE	NTIFICATION	CLIENT:	
IPE				
AMETER	(INCHES)			
'~z ——				
'				
		TABLE NUMBER REVIATION	CON ENTRE Say	Nona Tura
			ENVIRO-SCIE 312 E. MAIN	
			PATCHOGUE, PHONE: (631) 2	
IENT I	DENTI	FICATION	PALL	
			CORPORA	
			PILOT TE	ST
	FFIX (NO	T NORMALLY USED)		
	ING LETT		30 SEA CLIFF A GLEN COVE, NEW	
RST LETT	TER			
ICTION /	ABBREVI		PIPING & INSTRUM Diagram Lec	
	0C 00	OPEN-CLOSE ON-OFF (MAINTAINED) OVIDATION BEDUICTION DOTENTIAL	DESIGNED BY: DETAILED BY: DJS TRS	CHECKED BY:
	ORP OSC SS	OXIDATION REDUCTION POTENTIAL OPEN-STOP-CLOSE (MOMENTARY) START-STOP (MOMENTARY)	DATE: FILE:	
	> <	HIGH SELECT	PROJECT NO .: CONT	
T T	Σ	SQUARE ROOT ADD OR TOTALIZE	DRAWING: REVIS	7777 KNN:
			PO	



SZE WATERAM	PLACE WATERS LISET TO SUPPLIEMENT PERMANOANTE SUPPLIEMENT PERMANOANTE NACE-UP WATER WATER WATER SUPPLIEMENT PERMANOANTE SUPPLIEMENT br>SUPPLIEMENT SUPPLI	
PALL-GLEN COVE PALL-GLEN COVE	SIGNATURE OATE REVEW FINGE: PROJECT FINGE: PROJECT WOR: CLEENT: CLEENT: DENTIFY PATCHOCUE, N.Y. 11772 PROVE: (637) 207-8005	NO. DATE BY REVISION

UNIFIED SOIL CLASSIFICATION CHART

CLASSIFICATION CHART

MAJ	OR DIVISIONS	SYM	IBOLS	TYPICAL NAMES	ACAD FILL PATTERN
S		GW		Well graded gravels or gravel—sond mixtures, little or no fines	Cross/0.1/Q
SOILS	GRAVELS	GP		Poorly graded gravels or gravel—sand mixtures, little or no fines	Grass/0.5/0
NED	MORE THAN 1/2 OF COARSE FRACTION> Ng. 4 SIEVE SIZE	GМ	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Silty gravels, gravel-sand mixtures	Triang/0.2/30
E GRAINED >No.200 SIEV		cc		Cloyey gravels, gravel-sand-cloy mixtures	Hex/0.1/30
DARSE OVER >N		SW		Well graded sands or gravelly sands, little or na fines	Dats/0.5/0
COARSI	<u>SANDŞ</u>	SP		Poorly graded sands or gravelly sands, little or no fines	Ar-sand/0.03/0
MORE THAN 1/2 OF CDARSE FRACTION< No. 4 SIEVE SIZE	SM		Silty sond, sond-silt mixtures	Line/0.5/90	
		sc		Clayey sands, sond-clay mixtures	Socner/0.5/0
SILTS & CLAYS SILTS & CLAYS SO SO SO SO SO SO SO SO SO SO SO SO SO		ML		Inorganic siltys and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Steei/D.5/45
		CL		Inorganic clays of low to medium plasticity, grovelly clays, sandy clays, silty clays, lean clays	Cloy/0.35/90
	<u>[[[<50</u>	OL		Organic silts, and or organic silty clays of low plasticity	Plasti/0.5/90
R CRAI		мн		Inorganic silts, micaceous and datamaceous fine sandy or silty sails, slastic silts	Mudst/0.25/45
	<u>SILTS & CLAYS</u>	СН		Inorganic clays of high plasticity, fat clays	Cloy/0.35/135
	<u>LL<50</u>	он	\mathbf{N}	Organic clays of medium to high plasticity, organic silty clays, organic silts	Plöst/0.35/90
НІСНІ	Y ORGANIC SOILS	Pt		Peat and other highly argonic clays	Flex/0.125/0

GRAIN SIZE CHART

	RANGE OF GRAIN SIZES			
CLASSIFICATION -	U.S. STANDARD SIEVE_SIZE	GRAIN SIZE		
BOULDERS	Above 12	Above 36"		
COBBLES	12" to 3"	306 to 76.2		
GRAVEL COARSE FINE	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.75 78.2 to 10.1 10.1 to 4.75		
SANO COARSE MEDIUM FINE	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.75 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074		
SILT & CLAY	Below No. 200	Below No. 0.074		

SAMPLE TYPES

SS – Split Spoon

CC — Continuous Core CG — Cuttings Grab

SYMBOLS

- ∑ Initial Woter Level
- Y Static Water Level

WELL CONSTRUCTION MATERIALS







ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 PHONE: (631) 207-9005

		HOGU	-	.Y.	117	72	Well Number <u>PT-1</u> Project Number
-							30 Sea Cliff Ave., Glen Cove N.Y.
							e <u>57'</u> Diameter <u>8"</u> ([©] PT-1S PT-910
							th, Initial <u>NA</u> / © PT-11 PT-95 @
	-				•		
							35' Type <u>Sch 40 pvc</u>
	-						ig Method Hollow Stem Auger
<u>Driller</u>	Carl	Pederso	<u>n</u>	Log) by_	Ţ	Tom Stolworthy Sampling Method Split Spoon
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
- 0						Asp	(0-6") Asphalt/basecoarse. Hand dug to 5 feet.
- 1 - 2						sw	(6"3') Dark brown/black, dry, SAND.
- 3					22255		
- 4		28					(3'-4') Black, moist, PEAT and organic material. 1" lens of lime. (4'-5') Brown/black, moist, CLAY, trace coarse sand.
-5		20					
- 6 - 7 - 8 - 9		4.4				SP	(5'-10') Dark, brown, wet, fine SAND, some medium and coarse sand, trace coarse gravel.
-10 -11 -12 -13 -14 -15		16				SP	(10'-15') Brown, saturated, fine SAND, some coarse gravel, little medium and coarse sand. Poorly sorted.
-16 -17 -18 -19 -20		11.6				SP	(15'—20') Brown, wet, saturated, fine and coarse SAND, little fine gravel.
-21 -22 -23 -24 -25		4.3				Gw	(20'-25') Light brown, wet, saturated, fine SAND and fine GRAVEL, some coarse gravel.
-26 -27 -28 -29 -30		8.1				GW	(25'-30') Same as above, some medium sand.



Well Number _____PT-11____

	Well Construction	PID Reading (ppm)	tr ≢≢	Recovery (%)	Graphic Log	Class	Description
Depth (Feet)	nstru) Rei om)	Blow Count Sample #	cove	aphic	uscs c	(Color, Texture, Structure)
(Fe	S≹e	PIC (PIC	ы В S	Re	Ğ	n	Troce <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-32							
-33	1957) 1957) 1957)	3.5				GW	(30'-35') Light brown, saturated, fine SAND and fine GRAVEL, some medium sand, trace coarse gravel.
-34							-
-35							
36 37							
-38		8.2				GW	(35'-40') Same as above.
-39							
- 40 - 41							
-42				,			
-43		8.9				GW	(40'-45') Light brown, saturated, fine GRAVEL and fine SAND, little medium sand, trace coarse sand.
-44							
-45 -46					•••••		
-47							
-48		10.5				GW	(45'-50') Same as above, little coarse sond.
- 49							
-50 -51							
-52							
-53		10.4				GW	(50'-55') Same as above.
-54							
-55 -56		10.2				GW	(55'-57') Same as above.
-57							
-58							
-59 -60							
- 61					-		
-62					-		
-63							
-64 -65							
-66					_ _		

Date (T.O.C. Screen Casing Drillin	312 PATC PHONE Ct Pall C Drilled Crilled Drilled Drilled Drilled Crilled Drilled Crilled	Corp. G 9/23/0 NA 2 4 d, Air	AIN 2 (E, N () 207 (len Co)2 +" +" & Wat	STR. 7-90 T. T. W L. er El	EET 1177 05 Locat D. of Vater D ength ength ength	72 iion Hole lepti	Well Number <u>PT-21</u> Project Number <u>Project Number</u> <u>Project Nu</u>
0epth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	
$\begin{array}{c} - & 0 \\ - & 1 \\ - & 2 \\ - & 3 \\ - & 4 \\ - & 5 \\ - & 6 \\ - & 7 \\ - & 8 \\ - & 9 \\ - & 10 \\ - & 11 \\ - & 12 \\ - & 13 \\ - & 14 \\ - & 15 \\ - & 16 \\ - & 17 \\ - & 18 \\ - & 19 \\ - & 20 \\ - & 21 \\ - & 22 \\ - & 23 \\ - & 24 \\ - & 25 \\ - & 26 \\ - & 27 \\ - & 28 \\ - & 29 \\ - & 30 \end{array}$		731 562 64.6 61 45.4 107 45.8				Pt Pt GP GW GW	 (0-6") Asphalt/basecoorse. Hand dug to 5 feet. (6"-4') Black, moist, PEAT, some clay, little organic matter, trace clay, little organic matter, trace coarse gravel. (4'-5') Grey, moist, PEAT and CLAY, some fine sand, little fine gravel. (5'-10') Brown, wet, fine GRAVEL, some fine and coarse sond. Poorly sorted. (10'-15') Light brown, wet, fine GRAVEL and SAND, little coarse sand. (15'-20') Same as above, little coarse gravel. Saturated. Sheen, odor. (20'-25') Same as above. Sheen, odor. (25'-30') Brown, wet, fine GRAVEL, some fine sand, little coarse sand.



Well Number ____ PT-21

Dep th (Feet)	Well Construction	PID Reading (ppm)	Blow Caunt Sample #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
- 30 - 31 - 32 - 33 - 34 - 35		49.4				GW	(30'-35') Brown, wet, fine GRAVEL, some fine sand, little coarse sand.
-36 -37 -38 -39 -40		37				GW	(35'-40') Brown, wet, fine GRAVEL and SAND, little coarse sand.
-41 -42 -43 -44 -45		34.9				GW	(40'-45') Same as above, trace coarse gravel.
- 46 - 47 - 48 - 49 - 50		15.9				sw	(45'—50') Light brown, saturated, fine SAND, some medium sand.
51 52 53 54 55		26.8				sw	(50'-55') Light brown, soturated, fine SAND, some medium sand, little coarse sand.
-53 -56 -57 -58 -59 -60 -61 -62 -63 -64 -65 -66		7.9				SW	(55'-58') Same as above.

	ENVI 312 PATC PHONE	E. MA Hogu	AIN S VE, N	STR. 1.Y.	EET 117			Well Number Project Numbe	r
							30 Sea Cliff Ave., Glen Cove N.Y	/PTMW-65	Ø ◎ _{PT-31}
							<u> </u>	/ PTMW-61	@PT-45
							n, Initial <u>NA</u>	. ×	⊠ © PT−4i
					-		Slot Size0.020"		© _{PT-5S}
							35' Type Sch 40 pv	с. / мw10PD ⁺	@ PT-51
-							g Method <u>Hollow Stem Auger</u>		
Driller_			on	Log	g koy		om Stolworthy Sampling Metho	od Split Spoon	·
Depth (Feet)	Well Canstruction	PID Reading (ppm)	Blow Count Somple #	Recovery (%)	Grophic Log	USCS Class		scription xture, Structure) Some 20% to 35%, A	nd 35% to 50%
- 0						Asp	(0-6") Asphalt/basecoarse. Ha	nd dug to 5 feet.	
- 1						Pt	(6"-2.5') Block, moist, PEAT.		
- 2 - 3									
- 4		2.0				SP	(2.5'-5') Brown/black, dry, fine little fine gravel. Poorly		tle coarse sand
- 5 - 6 - 7 - 8 - 9 - 10		1.2				SP	(5'-10') Same as above, some	coarse sand.	
-11 -12 -13 -14 -15		1.2				GW	(10'-15') Light brown, wet, fine S	SAND and fine GRAVEL	
-16 -17 -18 -19 -20		0.6				GW	(15'-20') Same as above, trace	coarse gravel.	
-21 -22 -23 -24		1.1				GW	(20'25') Light brawn, saturated, silt.	fine SAND and fine G	RAVEL, some
-25 -26 -27 -28 -29		1.8				сw	(25'—30') Same as above.		
		1.0							

,



Well Number PT-31

Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% ta 20%, Some 20% to 35%, And 35% to 50%
- 30 - 31 - 32 - 33 - 34 - 35 - 36 - 37 - 38 - 37 - 38 - 39 - 40 - 41 - 42 - 43 - 44 - 45 - 46 - 47 - 48 - 50 - 51 - 52 - 53 - 54 - 55 - 56 - 57 - 58 - 59 - 60 - 61	Weil Weil	92 (Judd) 1.9 1.3 2.2	Blow C Sample	Recove		M SCS N NSCS	
-62 -63 -64 -65 -66							

312 PATO Project Pall Date Drilled T.O.C.	E: (631) 20 Corp. Glen Ca 10/7/02 NA 4" 4" 4" nd, Air & Wat	STREET N.Y. 11772 7-9005 DVE Location I.D. of Hol Water Dept Length Length Length Length Length	<u>30 Sea Cliff Ave., Glen Cove N.Y.</u> e <u>58'</u> Diameter <u>8"</u> h, Initial <u>NA</u> <u>20'</u> Slot Size <u>0.020"</u> <u>35'</u> Type <u>Sch 40 pvc</u> g Method <u>Hollow Stem Auger</u> om Stolworthy Sampling Method	/ РТМW-85, 0РТ-45 / РТМW-61 / Ж. Фрт-41 / мW-10P5 / МW-10P0 / МW-10P0 / 0P1-51
Depth (Feet) Well Construction	PID Reading (ppm) Blow Count Sample #	Recovery (%) Graphic Log USCS Class	Des (Color, Tex Trace <10%, Little 10% to 20%, S	cription ture, Structure) Some 20% to 35%, And 35% to 50%
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	 4.9 3.8 7.2 4.8 4.6 4.5 	Sw Sw Sw Sw Sw Sw Sw Sw Sw Sw Sw Sw Sw S	(0-6") Asphalt/basecoarse. Han (6"-5') Tan, dry, fine SAND, littl (5'-10') Same as obove, some o	d dug to 5 feet. le coarse sand. coarse sand. et at 14', fine and medium SAND,



Well Number _____PT-4|

·		D	ii	5			
	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	Class	Description
f f f	nstr.	a fe	w C mple	соче	phic	uscs ((Color, Texture, Structure)
Depth (Feet)	Cor	E G	BIO	Re	ů.	NS	Troce <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-30							
-31							
-32		6.1				SM	(30'-35') Light brown, wet, fine SAND, some silt, trace coarse sand.
-33		0.1					
-34							
-35					┠╋╋┥┥		
36 37							
-38		4.4				SМ	(35'-40') Light brown, wet, fine SAND, some silt, some medium sand.
-39							
- 40					╟╃╎┼┼		
-41							
- 42		7 5				C.L	(40'-45') Light brown, wet, fine SAND, some silt, little coarse sand.
L-43		3.5				121	(40 -45) Light brown, wet, the SAND, some sitt, little course sund.
-44							
-45					╟╫╫╢		
- 46 - 47							
48		4.3				SМ	(45'-50') Same as above.
-49							
-50							
-51					_		
-52		4.3			_		(50'-55') Same as above.
-53		4.5			 		
-54		ł					
-55 -56							
-57							(55'-58') No recovery.
-58					 		
-59							
-60					<u> </u>		
- 61					—		
-62					-		
-63					 		
-64				ĺ			
-65 -66			ľ				
	U	li	.11	11	U	1	

312 PAT PHOL roject Date Drilled T.O.C. Screen: Diam. Casing: Diam. Drilling Co.	E. MA CCHOCU NE: (631 Corp. G 10/8/(NA 4 4 and, Air	(IN S7 (E, N.) () 207- len Cove () () () () () () () () () () () () ()	Y. 11772 9005 Location T.D. of Ho Water Dep Length Length Env. Drilling	Well NumberPT-5	-31 c -41 SS
Depth (Feet) Well Construction	PID Reading (ppm)	Blow Count Sample #		Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35%	to 50%
-0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13 -14	5.2		SI	 (0-6") Asphalt/basecoarse. Hand dug to 5 feet. (6"-5') Brown, dry, fine and medium SAND, trace fine gravel (5'-10') No recovery. (10'-15') Light brown, moist, fine and medium SAND, some closed 	
-14 -15 -16 -17 -18 -19 -20 -21 -22 -23 -24	9.2			SC (15'-20') Same as above, little fine gravel. SC (20'-25') Same as above.	
-25 -26 -27 -28 -29 -30	2.0		50	SC (25'-30') Light brown, moist, fine and medium SAND, some clo	y.



Well Number _____PT-51

Depth (feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
$\begin{array}{c} -30 \\ -31 \\ -32 \\ -33 \\ -34 \\ -35 \\ -36 \\ -37 \\ -38 \\ -39 \\ -40 \\ -41 \\ -42 \\ -43 \\ -44 \\ -45 \\ -46 \\ -47 \\ -48 \\ -49 \\ -51 \\ -52 \\ -53 \\ -56 \\ -57 \\ -58 \\ -56 \\ -57 \\ -58 \\ -56 \\ -67 \\ -66 \\ -66 \\ -66 \end{array}$		4.5 3.5 3.4 5.3 2.5 2.4				SW SW SC	 (30'-35') Light brown, wet, fine SAND, little gravel. (35'-40') Same as above. (40'-45') Light brown, saturated, fine SAND, some clay, little gravel. (45'-50') Light brown, saturated, SILT, some fine sand, little fine gravel. (50'-55') Same as above. (55'-58') Same as above.

Proje Date T.O.C. Scree Casin Drillir	312 PATC PHON ect Pall Drilled n: Diam. g: Diam. ng Co. Lar	Corp. G 10/9/1 NA	41N S IE, N 1) 207 Sien Cc 02 4" 4" & Wat	STR. 7. Y. 7-90 	EET 1177 05 Locat D. of dater D ength ength ength	ion Hole Hole	Well Number <u>PT-61</u> Project Number <u>Project Number</u> <u>Project Nu</u>
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
$\begin{array}{c} -0\\ -1\\ -2\\ -3\\ -4\\ -5\\ -6\\ -7\\ -8\\ -9\\ -10\\ -11\\ -12\\ -13\\ -14\\ -15\\ -16\\ -17\\ -18\\ -19\\ -20\\ -21\\ -22\\ -23\\ -24\\ -25\\ -26\\ -27\\ -28\\ -29\\ -30\\ \end{array}$		3.9 2.7 20.7 3.5 126 78.1				SC OL SC	



Well Number ____PT-61

			·			11	
	Well Construction	PID Reading (ppm)	Biow Count Sampte #	Recovery (%)	Graphic Lag	Class	Description
- -	strue	Reo T	ပိ ချ	over	hic		(Color, Texture, Structure)
Depth (Feet)	Vell	0H Dg	Som	Rec	Grop	nscs	Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
						-	
-30							
-31	200022 02028						
-32		48.9				SM	(30'-35') Light brown, saturated, SILT, some fine sand.
-33		10.5					
-34							
-35					╈┧┾┥┾		
-36							
-37		18.6				SM	(35'-40') Same as above, little fine gravel.
- 38		10.0				5141	
- 39							
- 40					╵┝┼┝┼		
-41							
- 42		46.2				SM	(40'-45') Same os above.
⊢43		40.Z				SIMI	
-44							
-45					t i t i f i		
-46	\square						
-47		47				LAI	(45'-50') Light brown, saturated, SILT.
- 48		47				IVI L	
-49							
-50							
-51	=						
-52		29.5				м	(50'-55') Same as above.
-53		23.5				1 1	
-54							
-55							
-56							(55'-58') No recovery.
-57							
-58							
-59					-		
-60							
- 61							
-62							
-63	11				F		
-64							
-65							
-66							

			AINS E, N	5 <i>TR.</i> 7. Y.	ЕЕТ 1173				Well Number <u>PT-71</u> Project Number
-								Cliff Ave., Glen Cove N.Y.	PT-650
								Diameter8"	4
								NA	PT-6IO
									μ PT-75 Θ μ _{MW-2} λ PT-71Θ
								Type <u>Sch 40 pvc</u>	MW-2A MW-2A
	-						-	Hollow Stem Auger	
Driller			<u>, n</u>		, юу <u> </u>		om <u>Stolw</u>	orthy Sampling Method	
Depth (Feet)	Well Canstruction	PiD Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class		(cription ure, Structure) ame 20% to 35%, And 35% to 50%
- 0 - 1 - 2						Asp	(0-6")	Asphalt/basecoarse. Hanc	i dug to 5 feet.
- 2 - 3 - 4 - 5		62.6				SP	(6"-5')		nd medium SAND, some fine gravel, cuttings. Poorly sorted, strong
- 6 - 7 - 8 - 9		63.5				OL	(5'–10')	Black/gray, moist, CLAY, impacted.	some peat.Strong odor, visually
-10 -11 -12 -13 -14 -15		53.2				OL	(10'-15')	Same as above, strong	odor, visually impacted.
-16 -17 -18 -19 -20		198				SM	(15'–20')	Dark brown, wet, SILT an	d fine SAND, some fine gravel, odor.
-21 -22 -23 -24		233				SM	(20'–25')	Dark brown, saturated, S	ILT, some coarse sand. Strong odor.
-25 -26 -27 -28 -29 -30		96.9				SM	(25'–30')	Same as obove, some fi	ne sand. Odor.



Well Number ____ PT-71

Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
$\begin{array}{c} -30\\ -31\\ -32\\ -33\\ -34\\ -35\\ -36\\ -37\\ -38\\ -39\\ -40\\ -41\\ -42\\ -43\\ -44\\ -45\\ -46\\ -47\\ -48\\ -49\\ -50\\ -51\\ -52\\ -56\\ -57\\ -58\\ -59\\ -60\\ -61\\ -62\\ -63\\ -66\\ -65\\ -66\end{array}$		65.7 212 39.3 18.1 84				ML ML	(40'-45') Same as above. Odor.

Drillen Carl Pederson Log by Tom Stolworthy Sampling Method Split Spoon	o 50%
Description (Color, Texture, Structure) (Color, Struc	
0 1 2 1 2 1 2 1 3 177 4 5 6 7 7 329 5 5 6 7 7 329 9 10 11 12 12 65.7 13 65.7 14 15 15 16 17 73.6 5 SW (10'-15') Light brown, wet, fine and coarse SAND, little medium trace fine gravel. 13 17 14 15 15 16 17 73.6 18 19 20 57 21 57 22 57 23 57 24 25 25 192 28 192 192 5W (25'-30') Same as above, trace coarse sand.	n sand,



Well Number <u>PT-9</u>

Depth (Feet) Well Construction PID Reading (nom)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Troce <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
f_{1} f_{2} f_{2} f_{3		Recov		nscs	

3	12 E.	MA	IN S	TRE	EET	- •		Well NumberPT-101		
	ATCH					2		Project Number		
	HONE:						30 Sea Cliff Ave., Glen Cove N.Y.			
-								© PT−91		
•							58' Diameter8"	PT-95 O WW-11PS		
							, ····	PTMW-15		
							<u>20'</u> Slot Size <u>0.020"</u>	PTMW-11		
-							35' Type Sch 40 pvc	● PT-105 + PTMW-25 + · ● PT-111 + PTMW-21		
Drilling Co. Land, Air & Water Env. Drilling Method Hollow Stem Auger Driller Carl Pederson Log by Tom Stolworthy Sampling Method Split Spoon										
			<u></u>		юу		<u>Sumpting metho</u>			
	Construction	6uipi	r Count ¤ple #	y (%)	Log	Class	Des	scription		
- EF	nstru Rec	ppm)	Blow Co Sample	Recovery	Graphic		(Color, Tex	tture, Structure) Some 20% to 35%, And 35% to 50%		
Depth (Feet) Well		i g	SB	Re	č	ŝn	Trace <10%, Little 10% to 20%,	Some 20% to 35%, And 35% to 50%		
						٨٩٩	(0-6") Asphalt/basecoarse. Har	nd dug to 5 feet		
					20000000		(6"-1.5') Dark brown, dry, fine a	nd medium SAND, trace coarse sand,		
- 2						sw	trace fine gravel. (1.5'-3.5')Light brown, dry, fine S	AND, some medium sand.		
- 5		25.3	ĺ			OL	(3.5–5) Dark brown/black, mois little coarse gravel.	t, CLAY ond PEAT, some fine sond,		
- 6				· .						
- 7	1	16.5	•			sw), little medium sand, trace af silt,		
							trace coarse sand.			
-10					Const of the					
-11		ľ								
-12		22				SP		e SAND, some medium and coarse		
-14							sand, trace fine gravel			
-15										
-16										
-17		13.2				SM	(15'-20') Light brown, moist, fine coarse sand, trace fine	SAND and SILT, little medium and		
-19								grave.		
-20					┝┼┾┼┼┼					
-21										
-22 -23		14.4				SМ	(20'-25') Light brown, wet, fine S	SAND, some silt, trace fine gravel.		
-24										
-25					╟┼┼┼┽	-	. · ·			
-26 27		ľ								
4 27		15.3				SM	(25'—30') Same as above, little o	coarse sand.		
-29										
-30	1 18338									
LU			<u>II</u>	<u>11</u> -	<u>II</u>	Ш				



Well Number <u>PT-101</u>

Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Łag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
- 30 - 31 - 32 - 33 - 34 - 35		14.8				SM	(30'-35') Light brown, soturated, fine SAND and SILT, some coarse sand.
-36 -37 -38 -39	-37 -38 -39	11.0				SM	(35'-40') Same as above.
- 40 - 41 - 42 - 43 - 44 - 45		7.4				SM	(40'-45') Same as obove.
- 46 - 47 - 48 - 49 - 50		6.9				SW	(45'-50') Light brown, saturated, fine and coarse SAND.
-51 -52 -53 -54 -55							(50'-55') No recovery.
-56 -57 -58 -59							(55'-58') No recovery.
-60 -61 -62 -63 -64 -65							
-66							

PHONE: (631) 207-9005 Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove Note Date Drilled 9/30/02 T.D. of Hole 60' Diameter 8" T.O.C. NA Water Depth, Initial NA Screen: Diam. 4" Length 20' Slot Size 0.020 Casing: Diam. 4" Length 35' Type Sch 40 Drilling Co. Land, Air & Water Env. Drilling Method Hollow Stem Auger Driller Carl Pederson Log by Tom Stolworthy Sampling Method	© PT-91 PT-95 © WW-11PS MW-11PD PTMW-15 PT-101 © MW-11PI PTMW-15 PT-101 © PTMW-21 © PT-105 PTMW-21
Date Drilled 9/30/02 T.D. of Hole 60' Diameter 8" T.O.C. NA Water Depth, Initial NA Screen: Diam. 4" Length 20' Slot Size 0.024 Cosing: Diam. 4" Length 35' Type Sch 40 Dritting Co. Land, Air & Water Env. Dritting Method Hollow Stem Auger Dritter Carl Pederson Log by Tom Stolworthy Sampling Method	A.Y. () PT-93 () PT-95 () WW-11P5 () WW-11P0 () PT-101 () WW-11P1 () PT-101 () WW-11P1 () PT-105 () PT-105 () PT-105 () PT-101 () PT-105 () PT-101 () PT-105 () PT-101 () PT-101 () PT-105 () PT-101 ()
T.O.C. NA Water Depth, Initial NA Screen: Diam. 4" Length 20' Slot Size 0.024 Cosing: Diam. 4" Length 35' Type Sch 40 Dritting Co. Land, Air & Water Env. Dritting Method Hollow Stem Auger Dritter Carl Pederson Log by Tom Stolworthy Sampling Method	PT-9S @ WW-11PS MW-11PD PT-10/ @ MW-11PD PT-10/ @ MW-11PI PTMW-11 PTMW-11 PTMW-2S @PT-101 PTMW-21 PTMW
Screen: Diam. 4" Length 20' Slot Size 0.024 Casing: Diam. 4" Length 35' Type Sch 40 Drilling Co. Land, Air & Water Env. Drilling Method Hollow Stem Auger Driller Carl Pederson Log by Tom Stolworthy Sampling Method	mw-11PD PT-101 © mw-11PD PT-101 © mw-11PI PTMW-11 PTMW-11 PTMW-21 PT-101 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21
Casing: Diam. <u>4</u> " Length <u>35</u> ' Type <u>Sch 40</u> Drilling Co. <u>Land, Air & Water Env.</u> Drilling Method <u>Hollow Stem Auger</u> Driller <u>Carl Pederson</u> Log by <u>Tom Stolworthy</u> Sampling Met	pr PT-101 © MW-11Pl PTMW-11 PTMW-25 © PT-105 PTMW-25 © PT-111 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21 PTMW-21
Drilling Co. Land, Air & Water Env. Drilling Method <u>Hollow Stem Auger</u> Driller <u>Carl Pederson</u> Log by <u>Tom Stolworthy</u> Sampling Met	© _{PT-111} *PTMW-21 hod Split Spoon escription Texture, Structure)
Driller <u>Carl Pederson</u> Log by <u>Tom Stolworthy</u> Sampling Met	hod Split Spoon escription Texture, Structure)
	escription Texture, Structure)
	Texture, Structure)
	Texture, Structure)
(Color, Color, Color, CS Color, CS CS Color, CS CS CS CS CS CS CS CS CS CS CS CS CS C	
- 0 - 1 Asphalt/basecoarse.	Hand dug to 5 feet.
- 2 - 3 - 4 2.7 SC (6"-5') Brown, moist, fine S	AND and CLAY.
- 5 - 6 - 7 - 7 - 7 - 8 - 9 - 10	medium SAND, trace fine gravel.
-11 -12 -13 -14 -15	medium SAND, little coarse sand.
-16 -17 -18 -19 -20	medium SAND, little coarse sand, trace
	e SAND and SILT, little coorse sand.
	VEL and fine SAND, little silt, trace



Well Number <u>PT-111</u>

<u> </u>		,					
	Welł Construction	PID Reading (ppm)	Count Ple #	Recovery (%)	Graphic Log	Closs	Description
<u>ج</u> ع	struc	л Red	ple C	over	hic		(Color, Texture, Structure)
Depth (Feet)	Con	Dia Dia	Blow Cou Sample	Rec	Grap	uscs	Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-30							
-31							
-32							
-33		2.2				GW	(30'-35') Light brown, wet, fine and coarse SAND, some fine grave!.
-34							
- 35					////		
-36							
-37		5.3				CW	(35'-40') Light brown, wet, fine, medium and coarse SAND, some
-38		5.5				GW	fine gravel. Poorly sorted.
- 39							
- 40							
-41							
- 42		5.2				Gw	(40'-45') Same as above, gravel is subrounded.
⊢43 44							
-45							
-46							
- 47							
- 48		4.6				GW	(45'-50') Same as above, saturated.
- 49							
-50							
-51							
-52		4.5				GW	(50'-55') Rock at 50'. Light brown, saturated, fine, medium and
-53 -54							coarse SAND, some gravel.
-55							
-56							
-57							(55'-60') Same as above.
-58		6.9				GW	
-59							
-60	<u>Constant of the Constant Structure (Co</u>				<u> </u>		
- 61							
-62							
-63 -64							
-65							
-66					_		
	Ll	u	11		u	u	

312 PATC Project Pail (Date Drilled T.O.C.	10/4/02 NA 4" 4" Id, Air & Wo	STREE N.Y. 11 7-9005 Cove Loc T.D. Water Leng Lengt Lengt	T 772 atior of Ho Dep th Drillir	Well Number <u>PT-121</u> Project Number <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PTMW-45</u> <u>PT-121</u> <u>PTMW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5</u> <u>MW-12P5 <u>MW-12P5 <u>MW-12P5 <u>MW-1</u></u></u></u>
Depth (Feet) Well Construction	PID Reading (ppm) Blow Count Somple #	Recovery (%) Granhir Loo	USCS Class	
$ \begin{array}{c} 0 \\ -1 \\ -2 \\ -3 \\ -4 \\ -5 \\ -6 \\ -7 \\ -8 \\ -9 \\ -10 \\ -11 \\ -12 \\ -13 \\ -14 \\ -15 \\ -16 \\ -17 \\ -18 \\ -19 \\ \end{array} $	3.1 1.9 2.9 3.2		PT SC	 (0-6") Asphalt/bosecoarse. Hand dug to 5 feet. (6"-5') Brown/black, dry, fineSAND, medium SAND and PEAT. (5'-10') Light brown, moist, fine SAND, some clay. (10'-15') Some as above. (15'-20') Light brawn, wet, fine SAND and SILT, little fine gravel.
-20 -21 -22 -23 -24 -25 -26 -27 -28 -29 -30	1.8		SM	(20'-25') No recovery. (25'-30') Light brown, wet, fine SAND and SILT, little fine gravel.



Well Number _____PT-121

Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Somple #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
30 31 32 33 34 35		4.2				SM	(30'-35') Light brown, wet, fine SAND and SILT, little fine gravel.
36 37 38 39 40		2.9				SM	(35'-40') Same as above.
41 42 43 44 45		2.8				SM	(40'—45') Light brown, wet, fine SAND and SILT, some fine gravel.
46 47 48 49							(45'-50') No recovery.
50 51 52 53 54		2.8				SM	(50'—55') Light brown, wet, fine SAND and SILT, some fine gravel.
-55 -56 -57 -58 -59						SM	(55'-58') Same as above.
·60 ·61 ·62 ·63 ·64							
•65 •66							

	ENVI 312 PATC PHONE	HOGU	AIN S E, N	STR. 7. Y.	ÉET 1173		Project Number	
-							n 30 Sea Cliff Ave., Glen Cove N.Y.	
							ble <u>58</u> Diameter <u>8</u> "	
							th, Initial <u>NA</u> $PT-13i \odot$ $PT-13i \odot$ $WW-12P5$ WW-12P1 WW-12P1	2PD
							35' Type <u>Sch 40 pvc</u>	
							ng Method Hollow Stem Auger	
					, by_		Tom Stolworthy Sampling Method Split Spoon	
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Somple #	Recovery (%)	Graphic Log	USCS Closs	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 5	50%
- 0 - 1 - 2 - 3		4.7					p (0-6") Asphalt/basecoarse. Hand dug to 5 feet. (6"-5') Black/brown, dry, medium SAND, some fine sand, some	pea
- 4 - 5 - 6 - 7 - 8 - 9 - 10		7.6				sw	little fine gravel. V (5'-10') Brown, moist, medium SAND, some fine sand.	
-11 -12 -13 -14 -15		5.1				sc	(10'-15') Light brown, moist to wet, fine SAND, same clay.	
-16 -17 -18 -19 -20		4.9				sм	1 (15'-20') Light brown, wet, fine SAND and SILT, little clay.	
21 22 23 24 25		5.6				sм	A (20'-25') Same as above.	
-26 -27 -28 -29 -30							(25'-30') No recovery.	



Well Number ____ PT-131___

				T		<u>п. </u>	
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-30 -31 -32 -33 -34 -35 -36 -37 -38 -39		3.2				SM	(30'-35') No recovery. (35'-40') Brown, saturated, fine SAND and SILT.
-40 -41 -42 -43 -44 -45 -46		4.7				SM	(40'-45') Same as above, little fine gravel.
- 47 - 48 - 49 - 50 - 51 - 52 - 53 - 54	17 18 19 11 50 11 51 11 52 11 53 11						(45'-50') No recovery. (50'-55') No recovery.
-55 -56 -57 -58 -59 -60 -61 -62 -63 -64 -65 -66							(55'-58') No recovery.

	312 PATCA PHONE	E. MA HOGU : (631	IN S E, N) 207	STRI .Y. -90	1177 05	72	Well Number <u>PT-14</u> Project Number					
							30 Sea Cliff Ave., Glen Cove N.Y.					
							e <u>58'</u> Diameter <u>8" *</u> ©PT-14S					
							h. Initial <u>NA</u> @PT-141					
	Screen: Diam. 4" Length 20' Slot Size 0.020" MW-11PD OPT-15S MW-11PD 4" Length 35' Type Sch 40 pvc MW-11PI OPT-15S Casing: Diam. 4" Length 35' Type Sch 40 pvc MW-11PI OPT-15S											
							Type Sch 40 pvc + MW-11PI PTMW-11 @PT~15I					
							g Method <u>Hollow Stem Auger</u>					
Driller	<u>Carl F</u>	Pederso	n	Log) by	<u>T</u> (om Stolworthy Sampling Method Split Spoon					
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%					
- 0 - 1 - 2 - 3		9.2					(0-6") Asphalt/basecoarse. Hand dug to 5 feet. (6"-5') Black, medium SAND and PEAT, trace fine gravel.					
- 4 - 5 - 6 - 7 - 8 - 9 -10 -11		6.0				sw	(5'-10') Dark brown/black, dry, medium SAND, some fine sand, little coarse sand.					
-12 -13 -14 -15 -16 -17		7.0					(10'-15') Light brown, moist, fine SAND, some medium sond, little coarse sand. (15'-20') Same as above, little fine gravel.					
-18 -19 -20 -21 -22 -23 -24 -25 -26 -27 -28 -29 -30		7.7				sw	(20'-25') Light brown, saturated, fine SAND, trace medium and coarse sand. (25'-30') Light brown, saturated, fine GRAVEL and fine SAND, little medium and coarse sand.					



Well Number ____ PT-141

Date D T.O.C. Screen: Casing: Drilling	Diam. Diam. Diam.	E. M2 HOGL E: (63) Corp. G 10/1/0 NA d, Air	41N S /E, N 1) 207 Slen Cc 02 4" 4" & Wat	STR 7. Y. 7-90 	EET 117 05 Locat .D. of /ater [ength ength ength	72 Hold Dept	Well Number PT-151 Project Number <u>30 Sea Cliff Ave., Glen Cove N.Y.</u> <u>58'</u> Diameter <u>8" *</u> n, Initial <u>NA</u> <u>20'</u> Slot Size <u>0.020"</u> <u>35'</u> Type <u>Sch 40 pvc</u> <u>9 Method Hollow Stem Auger</u> <u>6 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Method Stem Auger</u> <u>6 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 PT-151</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw-11Pl</u> <u>9 Mw</u>
Depth (Feet)	Weil Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-0 -1 -2 -3 -4 -5 -7 -9 -10 -11 -12 -13 -14		22.4 14.5 18.8				Pt SC	 (0-6") Asphalt/basecoarse. Hand dug to 5 feet. (6"-5') Dark brown/black, dry, fine and medium SAND, some Peat, little clay. (5'-10') Dark brown, dry, fine and medium SAND, some clay, little coarse sand. (10'-15') Brown, saturated, fine SAND, some coarse sand.
-15 -16 -17 -18 -19 -20 -21 -22 -23 -23 -24		23.5 13.4					(15'-20') Brown, saturated, fine and coarse SAND, some fine gravel. (20'-25') Dark brown, saturated fine SAND and fine GRAVEL, little coarse sand.
-25 -26 -27 -28 -29 -30		17				GW	(25'-30') Dark brown, saturated, fine GRAVEL, some fine and coarse sand.



Well Number ____ PT-151____

Depth (Feet)	Welt Construction	PlD Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
- 30 - 31 - 32 - 33 - 34 - 35		10				GW	(30'-35') Dark brown, saturated, fine GRAVEL, some fine and coarse sand.
36 37 38 39 40		9				GW	(35'-40') Same as above.
41 42 43 -44							(40'-45') No recovery.
-45 -46 -47 -48 -49							(45'-50') No recovery.
-50 -51 -52 -53 -54		8.3				SM	(50'-55') Light brown, saturated, SILT and fine SAND.
55 56 57 58 59		7.7				SM	(55'—58') Same as above, little coarse sand.
-60 -61 -62 -63							
-64 -65 66							

	12 PATC	RO-S E. MA HOGU E: (631	IN S E, N	5 TR. . Y.	Е <i>ет</i> 1177			Well Number <u>PT-16</u> Project Numbe <u>r</u>
Date Driller T.O.C Screen: Di Casing: Die Drilling Co	d am am	10/1/0 NA 4 d. Air	02 	T. W Le <u>er Er</u>	D. of ater D ength ength <u>nv.</u> Dr	Hole epti 	30 Sea Cliff Ave., Glen Cove N.Y. 58' Diameter n, Initial NA 20' Slot Size 0.020" 35' Type Sch 40 pvc 9 Method Hollow Stem Auger om Stolworthy Sampling Method	© PT-175 © PT-175 • MW-4Pi • MW-4Pi • MW-4Pi • MW-4PD • MW-4PD • MW-4PD • MW-4PD • MW-4PD • MW-4PD • MW-4PD • MW-4PD
Depth (Feet) weit	Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Lag	USCS Class		scription «ture, Structure) Some 20% to 35%, And 35% to 50%
- 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 10 - 11 - 10 - 11 - 11 - 2 - 3 - 4 - 7 - 7 - 10 - 11 - 15 - 7 - 7 - 10 - 11 - 11 - 12 - 13 - 14 - 15 - 10 - 11 - 12 - 13 - 14 - 15 - 10 - 11 - 12 - 13 - 14 - 15 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 10 - 11 - 12 - 16 - 17 - 10 - 11 - 12 - 16 - 17 - 16 - 17 - 11 - 12 - 16 - 17 -	14.8 75.4 169				SW Pt SW SW	sand and fine gravel. (3'-4') Dark brown/black, mois (tree raots, etc.). (4'-5') Dark brown, dry, fine a (5'-10') Dark brown, wet, fine S (10'-15') Brown, wet, fine SAND, gravel.	fine and medium SAND, trace coarse at, PEAT and CLAY, organic matter and medium SAND. GAND, litle clay, little fine gravel.	
$ \begin{array}{c} -18\\ -19\\ -20\\ -21\\ -22\\ -23\\ -24\\ -25\\ -26\\ -27\\ -28\\ -29\\ -30\\ \end{array} $		194 201 196				SM		little gravel, little clay. SAND, some silt, little coarse sand. fine SAND, SILT and coarse sand,



Well Number ____ PT-16

-30 -31 -32 359 -33 -34 -35 -36 -37 227 -38 -39 -40 -41 -42 -44 -44 -44	Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-45 -46 -47 -48 -49 -50 -51 -52 -53 -54 -55 -56 -57 -58 -59 -60 -61 -62 -63 -64	$\begin{array}{c} -30\\ -31\\ -32\\ -33\\ -34\\ -35\\ -36\\ -37\\ -38\\ -39\\ -40\\ -41\\ -42\\ -43\\ -44\\ -45\\ -46\\ -47\\ -48\\ -49\\ -50\\ -51\\ -52\\ -56\\ -57\\ -58\\ -56\\ -57\\ -58\\ -59\\ -60\\ -61\\ -62\\ -63\\ \end{array}$	Well Well Cons Cons	359 227 84.5	Blow	Reco		SM SM	Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50% (30'-35') Light brown, saturated, SILT and coarse SAND, some fine sand. (35'-40') Light brown, saturated, fine SAND, some medium and coarse sand, some silt. Poorly sorted. (40'-45') Brown, saturated, fine GRAVEL and fine SAND. (45'-50') Same as above. (50'-55') No recovery.

312 PATC	IRO-S E. MA CHOGU E: (631 Corp. G	AIN S VE, N V) 207	5TRI .Y. '-900	ÉET 1177 05	72	Well Number <u>PT-171</u> Project Number <u>30 Sea Cliff Ave., Glen Cove N.Y.</u> @PT-151
						58' 9" #
						e Diameter ©PT-17S → MW-4Pi h, Initial NA
						<u>35'</u> Type <u>Sch 40 pvc</u> [©] PT-18S
						Method Hollow Stem Auger
						om Stolworthy Sampling Method Split Spoon
		<u>п</u>			1	
nctio	adine	e ⊯t	ery (%		Class	Description
Depth (Feet) Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	uscs ((Color, Texture, Structure)
		ĒŌ	2	Ū	Š	Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
					Asp	(0-6") Asphalt/basecoarse. Hand dug to 5 feet.
-2 -3 -4	14.2				PT	(4'-5') Black, dry, PEAT and CLAY, some medium sand. Organic odor.
- 5 - 6 - 7 - 8 - 9 -10 -11	16.4				sc	(5'—10') Brown/black, dry, fine and medium SAND, some clay. Boulder at 9 feet.
-12 -13 -14 -15	23.7				sw	(10'-15') Brown, wet, fine SAND, trace fine gravel.
-16 -17 -18 -19 -20	16.6				sw	(15'-20') Brown, wet, fine SAND, little fine gravel. Poor recovery.
-21 -22 -23 -24	17				sw	(20'-25') Brown, saturated, fine SAND, some medium sand, little fine gravel.
-25 -26 -27 -28 -29 -30	44.8				GW	(25'-30') Brown, wet, fine GRAVEL and fine SAND, trace coarse sond.



Well Number _____PT-171

Deoth	(Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
	30 31 32 33 34 35							(30'-35') No recovery.
-3	36 37 38 39							(35'-40') No recovery.
	42 43		24				sw	(40'-45') Brown, wet, fine SAND. Poor recovery.
- 4 - 4 - 4	46 47 48 49 50		17.3				sw	(45'-50') Light brown, wet, fine SAND, some medium and coarse sand.
	51 52 53 54 55		28.1				sw	(50'-55') Same as above.
-5	56 57 58 59							(55'-58') No recovery.
	50 51 52 53 54							· .
	55 56							

	ENVI 312 PATC PHONE	E. MA Hogu	AIN S VE, N	5 <i>TR.</i> . Y.	ЕЕТ 1177			Well Number <u>PT-18</u> Project Numbe <u>r</u>		
		-	-				30 See Cliff Ave Clep Cove NY	0 PT-16		
-							<u>30 Sea Cliff Ave., Glen Cove N.Y.</u> e <u>58'</u> Diameter <u>8" *</u>	● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●		
T.O.C.		NA		W	later D)epti	h, InitialNA	●PT-17I		
Screen:	: Diam	4	L"	L	ength		20' Slot Size 0.020"			
-							<u>35'</u> Type <u>Sch 40 pvc</u>	©PT-185 c PT-181@ c		
-							g Method Hollow Stem Auger			
Driller_	Carl F	ederso	<u>n</u>	Log	g loy	1	om Stalworthy Sampling Metho	d Split Spoon		
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	(Calas Tau	cription ture, Structure) Some 20% to 35%, And 35% to 50%		
- 0 - 1						Asp	(0-6") Asphait/basecoarse. Har	nd dug to 5 feet.		
- 2 - 3 - 4 - 5		6.3				PT	(6"-5') Black/brown, dry, PEAT	and medium SAND.		
- 7 - 7 - 8 - 9 - 10		8.9				sw	(5'—10') Dark brown, dry, fine ar	nd medium SAND, troce coarse sand.		
-11 12 13 14 15		12				sw	(10'-15') Brown, wet, fine SAND, sand.	some medium sand, trace coarse		
-16 -17 -18 -19 -20		10.9				sw	(15'-20') Same as above. Boulder	r at 18 feet.		
21 22 23 24		7.8				sw	(20'-25') Same as above.			
25 26 27 28 29 30		8.4				sw	(25'—30') Light brown, wet, fine S gravel.	SAND, some medium sand, little fine		



Well Number PT-181

-	П	c II			6		 _	
		Well Canstruction	PID Reading (ppm)	Blow Count Sample #	Recovery (%	Graphic Log	Class	Description
		struc	Reo L	င္လ န	JVEL	걸		(Color, Texture, Structure)
Depth	Feel	Vell		Nog mog	Sect	Ē	uscs	Troce <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
L ^a	키	<u>>0</u>	н.)			6		
-3	0	888 888						
-3	1							
-3	2							
-3	3	anda area	7.5				24	(30'-35') Light brown, wet, fine SAND, some medium sand, little fine gravel.
-3	11							y + - ·
-3	11.							
-3	- 112							
-3	L		10.5				sw	(35'-40') Same as above.
	- 12							
	11							
-4								
-4								
-4	- I P		6.8				sw	(40'-45') Light brown, wet, fine SAND, little coarse sand.
-4								
- 4	- 11-							
	5							
-4	6							
- -4	7		13				sw	(45'-50') Same as above, trace coarse sand.
-4	8		13				311	
-4	9							
-5	0							
-5	1							
-5	2	여름이	10 7					(FO' FE') Liebt brown wet (ing SAND and allow
	3		10.7				SC	(50'-55') Light brown, wet, fine SAND, some clay.
	4							
-5	5	約日刻				HA		
-5	6							
	7		18.6					(55'-60') Same as above.
-5			10.0				30	
-5								
-6		ار به معالی می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می مراجع از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می مراجع از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از می از م						
-6	- 11							
	2							
	3							
-6								
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Ĭ								
			l	U		u		

	312	RO-S E. MA HOGU	4 <i>IN</i> .	STR	EET			Well Number	
	PHON	•	-					Project Number	
							<u>30 Sea Cliff Ave., Glen Cove N.Y.</u> e <u>57'</u> Diameter <u>8"</u>	*	GPT-148
							h, Initial <u>NA</u>	© ^{PT-91}	● P [†] -14I
Screer	n: Diam.		4"	L	ength		<u> 10' </u>	© 1-93 ⊕ ₩₩-11PS	@#T-163
							45'Type <u>Sch 40 pvc</u>		+PTMW-1S
							g Method Hollow Stem Auger	PT-101 PTMW	(−1) ● PT−15I
	-						om Stolworthy _ Sampling Metho	dSplit_Spoon	
			11						
	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	60 J J	Class	Des	scription	
Depth (Feet)	ell	D d X (n d	ow (ecov	Graphic		(Color, Tex) Trace <10%, Little 10% to 20%, 1	ture, Structure) Some 20% to 35% Ar	a 159 to 509
	<u>≥ŭ</u>		ΒS		ۍ ا	5			
μo					 	1			
- 1					┣-				
- 2					-		(0'-4') Hand dug to 5 feet. 6"	Asphalt/basecoarse.	
- 3 - 4									
- 5				20%		sw	(4'-6') Brown, dry, fine SAND, I	little course sand and	fine gravel
- 6									
I 7					 		:		
- 8					—				
- 9 -10		20.3		30%		CW			
-11		20.5		30%		3₩	(9'-11') Brown, wet, fine SAND,	some medium sand, t	race fine gravel.
-12					-				
-13					-				
-14		4.0		1000					
-15 -16		19		40%		SW	(14'–16') Grey, wet, medium and	coarse SAND, little fin	ie gravel.
-17					_				
-18					 				
-19						_			
-20 -21		40.3		50%		SW	(19'—21') Grey, wet, medium and	coarse SAND, little fin	e gravel.
-22									
-23									
-24									
-25		8.3		60%		SW	(24'—26')Grey/brown, wet, fine SA little fine gravel.	AND, some medium ar	nd coarse sand,
-26 -27									*
-28					L				
-29									
-30	Ikea ka	80.3		50%		sw	(29'—31')Same as above.		
					<u> </u>				

File: PTMW11LOG.dwg



Well Number ____ PTMW-11

Depth (Feet)	Well Canstruction	PtD Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Troce <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
30 31 32		5.0		40%		sw	(29'-31') Same as above.
-33 -34 -35 -36 -37 -38		10.6		50%		SP	(34'36') Light brown, wet, fine and medium SAND, some coorse sond, little fine grave!.
- 39 - 40 - 41 - 42		17.9		30%		GP	(39'-41') Light brawn, wet, fine GRAVEL, some coarse and medium sand, little fine gravel.
-43 -44 -45 -46 -47		4.6		60%	- ////	sc	(44'-46') Light brown, wet, fine SAND, some clay, little medium sand, 2" grey, clay lens at 45'.
- 48 - 49 - 50 - 51 - 52 - 53		3.9		70%	- ////////////////////////////////////	sc	(49'-51') Light brown, wet, fine SAND, little medium sand, then grey, maist, clay and silt.
-54 -55 -56 -57 -58		3.1		80%	- -	SC	(54'-56') Same as abave.
-59 -60 -61 -62 -63 -64							
-65 66							

	312 PATO PHON		AIN . JE, N 1) 201	STR V.Y. 7–90	EET 117 05	72	<u>30 Sea Cliff Ave., Glen Cove N.Y.</u>	Well Number Project Number	<u>~</u>
							e <u>59'</u> Diameter <u>8"</u>	1 T	©≊1-:38 X PTMW−1S
T.O.C.		NA		v	Voter I	Dept	h, Initial <u>NA</u>	@ 97-105 _PTMW-25	• ● PT-151
Casing:	Diam.	4	4"	L	ength	<u> </u>	10' Slot Size <u>0.020"</u> 45' Type <u>Sch 40 pvc</u>	PTMW→2i	© PT-161 © PT-175
-							g Method <u>Hollow Stem Auger</u> Sabine Winslow Sampling Metho	d Split Spoon	08.493
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class		cription ture, Structure) Some 20% to 35%, Ar	id 35% to 50%
- 0 - 1 - 2 - 3		0.0					(0'-4') Hand dug to 5 feet. 6"	Asphalt/basecoarse.	
- 4 - 5 - 6 - 7		0.0				SP	(4'—6') Brown, wet, medium to gravel, trace cobbles.	coarse SAND, little fir	ne and coarse
- 9 -10 -11 -12 -13		0.0				SP	(9'—11') Brown, wet, medium to gravel.	coarse SAND, little fir	e to coarse
-14 -15 -16 -17 -18		0.0				SP	(14'-16') Same as above.		
-19 -20 -21 -22		0.0		15%		SP	(19'-21')Same as above.		
-23 -24 -25 -26 -27							(24'-26')No recovery.	, ·	
-28 -29 -30		0.0				SP	(29'31')Dark brown, wet, fine to gravel.	coarse SAND, little fi	ne to coarse

PTMW21LOG.DWG



ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 PHONE: (631) 207-9005

Well Number ____ PTMW-21

Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove N.Y. Date 10/14/02

	Well Construction	PID Reading (ppm)	Count ble #	Recovery (%)	Graphic Log	Class	Description
€.€		Э. Ке	Blow Cou Sample ∦	cover	iphic		(Color, Texture, Structure)
Depth (Feet)	C Kel	E e	Sai Sai	Re	Gro	nscs	Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-30		N N				SP	
-31							
-32 -33		Š.					
-34							
-35		0.0			a da na san Na san san san Na san san san san	SP	(34'-36') Brown, wet, fine to coarse SAND, little fine to coarse gravel.
-36		S.					
-37 -38							
-39					1.2.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1		
- 40		0.0				sw	(39'-41') Same os above.
-41					<u></u>		
- 42		2					
-43 44							
-45		0.0		5%		SP	(44'-46') Poor recovery, rock in spoon.
- 46					(a) a (a) a		Brown-gray, wet, fine to coarse SAND, little fine to coarse gravel.
- 47 - 48							
49							
-50		0.0				CL	(49'-51') Brown, wet, dense SILT and CLAY.
-51							
-52 -53							
-54							
-55		0.0					(54'-56') Brown, wet, dense SILT and CLAY to 55 feet then
-56							Brown, wet, dense SILT.
-57 -58							
-59		3			_		
-60							
- 61					\vdash		
-62 -63							
$\begin{bmatrix} 03\\-64 \end{bmatrix}$					—		
65					\vdash		
-66							
L	<u> </u>						

312 E	RO-SCIEN 1. MAIN S	TRE	ET			Well NumberPTMW-21
The second second second second second second second second second second second second second second second se	IOGUE, N (631) 207			٢		Project Number
Project <u>Pall Co</u>	orp. Glen Co	ve L	ocatio		30 Sea Cliff Ave., Glen Cove N.Y.	MW-5PI P*- (05.0) MW-5P # MW-5P # MW-5P PT-111.0
ate Drilled <u>1</u>	0/11/02	_ T.D). of H	lole	9 <u>57'</u> Diameter <u>8"</u>	И. Ж. [©] _{РТ-31} РТМЖ-35 [•] Ж.
T.O.C.	NA	Wa	ter De	ptł	n, InitialNA	
Screen: Diam	4"	Ler	ngth _		10' Slot Size0.020"	PTMW-51 0 PTMW-41 PT-12
Casing: Diam	4"	Ler	ngth _		45' Type Sch 40 pvc	Ø ⊕ _{PT-41} ₩₩~10PS
Drilling Co. Land	, Air & Wate	er Env	1. Drill	ling	Method Hollow Stem Auger	
Drille <u>r Carl P</u>	ederson	Log	by	T	om Stolworthy Sampling Metho	d Split Spoon
Dep th (Feet) Well Construction	PID Reading (ppm) Blow Count Sample #	Recovery (%)	<u>.</u>	USCS Class		cription ture, Structure) Some 20% to 35%, And 35% to 50%
- 0 - 1 - 2 - 3 - 4 - 5 - 6		10%	 		(0'-4') Hand dug to 5 feet. 6" (4'-6') Black/brown, moist, CLA	Asphalt/basecoarse. Y and fine SAND, some coarse sand.
L 7 8 -9 -10 -11 -12 -13	9.6	20%	- - - -	sw	(9'—11') Light brown, wet, coarse	e and medium SAND, little fine gravel.
-14 -15 -16 -17	42.1	50%	S	ŝW	(14'—16') Grey, wet, medium and	coarse SAND, little fine gravel.
-18 -19 -20 -21 -22	136.2	30%		SP	(19'—21') Light brown, wet, mediu little fine and coarse gr	m and coarse SAND, some fine sand, avel.
-23 -24 -25 -26 -27	26.2	5%		5м	(24'-26')Light brown, wet, fine S	AND and SILT.
-28 -29	51.2	15%	-	5W	(29'—31') Brown, wet, medium SAI	ND, some coarse sand.



ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 PHONE: (631) 207-9005

Well Number ____ PTMW-31

Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove N.Y. Date 10/11/02

Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	
-30 -31 -32 -33 -34 -35 -36 -37		37.1		35%		sw sw	
-38 -39 -40 -41 -42		32.3		40%		SW	W (39'-41') Same as above.
- 43 - 44 - 45 - 46 - 47		44.8		50%	- - -	sc	C (44'—46') Light brown, wet, medium and coarse SAND, little medium gravel, trace fine sand and fine gravel.
-48 -49 -50 -51 -52		22.0		30%	_ ////////////////////////////////////	sc	C (49'-51') Light brown, wet, SILT and CLAY, little fine sand.
-53 -54 -55 -56 -57 -58		29.3		40%		sc	C (54'-56') Light brown, wet, fine and medium SAND, trace coarse sand
-59 -60 -61 -62 -63							
-64 -65 -66							

		312 PATC	RO-S E. MA HOGU	AIN S E, N	STR. 7. Y.	EET 1177			Well Number <u>PTMW-41</u> Project Numbe <u>r</u>
		PHONE	•						PTHW-AS
~	-							<u>30 Sea Cliff Ave., Glen Cove N.Y.</u> <u>58'</u> Diameter <u>8</u> "	P7164wc-41 @ PT-121
								h, Initial <u>NA</u>	1977 To 40
								10' Slot Size0.020"	ि २४ - ३३
								45' Type Sch 40 pvc	● PT-51
								g Method Hollow Stem Auger	
	_							abine Winslow Sampling Method	dSplit_Spoon
					_	ir	1	F J	
	Depth (Feet)	Welt Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%	Graphic Log	USCS Class	(0) -	cription ture, Structure) Some 20% to 35%, And 35% to 50%
	- 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7		61.2 96.3				SP	(0'-4') Hand dug to 5 feet. 6" (4'-6') Dark brown-gray, coarse medium gravel, trace fir	e to medium SAND, little coarse and
~	- 8 - 9 -10 -11 -12 -13		118				sw	(9'—11') Light brown, wet, fine to trace fine and coarse g	o medium SAND, little coarse sand, ravel.
	14 15 16 17		158				sw	(14'—16') Light brown, wet, fine to little fine and medium o	o medium SAND, little coarse sand, gravel.
	-18 -19 -20 -21 -22		381		15%		GW	(19'—21')Gray, wet, coarse SAND medium sand, trace fine	and fine and medium GRAVEL, little sand, trace fine cobble.
<u>.</u>	-23 -24 -25 -26 -27 -28		178		15%		SP	(24'—26') Light brown, wet, medium medium gravel, trace.co	m to coarse SAND, little fine to parse gravel.
	-29 -30		59.3				GW	(29'—31') Light brown, wet, coarse little medium sand, trac	e SAND and fine to medium GRAVEL, e cobbles.

FILE: PTMW4ILOG.DWG



ENVIRO-SCIENCES, INC.
 312 E. MAIN STREET
 PATCHOGUE, N.Y. 11772
 PHONE: (631) 207-9005

Well Number ____ PTMW-41

Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove N.Y. Date 10/12/02

Depth (Feet)	Well Construction	P1D Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Łog	USCS Class	
30 31 32 33 34 35		10.0		35%		GW SP	
36 37 38 39 40		11.9		40%			W (39'-41') Reddish-light brown, wet, dense fine SAND, little silt, trace
-41 -42 -43 -44 -45 -46		89.2		80%		ML SW	L (44'-45') Light to reddish brown, wet, SILT and CLAY, then W (45'-46') light brown, wet, fine to medium SAND, trace fine gravel.
47 48 49 50 51 52		84.3		30%		sw	W (49'-51') Light Brown, wet, medium to coarse SAND, little fine ta medium gravel, trace coarse gravel.
-53 -54 -55 -56 -57		55.3				sw	W (54'-56') Light brown, wet, fine SAND, little silt, trace medium to coarse sand.
-58 -59 -60 -61 -62 -63	<u>19 64 64 63 62 74</u> 39						
-65 -66							

	ENVI 312 PATC	E. MA	IN S	STR.	ÉET			Well NumberPTMW-51
	PHONE					~		Project Number
Pro jeci	t_Pall C	arp. G	len Co	ve	Locat	ion:	30 Sea Cliff Ave., Glen Cove N.Y	
•							e <u>58'</u> Diameter 6'	. (³ ³ ³ ³ ³ ³ ³ ³ ³
T.O.C		NA		W	ater D)epti	h, Initial <u>NA</u>	• 0 PT-11 33 0 33 0
Screen:	Diam	4		L	ength		10' Slot Size 0.020"	
Casing:	Diam	4		L.	ength		45' Type Sch 40 pvd	© PT-21
Drilling	Co. <u>Lan</u>	d. Air d	& Wat	er Er	<u>ıv.</u> Dr	illin	g Method <u>Hollow Stem Auger</u>	<u>₩₩</u> _5₽ ↓ 21-33930
Driller_	Carl F	Pederso	n	Log	, by	T	om Stolworthy Sampling Metho	od Split Spoon
	uction	ading	ount e #	ery (%)	t rog	Class	De	scription
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic	nscs	(Color, Te Trace <10%, Little 10% to 20%,	xture, Structure) Some 20% to 35%, And 35% to 50%
- 0								
- 1 - 2 - 3							(0'-4') Hand dug to 5 feet. 6	" Asphalt/basecoarse.
- 4 - 5 - 6							(4'-6') No Recovery. Rock in S	Spoon.
		1134		30%		SP	(6'-8') Brown, wet, medium SA fine gravel. Sheen, stro	ND, some coarse and fine sand, little ng odor.
- 9 -10 -11 -12		340		25%	-	SP	(9'-11') Dark brown, wet, fine c little fine gravel. HC od	and medium SAND, some coarse sand, Ior.
-13 -14 -15 -16 -17		183		20%		SP	(14'—16') Dork brown, wet, fine o ond fine gravel. HC odd	and medium SAND, some coarse sand or.
-18 -19 -20 -21 -22		302		40%		SP	(19'—21')Dark brown, wet, fine c little coarse sand. Sligh	and medium SAND, some fine gravel t odor.
-23 -24 -25 -26 -27		183		40%	-	SP	(24'26')Same as obove.	
-28 -29 -30		80.3		50%		SP	(29'—31') Same as above.	

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ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 **E** PHONE: (631) 207-9005

Well Number ____ PTMW-51

Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove N.Y.

<u> </u>								
Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recavery (%)	Graphic Log	USCS Class	Troce	Description (Color. Texture, Structure) <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-30 -31 -32 -33 -34 -35 -36 -37 -38 -40 -41 -42 -44 -45 -46 -51 -52 -53 -56 -57 -58 -56 -57 -66 -66		90.2		60%		SP	(6'-8')	Brown/grey, wet, fine and medium SAND, some coarse sand little fine grovel.

	312 PATC	HOGU	AIN S E, N	STR. 7. Y.	ЕЕТ 1177			Well Number <u>PTMW-61</u> Project Numbe <u>r</u>	
Dec. ic.	PHONE						30 Sea Cliff Ave., Glen Cove N.Y	N /PTHW-65	
•							9 <u>58'</u> Diameter <u>8"</u>	ртмw-61 ⁺ Х © _{рт−41}	
							n, Initial~7'		
							10' Slot Size0.020"		
					-			© PT−5i	
-							Method Hollow Stem Auger		
	-						om Stolworthy Sampling Metho	od Split Spoon	
	<u> </u>	6							
	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	Class		scription	
Depth (Feet)	(ell onstr	iD R PPm)	low (ecov	raphi	scs	(Color, Te Trace <10%. Little 10% to 20%.	xture, Structure) Some 20% to 35%, And 35% to 50%	%
<u> </u>	<u> ≭ 0</u>		BS	<u> </u>	5	D			
- 0									
- 1								n	
- 2		18.7						and medium SAND, some peat,	
- 4					77777		little fine grovel.		
- 5		22.6		40%		sc		and CLAY to five feet, then	
- 6							fine gravel.	medium SAND, little coarse sand a	na
- 7 - 8									
- 9									
-10		38.7		20%		sw	(9'-11') Light brown, wet, fine	SAND, some medium and coarse	
-11							sand, trace fine gravel.		
-12 -13									
-14									
-15		60.5		50%		ЯΜ	(14'—16') Tan/orange—brown, dry	to moist, fine SAND and SILT.	
-16									
-17 -18									
-19									
-20		41.2		50%		sм	(19'-21')Light brown, wet, fine !	SAND and SILT, little fine gravel.	
-21									
-22									
-23 -24									
-25		23.2		70%		sw	(24'—26')Tan/orange—brown, wet	, fine SAND, some coorse sond.	
-26			-						
L−27									
-28 -29									
-30		25.4		30%		SP	(29'—30')Tan, wet, fine SAND, so trace of fine gravel.	ome medium and coarse sand,	



ENVIRO-SCIENCES, INC. 312 E. MAIN STREET PATCHOGUE, N.Y. 11772 **2** PHONE: (631) 207-9005

Well Number ____ PTMW-61

Project Pall Corp. Glen Cove Location 30 Sea Cliff Ave., Glen Cove N.Y.

	Depth (Feet)	Well Construction	PID Reading (ppm)	Blow Count Sample #	Recovery (%)	Graphic Log	USCS Class	Description (Color, Texture, Structure) Trace <10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-	-30 -31 -32						ML	(30'-31') Tan, wet, SILT, trace of coarse sand.
	33 34 35 36 37		33.9		60%		ML	(34'-36') Tan, moist to dry, SILT, little fine sand, little clay.
	38 39 40 41 42		33.2		40%		MĻ	(34'-36') Same as above.
<u> </u>	43 44 45 46 47		8.7		60%		ML	(44'-46') Tan, moist to wet, SILT, little fine sond, little clay.
	48 49 50 51 52		5.1		50%		SM	(49'-51') Tan to orange-brown, moist, SILT, some fine sand.
	·53 ·54 ·55 ·56 ·57		11.1		70%		SM	(54'-56') Some as obove.
	-58 -59 -60 -61 -62 -63 -64 -65 -65 -66	<u>, 2. 4. 4. 5. 5. 5. 7. 7.</u>						

Feasibility Study of KMnO₄ Oxidation of VOCs and Soils For the Glen Cove, New York Site

Prepared for: Enviro-Sciences Inc.,

by:

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June 18, 2001

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1. Introduction

A groundwater remediation program is being implemented at a facility located at Glen Cove, New York (GCNY). The groundwater at the site is contaminated with volatile organic compounds (VOCs) that primarily include tetrachloroethylene (PCE), trichloroethylene (TCE), dichloroethylenes (DCEs), vinyl chloride (VC) and two freons (i.e., chlorotriflouoroethene and 1,1,2-trichloro-1,2,2-trifluoroethane).

In-Situ Chemical Oxidation is being evaluated as the remedial technology for the restoration of the GCNY site. Potassium permanganate (KMnO₄) is the oxidant that is evaluated as the oxidant to be used in this site. The Environmental Research Institute (ERI) of the University of Connecticut was retained by Enviro-Sciences Inc. (ESI) to conduct bench-scale tests for evaluating the feasibility of using KMnO₄ to destroy PCE, TCE, DCEs, VC and freons. In particular, the study has focused on the following: (1) a preliminary characterization of the site soil and groundwater (2) the degradation of target VOCs by permanganate ions in the site groundwater (3) the determination of oxidant demand for the actual site soil (4) the impact of oxidant injection on soil metal leaching.

2. Goals of Proposed Tests

Four bench-scale tests recognized as Tasks 1A, 1B, 1C and 1D were conducted.

- Task 1A: Preliminary soil and groundwater characterization
- Task 1B: Oxidation of VOCs in the site contaminated groundwater by KMnO₄
- Task 1C: Determination of oxidant (KMnO₄) demand of the GCNY site soil
- Task 1D: Examination of the extent of metals leaching from soils due to KMnO₄ oxidation

The goals of the tests were to investigate the feasibility of using $KMnO_4$ to remediate the VOCs at the GCNY site. In addition, the oxidant demand of the actual site soil and the impact of oxidant injection on metal leaching from the site soil were determined. Investigation methods used to fulfill the proposed tests are described below.

3. Experimental Section

3.1 Soil and Groundwater Characterization (Task 1A)

The characteristics of the site soil and groundwater are valuable and useful for data interpretation of the proposed tests and for future field applications. Duplicate soil samples (sample ID TS1-S) and groundwater samples (sample ID TS1-GW), collected near MW-12PS, were characterized for parameters including metal content [e.g., iron (Fe), aluminum (Al), manganese (Mn), chromium (Cr), arsenic (As), selenium (Se) and lead (Pb)], pH and total organic carbon content (TOC). The soil was also characterized for its grain size distribution. A list of the analysis methods employed is summarized in Table 1.

• Selection of Sample Soil and Groundwater for the Tests

Five soil samples (labeled as TS1-S to TS5-S) and five groundwater samples (labeled as TS1-GW to TS5-GW) were collected from the GCNY site on 03/14/01 and delivered to ERI on 03/15/01 by ESI. The groundwater samples were first analyzed for their VOC levels by the SW-846 8260 method. The results showed that the TS1-GW groundwater contained all targeted VOCs [i.e., chlorinated ethenes (CEs) and freons]. Thus, TS1-S soil and TS1-GW groundwater were selected as the media for this study.

• Sampling for Characterization of Metals and TOC in Soil (TS1-S) and Groundwater (TS1-GW)

Samples for metal and TOC analysis were collected in duplicate from the TS1-S soil and from the TS1-GW groundwater, both samples were stored in 2-L amber glass jars and preserved at 4 °C after being received. Sampling of the GCNY soil for metal analysis involved placing approximately 25 g of soil from the soil container into two 20-mL glass vials. The two vials were capped and delivered to ERI's Metal Laboratory for metal analysis, following ERI's QA/QC protocol. Two 40-mL glass vials were used to collect the TS1-GW groundwater. The level of selected metals (i.e., Fe, Al, Mn, As, Cr, Se and Pb) in both soil and groundwater samples was determined using an induced-couple plasma atomic emission system (Perkin-Elmer ICP-Optima 3300 XL) or a graphite furnace atomic adsorption system (Perkin-Elmer Zeeman 5100 PC).

Samples for TOC analysis were collected in duplicate into two 20-mL glass vials for both the sample soil and groundwater. These samples were delivered to ERI's Nutrient Laboratory for TOC measurement using CHN Elemental Analyzer (for soil samples) or TOC Analyzer (for groundwater samples).

• Soil pH Measurement and Grain Size Analysis

The soil pH measurement is performed by following SW-846 Method 9045C, an electrometric procedure for measuring pH in soils, sludge and waste samples. The measurement of the soil pH involved adding 20 g of the site soil (with moisture content of 8.1% by weight) and 20 mL of D.I. water in a 50-mL beaker. The beaker was covered with aluminum foil and continuously stirred for 5 minutes. The soil suspension was then let to stand for 1 hour to allow most of the suspended particles to settle down. The soil pH was determined by measuring the pH of the supernatant in the soil-water mixture.

The grain size distribution of the GCNY soil was determined following ASTM Method D 422-63. The fraction of gravel, sand, silt and clay in the sample soil was determined using a series of sieves of specified openings

3.2 Oxidation of VOCs in the GCNY Groundwater by KMnO₄ (Task 1B)

The ability of KMnO₄ to degrade VOC contaminants in the site groundwater was investigated in three sets of batch experiments (1B-1, 1B-2 and 1B-3), 1B-1 and 1B-2 being two experiments with KMnO₄ in different doses (i.e., 0.25 g/L and 1 g/L) and 1B-3 being a control experiment (i.e., without adding KMnO₄ solution). Five groundwater samples were analyzed for its VOC levels prior to usage in the tests. The TS1-GW groundwater was found to have VOC levels that were comparable to those reported in an early site investigation report. It was thus selected as the media for the Task 1B study.

The experiments, as shown in Table 2, were conducted under isothermal, completely mixed and headspace free conditions using syringe reactors (Figure 1). A typical experimental system consisted of a 100-mL gas-tight glass syringe connected to a sampling syringe by means of a control valve and luer-lock fitting. The loss of VOCs due to evaporation was minimized by maintaining a zero-headspace condition in the reactor by moving the plungers of both the sampling and reactor syringes simultaneously during the injection of reactants or sampling. At least two samples were collected each day from the reactor and analyzed by a GC-MS system for VOC levels. The samples after being collected were immediately quenched with 5 (1B-1) or 20 μ L (1B-2) of 1N sodium thiosulfate (Na₂S₂O₃) to stop the reactions between KMnO₄ and VOCs. Other parameters including pH, chloride and KMnO₄ concentrations were monitored only in the beginning and at the end of the experiments. The experiments were continued for a period of three days (72 h). A list showing experimental conditions and monitored parameters for Task 1B is shown in Table 2. The tests established the VOC degradation by KMnO₄ oxidation against time.

In a typical run, ~110 mL of contaminated site groundwater (preserved at 4 °C) and a Tefloncoated stirrer bar were first placed into a syringe reactor. Two samples (5 mL each) were then collected from the reactor and injected into 43-mL volatile organic analysis (VOA) vials that had deionized (DI) water of 38 mL. These two samples were used to determine initial VOC levels in the reactor. Subsequently, 2.5 mL of stock KMnO₄ solutions (10 g/L for 1B-1 and 40 g/L for 1B-2) was injected into the reactor to obtain a desired initial KMnO₄ concentration (i.e., 0.25 g/L and 1 g/L) and to initiate the reactions. A control experiment (without KMnO₄ injection, Task 1B-3) was conducted paralleled to Tasks 1B-1 and 1B-2 to elucidate the degradation of targeted VOCs by KMnO₄ oxidation. Parameters such as chlorinated ethenes and two detected freons were monitoring with time by the GC-MS analysis. Other parameters including KMnO₄, chloride and pH were measured in the beginning and at the end of the experiment.

• Measurement of Monitored Parameters (KMnO₄, chloride and pH)

KMnO₄ concentrations were determined using an UV-VIS spectrometer (Milton Roy, Spectronic 601). The instrument was set-up for this particular experiment at the wavelength of 526 nm, where KMnO₄ shows its maximum of light absorbance. KMnO₄ samples were filtered using 0.45 μ m filters and measured immediately after sampling. The concentration of KMnO₄ was obtained using a pre-built calibration curve, which relates the absorbance as a function of the concentration. Chloride was determined using an ion chromatograph (Dionex DX-500) equipped with an ion exchange column (Dionex Ionpac 4 mm AS9H). All the pH determinations were made using a pH meter (Accumet, Fisher Scientific).

3.3 Determination of Oxidant Demand of the GCNY Soil (Task 1C)

The GCNY sample soil was determined for its KMnO₄ demand through a set of vial experiments performed in duplicate. The experiments were conducted using a vial rotator system (minimizing the breakdown of soil particles) under various KMnO₄/soil ratios (e.g., 1 mg/g, 2 mg/g, 4 mg/g, 8 mg/g, 16 mg/g, 40 mg/g) at 20 °C (Figure 2). A summary of the experimental conditions is shown in Table 3. KMnO₄ concentrations were monitored every two to three days during the test. The soil oxidant demand (SOD) was determined using equation 1.

$$SOD = V(C_0 - C_s)/m_{soil}$$
(1)

where V = total volume of KMnO₄ solution in the vials; C_0 = initial KMnO₄ concentration; $C_s = KMnO_4$ concentration at the relatively steady state or at 14 days reaction period; m_{soil} = the mass of dry soil in reactors

The test was terminated and the SOD was calculated when $KMnO_4$ concentration reached a steady state condition or the experiments reached a 14-day testing period (whichever came first). The results of the test provided the oxidant demand of the GCNY soil and the information on reactivity of the site soil with $KMnO_4$.

3.4 Impact of KMnO₄ oxidation on Soil Metal Leaching (Task 1D)

The impact of KMnO₄ oxidation on the leaching of several metals (i.e., Pb, Cr, As and Se) from the soil was investigated by determining the increase in dissolved metal ions in the samples (made in Section 3.3) at the end of the test. The amount of the increase in dissolved metal ions was determined by comparing the metal ion concentrations of control samples with those of the KMnO₄-containing samples. The pH and oxidation-reduction potential (ORP) of all samples were measured so that the correlation between metal leaching with pH, ORP and KMnO₄ concentration could be established. The results of Task 1D provide the

information on the impact of $KMnO_4$ injection on the leaching of metal ions from the site soil.

4. Results and Discussion

4.1 Soil and Groundwater Characterization (Task 1A)

The soil and groundwater collected from a location near MW-12PS at the GCNY site were characterized for VOCs, metals, TOC and pH. The metal contents of the sample soil and groundwater are listed in Tables 4 and 5, respectively. The GC-MS analysis data of the TS1-GW groundwater is shown in Appendix A. The results indicate that the groundwater is contaminated by *cis*-1, 2-DCE (374 μ g/L and 375 μ g/L), TCE (91.1 μ g/L and 93.8 μ g/L), VC (27.7 μ g/L and 24.6 μ g/L) and two freons (i.e., chloro-triflouoroethene and 1,1,2-trichloro-1, 2, 2-trifluoroethane). The two detected freons are not in the chemical list of the EPA SW-846 8260 method and their quantification standards are currently not available in the market. Therefore, integration area based on the GC-MS chromatogram was used to evaluate their degradation in this study. Two other contaminants (i.e., m-xylene + p-xylene (7.2 μ g/L and 7.3 μ g/L) and dichloromethane (18 μ g/L) were also found in the TS1-GW groundwater.

The metal analysis indicates that iron (5260 mg/kg and 5160 mg/kg) and aluminum (1558 mg/kg and 1811 mg/kg) are relatively abundant in the sample soils (Table 4). Se, As and Cr are three metal elements whose mobilization due to $KMnO_4$ injection is of concern. The soil contains Cr in the level of 9 to 14 mg/kg and has As and Se close to the instrument detection limits (Table 4).

Grain size analysis shows that the sample soil primarily consists of fine sand (32%) and silt (32%) mixed with medium and coarse sand (18%), gravel (12%) and clay (6%) as shown in Figure 3. This soil has a pH of \sim 8.0 and a total organic carbon content of \sim 0.1%.

The TS1-GW groundwater contains iron (9960 μ g/L and 10900 μ g/L), aluminum (5170 μ g/L and 5710 μ g/L) and manganese (3510 μ g/L and 3520 μ g/L) (Table 5). As and Se are below

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the instrument limit and Cr is in the level of 22 to 24 μ g/L. The sample ground water has a pH level of 6.8 and a TOC level of 29 mg/L.

4.2 Oxidation of VOCs in the GCNY Groundwater by KMnO₄ (Task 1B)

The ability of KMnO₄ to degrade target VOCs (i.e., PCE, TCE, DCEs, VC and freons) in the GCNY groundwater was investigated at 20 °C and under completely mixed conditions. Three sets of batch experiments under various reaction conditions were conducted (Table 2). In the first and second set (1B-1 and 1B-2), different concentrations of KMnO₄ solutions (i.e., 0.25 g/L and 1 g/L) were employed separately to degrade VOCs in the site groundwater. The third set (1B-3) was the control experiment where no oxidant was added in the reactor. Degradation of PCE, TCE, *cis*-DCE and VC in the three sets of batch experiments is given in Figures 4 to 6, Table 6 and Appendix B (showing the GC-MS raw data of Task 1B samples). The results indicated that KMnO₄ degraded both VC and *cis*-DCE within 2 hrs (the first sampling point). TCE and PCE were degraded to below their method detection limits (~1 μ g/L) within 32 h. The ability of KMnO₄ to degrade PCE, TCE, *cis*-DCE and VC is illuminated when comparing the data of 1B1 and 1B2 experiments with that of 1B-3 (the control experiment). The control experiment in which no oxidant was added showed relatively constant concentrations of VOCs in the GCNY groundwater during the experiment.

Indeed, the behavior of rapid degradation of chlorinated ethenes (CEs) including PCE, TCE, DCEs and VC by KMnO₄ was expected. While the degradation rates of these compounds were too fast to determine under the test conditions (i.e., low CE concentrations), the kinetics data of oxidation of CEs with KMnO₄ can be found in the literature (Huang et al., 2001). The kinetics study by Huang et al. (1999 and 2001) indicates that KMnO₄ can completely mineralize CEs (i.e., oxidatively transform CEs into chloride and carbon dioxides). Permanganate is primarily reduced to manganese oxides during the reactions. The final products of KMnO₄ oxidation of CEs are nontoxic to the environment.

Of the two detected freons, chloro-triflouroethene was rapidly degraded (i.e., within 2 h) in KMnO₄ solutions in sets 1-B1 and 1-B2 (Tables 7 and 8) while 1,1,2-trichloro-1,2,2-trifluoro was degraded in a relatively slow rate. However, it is expected that both ferons may go further to completion once the oxidant remains in the solutions. Additionally, in 1B-3 (the

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control experiment), degradation of 1,1,2-trichloro-1,2,2-trifluoro ethane was observed, indicating biological activities might have occurred in 1B-3 during the experiment. Of the two other trace contaminants found in the groundwater, m-xylene and p-xylene were rapidly degraded by $KMnO_4$ while dichloromethane showed little reaction with $KMnO_4$ (Appendix B).

The pH, chloride and KMnO₄ were measured for all the three sets in the beginning and at the end of the experiments. The results are shown in Table 9. The average pH value was 6.84 for all the three sets in the beginning and was 6.74 for 1B-1, 6.86 for 1-B2 and 6.96 for 1-B3 at the end of the experiments. KMnO₄ concentrations decreased from 250 mg/L to 195 mg/L in 1B-1 and from 1000 mg/L to 773 mg/L in 1B-2. The chloride concentration in 1B-1 and 1B-2 remained ~45 mg/L because the influence from dechlorination of the VOCs (in μ g/L level) in the sample groundwater was not significant.

4.3 Oxidant Demand of the GCNY Soil (Task 1C)

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The oxidant demand of the GCNY soil was determined through a set of vial experiments under various KMnO₄/soil ratios and a water/soil ratio of ~4:1 at 20 °C. The results are shown in Figures 7 and 8, where the KMnO₄ concentration (in C/Co) versus time (h) was made to show the consumption tendency of KMnO₄ in the actual site soil and in DI water, respectively. It is evident that KMnO₄ concentrations remained nearly unchanged in DI water over the course of the test (Figure 8), while KMnO₄ degraded in the GCNY soil (Figure 7 and Appendix C). KMnO₄ concentration in higher KMnO₄ dose vials (i.e., 4 g/L) decreased rapidly in the early stage and slowed down after a reaction period of 120 h. Since the KMnO₄ concentration remained relatively constant in control experiments (with no soils), the consumption of KMnO₄ in the site soils revealed the demand of soil constituents for KMnO₄. For lower concentration vials (0.25 g/L), KMnO₄ concentration changed more rapidly during the tests and it was almost completely consumed by 336 h.

The data, observed in the test period of 14 days, was used to determine the SOD using equation 1. The results as shown in Figure 9 and Appendix D indicated that the SOD of the GCNY soil varied from ~ 1.0 to 4 g KMnO₄/kg soil, influenced by the oxidant concentration. The SOD increased as the dosed KMnO₄ concentration increased, most likely because the

reactivity of permanganate with many organic and inorganic compounds is greater in a higher $KMnO_4$ concentration. In addition, soil-induced $KMnO_4$ decomposition may also contribute in a significant degree to the observed phenomena.

4.4 Impact of KMnO₄ oxidation on Soil Metal Leaching (Task 1D)

The impact of KMnO₄ concentration and ORP on the mobility of four selected metals (i.e., Pb, As, Cr and Se) of environmental concern was investigated. The change in dissolved concentrations of the four selected metals after 14 days of tests is shown in Table 10 and Appendix E. The data indicates that As remained in not-detected level while Cr, Pb and Se had little increase (in μ g/L level) at the end of the tests. The increase in Se is likely from the impurities of KMnO₄ used in this study since the Se level in both the sample soil and groundwater is not detected. The slight increase in Cr, most likely the hexavalent Cr under the test conditions, is possibly mainly due to the oxidation of naturally occurring chromium oxides in the soil. However, the increased level (e.g., $102\sim215 \mu$ g/L) is likely to be attenuated by natural soils through both adsorption onto soil surface or by soil reducing capacity. The impact of KMnO₄ oxidation and increased ORP during the tests on the metal leaching of As, Pb, Se and Cr from the GCNY soil appears to be insignificant.

5. Conclusions and Recommendations

CONCLUSIONS:

This study was conducted to investigate the feasibility of using $KMnO_4$ as the in-situ oxidant to degrade VOC contaminants at the GCNY site. In addition, the oxidant demand of the GCNY site soil was determined, and the impact of $KMnO_4$ injection on metal ion leaching from the soil was evaluated. Based on the experimental results, the following conclusions were made:

• KMnO₄ rapidly degraded PCE, TCE, *cis*-1,2-DCE, VC, chloro-trifluoroethene and xylenes in the GCNY sample groundwater under the experimental conditions.

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Remediation of soil and groundwater contaminated with the above compounds by in-situ KMnO₄ oxidation is a feasible and effective alternative.

- The degradation of 1,1,2-trichloro-1,2,2-trifluoroethane in the control experiment implied that active biological activities might have occurred in the control experiment during the test. In addition, 1,1,2-trichloro-1,2,2-trifluoroethane in the site groundwater was slowly degraded by KMnO₄ oxidation.
- . The oxidant demand of the GCNY soil was in the range of 1~4 g/kg soil for KMnO₄ and it appeared to increase with the increase in KMnO₄ concentration.
- The soil has a low oxidant demand. KMnO₄ consumption by soil substances is not considered a hindrance to the use of in situ KMnO₄ oxidation technologies.
- The sample soil contains Cr in the level of 9 to 14 mg/kg and has As, Pb and Se close to or below the instrument detection limit (0.199 mg/kg). The data in Table 10 indicates that the impact of KMnO₄ injection on the metal leaching of As, Pb, Se and Cr from the GCNY soil is not significant.

RECOMMENDATIONS:

This feasibility study illuminates the ability of $KMnO_4$ to destroy VOCs including PCE, TCE, *cis*-1,2-DCE, VC, chloro-trifluoroethene and xylenes in the GCNY groundwater. It appears that In Situ KMnO₄ Oxidation is a feasible remedial technology for the GCNY site. To enhance the effectiveness of KMnO₄ oxidation in the remediation application, based on the experimental results, ERI recommends the followings:

- The GCNY soil has a low KMnO₄ demand, and the decomposition of KMnO₄ in the soil matrix is slow. Thus, a low KMnO₄ dose (e.g., 1 g/L or 2 g/L) is recommended to be used during the remediation application.
- The permanganate oxidation technology, like other chemical flushing technologies, requires delivery of the oxidant to contaminants. While the ability of KMnO₄ to destroy VOCs and the suitability of the oxidant being used in the site soil have been demonstrated, the success of using this technology for clean-up of the contaminated site depends on whether the oxidant is able to contact the contaminants. Thus, a precise site

investigation and characterization is suggested so that an effective oxidant delivery system can be developed.

6. References

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Huang, K. C., Hoag, G. E., Chheda, P., Woody, B. A., and Dobbs, G. (2001). Kinetics Study of Oxidation of Chlorinated Ethenes with Permanganate. *Journal of Hazardous Materials*. (In Press)

Bilinge		
pH, ORP and grain size analysis	pH meter (Accumet Fisher Scientific) and standard sieves	Standard methods
KMnO ₄	Spectrophotometer (Milton Roy)	Colorimetric method
VOCs	GC-MS	USEPA SW-846 8260
•Total organic Carbon	TOC Analyzer (for groundwater) and CHN Analyzer (for soil)	Standard methods for water and soil
Metals (Fe, Al, Mn,	ICP-AES/OES or AA-GFAAS	3050A for digestion/6010A for ICP or 7000A for GFAA (SW-
Pb, Cr, As and Se)		846)

Table 2. Experimental conditions of Task 1B conducted to investigate the oxidation of VOCs in the GCNY groundwater by KMnO4

Ricou	的现在分词		alman Alcomula		ารสาร์สิมร์สุรีสิริ
្រ ខ្មែ រប្រទាំងព្រោះអា ក្រុម				- Kanni Segera	
Aqueous	Oxidation of	VOC-	KMnO₄	20	VOCs, pH,
batch Set 1	VOCs in the	contaminated	(0.25 g/L)		KMnO₄ and
(1B-1)	GCNY	groundwater			chloride
	groundwater by				
	KMnO ₄				
Aqueous	Oxidation of	VOC-	KMnO ₄	20	VOCs, pH,
batch Set 2	VOCs in the	contaminated	(1 g/L)		KMnO₄ and
(1B-2)	GCNY	groundwater			chloride
	groundwater by				
	KMnO ₄				
Aqueous	Control	VOC-	None	20	VOCs and pH
batch Set 3	experiment	contaminated			and chloride
(1B-3)	[groundwater			

Note: KMnO₄, pH and chloride were measured in the beginning and at the end of each run.

BETHE	Smillswing.			A HIGH PALE
1	GCNY Site Soil	0.25	1	~ 4:1
2	GCNY Site Soil	0.5	2	~ 4:1
3	GCNY Site Soil	1	4	~ 4:1
. 4	GCNY Site Soil	2	8	~4:1
5	GCNY Site Soil	4	16	~ 4:1
6	GCNY Site Soil	10	40	~ 4:1

Table 3. Test conditions of the vial experiments for determining soil oxidant demand

Note 1. All experiments were conducted in duplicate.

Simult (1)							
						Fe	
ES-soil-M	1.09	1.44	ND	1558	14.4	5260	160
ES-soil-M(D)	0.748	1.80	ND	1811	8.73	5160	195
Detection Limit	0.199	0.199	0.199	0.496	0.248	0.496	0.248

Note: (D) = duplicated

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Shinan Shi							
		14) 14			2(C)+ 		
ES-GW-M	ND	6	ND	5170	22	9960	3510
ES-GW-M(D)	ND	7	ND	5710	24	10900	3520
Detection Limit	4	4	4	10	5	10	5

Table 5. Results of metal characterization of the GCNY site gro	coundwater
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Note: (D) = duplicated

Spin)(and a support of the second second second second second second second second second second second second second		Pleistikese ?
1B1	0	54.18/55.9	278.64/291.54	67.94/62.9	ND
	2	ND	ND	6.02	8.6
	8	ND	ND	5.16	ND
	22	ND	ND	5.16	ND
	32	ND/ND	ND/ND	ND/ND	ND/ND
	48	ND	ND	ND	ND
	56	ND	ND	ND	ND
	72	ND/ND	ND/ND	ND/ND	ND/ND
1B2	0	54.18/53.32	275.2/281.22	66.22/68.8	11.18/11.18
	2	ND	ND	4.3	ND
	8	ND	ND	4.3	ND
	22	ND	ND	ND	ND
	32	ND/ND	ND/ND	ND/ND	ND/ND
	48	ND	ND	ND	ND
	56	ND	ND	ND	ND
	72	ND/ND	ND/ND	ND/ND	ND/ND
1B3	0	54.18	273.48	66.22	16.18
	2	52.46	· 270.9	69.66	13.76
	8	51.6	268.32	71.38	15.48
	22	52.46	268.32	68.8	17.20
	32	50.74	259.72	67.08	17.20
	48	49.02	256.28	67.94	17.20
	56	49.88	254.56	65.36	17.20
	72	50.74	254.56	67.08	16.34

Table 6. Degradation of VOCs by KMnO4 against time in the GCNY groundwater

N.D.= Non-detected

Dinc in the		inneann from 65 (20) for all The state of the second second second second second second second second second second second second second second	
0	1.00/1.00	1.00/1/00	1.00/1.00
2	0	0	0.92
8	0	0	0.86
22	0	0	0.90
32	0/0	0/0	0.82
48	0	0	0.75
56	0	0	0.74
72	0/0	0/0	0.71

Table 7. Degradation of chloro-triflouroethene by KMnO4 with time in the GCNY
groundwater

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0	1.00	1.00	1.00
2	0.85	0.93	0.85
8	0.88	0.98	0.80
22	0.87	0.83	0.82
32	0.86/0.86	0.87	0.77
48	0.75	0.79	0.70
56	0.72/0.76	0.73/0.76	0.66
72	0.73/0.7	0.77/0.75	0.62

Table 8.	Degradation of 1,1,2-trichloro-1,2,2-trifluoro ethane by KMnO ₄ with time in
	the GCNY groundwater

		hitetaja er	Tim	e (hr)	tito a contestad				
Samples	0				72				
	pH	chloride, mg/L	KMnO4,	pН	chloride, mg/L	KMnO4,			
			mg/L			mg/L			
1 B1	6.84	44.15	250	6.74	44.24	194.72			
1B2	6.84	43.93	1000	6.86	44.4	772.86			
1 B3	6.84	45.28	0	6.91	44.84	Control			

Table 9. The pH, chloride and KMnO₄ in the beginning and at end of Task 1B experiments

Sample				Metal concentration, µg/L			
				As	Cr	Pb	Se
0104025-ES-0D	0.00	7.85	360.00	ND	10	ND	ND
010425-ES-0.25	13.87	7.59	440.15	ND	102	ND	ND
-010425-ES-0.5	119.69	7.52	566.25	ND	142	60	16
010425-ES-1	508.99	7.51	590.75	ND	127	15	46
010425-ES-2	3263.91	7.43	611.20	ND	153	29	107
010425-ES-4	6179.96	7.40	627.90	ND	150	65	254
010425-ES-10	9096.15	7.38	651.40	ND	215	166	320

Table 10. The dissolved concentrations of Pb, As, Cr and Se in Task 1D vials after a reaction period of 14 days

¹ 0104025-ES-0.25 = Sampling date-ESI sample soil-KMnO₄ concentration ² Parameters measured at the end of the tests.

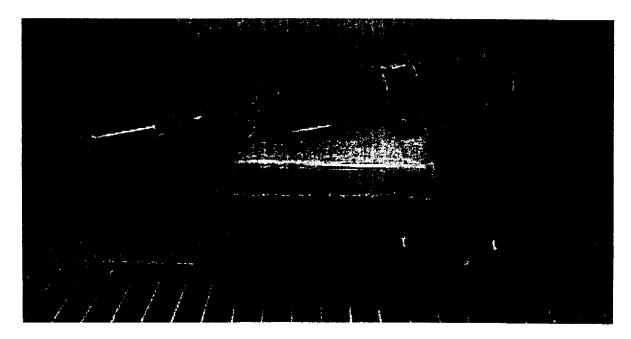


Figure 1. The syringe reactor system used in Task 1B experiment

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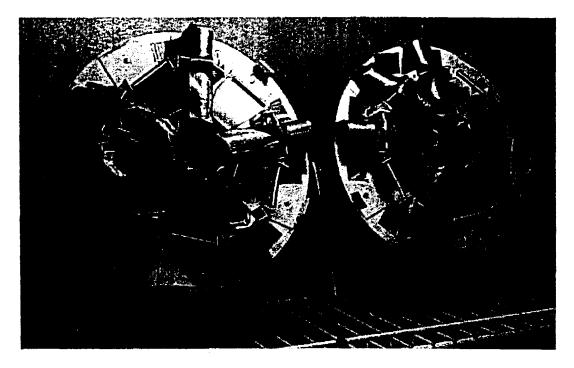


Figure 2. The rotator system used to determine soil oxidant demand

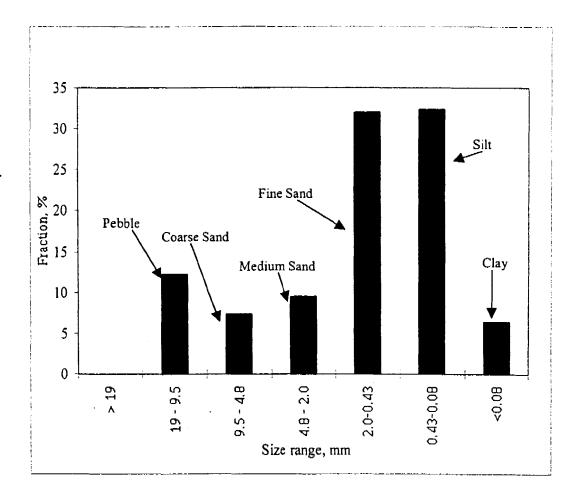
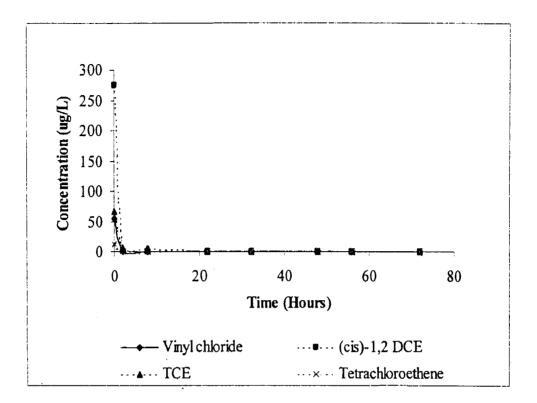
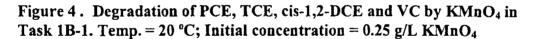


Figure 3. Grain size distribution of the GCNY sample soil.





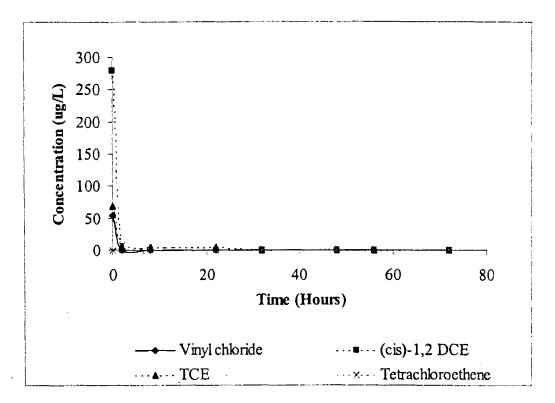


Figure 5. Degradation of PCE, TCE, cis-1,2-DCE and VC by KMnO₄ in Task 1B-2. Temp. = 20 °C; Initial concentration of 1 g/L KMnO₄

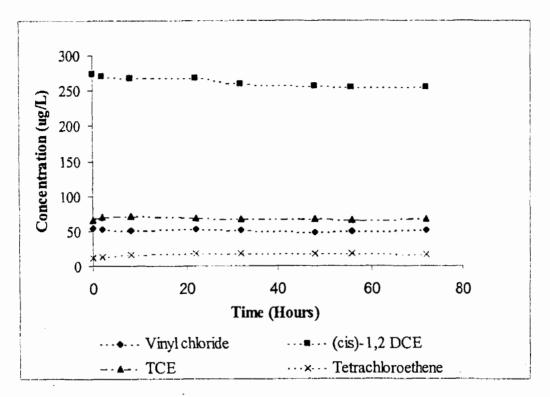
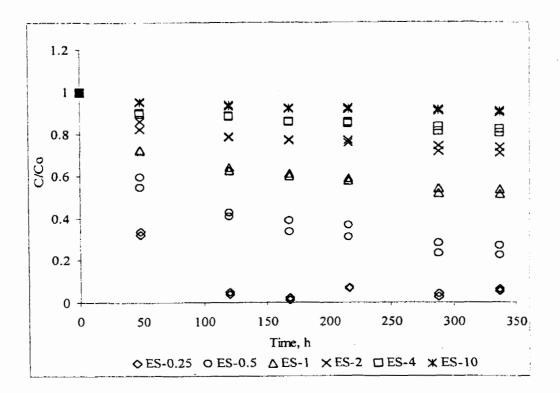
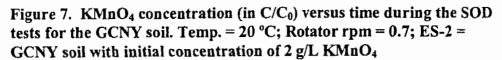


Figure 6. The variation of PCE, TCE, cis-1,2-DCE and VC during Task 1B-3 (the control experiment). = 20 °C; KMnO₄ concentration = 0 g/L





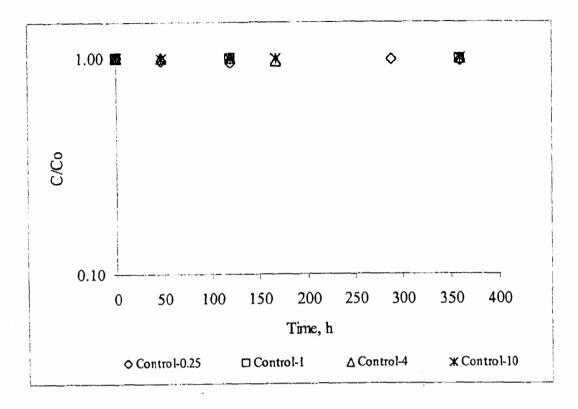


Figure 8. $KMnO_4$ concentration (in C/C₀) versus time during the SOD tests in the control experiment

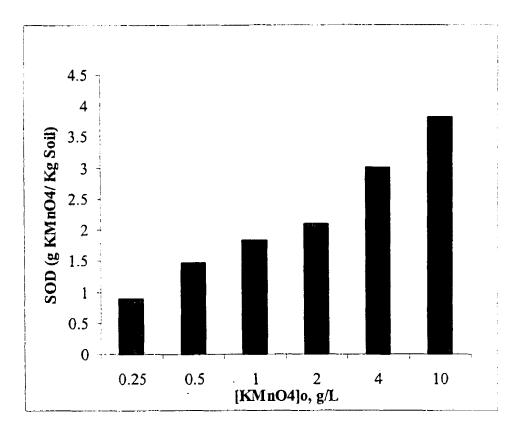


Figure 9. Oxidant demand of the GCNY soil, determined in a reaction period of 14 days.

APPENDIX A:

The GC-MS analysis raw data of TS-1 GW sample groundwater (in duplicate)

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<u>Environmentul Research Institute</u> Environmentul Research Institute 270 Middle Turupike U-5210 Storrs, C1 06269-5210 (Sco)486-4015 รับสายแตะรงทุกเศญิตาน์ แรงทาน edu



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ieler or CAS Number	Teved 1987	1	1								

Environmental Research Institute The University of Connecticut and ES TREATBILITY TEST

Sample Identification: Laboratory Identification: Sampling Date: Sample Receiving Date:	LAB BLK	Reporting Date: Sample Matrix: Report Data File: Raw Data File;	3/27/01 Aqueous ol010325L.xls. 01032503.D
Date Analyzed:	03/26/20 -1:2:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichtorodifluoromethane	ND	0.3
74-87-3	Chlorometlane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-09-4	Trichlorofluoromethane	ND ND	0.1
75-09-2	Dichloromethane	ND	<u> </u> 1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.5
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1.2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	NĎ	0.2
56-23-5	Tetrachloromethane	ND	. 0.1
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND .	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
<u>95-47-6</u> 100-42-5	o-Xylenc	ND ND	0.1
75-25-2	Styrene Bromoform	ND	0.2
98-82-8	iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	see-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene		0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND ND	<u> </u>
67-64-1	Acctone	ND	<u> </u>
Surrogate Recovery Compound	Recovery (%)	Limit (%)	Cardin
Dibramofluoromethane(surr1)	104	80-116	Condition
1,2-dichloroethane-d4(surr2)	104	80-116	Páss
tolucno-d8(surr3)	100	80-116	Pass
4-bromofluorobenzene(surr4)	101	80-120	Pass

ND = Not Deteoted

Sample Identification: Laboratory Identification:	I Results, Project: '0103032-001,010321-ES-TS1,1 '0103032-001	7/10 Reporting Date: Sample Mateix:	3/27/01 Aqueous	
ampting Date:	3 21 01	Report Data File:	ol0103251, xis	
Sample Receiving Date:	3(21)(01)	Raw Data File:	01032510.10	
Date Analyzed:	03/26/20 -1:6	Method:	EPA-8260	
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)	
75-71-8	Dichlorodifluoromethane	ND	3.0	
74-87-3	Chloromethane	ND	1.0	
75-01-4	Chloroethene(Vinyl Chloride) Bronomethane	27.7 ND	2.0	
7478,007	t'hloroethane	ND	2.0	
75-60-4	Trichlorofluoromethane	ND	1.0	
75.35.1	1.1-Dichloroethane	ND	10	
25.09.2	Dichloromethine	81	10	
01034-04-4	MUBE	ND	3.0	
156-60-5	(trans)-1,2-Dichloroethene 1,1-Dichloroethane	ND ND	3.0	
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1.0	
594-20-7	2.2-Dichloropropane	ND	1.0	
156-59-2	(eis)-1,2-Dichloroethene	373.6	1.0	
74-97-5	Bromochloromethane	ND	3.0	
67-66-5	Chlorotom	ND	1.0	
71+55-0	1.1.1. Frichtoroethane	ND	1.0	
563-58-6 56-23-5	1.1-Dichloropropene Tetrachloromethane	ND ND	2.0	
71-43-2	Benzenc	ND	1.0	
107-06-2	1.2-Dichloroethane	ND	1.0	
79-01-6	Trichloroethene	91.1	1.0	
78-87-5	1,2-Dichloropropane	ND	1.0	
74-95-3	Dibromomethane	ND	1.0	
75-27-4	Bromodichloromethane	ND	2.0	
10061-01-5	(cis)-1.3-Dichloropropene MIBK	ND	2.0	
108-88-3	Toluene	ND	1.0	
10061-02-6	(trans)-1,3-Dichloropropene	ND	1.0	
79-00-5	1,1.2-Trichloroethane	ND	3.0	
142-28-9	1,3-Dichloropropane	ND	2.0	
127-18-4	Tetrachloroethene	17.7	2.0	
124-48-1 106-93-4	Dibromochloromethane	ND ND	3.0	
108-90-7	Chlorobenzene	ND	1.0	
630-20-6	1.1.1.2-Tetrachloroethane	ND	2.0	
100-41-4	Ethylbenzene	ND	1.0	
108-38-3	m-Xylene + p-Xylene	7.2	2.0	
95-47-6	o-Xylene	ND	1,0	
100-42-5	Styrene	ND	2.0	
75-25-2 98-82-8	Bromoform iso-Propylbenzene	ND ND	1.0	
79-34-5	1.1.2.2-Tetrachloroethane	ND	2.0	
96-18-4	1,2,3-Trichloropropane	ND	2.0	
108-86-1	Bromobenzene	ND	1.0	
103-65-1	n-Propythenzene	ND	1.0	
108-67-8	1.3.5-Trimethylbenzene	ND	1.0	
106-43-4	4-Chlorotoluene 2-Chlorotoluene	ND ND	1.0	
98-06-9	tert-Butyllienzene	ND ND	1.0	
95-63-6	1.2.4-Trimethylbenzene	ND	2.0	
135-98-8	sec-Butylbenzene	ND	1.0	
99-\$7-6	4-iso-Propyltoluene	ND	1.0	
541-73-1	1.3-Dichlorobenzene	ND	1.0	
106-46-7	1.4-Dichlorobenzene	ND	1.0	
104-51-8 95-50-1	n-Butylbenzene 1.2-Dichlorobenzene	ND ND	1.0	
96-12-8	1.2-Dibrono-3-chloropropane	ND	<u> </u>	
120-82-1	1.2.4-Trichtorobenzene		10	
\$7-68-3	Hexachlorobutadiene	ND	3.0	
91-20-3	Naphthalene	ND	2.0	
\$7-61-6	1.2,3-Trichlorobenzene	ND	10	
67-64-1	Acetone	ND	10	
Surrugate Recovery	Recovery (%)	Limit (%)	Constant	
Dibrontofluoromethane(surr1)	102	80-116	Condition Pass	
1,2-dichloroethanc-d4(sur2)	103	80-116	Pass	
tolucne-d8(sur3)	101	80-116	Pass	

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latile Organic Compound uple Identification:	'0103032-002,010321-ES-TS1L	,1/1-Reporting Date:	3/27/01
uple Identification:		Sample Matrix:	Aqueous
boratory Identification:	3 21 01	Report Data File:	ol010325L.xls.
npling Date:	3-21-01	Raw Data File:	01032511.D
nple Receiving Date:	03/26/20 -1:7:	Method:	EPA-8260
te Analyzed: CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodithioromethane	ND	3.0
74-87-3	Chloromethane	ND	1.0
75-01-4	Chloroethene(Vinyl Chloride)	24.6	2.0
74-83-9	Bromomethane	ND ND	2.0
75-00-3	Chloroethane		10
75-69-4	Trachlorofluoromethane	ND	10
75-35-4	Dichloromethane	26	10
01034-04-4	MIBE	ND	3,0
156-60-5	(trans)-1,2-Dichloroethene	ND	3.0
75-34-3	1.1-Dichloroethane	ND	1.0
78-93-3	Methyl Ethyl Ketone (MEK)	ND ND	1.0
594-20-7	2.2-Dichloropropane	374.7	1.0
156-59-2	(cis)-1.2-Dichloroethene Bromochloromethane	ND	3.0
74-97-5	Chloroform	ND	1.0
71-55-6	1.1.1. Trichloroethane	ND	1.0
563-58-6	1,1-Dichloropropene	ND	2,0
56-23-5	Tetrachloromethane	ND	1.0
71-43-2	Benzene	ND ND	1.0
107-06-2	1.2-Dichloroethane	93.8	1.0
79-01-6	Trichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane Dibromonethane	ND	1.0
74-95-3	Bromodichloromethane	ND	2.0
10061-01-5	(cis)-1.3-Dichloropropene	ND	2.0
108-10-1	MIBK	ND ·	2.0
108-88-3	Toluenc	2.0	1.0
10061-02-6	(trans)-1,3-Dichloropropene	ND	1.0
79-00-5	1,1,2-Trichloroethane	ND	2.0
142-28-9	1,3-Dichloropropane	18.0	2.0
127-18-4	Tetrachloroethene Dibromochloromethane	ND	3.0
124-48-1 106-93-4	1.2-Dibromoethane	ND	1.0
108-90-7	Chlorohenzene	ND	1.0
630-20-6	1.1.1.2-Tetrachloroethane	ND	2.0
1(0)-41-4	Ethylbenzene	ND	1.0
108-38-3	m-Xylene + p-Xylene	7.3 ND	1.0
95-47-6	o-Nylene	ND ND	2.0
1(11-42-5	Styrene Bromoform	ND	1.0
75-25-2 98-82-8	iso-Propylbenzene	ND	2.0
79-34-5	1,1.2.2-Tetrachloroethane	ND	2.0
96-18-4	1.2.3-Trichloropropane	ND	2.0
108-86-1	Bromohenzene	ND	1.0
103-65-1	n-Propylbenzene	ND ND	1.0
108-67-8	1.3.5-Trimethylbenzene	ND	1.0
106-43-4 95-49-8	4-Chlorotoluene	ND	1.0
98-06-9	tert-Butylhenzene	ND	1.0
95-63-6	1.2.4-Trimethylbenzene	ND	2.0
135-98-8	see-Butylbenzene	ND	1.0
99-87-6	4-iso-Propyltoluene	ND	1.0
541-73-1	1.3-Dichlorobenzene	ND ND	1.0
106-46-7	1.4-Dichlorobenzene	ND	1.0
104-51-8	n-Butylbenzene 1.2-Dichlorobenzene	ND	1.0
95-50-1	1.2-Dibromo-3-chloropropane	ND	6.0
120-82-1	1.2.4-Trichlorobenzene	ND	10
87-68-3	Hexachlorobutadiene	ND	3.0
91-20-3	Naphthalene	ND	2.0
\$7-61-6	1,2.3-Trichlorobenzene	ND	10
67-64-1	Acetone	ND	10
Surrogate Recovery		Limit (%)	Candition
Compound	1) 101	80-116	Pass
Dibromolluoromethane(sun 1,2-dichloroethane-d4(sur2		80-116	Pass
soucionoroconanc=0+tsWT2			Pass

APPENDIX B:

The GC-MS analysis raw data of Task 1B samples

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ample Identification:	d Results, Project: ESTreatibilit ST MIX 40 PPB	Reporting Date:	4/11/01
aboratory Identification:		Sample Mutrix:	Aqueous
ampling Date:		Report Data File:	010409.xls.
ample Receiving Date:		Raw Data File:	01040904 D
ample Receiving issue. Jate Analyzed:	04/9/20-1:2:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	Recovery %
75-71-8	Dichlorodifluoromethane	23.3	58%
74-87-3	Chloromethane	31.1	78%
75-01-4	Chloroethene(Vinyl Chloride)	31.2	73%
74-83-9	Bromomethane	38.2	95%
75-00-3	Chlorocthane	35.8	90%
75-69-4	Trichlorofluoromethane	30.2	75%
75-35-4	1,1-Dichloroethene		89%
75-09-2	Dichloromethane	43	108%
01634-04-4	MTBE	40.7	102%
156-60-5	(trans)-1,2-Dichloroethene	36.9	92%
75-34-3	1,1-Dichloroethane	38.9	97%
78-93-3	Methyl Ethyl Ketone (MEK) 2,2-Dichloropropane	43.6	109%
594-20-7 156-59-2	(cis)-1,2-Dichloroethene	38.6	97%
74-97-5	Bromochloromethane	38.4	96%
67-66-3	Chloroform	39.4	99%
71-55-6	1.1.1-Trichloroethane	36.1	90%
563-58-6	1,1-Dichloropropene	36.0	90%
56-23-5	Tetrachloromethane	34.0	85%
71-43-2	Benzene	40.2	101%
107-06-2	1,2-Dichloroethane	40.5	101%
79-01-6	Trichloroethene	36.8	92%
78-87-5	1.2-Dichloropropane	40.9	102%
74-95-3	Dibromomethane	39.8	100%
75-27-4	Bromodichloromethane	39.5	99%
10061-01-5	(cis)-1,3-Dichloropropene	40.9	102%
108-10-1	MIBK	36.2.	91%
108-88-3	Toluene	38.5	<u>96%</u> 100%
10061-02-6	(trans)-1,3-Dichloropropene	38.8	97%
79-00-5	1,3-Dichloropropane	39.9	100%
142-28-9 127-18-4	Tetrachloroethene	35.7	89%
127-18-4	Dibromochloromethane	37.7	94%
106-93-4	1,2-Dibromoethane	37.8	95%
108-90-7	Chloróbenzene	38.7	97%
630-20-6	1.1.1.2-Tetrachloroethane	38.1	95%
100-41-4	Ethylbenzene	38.9	97%
108-38-3	m-Xylene + p-Xylene	78.0	98%
95-47-6	o-Xylene	39.6	99%
100-42-5	Styrene	38.5	96%
75-25-2	Bromoform	35.3	88%
98-82-8	iso-Propylbenzene	37.4	93%
79-34-5	1,1,2,2-Tetrachloroethane	38.9	97%
96-18-4	1,2,3-Trichloropropane	38.7	97%
108-86-1	Bromobenzene	38.4	96% 95%
103-65-1	n-Propylbenzene	38.1	95%
108-67-8	4-Chlorotoluene	38.2	95%
95-49-8	2-Chlorotoluene	40.4	101%
98-06-9	tert-Butylbenzene	41.7	104%
95-63-6	1,2,4-Trimethylbenzene	38.8	97%
135-98-8	sec-Butylbenzene	36.4	91%
99-87-6	4-iso-Propyltoluene	37.6	94%
541-73-1	1.3-Dichlorobenzene	40.2	100%
106-46-7	1,4-Dichlorobenzene	38.0	95%
104-51-8	n-Butylbenzene	37.4	93%
95-50-1	1,2-Dichlorobenzene	38.3	96%
96-12-8	1,2-Dibromo-3-chloropropane	32.7	82%
120-82-1	1.2,4-Trichlorobenzene	37	92%
87-68-3	Hexachlorobutadiene	34.8	87%
91-20-3	Naphthalene	35.4	89%
87-61-6	1,2,3-Trichlorobenzene	37	90%
67-64-1 Surrogate Recovery	Ivremme	130	1 7070
Compound	Recovery (%)	Limit (%)	Condition
Dibromofroromethane(sur1)	98	80-116	Pass
1,2-dichiorosthano-d4(surr2)	99	80-116	Pass
		80-116	Pass

Sample Identification:	I Results, Project: ESTreadbilit ST MIX 40 PPB ULTRA	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:		Report Data File:	010409.xls
		Raw Data File:	01040905 D
ample Receiving Date:	A ((A TA A A A A	Method:	EPA-8260
Jute Analyzed:	04/9/20-1:1: IName	Concentration(ug/L)	Recovery %
CAS Number 75-71-8	Dichloroditluoromethene	55.5	139%
74-87-3	Chloromethane	43.7	109%
75-01-4	Chloroethene(Vinyl Chloride)	45.2	113%6
74-83-9	Bromomethane	39.9	100%
75-00-3	Cluloroethane	37.5	94%
75-69-4	Trichlorofluoronethane	38.1	95%
75-35-4	1,1-Dichloroethene	44	110%
75-09-2	Dichloromethane	45	113%
01634-04-4	MTBE	ND 43.2	<u>NA</u> 108%
156-60-5	(trans)-1,2-Dichloroethene	43.9	110%
78-93-3	Methyl Ethyl Ketone (MEK)	ND	NA
594-20-7	2.2-Dichloropropane	48,3	121%
156-59-2	(cis)-1.2-Dichloroethene	40.8	102%
74-97-5	Bromochloromethane	41.0	102%
67-66-3	Chloroform	42.8	107%
71-55-6	1,1,1-Trichloroethane	41.1	103%
563-58-6	1,1-Dichloropropene	40.5	101%
56-23-5	Tetrachloromethane	40,5	101%
71-43-2	Benzene	43.6	109%
107-06-2	1,2-Dichloroethane	43.2	108%
79-01-6	Trichloroethene	40.5	101%
78-87-5	1,2-Dichloropropane Dibromomethane	41.4	107%
74-95-3	Bromodichloromethane	42.4	105%
10061-01-5	(cis)-1,3-Dichloropropene	44.1	110%
108-10-1	MIBK	ND	NA
108-88-3	Toluene	41.0	102%
10061-02-6	(trans)-1,3-Dichloropropene	43.2	108%
79-00-5	1,1,2-Trichloroethane	40.2	100%
142-28-9	1,3-Dichloropropane	39.7	99%
127-18-4	Tetrachloroethene	39.2	98%
124-48-1	Dibromochloromethane	39.2	98%
106-93-4	1,2-Dibromoethane	39.3	98%
108-90-7	Chlorobenzene	41.2	103%
630-20-6	1,1,1,2-Tetrachloroethanc	40.3	101%
100-41-4	Ethylbenzene m-Xylene + p-Xylene	84.9	106%
95-47-6	o-Xylene	42.8	107%
100-42-5	Styrene	40.3	101%
75-25-2	Bromoform	37.0	92%
98-82-8	iso-Propylbenzene	39.7	99%
79-34-5	1,1,2,2-Tetrachloroethane	39.5	99%
96-18-4	1,2,3-Trichloropropane	39.2	98%
108-86-1	Bromobenzene	40.1	100%
103-65-1	n-Propylbenzene	42.1 41.5	105%
108-67-8	1,3,5-Trimethylbenzene	40.9	104%
<u>106-43-4</u> 95-49-8	4-Chlorotoluene	43.8	1102%
93-49-8	tert-Butylbenzene	41.1	103%
95-63-6	1,2,4-Trimethylbenzene	41.6	104%
135-98-8	scc-ButyIbenzene	39.7	99%
99-87-6	4-iso-Propyltoluene	39.7	99%
541-73-1	1,3-Dichlorobenzene	40.5	101%
106-46-7	1,4-Dichlorobenzene	40.4	101%
104-51-8	n-Butyibenzene	42.2	105%
95-50-1	1,2-Dichlorobenzene	41.0	102%
96-12-8	1,2-Dibromo-3-chloropropane	35.4	88%
120-82-1	1,2,4-Trichlorobenzene Hexachlorobutadiene	39.1	99%
87-68-3 91-20-3	Naphthalene	39.1	94%
87-61-6	1,2,3-Trichlorobenzene	40	99%
67-64-1	Acetone	ND	#VALUE!
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromoffuoromethens(sur1)	99	80-116	Pass
,2-dichloroethano-d4(surt2)	101	80-116	Pass
tohuene-d8(surr3)	101	80-116	Pass

	80-119	100	0000-98(81113)
<u>8869</u>	911-08	105	(Sma) Ab-action of (sures)
- F255	80-119	100	(ITHE) anadiento roution of
Condition	(%) itesi.i	Kecovery (%)	Сопрояла
%76	8€	γοιοιο	Surrorate Recovery
%68	96	1,2,3-Trichlorobenzene	<u>1-79-19</u> 9-19-18
%88	2'52	Naphthalcoc	£-07-16
%88	2'52	Hexachlotobuladiene	£-89-L8
%68	98	1,2,4-Trichlorobenzene	120-82-1
%08	0.25	1,2-Dibromo-3-chloropropane	8-21-96
%16	38.9	1,2-Dichlorobenzene	1-05-56
%56	1.85	n-Butylbenzene	8-15-401
%96	*86	1,4-Dichlorobenzene	L-91-901
%26	8.85	1,3-Dichlorobenzene	1-22-175
<u>%</u> 96	₱°8€	4-iso-Propytolucne	9-18-66
%56	672	sc-Butylbenzene	8-86-5£1
100%	40.0	1,2,4-Trinethylbenzene	<u> </u>
%011	8'67	tert-Butylbenzene	6-90-86
104%	9'1#	2-Chlorotoluene	8-61-56
%66	9'6£	4-Chlorotolucne	100-43-4
100%	<u>8'6E</u>	ənəznədlytilæninT-2, E, I	8-29-801
%001	8.65		1-59-501
%86	36.0	Bromobenzene	1-98-801
%76	8.95	1,1,2,2-Tetrachioroethane 1,2,3-Trichloropropane	<u>+-81-96</u> 5-78-6L
%LL	30.8	iso-Propylbenzene	
%66	¥'6E	Bromoform	<u> </u>
%58	3376	Shrene	<u>5-21-001</u>
101 <u>%</u> 104%	+0+ +18	o-Xyene	9-11-56
%E01	278	m-Xylene + p-Xylene	E-8E-80I
%£01 %£01	1'17	Ethylbenzene	100-41-4
%26	1.85	1,1,1,2-Tetrachloroethane	930-50-6
%101	£'07	Chlorobenzene	L-06-801
%\$6	0.85	[,2-Dibromethane	1-66-901
%£6	0.75	Dibromochloromethane	154-48-1
%16	. 5.95	Tetrachloroethene	127-18-4
%001	0.04	1,3-Dichloropropane	I#3-28-9
%L6	6.85	1,1,2-Trichlorocthane	\$-00-6L
%06	1'9E	(trans)-1,3-Dichloropropene	9-20-19001
%66	8.95	Toluene	£-88-801
%06	6.2E	WIBK	1-01-801
%96	£.8£	(cis)-1,3-Dichloroptopene	5-10-19001
%EOI	1.14	Bromodichloromethane	+-LZ-SL
103%	119	Dibromentane	£-56-\$L
104%	41.8	1,2-Dichloropropane	<u>5-78-87</u>
%111	- 577	Trichloroethene	9-10-6L
%LOI	677	1,2-Dichlorocthane	Z-90-L01
%901	453	Benzene	11-43-5
%06	1'98	Terschloromethane	5-53-95
%\$6	38.2	1,1-Dichloropropene	9-85-895
%26	8'85	1,1,1,1,Trchlorochane	9-55-12
%t01		Chloroform	<u>E-99-19</u> 5-16-#1
<u>%66</u> %001	1'6E	(cis)-1,2-Dichloroethene	2-65-951
%EL	1.62	2.2-Dichloropropane	L-02-\$65
<u>%06</u>	95	Methyl Ethyl Ketone (MEK)	£-£6-8L
%00I	1'0#	1,1-Dichloroethane	E-\$E-\$L
%46	6'85	(trans)-1,2-Dichlorocthene	<u>\$-09-951</u>
%001	1.04	MTBE	+-+0-+E910
115%	51	Dichloromethane	2-60-5L
%+6	<u></u>	I,I-Dichloroethene	t-52-5L
%18	133.4	Trehlorofluorometinine	t-69-5L
%66	1728	Сілотосціяте	£-00-5L
%46	L'SE	ອມສາມສາມອາຍຸ	6-18-12
%08	<u>8'1£</u>	Chloraethene(Vinyl Chloride)	t-10-\$L
%28	875	Chloronethane	£-18-+1
%19	512	Dichlorodifluoronrethene	8-12-52
Recovery %	Concentration(ug/L)	JUEN	CAS Number
EPA-8260	Method:	:0:1-02/01/10	te Analyzed:
1.5560+010	Raw Data File:		:otutt gniviooosi olqm
			npling Date:
SIX 607010	Report Data File:		
snoanby	Sample Matrix:		noiseartification:
	Reporting Date:	844 01 XIX IS	mple Ldentfficution:

Sample Identification:	Results, Project: ESTreatibility ST MIX 40 PPB ULTRA	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
ampling Date:		Report Data File:	010409.xls.
ample Receiving Date:		Raw Data File:	01040934.D
ample Receiving Dave.	04/10/20 -1:0:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	Recovery %
75-71-8	Dichlorodifluoronzthane	46.8	117%
74-87-3	Chloronethane	46.1	115%
75-01-4	Chloroethene(Vinyl Chloride)	41.4	103%
74-83-9	Bromornethane	47.3	118%
75-00-3	Chloroethane	42.0	105%
75-69-4	Trichlorofluoromethane	34.5	\$6%
75-35-4	1.1-Dichloroethene	40	101%
75-09-2	Dichloromethane	43 ND	103% NA
01634-04-4	MTBE	40.3	101%
156-60-5	(trans)-1,2-Dichloroethene	40.3	101%
78-93-3	Methyl Ethyl Ketone (MEK)	ND	NA
594-20-7	2,3-Dichloropropane	28.5	71%
156-59-2	(cis)-1_2-Dichloroethene	38.2	96%
74-97-5	Bromochloromethane	39.5	99%
67-66-3	Chloroform	40.2	101%
71-55-6	1,1,1-Trichloroethane	38.3	96%
563-58-6	1,1-Dichloropropene	37.4	93%
56-23-5	Tetrachloromethane	37.3	· 93%
71-43-2	Benzene	41.3	103%
107-06-2	1,2-Dichloroethane	42.2	105%
79-01-6	Trichloroethene	42.5	106%
78-87-5	1.2-Dichloropropane	40.5	101%
74-95-3	Dibromomethane	41.1	103%
75-27-4	Bromodichloromethane	40.1	100%
10061-01-5 108-10-1	(cis)-1,3-Dichloropropene MIBK	ND	9376 NA
108-88-3	Toluene	38.5	96%
10061-02-6	(trans)-1,3-Dichloropropene	37.5	94%
79-00-5	1,1,2-Trichloroethane	38.3	96%
142-28-9	1,3-Dichloropropane	38.2	96%
127-18-4	Tetrachloroethene	35.3	88%
124-48-1	Dibromochloromethane	37.2	93%
106-93-4	1,2-Dibromethane	38.3	96%
108-90-7	Chlorobenzene	38.8	97%
630-20-6	1,1,1,2-Tetrachloroethane	38.5	96%
100-41-4	Ethylbenzene	39.6	99%
108-38-3	m-Xylene + p-Xylene	78.8	98%
95-47-6	o-Xylene	40.2	100%
100-42-5	Styrene	38.1	95%
75-25-2	Bromoform	34.6	86%
98-82-8	iso-Propylbenzene 1,1,2,2-Tetrachloroethane	37.0	83%
<u> </u>	1,2,3-Trichloropropane	37.9	95%
108-86-1	Bromobenzene	38.2	95%
103-65-1	p-Propylbenzene	38.7	97%
108-67-8	1.3.5-Trimethylbenzene	38.6	96%
106-43-4	4-Chlorotoluene	36.8	92%
95-49-8	2-Chlorotoluene	40.4	101%
98-06-9	tert-Butylbenzene	42.9	107%
95-63-6	1,2,4-Trimethylbenzene	38.6	96%
135-98-8	sec-Butylbenzene	35.9	90%
99-87-6	4-iso-Propyltoluene	36.3	91%
541-73-1	1.3-Dichlorobenzene	37.6	94%
106-46-7	1,4-Dichlorobenzene	38.1	<u>95%</u> 92%
104-51-8 95-50-1	n-Butylbenzene	38,4	92%
95-30-1	1,2-Dibromo-3-chloropropane	32.0	80%
120-82-1	1.2.4-Trichlorobenzene	36	89%
87-68-3	Hexachlorobutadiene	33.7	84%
91-20-3	Naphthelenc	34.2	85%
87-61-6	1,2,3-Trichlorobenzene	36	89%
67-64-1	Acetone	ND	NA
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromofluoromethane(sur1)	99	80-116	Pass
1.2-dichloroethane-d4(aurr2)	103	80-116	Pass
tolmene-dif(start3)	100	80-116	Pass

Sample Identification: Luboratory Identification: Sampling Date:	l Results, Project: ESTreatibilit LAB BLK	Reporting Date: Sample Matrix: Report Data File:	4/11/01 Aqueous 010409.xis.
Sample Receiving Date:	AU 0/20 1 4	Raw Data File:	01040910.D
Date Analyzed:	04/9/20-1:4:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L) ND	MDL (ug/L)
75-71-8	Dichlorodilluoromethane Chloromethane	ND ND	0.3
74-87-3 75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoronethane	ND	0,1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1.1.1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	ND ND	0.1
107-06-2	1.2-Dichloroethane	ND	0.1
79-01-6	Trichleroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromornethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Tolucne	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chloróbenzene	ND	0.1
630-20-6	1.1.1.2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	a-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0,1
96-12-8	1,2-Dibromo-3-chloropropauc	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Cempeund	Recovery (%)	Lindt (%)	Condition
Dibromofluorometheno(sur 1)	101	80-116	Pass
1,2-diabloroethane-d4(aur2) tolnege-d8(aur3)	108	80-116 80-116	Pass Pass

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Sample Identification:	d Results, Project: ESTreatibili LAB BLK (SPI)	Reporting Date:	4/11/01
_aboratory Identification:	LAD BLA (SI I)	Sample Matrix:	Aqueous
Sampling Date:		Report Data File:	010409.xls.
Sample Receiving Date:		Raw Data File:	01040907.D
Date Analyzed:	44/0/20 1.2	Method:	EPA-8260
CAS Number	04/9/20 -1:2:	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chiororrethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4 75-35-4	Trichlorofluoromethene	ND 22	0.1
75-09-2	Dichloromethane	ND	
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2 74-97-5	(cis)-1,2-Dichloroethene Bromochloromethane	ND ND	0.1
67-66-3	Chloroform	ND	0.1
71-55-6	1.1.1.1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	• 0.1-
71-43-2	Benzene	23.9	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	21.2 ND	0.1
78-87-5 74-95-3	1,2-Dichloropropane	ND	0.1
75-27-4	Bromodichloromethane	ND ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	МІВК	ND	0.2
108-88-3	Toluene	22.0	0.1
10061-02-6	(trans)-1,3-Dicbloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND ND	0.3
142-28-9 127-18-4	1,3-Dichloropropane	ND ND	0.2
124-48-1	Dibromochloromethane	ND ND	0.2
106-93-4	1.2-Dibromocthane	ND	0.1
108-90-7	Chlorobenzene	22.0	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3 95-47-6	m-Xylene + p-Xylene	ND ND	0.2
100-42-5	o-Xylene Styrene	ND	0.1
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethanc	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene 4-Chlorotoluene	ND ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trinethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND ND	0.1
106-46-7	n-Butylbenzene	ND ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1.2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	- <u> </u>
67-64-1 Surrogate Recovery	Acetope	ND	11
Compound	Recovery (%)	Limit (%)	Condition
Dibromofisoromathene(surr1)	102	80-116	Pass
1,2-dichlorosthane-d4(surr2)	109	80-116	Pass
tohene-d8(sur3)	100	80-116	Pass

· · ·	l Results, Project: ESTreatibili		
Sample Identification:	10403-1B1-0k	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040915.D
Date Analyzed:	04/9/20 -1:8:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/1,)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4 74-83-9	Chloroethene(Vinyl Chloride)	6.3 ND	0.2
74-39	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	NĎ	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	32.4	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform 1.1.1-Trichloroethane	ND ND	0.1
563-58-6	1,1.1-Inchloropropene	ND ND	0.1
56-23-5	Tetrachloromethane	ND ND	0.2
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	7.9	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND ND	0.3
127-18-4	1,3-Dichloropropane Tetrachloroethene	ND ND	0.2
124-48-1	Dibromochloromethane	ND ND	0.2
106-93-4	1,2-Dibromothane	ND	0.1
108-90-7	Chlorobenzene	ND ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	0.7	0.2
95-47-6	o-Xytene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND ND	0.2
108-86-1	Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8 95-50-1	n-Butylbenzene	ND ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.1
120-82-1	1,2.4-Trichlorobenzene	ND	0.0
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromofluoromethene(aur1)	99	80-116	Pass
1,2-dickloroethane-d4(aur2) tolucae-d3(aur3)	108	80-116	Pass Pass
~~~~~~~~~~~~~~~~~ ( ##L1# )	100	011-06	Pass

#### Environmental Research Institute The University of Connecticut mpound Results, Project: ESTreatibility Tests

Sample Identification:	J Results, Project: ESTreatibility 10403-1B1-0(D)	Reporting Dute:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040916.D
Date Analyzed:	04/9/20-1:9:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethene	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.5	0.2
74-83-9 75-00-3	Bromomethane	ND ND	0.2
75-69-4	Chloroethane	- ND ND	0.2
75-35-4	1,1-Dichloroethene	ND	
75-09-2	Dichloromethane	1	i
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7 156-59-2	2,2-Dichloropropane (cis)-1,2-Dichloroethene	ND 33.9	0.1
74-97-5	Bromochloromethane		0.3
67-66-3	Chloroform		0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	ND	0.1
<u> </u>	1,2-Dichloroethane	ND 8.4	0.1
79-01-0	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromornethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	МІВК	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6 79-00-5	(trans)-1,3-Dichloropropene 1,1,2-Trichloroethane	ND ND	0.1
142-28-9	1,3-Dichloropropane	ND ND	0.3
127-18-4	Tetrachloroethene	1.5	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4 108-38-3	Ethylbenzene m-Xylene + p-Xylene	<u>ND</u> 0.7	0.1
95-47-6	o-Xylene	ND ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
<u>96-18-4</u> 108-86-1	1,2,3-Trichloropropane	ND ND	0.2
103-65-1	Bromobenzene n-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8 99-87-6	sec-Butylbenzene 4-iso-Propyltoluene	ND ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
<u>120-82-1</u> 87-68-3	1,2,4-Trichlorobenzene	ND	1
91-20-3	Hexachlorobutadiene Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
All il and a state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state	100	80-116	Pass
,2-dichlorosthene-d4(surr2)	108	80-116	Pass
	100	80-116 80-120	Pass

	d Results, Project: ESTreatibilit	y Tests	
Sample Identification:	10403-1B2-0h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-003-	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409 xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040917.D
Date Analyzed:	04/9/20-1:0:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.3	0.2
74-83-9	Bromornethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND ND	0.3
75-34-3 78-93-3	Methyl Ethyl Ketone (MEK)	ND ND	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	32.0	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	7.7	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3 10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.1
142-28-9	1,3-Dichloropropane	ND	0.3
127-18-4	Tetrachloroethene	1.3	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	0.7	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND ND	0.2
96-18-4 108-86-1	1.2.3-Trichloropropane Bromobenzene		0.2
108-86-1	n-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-ButyIbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1.3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND ND	0.3
91-20-3 87-61-6	Naphthalene 1,2,3-Trichlorobenzene	ND	0.2
67-64-1	Acetone	ND	1
Surrogate Recovery			<u>ــــــــــــــــــــــــــــــــــــ</u>
OULIVERIC MELOVELA			<b>C</b>
Compound	Recovery (%)	Limit (%)	Condition
Compound Dibromofinoromethene(surr1)	Recovery (%) 101	80-116	Pass

#### Environmental Research Institute The University of Connecticut Volutile Organic Compound Results, Project: ESTreatibility Tests

Sample Identification:	10403-1B2-0(D)	Reporting Date:	4/11/01
aboratory Identification:	0104012-004-	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040918.D
Date Analyzed:	04/9/20-1:0:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodilluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.2	0.2
74-83-9	Bromometume	ND	0.2
75-00-3	Chloroethane Trichlorofluoromethane	ND	0.2
75-35-4	1.1-Dichloroethene	ND ND	0.1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethene	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	32.7	0.1
74-97-5	Bromochloromethane	ND	0.3
<u>67-66-3</u> 71-55-6	Chloroform 1,1,1-Trichloroethane	ND ND	0.1
563-58-6	1,1,1-Dichloropropene	ND ND	0.1
56-23-5	Tetrachloromethane	ND	0.2
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	8.0	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	(trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	1.3	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3 95-47-6	m-Xylene + p-Xylene	0.7 ND	0.2
100-42-5	o-Xylene Styrene	ND	0.1
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachlorocthanc	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
95-49-8	4-Chlorotoluene 2-Chlorotoluene	ND ND	0.1
98-06-9	tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.1
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8 120-82-1	1.2-Dibromo-3-chloropropane	ND ND	0.6
87-68-3	1,2,4-Trichlorobenzene Hexachlorobutadiene	ND ND	0.3
91-20-3	Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND	1 0.2
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromoficoromothene(aur1)	100	80-116	Pass
1,2-dichloroethene-d4(surr2) toluene-d8(surr3)	110	80-116 80-116	Pass Pass
		I XILIA	

Environmental	Research Institute
The Universit	y of Connecticut
ound Results, Project: ESTre	atibility Tests
10403-1B3-0h	Reporting Date:

Sample Identification:	I Results, Project: ESTreatibilit 10403-183-0h	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	
Sampling Date:	4/6/01	Report Data File:	Aqueous 010409.xls.
	4/9/01	Report Data File: Raw Data File:	
Sample Receiving Date:			01040919.D
Date Analyzed:	04/9/20 -1:1: Name	Method:	EPA-8260
CAS Number 75-71-8	Dichlorodifluoromethane	Concentration(ug/L) ND	MDL (ug/L) 0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.3	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethnne	ŇD	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2 01634-04-4	Dichloromethane	ND ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2.2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	31.8	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0,1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND ND	0.2
56-23-5	Tetrachloromethane	ND ND	0,1-
107-06-2	Benzene 1.2-Dichloroethane		0.1
79-01-6	Trichloroethene	7.7	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Tolucue	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	1.3	0.2
124-48-1 106-93-4	Dibromochloromethane	ND ND	0.3
108-90-7	Chlorobenzene	ND ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane		0.1
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	0.7	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane Bromobenzene	ND ND	0.2
108-86-1 103-65-1	n-Propylbenzenc	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
<u>541-73-1</u> 106-46-7	1,3-Dichlorobenzene	ND ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery	<b>D</b> (0/)	Timis (b/)	C
Compound Dibromofinoromethene(surr1)	Recovery (%) 101	Limit (%) 80-116	Condition Pass
1,2-dichloroethans-d4(surt2)	101	80-116	Pass
tohuene-d8(surt3)	100	80-116	Pass
4-brompftuorobenzens(surs4)	104	80-120	Pass

Environmental Research Institute The University of Connecticut			
	i Results, Project: ESTreatibility T		4/11/01
Sample Identification:	10403-1B1-2h	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040920.D
Date Analyzed: CAS Number	04/10/20 -1:2: IName	Method: Concentration(ug/L)	EPA-8260 MDL (ug/L)
75-71-8	Dichlorodifluoronwthane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromoniethane	ND	0.2
75-00-3	Chlorocthane	ND	0.2
75-35-4	Trichlorofluoromethane	ND ND	0.1
75-09-2	Dichloromethane	1	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK) 2,2-Dichloropropane	ND ND	1
156-59-2	2,2-Dichloropropane (cis)-1,2-Dichloroethene	ND ND	0.1
74-97-5	Bromochloromethane	ND	0.1
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1
71-43-2 107-06-2	Benzene 1.2-Dichloroethane	ND ND	0.1
79-01-6	Trichloroethene	0.7	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1 108-88-3	MIBK	ND ND	0.2
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	1.0	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane Chlombenzene	ND ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.1
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND ND	0.2
75-25-2 98-82-8	Bromoform iso-Propylbenzene	ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8 106-43-4	1,3,5-Trimethylbenzene 4-Chlorotoluene	ND ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	scc-Butylbenzene	ND	0.1
99-87-6 541-73-1	4-iso-Propyltoluene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
<u>87-68-3</u> 91-20-3	Hexachlorobutadiene Naphthalene	ND ND	0.3
87-61-6	Naphthalene	ND	0.2
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromofiuoromethane(sur1) 1,2-dichlorosthane-d4(sur2)	102	80-116	Pass
(#TTL)+O-OddMotoGuldenc-O+		80-116	Pass
toluene-d8(aur3)	100	80-116	Pass

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	d Results, Project: ESTreatibility T		
Sample Identification:	10403-1B2-2h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-007	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040921.D
Date Analyzed:	04/10/20 -1:1:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluorom:thane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromornethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-09-2	Dichloromethane	ND 2	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1 -
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0,1
79-01-6	Trichloroethene	0.5	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3 75-27-4	Bromodichloromethane	ND ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene	ND ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Tolucne	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1.3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3 95-47-6	m-Xylene + p-Xylene	ND	0.2
100-42-5	o-Xylene	ND ND	0.1
75-25-2	Styrene Bromoform	ND	0.2
98-82-8	iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
<u>135-98-8</u> 99-87-6	sec-Butylbenzene	ND ND	0.1
541-73-1	4-iso-Propyltoluene 1,3-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery	Description	1	
Compound Disconstituoromethane(aur1)	Recovery (%) 101	Limit (%) 80-116	Condition Pass
1,2-dichlorosthane-d4(sur2)	101	80-116	Pass Pass
	109		Pass
tohene-d8(serr3)	100	80-116	( 7433

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120-82-1	1,2,4-Trichlorobenzene	ND ND	0.3
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
95-50-1	1,2-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
<u>95-63-6</u> 135-98-8	1,2,4-Trimethylbenzene sec-Butylbenzene	ND ND	0.2
98-06-9	tert-Butylbenzene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-86-1	Bromobenzene	ND	0.1
96-18-4	1,2,3-Trichloropropane	ND	0.2
<u>98-82-8</u> 79-34-5	iso-Propylbenzene 1,1,2,2-Tetrachloroethane	ND ND	0.2
<b>75-</b> 25-2	Bromoform	ND	0.1
100-42-5	Styrene	ND	0.2
95-47-6	o-Xylene	ND	0.1
108-38-3	m-Xylene + p-Xylene	0.7	0.2
100-41-4	Ethylbenzene	ND	0.2
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.1
106-93-4 108-90-7	1,2-Dibromoethane Chlorobenzene	ND ND	0.1
124-48-1	Dibromochloromethane	ND	0.3
127-18-4	Tetrachloroethene	1.6	0.2
142-28-9	1,3-Dichloropropane	ND	0.2
79-00-5	1,1,2-Trichlorocthane	ND	0.3
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
108-88-3	Tolucne	ND	0.1
108-10-1	MIBK	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND ND	0.2
75-27-4	Bromodichloromethane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
79-01-6	1,2-Dichloropropane		0.1
107-06-2 79-01-6	1.2-Dichloroethane Trichloroethene	ND 8.1	0.1
71-43-2	Benzene	ND	0.1
56-23-5	Tetrachloromethane	ND	0.1-
563-58-6	1,1-Dichloropropene	ND	0.2
71-55-6	1,1,1-Trichloroethane	ND	0.1
67-66-3	Chloroform	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
156-59-2	(cis)-1,2-Dichloroethene	31.5	0.1
594-20-7	2,2-Dichloropropane	ND ND	0.1
75-34-3 78-93-3	1.1-Dichloroethane Methyl Ethyl Ketone (MEK)	ND ND	0.1
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
01634-04-4	MTBE	ND	0.3
75-09-2	Dichloromethane	1	<u>_</u>
75-35-4	1.1-Dichloroethene	ND	1
75-69-4	Chloroethane Trichlorofluoromethane	ND	0.2
74-83-9 75-00-3	Bromomethane		0.2
75-01-4	Chloroethene(Vinyl Chloride)	6.1	0.2
74-87-3	Chloromethane	ND	0.1
75-71-8	Dichlorodifluoronwthane	ND	0.3
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
Date Analyzed:	04/10/20 -1:1:	Method:	EPA-8260
Sample Receiving Date:	4/9/01	Raw Data File:	01040922.D
Sampling Date:	4/6/01	Report Data File:	010409.xls.
-	0104012-008	Sample Matrix:	Aqueous
Sample Identification:			
	10403-1B3-2h	Reporting Date:	4/11/01

1,2-dichloroethane-d4(surr2)	109	80-116	Pass
Compound Dibromofinoromethene(mrr1)	Recovery (%) 100	Limit (%) 80-116	Condition Pass
Surrogate Recovery	D	Vi-la (Di)	
67-64-1	Acetone	ND	1
87-61-6	1,2,3-Trichlorobenzene	ND	1
87-68-3 91-20-3	Hexachlorobutadiene Naphthalenc	ND ND	0.3
120-82-1	1.2,4-Trichlorobenzene	ND	1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
104-51-8 95-50-1	n-Butylbenzene 1.2-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
95-63-6 135-98-8	1,2,4-Trimethylbenzene	ND ND	0.2
98-06-9	tert-Butyibenzene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
103-65-1 108-67-8	n-Propylbenzene	ND ND	0.1
108-86-1 103-65-1	Bromobenzene	ND ND	0.1
96-18-4	1,2,3-Trichloropropane	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
98-82-8	Bromoform iso-Propylbenzene	ND ND	0.1
100-42-5 75-25-2	Styrene	ND	0.2
95-47-6	o-Xylene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.1
<u>630-20-6</u> 100-41-4	1,1,1,2-Tetrachloroethane Ethylbenzene	ND ND	0.2
108-90-7	Chlorobenzene	ND	0.1
106-93-4	1,2-Dibtomoethane	ND	0.1
127-18-4	Dibromochloromethanc	ND	0.2
142-28-9 127-18-4	1,3-Dichloropropane	ND ND	0.2
79-00-5	1,1,2-Trichloroethane	. ND	0.3
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
108-88-3	Toluene	ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene MIBK	ND ND	0.2
75-27-4	Bromodichloromethane	ND	0.2
74-95-3	Dibromomethane	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
79-01-6	Trichloroethene	0.6	0.1
71-43-2 107-06-2	Benzene 1.2-Dichloroethane	ND ND	0.1
56-23-5	Tetrachloromethane	ND	0.1 -
563-58-6	I,1-Dichloropropene	ND	0.2
71-55-6	1,1,1-Trichloroethane	ND	0.1
74-97-5	Bromochloromethane	ND ND	0.3
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
156-60-5 75-34-3	(trans)-1,2-Dichloroethene	0.8	0.3
01634-04-4	MTBE	ND	0.3
75-09-2	Dichloromethane	1	1
75-69-4 75-35-4	Trichlorofluoromethane	ND ND	0.1
75-00-3	Chlorocthane	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
75-71-8 74-87-3	Dichlorodifluoromethane Chloromethane	ND ND	0.3
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
Date Analyzed:	04/10/20 -1:2:	Method:	EPA-8260
Sample Receiving Date:	4/9/01	Raw Data File:	01040923.D
Sampling Date:	4/6/01	Report Data File:	010409.xls.
aboratory Identification:	0104012-009	Sample Matrix:	Aqueous
ample Identification:	10403-1 <b>B</b> 1-8h	Reporting Date:	4/11/01

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Sample Identification:	1 Results, Project: ESTreatibility 10403-182-8h	Reporting Dute:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
		•	010409.xls.
Sampling Date:	4/6/01	Report Data File:	
Sample Receiving Date:	4/9/01	Raw Data File:	01040924.D
Date Analyzed:	04/10/20 -1:3:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND ND	0.1
75-01-4	Chloroethene(Vinyl Chloride) Bromomethane		0.2
74-83-9 75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1.1-Dichloroethene	ND ND	1
75-09-2	Dichloromethane	2	<u> </u>
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1.1.1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	• 0.1-
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	0.5	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	
10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	Tetrachloroethene	ND ND	0.2
127-18-4	Dibromochloromethane	ND	0.2
106-93-4	1.2-Dibromoethane	ND ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND ND	0.2
135-98-8	sec-Butylbenzene		0.1
541-73-1	4-iso-Propyltolucne 1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1.2.4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalenc	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Cendition
Dibromofheoromethene(aur1)	100	80-116	Pass
1,2-dichloroethane-d4(surr2)	109	80-116	Pass
tolucus-dif(sur3)	99	80-116	Pass

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	l Results, Project: ESTrestibili		
Sample Identification:	10403-1B3-8h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-011	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040925.D
Date Analyzed:	04/10/20 -1:4:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloronethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.0	0.2
74-83-9	Bromomethane	ND	0.2
75-()()-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluorom:thane	ND ND	0.1
75-35-4	1.1-Dichloroethene		1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	31.2	0.1
74-97-5	Bromochlorornethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane Benzene		0.1-
107-06-2	1.2-Dichloroethane		0.1
79-01-6	Trichloroethene	8.3	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	<u>ND</u>	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane Tetrachloroethene	ND	0.2
127-18-4 124-48-1	Dibromochloromethane		0.2
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1.1.1.2-Tetrachloroethane		0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	NĎ	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachlorocthane	ND ND	0.2
96-18-4 108-86-1	1,2,3-Trichloropropane Bromobenzene	ND ND	0.2
108-86-1	n-Propylbenzene	ND	0.1
103-03-1	1.3.5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotolucne	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND ND	0.1
106-46-7 104-51-8	n-Butylbenzene	ND ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND ND	0.6
120-82-1	1.2.4 Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Nephthalepe	ND	0.2
87-61-6	1.2.3-Trichlorobenzene	ND	1
67-64-1	Acctone	ND	1
Surrogate Recovery			A
Compound Dibromofluoromothane(auri)	<u> Recovery (%)</u> 100	Limit (%)	Condition Pass
1,2-dichloroethano-d4(surr2)	109	80-116	Pass
taluene-d8(satt3)	100	80-116	Pass
4-bromofinorobenzene(surr4)	A		Pass

	Environmental Res The University of		
olatile Organic Compound	d Results, Project: ESTreatibilit		
ample Identification:	10404-1B1-22h	Reporting Date:	4/11/01
aboratory Identification:	0104012-012	Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409.xts.
ample Receiving Date:	4/9/01	Raw Data File:	01040926.D
auto Analyzed:	04/10/20 -1:4:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	1	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3 78-93-3	1,1-Dichloroethane	0.9 ND	0.1
594-20-7	Methyl Ethyl Ketone (MEK) 2,2-Dichloropropane	ND ND	1
156-59-2	(cis)-1.2-Dichloroethene	ND ND	0.1
74-97-5	Bromochloromethane	ND	0.1
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0,1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1.
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	0.6	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND NE	0.1
79-00-5	1,1,2-Trichloroethane	ND ND	0.3
127-18-4	Tetrachloroethene	ND ND	0.2
124-48-1	Dibromochloromethane	ND	0.2
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	a-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
<u> </u>	4-Chlorotoluene	ND ND	0.1
93-49-8	2-Chlorotoluene tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.1
135-98-8	sec-Butylbenzene	ND	0.2
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzenc	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	NĎ	1
87-68-3	Hexachlorobutadicne	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetope	ND	1
Surrogate Recovery Compound	Decover (4/ )	Limit (%)	Candidan
Dibromitionremethene(surl)	Recovery (%) 100	80-116	Condition Pass
1,2-dichloroethane-d4(surt2)	108	80-116	Pass
lotume-d8(mm3)	100	80-116	Pass
Horomofinorobenzane(surt4)	100	80-120	Pass

#### ND = Not Detected

Sample Identification:	J Results, Project: ESTreatibillt 10404-1B2-22h	Reporting Date:	4/11/01
aboratory Identification:	0104012-013	Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/01	Raw Data File:	01040927.D
Date Analyzed:	04/10/20 -1:5:	Method:	EPA-8260
CAS Number	IName	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichloraditluoromethene	DN	0.3
74-87-3	Chloromethane	NÐ	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	NĎ	0.2
75-00-3	Chloroethane	ND ND	0.2
75-69-4	1.1-Dichloroethene	ND ND	0.1
75-09-2	Dichloromethane	3	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0,3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane Chloroform	ND ND	0.3
71-55-6	1.1.1-Trichloroethane		0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	. 0.1
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethene	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4 10061-01-5	Bromodichloromethane (cis)-1,3-Dichloropropene	ND ND	0.2
108-10-1	MIBK	ND ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND ND	0.1
<u>108-90-7</u> 630-20-6	1,1,1,2-Tetrachloroethane	ND	0.1
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylenc	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0,2
79-34-5 96-18-4	1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane	ND ND	0.2
108-86-1	Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6 135-98-8	1,2,4-Trimethylbenzene	ND ND	0.2
99-87-6	4-iso-Propyltoluene		0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3 91-20-3	Hexachlorobutadiene Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND ND	0.2
67-64-1	Acetone	ND	1
Surrogate Recovery			·
Compound	Recovery (%)	Limit (%)	Condition
Dibromofinorometheno(sur1)	102	80-116	Pass
olume-d8(mrr3)	110	80-116	Pass Pass

Sample Identification:	10404-1B3-22h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-014	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
	4/9/01	Report Data File:	
Sample Receiving Date:			01040928.D
Date Analyzed:	04/10/20 -1:6: Name	Method:	EPA-8260
CAS Number	Dichlorodifluoromethane	Concentration(ug/L)	MDL (ug/L) 0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	6.1	0.2
74-93-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromediane	NĎ	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichloromethane	1	I
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3 594-20-7	Methyl Ethyl Ketone (MEK)	ND	1
156-59-2	2.2-Dichloropropane (cis)-1,2-Dichloroethene	ND 31.2	0.1
74-97-5	Bromochloromethane	ND	0.1
67-66-3	Chloroform	ND ND	0.3
71-55-6	1.1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
\$6-23-5	Tetrachloromethane	ND	• 0.1
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	8.0	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MBK	ND	0.2
108-88-3	Tolucne	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
142-28-9	1,3-Dichloropropane	ND	0.3
127-18-4	Tetrachloroethene	2.0	0.2
124-48-1	Dibromochloromethane	ND	0.2
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
<u>79-34-5</u> 96-18-4	1,1,2,2-Tetrachloroethane	ND ND	0.2
108-86-1	Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND ND	0.1
108-67-8	1.3.5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotolucne	ND	0.1
95-49-8	2-Chlorotolucne	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7 104-51-8	1,4-Dichlorobenzene	ND ND	0.1
95-50-1	1.2-Dichlorobenzene		0,1
96-12-8	1,2-Dibrono-3-chloropropane	ND ND	0.6
120-82-1	1.2.4-Trichlorobenzene	ND ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Cempeund	Recovery (%)	Limit (%)	Condition
Dibromofbioromothene(surr1) 1,2-dichloroethene-d4(surr2)	101	80-116	Pass
1,2-chonioroechino-d4(surt2)	110	80-116	Pass Pass
4-bromofinorobenzene(surr4)	104	80-120	Pass
ND = Not Detected			

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•• •	I Results, Project: ESTreatibili		
Sample Identification:	10404-1B1-32h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-015	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040929.D
Date Analyzed:	04/10/20 -1:7:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8 74-87-3	Dichlorodifluoromethane Chloromethane	ND ND	0.3
75-01-4	Chloroethene(Vinyl Chloride)	ND ND	0.1
74-83-9	Bromomethane	ND	0.2
75-00-3	Chioroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichlorometlane	1	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3 78-93-3	1,1-Dichloroethane Methyl Ethyl Ketone (MEK)	0.8 ND	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1.2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1
71-43-2	Benzene	ND	0.1
107-06-2 79-01-6	1,2-Dichloroethane	ND ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9 127-18-4	1,3-Dichloropropane	ND ND	0.2
127-18-4	Dibromochloromethane	ND	0.2
106-93-4	1.2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5 75-25-2	Styrene Bromoform	ND ND	0.2
98-82-8	iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8 98-06-9	2-Chlorotoluene tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND ND	0.1
135-98-8	scc-Butylbenzene	ND ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8 120-82-1	1,2-Dibromo-3-chloropropane	ND ND	0.6
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Nephthalene	ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromofisoromsthane(sur1) ,2-dichloroethane-d4(sur2)	101	80-116	Pass
A THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE		80-116	
chuene-d8(surr3)	101	80-116	Pass

Sample Identification:	l Results, Project: ESTreatibili 10404-181-32(D)	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/01	Raw Data File:	01040930.D
ate Analyzed:	04/10/20 -1:7:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0,3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0,2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2 01634-04-4	Dichloromethane	1 ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND ND	0.3
75-34-3	1.1-Dichloroethane	0.8	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	NĎ	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachlorornethane	ND	0.1-
71-43-2	Benzene	ND	0.1
107-06-2 79-01-6	1,2-Dichloroethane	ND ND	0.1
78-87-5	1,2-Dichloropropane	ND ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichlorocthane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochlorome thane	ND	0.3
106-93-4	1,2-Dibrompethane	ND	0.1
108-90-7 630-20-6	Chlorobenzene 1,1,1,2-Tetrachloroethane	ND ND	0.1
100-41-4	Ethylbenzene	ND ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND ND	0.1
108-67-8	1,3,5-Trimethylbenzene 4-Chlorotoluene		0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibrono-3-chloropropane	ND	0.6
120-82-1 87-68-3	1,2,4-Trichlorobenzene Hexachlorobutadiene	ND ND	1 0.3
91-20-3	Naphthalepe	ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND ND	1
Surrogate Recovery			•
Compound	Recovery (%)	Limit (%)	Condition
Abromofinoromethane(sur1)	101	80-116	Pass
2-dichloroethane-d4(sur2)	108	80-116	Pass
oluene-d8(sur3)	101	80-116	Pass
-broupfluorobenzono(sur14)	100	80-120	Pass

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Sample Identification:	I Results, Project: ESTreatibilit 10404-182-32h	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/01	Raw Data File:	01040940.0
ample Receiving Date.	04/10/20 -1:3:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0,3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane Trichlorotluoronxthane	ND ND	0.2
75-35-4	1.1-Dichloroethene	ND ND	0.1
75-09-2	Dichloromethane	4	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	0.8	0.1
78-93-3 594-20-7	Methyl Ethyl Ketone (MEK) 2.2-Dichloropropane	ND ND	1
156-59-2	(cis)-1.2-Dichloroethene	ND	0.1
74-97-5	Bromochlororrethane	ND	0.1
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND 0.1	0.1
71-43-2	Benzene 1,2-Dichloroethane	0.7 ND	0.1
79-01-6	Trichloroethene	ND ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND ND	0.2
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4 108-90-7	1,2-Dibromoethane Chlorobenzene	ND ND	0,1
630-20-6	1,1,1,2-Tetrachlorocthane	ND	0.1
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2 98-82-8	Bromoform iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethanc	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4 95-49-8	4-Chlorotoluene	ND ND	0.1
98-06-9	tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	scc-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1.3-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0,1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalcuc	ND	0.2
87-61-6 67-64-1	1.2.3-Trichlorebenzene	ND ND	1
Surrogate Recovery	P		L4
Compound	Recovery (%)	Limit (%)	Condition
Dibromofisoromethene(sur1)	101	80-116	- Pass
1,2-dichloroethane-d4(arr2)	110	80-116	Pass
olucne-d5(auri) I-bromofiuorobeuzone(auri4)	100	80-116 80-120	Pass Pass

Sample Identification:	3 Results, Project: ESTreatibility 10404-1B2-32(D)	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4(6)01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040941.D
Date Analyzed:			
CAS Number	04/10/20 -1:3: Name	Method:	EPA-8260
75-71-8	Dichlorodifluoromethane	Concentration(ug/L) ND	0.3
74-87-3	Chloromethane		0.3
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.1
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethanc	ND	0.2
75-69-4	Trichlorothoromethane	ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	3	1
01634-04-4	MTBE	ND	0,3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7 156-59-2	2,2-Dichloropropane (cis)-1,2-Dichloroethene	ND ND	0.1
74-97-5	Bromochloromethane	ND	0.1
67-66-3	Chloroform	ND ND	0.3
71-55-6	1.1.1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.1
56-23-5	Tetrachloromethane	ND	0.1 -
71-43-2	Benzene	0.6	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1 108-88-3	MIBK	ND ND	0.2
10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1.1.2-Trichloroethane	ND	0.1
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
<u>75-25-2</u> 98-82-8	Bromoform iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	NĎ	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND ND	0.1
99-87-6 541-73-1	4-iso-Propyltoluene 1,3-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery	D	TA-14/07	0
Cempound Moromofiluoromethene(surri)	Recovery (%) 100	Limit (%) 80-116	Condition Pass
2-dichloroethane-d4(surt2)	100	80-116	Pass -
ohme-d8(mr3)	101	80-116	Pass
bromoguorobenzene(surr4)		80-120	Pass

Volatile Organic Compound	d Results, Project: ESTreatibilit	y Tests	
Sample Identification:	10404-1B3-32h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-019	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040942.D
Date Analyzed:	04/10/20 -1:4:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluororathane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	5.9	0.2
74-83-9 75-00-3	Bromornethane	ND ND	0.2
75-69-4	Trichlorofluoromethane	ND ND	0.2
75-35-4	1.1-Dichloroethene	ND ND	<u> </u>
75-09-2	Dichloromethane	2	1
01634-04-4	МТВЕ	ND	0.3
156-60-5	(trans)-1.2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2 74-97-5	(cis)-1,2-Dichloroethene Bromochloromethane	30.2 ND	0.1
67-66-3	Chloroform		0.3
71-55-6	1,1,1-Trichloroethane	ND ND	0.1
\$63-58-6	1,1-Dichloropropene	ND	0.1
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	7.8	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3 75-27-4	Dibromomethane Bromodichloromethane	ND ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene		0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	2.0	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4 108-90-7	1,2-Dibrompethane Chlorøbenzene	ND ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.1
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachioroethane	ND	0.2
96-18-4 108-86-1	1,2,3-Trichloropropane Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0,1
95-49-8	2-Chlorotolucne	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
<u>135-98-8</u> 99-87-6	sec-Butylbenzene 4-iso-Propyltoluene	ND ND	0.1
541-73-1	1.3-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1.2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3 87-61-6	Naphthalene	ND ND	0.2
67-64-1	Acetone	ND ND	1
Surrogate Recovery	1		L
Compound	Recovery (%)	Limit (%)	Condition
Dibromofinoromethens(sur1)	99	80-116	- Pass
1,2-dichloroethane-d4(sur2)	108	80-116	P2\$\$
toluene-d5(enr3) 4-bromofiuorobenzene(surr4)	100	80-116	Pass
	102	80-120	Pass

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Sample Identification:	I Results, Project: ESTreatibili 10405-1B1-48h	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/01	Raw Data File:	01040943.D
Date Analyzed:	04/10/20 -1:5:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0,3
74-87-3	Chloromethane	ND	0,1
75-01-4 74-83-9	Chloroethene(Vinyl Chloride) Bromonethane	ND ND	0.2
75-00-3	Chloroethane	ND ND	0.2
75-69-4	Trichlorofluoroinethane	ND	0.1
75-35-4	1,1-Dicldoroethene	ND	1
75-09-2	Dichloromethane	2	l
01634-04-4	MTBE	ND ND	0.3
156-60-5 75-34-3	(trans)-1,2-Dichloroethene	ND ND	0.3
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform 1.1.1-Trichloroethane	ND	0.1
<u>71-55-6</u> 563-58-6	1,1,1-1 nchlorocthane 1,1-Dichloropropene	ND ND	0.1
56-23-5	Tetrachloromethane	ND	0.2
71-43-2	Benzene	0.6	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3 75-27-4	Dibromomethane	ND ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	МІВК	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9 127-18-4	1,3-Dichloropropane	ND ND	0.2
124-48-1	Dibromochloromethane	ND	0.2
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4 108-38-3	Ethylbenzene	ND ND	0.1
95-47-6	m-Xylene + p-Xylene o-Xylene	ND	0.2
100-42-5	Styrene	ND	0.1
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
<u>96-18-4</u> 108-86-1	1,2,3-Trichloropropane Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
<u>95-63-6</u> 135-98-8	1,2,4-Trimethylbenzene sec-Butylbenzene	ND ND	0.2
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
<u>95-50-1</u> 96-12-8	1,2-Dichlorobenzene 1,2-Dibromo-3-chloropropane	ND ND	0.1
120-82-1	1,2-Dibromo-3-chloropropane	ND ND	0.6
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Nephthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery Compound	Recovery (%)	Limit (%)	Condition
Dibromofuoromethane(sur1)	99	80-116	- Pass
,2-dichlorostheno-d4(sur2)	107	80-116	Pass
aluene d8(sur3)	100	80-116	Pass
4-bromofiuorobenzeno(sur4)	103	80-120	Pass

nple Identification:	10405-1B2-48h	Reporting Date:	4/11/01
boratory Identification:		Sample Matrix:	Aqueous
npling Dute:	4/6/01	Report Data File:	010409.xls.
	4/9/01	Raw Duta File:	01040944.D
nple Receiving Date:		Method:	
te Analyzed:	04/10/20-1:6:		EPA-8260
CAS Number	Name Dichlorodifluoronethane	Concentration(ug/L) ND	MDL (ug/L) 0.3
75-71-8 74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)		0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chlorocthane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichloromethane	5	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND	0,1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND ND	0.1
74-97-5 67-66-3	Bromochloromethane	ND	0.3
71-55-6	1.1.1-Trichloroethane	ND ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	0.8	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND ND	0.2
108-88-3	Tolucne (trans)-1,3-Dichloropropene	ND ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.1
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND ND	0.2
75-25-2	Bromoform iso-Propylbenzene	ND	0.1
<u>98-82-8</u> 79-34-5	1,1,2,2-Tetrachloroethane	ND ND	0.2
96-18-4	1.2.3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotolucne	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND ND	0.1
<u>99-87-6</u> 541-73-1	4-iso-Propyltoluene 1.3-Dichlorobenzene	ND	0.1
106-46-7	1.4-Dichlorobenzene	ND ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalone	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			1
Compound	Recovery (%)	Limit (%)	Condition
romofilioromothane(sur1)	100	80-116	- Pass Pass
-cacegoroeconcer-o+(nurr2)	107	80-116	Pass

#### Environmental Research Institute The University of Connecticut Volatile Organic Compound Results, Project: ESTreattbility Tests

Sample Identification:	d Results, Project: ESTreatibili 10405-1B3-48h	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Report Data File:	01040945.D
			· · · · · ·
Date Analyzed: CAS Number	04/10/20 -1:6:	Method: Concentration(ug/L)	EPA-8260 MDL (ug/L)
75-71-8	Dichlorodifluoronethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	5.7	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichlororrethane MTBE	2 ND	1
01634-04-4 156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	29.8	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6 56-23-5	1,1-Dichloropropene Tetrachloromethane		0.2
71-43-2	Benzenc	ND ND	· 0.1 - 0.1
107-06-2	Denzenc 1_2-Dichloroethane	ND ND	0.1
79-01-6	Trichloroethene	7.9	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6 79-00-5	(trans)-1,3-Dichloropropene 1,1,2-Trichloroethane	ND ND	0.1
142-28-9	1,3-Dichloropropane	ND ND	0.2
127-18-4	Tetrachloroethene	2.0	0.2
124-48-1	Dibromochioromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
<u>95-47-6</u> 100-42-5	o-Xylene Styrene	ND ND	0.1
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachlorocthane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4 95-49-8	4-Chlorotoluene	ND ND	0.1
93-49-8	tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	scc-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltolucne	ND	0.1
541-73-1	1.3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
<u>95-50-1</u> 96-12-8	1,2-Dichlorobenzene 1,2-Dibromo-3-chloropropane	ND ND	0.1
120-82-1	1,2-Librono-3-chloropropane	ND ND	0.6
87-68-3	Hexachlorobutadiene	ND ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1.2.3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Compound Dibromofluoromethane(sur1)	Recovery (%) 99	Limit (%)	Condition
1,2-dichloroethane-d4(surr2)	109	<u> </u>	Pass Pass
tohume-d8(surr3)	100	80-116	Pass
4-bromo morobenzene (aur4)	102	80-120	Pass

Sample Identification:	d Results, Project: ESTreatibili 10405-1B1-56h	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409 xis
ample Receiving Date:	4/9/01	Raw Data File:	01040946.D
1 0			
ate Analyzed: CAS Number	04/10/20 -1:7: IName	Method: Concentration(ug/L)	EPA-8260 MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1,1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND ND	0,3
75-34-3	(trans)-1,2-Dichloroethene	ND	0.3
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1
71-43-2	Benzene	0.7	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6 78-87-5	Trichloroethene	ND ND	0.1
74-95-3	1,2-Dichloropropane Dibromomethane		0.1
75-27-4	Bromodichloromethane	ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7 630-20-6	Chlorobenzene 1.1.1.2-Tetrachloroethane	ND ND	0.1
100-41-4	Ethylbenzene	ND ND	0.2
108-38-3	m-Xylene + p-Xylene	ND	0.1
95-47-6	o-Xylene	ND	0.2
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8 106-43-4	1,3,5-Trimethylbenzene	ND	0.1
95-49-8	4-Chlorotoluene	ND ND	0.1
93-49-8	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.1
135-98-8	scc-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1.3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3 91-20-3	Hexachlorobutadiene Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND ND	0.2
67-64-1	Acetone	ND	1
Surrogate Recovery			•
Compound	Recovery (%)	Limit (%)	Condition
Dibromofinocomethene(aur1)	101	80-116	Pass
,2-diabloroothane-d4(surr2)	108	80-116	Pass
ohene-d8(aur3)	100	80-116	Pass Pass

Sample Identification:	1 Results, Project: ESTreatibili 10405-1B1-56(D)	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040947.D
Date Analyzed:	04/10/20 -1:8:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane Trichlorofluoromethane	ND ND	0.2
75-35-4	L1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3 78-93-3	1,1-Dichloroethane	0.8 ND	0.1
594-20-7	Methyl Ethyl Ketone (MEK) 2,2-Dichloropropane	ND	0,1
156-59-2	(cis)-1,2-Dichloroethene	ND ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene Tetrachloromethane	ND ND	0.2
<u> </u>	Benzene	0.7	0.1-
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene MIBK	- ND ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichlorosthane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene Dibromochloromethane	ND	0.2
124-48-1 106-93-4	1.2-Dibromoethane		0.3
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6 100-42-5	o-Xylene	ND ND	0.1
75-25-2	Styrene Bromoform	ND	0.2
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1 108-67-8	n-Propylbenzene 1,3,5-Trimethylbenzene	ND ND	0.1
106-43-4	4-Chlorotoluene	ND ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
<u>135-98-8</u> 99-87-6	sec-Butylbenzene	ND ND	0.1
541-73-1	4-iso-Propyltoluene 1,3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene Hexachlorobutadiene	ND ND	1
<u>87-68-3</u> 91-20-3	Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	- DN DN	
67-64-1	Acetone	ND	1
Surrogate Recovery		· · · · · · · · · · · · · · · · · · ·	
Compound	Recovery (%)	Limit (%)	Condition
Dibromofinoromethane(sur1) 1,2-dichloroethane-d4(sur2)	101	80-116	Pass Pass
toluene-di(mrr3)	108	80-116	Pass
4-bromofinorobenzene(surr4)	103	80-120	Pass

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mple Identification:	I Results, Project: ESTreatibilit 10405-1B2-56h	Reporting Date:	4/11/01
boratory Identification:	0104012-025	Sample Matrix:	Aqueous
impling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/01	Raw Data File:	01040948.D
ate Analyzed:	04/10/20 -1:9:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane Trichlorofluoromethane	ND ND	0.2
75-35-4	1.1-Dichloroethene		1
75-09-2	Dichloronuthane	5	_ 1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK) 2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1.2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND ND	0.2
56-23-5 71-43-2	Benzene	0.9	0.1
107-06-2	1.2-Dichloroethane	ND	0.1
79-01-6	Trichlorocthene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene MIBK	ND ND	0.2
103-10-1 103-88-3	Toluene		0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND ND	0.3
106-93-4 108-90-7	1,2-Dibromoethane	ND ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND ND	0.2
75-25-2 98-82-8	Bromoform iso-Propylbenzene	ND ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND ND	0.1
<u>106-43-4</u> 95-49-8	4-Chlorotoluene	ND ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
<u>541-73-1</u> 106-46-7	1,3-Dichlorobenzene	ND ND	0.1
106-46-7	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene 1,2,3-Trichlorobenzene	ND ND	0.2
<u> </u>	Acetone	ND ND	1
Surrogate Recovery			
Compound	Recovery (%)	Limit (%)	Condition
Dibromofbuoromethane(aur1)	101	80-116	Pass Pass
1,2-dichloroethene-d4(sur2) tolume-d8(sur3)	109	80-116	Pass
CONTRACTOR OF STREET, S. I.		VV-11V	

Sample Identification:	I Results, Project: ESTreatibility 10405-1B2-56(D)	Reporting Date:	4/11/01
_aboratory Identification:	0104012-026	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xis.
Sample Receiving Date:	4/9/01	Report Data File:	01040949.D
Date Analyzed:		Method:	
CAS Number	Name	Concentration(ug/L)	EPA-8260 MDL (ug/L)
75-71-8	Dichlorodifluorom:thane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-(11-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	NĎ	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND ND	0.1
75-09-2	Dichloromethane	5	1
01634-04-4	MTBE	ND	0,3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane (cis)-1,2-Dichloroethene	ND	0.1
<u>156-59-2</u> 74-97-5	Bromochloroniethane	ND ND	0.1
67-66-3	Chloroform	ND	0.3
71-55-6	1,1,1-Trichloroethene	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1-
71-43-2	Benzene	0.8	0.1
<u>107-06-2</u> 79-01-6	1,2-Dichloroethane Trichloroethene	ND ND	0.1
79-01-6	1,2-Dichloropropane	ND ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3 10061-02-6	Toluene	ND ND	. 0.1
79-00-5	(trans)-1,3-Dichloropropene 1,1,2-Trichloroethane	ND ND	0.1
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane Ethylbenzene	ND ND	0.2
108-38-3	m-Xylene + p-Xylene	ND	0.1
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
<u>79-34-5</u> 96-18-4	1,1,2,2-Tetrachloroethane	ND ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	NĎ	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
<u> </u>	2-Chlorotoluene tert-Butylbenzene	ND ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1.3-Dichlorobenzene	ND	0.1
106-46-7	1,4-Dichlorobenzene	ND ND	0.1
104-51-8 95-50-1	n-Butylbenzene 1,2-Dichlorobenzene	ND ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.1
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadicne	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6 67-64-1	1,2,3-Trichlorobenzene	ND ND	1
Surrogate Recovery	Accione		1
Cempound	Recovery (%)	Limit (%)	Condition
Dibromofinoromethano(surr1)	100	80-116	Pass
1,2-diablorosthane-d4(surr2)	110	80-116	Pass Pass

ample Identification:	10405-1B3-56h	Reporting Date:	4/11/01
aboratory Identification:		Sample Matrix:	Aqueous
ampling Dute:	4/6/01	Report Data File:	010409 xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040950.D
		Method:	
Date Analyzed: CAS Number	04/10/20 -1:0:	Concentration(ug/L)	EPA-8260
75-71-8	Dichlorodifluoromethane	ND	MDL (ug/L) 0.3
74-87-3	Chloromethane	ND	0.3
75-01-4	Chloroethene(Vinyl Chloride)	5.8	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
<u>156-60-5</u> 75-34-3	(trans)-1,2-Dichloroethene	ND ND	0.3
78-93-3	Methyl Ethyl Ketone (MEK)	ND	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichlaroethene	29.6	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1
71-43-2	Benzene	ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	7.6	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND ND	0,1
75-27-4	Bromodichloromethane (cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND ND	0.2
108-88-3	Tolucne	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	2.0	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3 95-47-6	m-Xylene + p-Xylene	ND ND	0.2
100-42-5	o-Xylene Styrene		0.1
75-25-2	Brompform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Brompbenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-3	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	NĎ ND	0.1 •
<u>98-06-9</u> 95-63-6	tert-Butylbenzene	ND ND	0.1
135-98-8	sec-Butylbenzene	ND ND	0.2
99-87-6	4-iso-Propyltoluene	ND	0.1
541-73-1	1,3-Dichlorobenzene	ND ND	0.1
106-46-7	1,4-Dichlorobenzene	ND	0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6 67-64-1	1,2,3-Trichlorobenzene	ND ND	1
507-64-1 Surrogate Recovery	Accione		<u> </u>
Compound	Recovery (%)	Limit (%)	Condition
Dibromofiuorometheno(sur1)	100	80-116	Pass
1,2-dichlorosthane-d4(surr2)	108	80-116	Pass
lohene-d8(mrr3)	101	80-116	Pass
4-broundmorobenzene(surr4)	102	80-120	Pass

#### nvironmental Research Institute Ы

Volatile Organic Compound Results, Project: ESTreatibility Tests
The University of Connecticut
FUNCOUNCINE RESERVED

5584	911-08	100	(Errended)
2264	911-08	110	1.2-dichlorosthemo-d4(surr2)
nobibae)	(%) 10011 (%) 1011	100 Keconery (%)	Dibromofinorometheno(sure1)
	(%) (m) [	(%) \13\03\8	Surrorate Recovery
I		Acetone	1+9-69
1		anaznadoroldari T-E,S, 1	9-19-18
2'0		Nephthelene	61-50-3
6.0		Hexachlorobuladiene	£-89-28
1		1,2,4-Trichlorobenzene	1-28-021
9'0	<u>UN</u>	1,2-Dibromo-3-chloropropane	8-71-96
1.0	<u>an</u>	1,2-Dichlorobenzene	1-05-56
1.0	<u> </u>	a-Butylbeazeae	8-15-101
1.0	<u>an</u>	1,4-Dichlorobenzene	L-9#-90I
1'0		1.3-Dichlorobenzene	1-22-145
I'0	UN	4-iso-Propyltoluene	9-18-66
TO	ND	sec-Butylbenzene	8-86-5£1
0.2	ND	1,2,4-Trimethylbenzene	9-29-56
1.0	<u>UN</u>	iert-Butylbenzene	6-90-86
1.0	<u>AN</u>	2-Chlorotoluene	8-61-56
1.0	ND	4-Chlorotoluene	1-61-901
10		anasaadiyihaninT-2,5,1	8-L9-801
1.0	<u> </u>	n-Propylbenzene	1-59-601
1.0	ND	Bromobenzene	1-98-801
2.0		1.2.3-Trichloropropane	<del>**</del> 81-96
2.0	MD	anadisorohiostra.T-2,2,1,1	5-7E-6L
2.0	<u>ND</u>	iao-Propylbenzene	8-28-86
1:0	<u>UN</u>	เมางใจแองยิ	Z-57-5L
0.2		Styrene	100-42-5
1.0		o-Xylene	9-11-56
2.0	<u>an</u>	<u>υν-Χλιευε + b-Χλιευε</u>	E-8E-801
1.0	<u>AD</u>	Ethylbenzene	100-41-4
2.0	<u>ND</u>	1,1,1,2-Tetrachloroethane	<u> </u>
1.0		Сыореписте	2-06-801
1.0	<u> </u>	1,2-Dibromethanc	10903-1
6.0		Dibromehloromethane	1-84-48-1
0.2		l'etrachiorthene	1-81-721
2.0		1,3-Dichloropropane	145-58-6
6.0		1,1,2-Trichlorocthane	\$-00-6L
1.0	MD	(tens)-1,3-Dichloropropene	10001-03-0
1.0	N	Tolucne	108-88-3
2.0	<u>ND</u>	WIBK	1-01-801
0.2		(cis)-1,3-Dichloropropene	\$-10-19001
2'0	<u>N</u>	Bromedichloromethane	<u>+-LZ-SL</u>
1.0	<u>ND</u>	Dibromorthene	E-56-#L
1.0	<u> </u>	1 2-Dichloropropane	5-28-82
1'0	ND	Τιτήοτοςτήτεπε	9-10-6L
10		1.2-Dichloroethane	102-06-2
1.0	8.0	Benzene	2-61-12
7.0 .	<u>N</u>	Тецесідогопсільпе	295-23-2
2:0	<u> </u>	1,1-Dichloropropene	9-85-295
1.0		1,1,1-Trichloroethane	9-55-12
0.1		புரல்லா	£-99-L9
<u>£'0</u>			<u>\$-16-\$1</u>
<u> </u>	<u> </u>	(cis)-1,2-Dichlorochene	7-65-951
1.0		2.2-Dichloropropane	<u>L-02-</u> +65
<u> </u>		Methyl Ethyl Ketone (MEK)	<u>£-£6-8/</u>
1.0			E++E-5L
<u>E.0</u>		(rans)-1,2-Dichloroethene	5-09-951
<u> </u>		VITBE	t-t0-t£910
<u> </u>			2-60-5L
10		1,1-Dichlorocthene	t-SE-SL
20		Cinoroetinite Trichlorofluoronætinne	t-69-5L
		Сиросостряне	<u>{-00-5L</u>
0.2		Bromomethene Children (Army Children)	6-18-12
<u> </u>		Chloroethene(Vinyl Chloride) Chloroethene(Vinyl Chloride)	<u>+-10-52</u> <u>E-28-72</u>
10		Dichlorodifluorometinne	
<u>£'0</u> (ק/2n) קמוע	Concentration(ug/L)	Name Dichorodifluoronetimne	8-12-5L
EPA-8260	Method:	:1:1-02/01/f0	Date Anarysed:
0.12204010	Raw Data File:	10/6/#	Sample Receiving Date:
SIX 60r010	Report Data File:	10/9/†	Sampling Date:
snoonby	Sample Matrix:	820-210+010	Laboratory Identification:
10/11/1	Reporting Date:	472-181-90r01	Sample Identification:
+ U/ + 1/Y		10100 181 127 ארפסוואי 1 ואלברוי דיסו גרסוואוויל ובי	

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-	I Results, Project: ESTreatibility 7		
Sample Identification:	10406-1B1-72(D)	Reporting Date:	4/11/01
aboratory Identification:	0104012-029	Sample Matrix:	Aqueous
ampling Date:	4/6/01	Report Data File:	010409.xls.
ample Receiving Date:	4/9/0 I	Raw Data File:	01040952.D
ate Analyzed:	04/11/20 -1:2:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoronathane	ND	0.3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	NĎ	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	ND	1
01634-04-4	MTBE	ND	0.3
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1,1-Dichloroethane	0.8	0,1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	0.1.
71-43-2	Benzene	0.8	0.1
107-06-2	1,2-Dichloroethane	ND ND	0.1
79-01-6	Trichloroethene	ND ND	0.1
78-87-5	1,2-Dichloropropane	ND ND	0.1
74-95-3	Dibromomethane	ND	0,1
75-27-4	Bromodichloromethane	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1 108-88-3	MIBK	ND ND	0.2
the second second second second second second second second second second second second second second second se		ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND ND	0.1
142-28-9	1,3-Dichloropropane	ND ND	0.3
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND ND	0.2
106-93-4	1.2-Dibromethane	ND ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1.1.1.2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
<u>99-87-6</u> 541-73-1	4-iso-Propyltoluene	ND ND	0.1
106-46-7	1,3-Dichlorobenzene	ND	0.1
106-46-7	n-Butylbenzene	ND	0.1
95-50-1	1.2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND ND	0.6
120-82-1	1.2.4-Trichlorobenzene	ND	
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND ND	0.3
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Actione	ND	<u> </u>
Surrogate Recovery		· · · · · · · · · · · · · · · · · · ·	•
Compound	Recovery (%)	Limit (%)	Condition
Dibromofineromethene(aurr1)	100	80-116	Pass
,2-dichlorostheno-d4(surr2)	108	80-116	Pass
oluone-d8(sur3)	101	80-116	Pass
4-bromofinorobenzeno(sur4)	103	80-120	Pass

### Environmental Research Institute The University of Connecticut Volatile Organic Compound Results, Project: ESTreatibility Tests

Sample Identification:	10406-1B2-72h	Reporting Date:	4/11/01
Laboratory Identification:	0104012-030	Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040953.D
Date Analyzed:	04/11/20 -1:2:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluoromethane	ND	0,3
74-87-3	Chloromethane	ND	0.1
75-01-4	Chloroethene(Vinyl Chloride)	ND	0.2
74-83-9	Bromomethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoromethane	ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2 01634-04-4	Dichloromethane	7 ND	1
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3	1.1-Dichloroethane	0.8	0.3
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0,1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	. 0.1
71-43-2	Benzene	1.1	0,1
107-06-2	1,2-Dichloroethane	ND	0.1
79-01-6	Trichloroethene	ND	0.1
78-87-5	1,2-Dichloropropane	ND	0.1
74-95-3	Dibromomethane	ND	0.1
75-27-4 10061-01-5	Bromodichloromethane	ND ND	0.2
108-10-1	(cis)-1,3-Dichloropropene MIBK	ND	0.2
108-88-3	Tolucne		0.2
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0.3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1	Dibromochloromethane	ND	0.3
106-93-4	1,2-Dibromoethane	ND	0.1
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene Bromoform	ND ND	0.2
98-82-8	iso-Propylbenzene	ND	0.1
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane	ND	0.2
108-86-1	Bromobenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
106-43-4	4-Chlorotolucne	ND	0.1
95-49-8	2-Chlorotoluene	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND ND	0.1
99-87-6	4-iso-Propyltoluene 1,3-Dichlorobenzene	ND ND	0.1
<u> </u>	1,4-Dichlorobenzene		0.1
104-51-8	n-Butylbenzene	ND	0.1
95-50-1	1.2-Dichlorobenzene	ND ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Naphthalene	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acetone	ND	1
Surrogate Recovery			
Cempound	Recovery (%)	Limit (%)	Condition
Dibromofinoromethene(sur1)	100	80-116	Pass
1,2-dichlorosthano-d4(surr2)	108	80-116	Pass
toluone-d8(surr3)	99	80-116	Pass

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	I Results, Project: ESTreatibilit		4/11/01
Sample Identification:	10406-1B2-72(D)	Reporting Date:	4/11/01
Laboratory Identification:		Sample Matrix:	Aqueous
Sampling Date:	4/6/01	Report Data File:	010409.xls.
Sample Receiving Date:	4/9/01	Raw Data File:	01040954.D
Date Analyzed:	04/11/20 -1:1:	Method:	EPA-8260
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
75-71-8	Dichlorodifluororrethune	ND	0.3
74-87-3	Chloromethane Chloroethene(Vinyl Chloride)	ND ND	0.1
74-83-9	Bromoniethane	ND	0.2
75-00-3	Chloroethane	ND	0.2
75-69-4	Trichlorofluoronuthanc	ND	0.1
75-35-4	1.1-Dichloroethene	ND	1
75-09-2	Dichloromethane	7	1
01634-04-4	МТВЕ	ND	<u>U.3</u>
156-60-5	(trans)-1,2-Dichloroethene	ND	0.3
75-34-3 78-93-3	1,1-Dichloroethane Methyl Ethyl Ketone (MEK)	ND ND	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
156-59-2	(cis)-1,2-Dichloroethene	ND	0.1
74-97-5	Bromochloromethane	ND	0.3
67-66-3	Chloroform	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.2
56-23-5	Tetrachloromethane	ND	· 0.1_
71-43-2	Benzene	1.1	0.1
107-06-2	1.2-Dichloroethane	ND	0.1
79-01-6 78-87-5	Trichloroethene	ND ND	0.1
74-95-3	1,2-Dichloropropane	ND ND	0.1
75-27-4	Bromodichloromethane	ND	0.1
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
108-10-1	MIBK	ND	0.2
108-88-3	Toluene	ND	0.1
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
79-00-5	1,1,2-Trichloroethane	ND	0,3
142-28-9	1,3-Dichloropropane	ND	0.2
127-18-4	Tetrachloroethene	ND	0.2
124-48-1 106-93-4	Dibromochloromethane	ND ND	0.3
108-90-7	Chlorobenzene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane	ND	0.2
100-41-4	Ethylbenzene	ND	0.1
108-38-3	m-Xylene + p-Xylene	ND	0.2
95-47-6	o-Xylene	ND	0.1
100-42-5	Styrene	ND	0.2
75-25-2	Bromoform	ND	0.1
98-82-8	iso-Propylbenzene	ND	0.2
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.2
96-18-4	1,2,3-Trichloropropane Bromobenzene	ND ND	0.2
103-65-1	n-Propylbenzene	ND	0.1
103-67-8	1.3.5-Trimethylbenzene	ND ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
95-49-8	2-Chlorotolucue	ND	0.1
98-06-9	tert-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.2
135-98-8	sec-Butylbenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0,1
541-73-1	1,3-Dichlorobenzene	ND ND	0.1
106-46-7 104-51-8	1,4-Dichlorobenzene n-Butylbenzene	ND ND	0.1
95-50-1	1,2-Dichlorobenzene	ND	0.1
96-12-8	1,2-Dibromo-3-chloropropane	ND.	0.6
120-82-1	1,2,4-Trichlorobenzene	ND	1
87-68-3	Hexachlorobutadiene	ND	0.3
91-20-3	Nephthalcne	ND	0.2
87-61-6	1,2,3-Trichlorobenzene	ND	1
67-64-1	Acctone	ND	1
Surrogate Recovery Compound	Baser/0/ )	Limit (%)	Condition
Dibromoficorounthano(aurr1)	Recovery (%) 100		Pass
1,2-dichloroethano-d4(surt2)	109	80-116	Pass
toluene-d8(surr3)	100	80-116	Pass
4-bromofiluorobenzene(sur4)	104	80-120	Pass

olucae-d8(sur3) -bromofuorobenzene(sur4)	100	80-116 80-120	Pass Pass
,2-dichlorosthane-d4(aur2)	100	80-116 80-116	Pass
Compound Dibromofluorometheno(surr1)	Recovery (%) 100	Limit (%)	Condition Pass
Surrogate Recovery	·····		
67-64-1	Acetone	ND	1
87-61-6	1,2,3-Trichlorobenzene	ND	0.2
<u> </u>	Hexachlorobutadiene Naphthalene	ND ND	0.3
120-82-1	1,2,4-Trichlorobenzene	ND	1
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.6
95-50-1	1,2-Dichlorobenzene	ND	0.1
<u> </u>	1,4-Dichlorobenzene n-Butylbenzene	ND ND	0.1
541-73-1	1,3-Dichlorobenzene	ND	0.1
99-87-6	4-iso-Propyltoluene	ND	0.1
135-98-8	sec-Butylbenzene	ND	0.1
95-63-6	1,2,4-Trimethylbenzene	ND	0.1
<u>95-49-8</u> 98-06-9	2-Chlorotoluene tert-Butylbenzene	ND ND	0.1
106-43-4	4-Chlorotoluene	ND	0.1
108-67-8	1,3,5-Trimethylbenzene	ND	0.1
103-65-1	n-Propylbenzene	ND	0.1
108-86-1	Bromobenzene	ND	0.2
96-18-4	1,1,2,2-Tetrachlorocthane	ND ND	0.2
98-82-8 79-34-5	iso-Propylbenzene 1,1,2,2-Tetrachloroethane	ND	0.2
75-25-2	Bromoform	ND	0.1
100-42-5	Styrene	ND	0.2
95-47-6	o-Xylene	ND	0.2
108-38-3	m-Xylene + p-Xylene	ND	0.1
630-20-6	1,1,1,2-Tetrachloroethane Ethylbenzene	ND ND	0.2
108-90-7	Chlorobenzene	ND	0.1
106-93-4	1,2-Dibromoethane	ND	0.1
124-48-1	Dibromochloromethane	ND	0.3
127-18-4	Tetrachloroethene	1.9	0.2
79-00-5 142-28-9	1,1,2-Trichloroethane 1,3-Dichloropropane	ND ND	0.3
10061-02-6	(trans)-1,3-Dichloropropene	ND	0.1
108-88-3	Toluene	ND	0.1
108-10-1	MIBK	ND	0.2
10061-01-5	(cis)-1,3-Dichloropropene	ND	0.2
75-27-4	Bromodichloromethane	ND	0.1
74-95-3	1,2-Dichloropropane Dibromomethane	ND ND	0.1
79-01-6	Trichloroethene	7.8 ND	0.1
107-06-2	1,2-Dichloroethane	ND	0.1
71-43-2	Benzene	ND	0.1
56-23-5	Tetrachloromethane	ND	0.1
563-58-6	1,1-Dichloropropene	ND	0.1
71-55-6	1,1,1-Trichloroethane	ND ND	0.1
74-97-5 67-66-3	Bromochloromethane Chloroform	ND ND	0.3
156-59-2	(cis)-1,2-Dichloroethene	29.6	0.1
594-20-7	2,2-Dichloropropane	ND	0.1
78-93-3	Methyl Ethyl Ketone (MEK)	ND	1
75-34-3	1.1-Dichloroethane	ND	0.3
01634-04-4 156-60-5	MTBE (trans)-1,2-Dichloroethene	ND ND	0.3
75-09-2	Dichloromethane	ND	1
75-35-4	1,1-Dichloroethene	ND	1
75-69-4	Trichlorofluoronethine	ND	0.2
74-83-9 75-00-3	Bromonicthane	ND ND	0.2
75-01-4	Chloroethene(Vinyl Chloride)	5.9	0.2
74-87-3	Chloromethane	NU	0.1
75-71-8	Dichlorodifluoromethane	ND	0.3
CAS Number	Name	Concentration(ug/L)	MDL (ug/L)
Date Analyzed:	04/11/20 -1:2:	Method:	EPA-8260
Sample Receiving Date:	4/9/01	Raw Data File:	01040955.D
Sampling Date:	4/6/01	Report Data File:	010409.xls.
aboratory Identification:	0104012-032	Sample Matrix:	Aqueous
ample Identification:	10403-1B3-72h	Reporting Date:	4/11/01